

SPECIAL ISSUE | Vol. 8 (S) Oct. 2026



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JOURNAL OF
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DOI
10.37534



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Journal of Humanities and Social Sciences Research

About the Journal

Overview

Horizon Journal of Humanities and Social Sciences Research (JHSSR) is an **open-access academic journal** published by BP Services, independently owned, dependent upon contributions and run on a non-profit basis for the benefit of the world-wide social science community. It neither accepts nor commissions third party content. It is an online scientific journal and does not impose any publication or page fee on authors intending to publish in the journal. It publishes the scientific outputs.

Recognized internationally as a leading peer-reviewed scholarly journal devoted to the publication of original papers, it serves as a forum for practical approaches to improving quality in issues pertaining to social and as well as the humanities.

JHSSR is currently a **bi-annual** (*July and December*) periodical that considers for publication original articles as per its scope. The journal publishes in **English** and it is open to authors around the world regardless of the nationality.

The Journal is available world-wide online.

Aim and scope

Horizon Journal of Humanities and Social Sciences Research aims to develop as a pioneer journal for the social sciences with a focus on emerging issues pertaining to the social sciences as well as the humanities.

JHSSR is a principal outlet for scholarly articles. The journal provides a unique forum for theoretical debates and empirical analyses that move away from narrow disciplinary focus. It is committed to comparative research and articles that speak to cases beyond the traditional concerns of area and single-country studies. JHSSR strongly encourages transdisciplinary analysis of contemporary and historical social change particularly in Asia, or beyond by offering a meeting space for international scholars across the social sciences.

Scope of the journal includes HUMANITIES— Field of Languages, Linguistics, Literature, and Education. SOCIAL SCIENCES—Anthropology, Economics, Law, psychology, Political Sciences, sociology, music, sport, and Technology Management.

History and Background

A premier journal in its field, JHSSR was established in 2019, and has been in circulation continuously since then. Horizon is an open access scholarly journal that currently publishes *semi-annually*. The journal uses a stringent yet relatively rapid **double-blind peer-review process**, which translates to benefits such as timeliness of publication, widespread dissemination, high visibility, and likelihood of high citations and broader impacts. JHSSR follows code of conduct stipulated by the Committee on Publication Ethics (COPE).

It primarily publishes for dissemination of academic research meant for scholars and scientists worldwide. We seek to present the cutting-edge innovations and/or latest insights and strive to maintain the highest standards of excellence for JHSSR. The journal publishes on a non-profitable basis and does not have any income from subscription or other sources. It does not impose any publication or page fee on authors intending to publish in JHSSR.

JHSSR is distributed worldwide to more than 1000 institutions via *e-alerts*, in addition to authors upon request. To provide expert evaluation of the various segments of the broad spectrum of Humanities and Social Sciences research, the editorial office is assisted by scholars who serve as Associate Editors, editorial board members, Emeritus editors and international advisory board members from academic institutions across 35 countries, and ad-hoc reviewers chosen for their expertise. They provide constructive evaluation and, fair and rapid editorial processing. The frequency of citations to articles published in JHSSR by scientists, students, and others increases each year.

To facilitate review, the Editor-in-Chief and the Chief Executive Editor previews all submitted manuscripts and independently or in consultation with an Associate Editor, decides if a manuscript is appropriate for review by members of JHSSR's editorial board and/or *ad hoc* reviewers. Manuscripts outside of the scope of JHSSR or those articles in poor English are returned without the delay of a full review, generally within a week of submission. Authors may contact the Chief Executive Editor in advance to inquire about the potential suitability of their research topic for review.

Manuscript submissions and inquiries are encouraged. Manuscript style and formatting are described in the **"Instructions to Authors"**. Manuscript submissions should be made using JHSSR online manuscript submission system, or manuscripts should be mailed through email to the Chief Executive Editor. Direct inquiries to CEE.horizon@gmail.com

Goal

Our goal is to bring the highest quality research to the widest possible audience. Our objective is **"Today's research, tomorrow's impact"**.

Quality

We aim for excellence, sustained by a responsible and professional approach to journal publishing. Submissions are guaranteed to receive a decision within 14 weeks. The elapsed time from submission to publication for the articles averages 3-4 months.

Editorial and International Advisory Board

The editorial and the advisory board of the Horizon has a presence of an international base of renowned scholars from various disciplines of research with diverse geographical background.

Our editorial team is engaged with **universities in 35 countries across the world** including **Australia, Austria, Bangladesh, Canada, Fiji, Finland, France, Germany, India, Indonesia, Iran, Italy, Lithuania, Malaysia, Nepal, Netherlands, New Zealand, Nigeria, Oman, Pakistan, Philippines, Russia, Saudi Arabia, Singapore, South Africa, Sweden, Taiwan, Thailand, Turkey, United Kingdom, USA, and Vietnam.**

Abstracting and indexing of *Horizon*

As is the case with any new journal, indexing in all prestigious relevant databases takes some time, and is heavily dependent upon citations the articles generate.

The Horizon Journal of Humanities and Social Sciences Research (Online ISSN 2682-9096) is a *high-quality, peer-reviewed academic journal* in its field.

It is an [Open Access](#) journal and indexed in major academic databases to maximize article discoverability and citation. The journal follows best practices on publication ethics outlined in the [COPE Code of Conduct](#). Editors work to ensure timely decisions after initial submission, as well as prompt publication online if a manuscript is accepted for publication.

Upon publication, articles are immediately and freely available to the public. The final version of articles can immediately be posted to an institutional repository or to the author's own website as long as the article includes a link back to the original article posted on JHSSR. All published articles are licensed under a [Creative Commons Attribution 4.0 International License](#).

The journal has been indexed and abstracted in: SSRN, CrossRef, Google Scholar, [EBSCOhost](#), ProQuest. The journal has been listed in: CiteFactor, Cornell University Library, CrossCheck, DRJI, Journalseek, [openaccessarticles.com](#), Open Access Library, Rubrig, Scirus, Ulrichs. In addition, the journal has been archived in: [Academia.edu](#), National Library of Malaysia, and [Malaysian Citation Index](#) (MyCite).

The journal editors and the publisher continue to do their best for this journal to be included in the top abstracting and bibliographic databases around the world; however, for the journal to be indexed in any indexing body is beyond the Journal's direct control. Nevertheless, the journal ensures that the papers published are of high quality. The publisher from time to time recommends the journal to the indexing and abstracting bodies.

The authors must also ensure that the manuscripts they submit to JHSSR are of top quality and are innovative.

Citing journal articles

The abbreviation for *Horizon Journal of Humanities and Social Sciences Research* is [Horizon J. Hum. Soc. Sci. Res.](#)

Publication policy

Horizon publishes original work and its policy prohibits an author from submitting the same manuscript for concurrent consideration by two or more publications, and is not under concurrent consideration elsewhere at the time of submitting it to Horizon. It prohibits as well publication of any manuscript that has already been published either in whole or substantial part elsewhere in any language. It also does not permit publication of manuscript that has been published **in full** in Proceedings.

Originality

The author must ensure that when a manuscript is submitted to Horizon, the manuscript is an original work. The author should check the manuscript for any possible plagiarism using any software such as **Turnitin, i-Thenticate** or any other similar program before submitting the manuscripts to the Horizon journal.

All submitted manuscripts must be in the Journal's acceptable **similarity index range**:
< 25%– PASS; 30-35%– RESUBMIT MS; > 35%– REJECT.

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The author/s must declare the use of Generative AI and AI-Assisted Tools in Figures, Images, and Artwork. For further details, please refer to: <https://horizon-jhssr.com/publishing-policies.php>.

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The Horizon Journals takes seriously the responsibility of all of its journal publications to reflect the highest in publication ethics. Thus, all journals and journal editors abide by the Journal's codes of ethics. Refer to Horizon's **Code of Conduct** for full details at the Journal's web link <https://horizon-jhssr.com/code-of-conduct.php>

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In case of any queries, contact the Journal's Editorial office via email to info.jhssr@gmail.com

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Horizon JHSSR **does not impose** any submission fees, publication fees or page charges for those intending to publish their research in this journal. However, as JHSSR is an open access journal, in norms with all open access journals, the journal imposes an Article Processing Charge (APC). To publish in JHSSR, authors are currently required to pay an APC of **USD100 per article** (*subject to revision*). A waiver to this available for academics with a heavily subsidized fee of USD50 per accepted manuscript.

In addition, this journal offers discount on Article Processing Charges to authors based in any of the countries which were classified by the World Bank as Low-income economies or Lower-middle-income economies. All requests can be sent directly to the journal's Chief Executive Editor.

In an open access model, the publication costs of an article are paid from an author's research budget, or by their supporting institution, in the form of Article Processing Charges. These Article Processing Charges replace subscription charges and allow publishers to make the full-text of every published article freely available to all interested readers. In addition, authors who publish in JHSSR open access journal retain the copyright of their work, which is released under a "**Creative Commons Attribution 4.0 International License**," enabling the unrestricted use, distribution, and reproduction of an article in any medium, provided that the original work is properly cited.

However, in case of a print version, if it is necessary for the figures to be reproduced in color, a charge of USD50 per figure will apply.

International Standard Serial Number (ISSN)

An ISSN is an 8-digit code used to identify periodicals such as journals of all kinds and on all media—*print and electronic*. All Horizon journals have an e-ISSN.

Horizon Journal of Humanities and Social Sciences Research: **e-ISSN 2682-9096**.

Lag time

A decision on acceptance or rejection of a manuscript is reached in 3 to 4 months (average 12 weeks). The elapsed time from submission to publication for the articles averages 4-5 months.

Authorship

Authors are not permitted to add or remove any names from the authorship provided at the time of initial submission without the consent of the Journal's Chief Executive Editor. Requests for changes to authorship must be directed to the journal's chief executive editor. Changes in authorship will only be permitted where valid reasons are provided and all authors are in agreement with the change. Post-publication changes to authorship will typically be made via a published correction and authors may be charged for this additional service.

One author will need to be identified as the corresponding author, with their email address normally displayed in the article. Authors' affiliations are the affiliations where the research was conducted. If any of the named co-authors moves affiliation during the peer-review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after your paper is accepted.

Manuscript preparation

Refer to Horizon's **INSTRUCTIONS TO AUTHORS** at the back of this journal or visit <https://horizon-jhssr.com/manuscript-preparation.php>



A well-formatted manuscript follows all journal instruction. All elements of the manuscript are printed in English with 1-inch margins at top, bottom, and sides. Right margins are unjustified. Horizon journals accept manuscript submissions which uses any consistent text— Format-free Submission! This saves you time and ensures you can focus on your priority: the research.

However, citations/references must be formatted by you as per APA format.

Checklist for Manuscript Submission

- Cover letter
- Declaration form
- Referral form
- Manuscript structure

(Title, Author details and affiliation, Abstract, Keywords, etc. using the **IMRAD** style).

Each submission must fulfil the following criteria and documents listed below must be submitted along with the manuscript for intended publication.

1) Cover letter

Your cover letter should be complete and make a strong pitch. The cover letter should include all these details:

- Author(s): Full contact details (email, institutional address, telephone number, etc.) of all authors listed including who the corresponding author will be [full name(s) written as First Name then Last Name]. Understand the differences between lead author and co-author(s). Lead-author: who has done most of the research and writing; Co-author: Has collaborated with the lead author and contributed some parts.
- A brief explanation of your article's relevance and impact.
- Disclosure of whether you have published this study previously elsewhere or if it is in consideration by another journal.
- Disclosure of any commercial or financial relationship that may be viewed as any potential conflict of interest.
- A brief statement explaining why the journal should publish your study.

(Refer to sample available at <https://horizon-jhssr.com/download.php>).

2) Declaration form

Do not forget to complete the declaration form and submit it along with your manuscript. Sign the declaration that your manuscript is original, you have NOT published this study previously elsewhere in any language and is not under concurrent consideration elsewhere at the time of submitting it to Horizon.

3) Referral form

The authors are strongly recommended to complete the "Reviewers Suggestion" form along with the manuscript during submission. Authors should suggest up to 3 names of potential reviewers, experts in the subject area of the manuscript, and are not the co-authors listed in the manuscript submitted. The suggested reviewers may be from any part of the world. The journal is not, however, bound by these suggestions.

4) Language and flow

A well-written manuscript has greater chances of acceptance. Some tips:

- Avoid long, complicated sentences; keep it simple. Your sentences should be understandable.
- Your ideas should flow smoothly.
- Use correct terminology, avoid excessive jargon and grandiose language.
- Make sure there are no grammatical mistakes.
- It is highly recommended to approach an editing service for help with polishing your manuscript. The journal has a long-term proven affiliation with a good certified editor at Beyond Proofreading Services PLC.

You may contact **Dr. Brown at Beyond Proofreading**, beyondproofreading@gmail.com at your own discretion.

Language Accuracy

JHSSR **emphasizes** on the linguistic accuracy of every manuscript published. Articles must be in English and they must be competently written and argued in clear and concise grammatical English. Contributors are strongly advised to have the manuscript checked by a colleague with ample experience in writing English manuscripts or a competent English language editor.

Author(s) **should provide a certificate** confirming that their manuscripts have been adequately edited. A proof from a certified editing service should be submitted together with the cover letter at the time of submitting a manuscript to Horizon.

All editing costs must be borne by the author(s). This step, taken by authors before submission, will greatly facilitate reviewing, and thus publication if the content is acceptable.

Refer to JHSSR's **MANUSCRIPT FORMAT GUIDE** at <https://horizon-jhssr.com/online-submission.php>

Editorial process

Authors are notified with an acknowledgement containing a *Manuscript ID* upon receipt of a manuscript, and upon the editorial decision regarding publication.

JHSSR follows a **double-blind peer-review** process. Authors are encouraged to suggest names of at least three potential reviewers at the time of submission of their manuscript to Horizon using the **Referral form**. The editors are not, however, bound by these suggestions.

The Journal's peer-review

In the peer-review process, three referees independently evaluate the scientific quality of the submitted manuscripts.

Peer reviewers are experts chosen by journal editors to provide written assessment of the **strengths and weaknesses** of written research, with the aim of improving the reporting of research and identifying the most appropriate and highest quality material for the journal.

The Review process

What happens to a manuscript once it is submitted to *Horizon*? Typically, there are seven steps to the editorial review process:

1. The Journal's chief executive editor and the editorial board examine the paper to determine whether it is appropriate for the journal and should be reviewed. If not appropriate, the manuscript is rejected outright and the author is informed. Linguistically hopeless manuscripts will be rejected straightaway (e.g., when the language is so poor that one cannot be sure of what the authors really mean).
2. The chief executive editor sends the article-identifying information having been removed, to three reviewers. Typically, one of these is from the Journal's editorial board. Others are external specialists in the subject matter represented by the article. The chief executive editor requests them to complete the review in three weeks.

Comments to authors are about the appropriateness and adequacy of the theoretical or conceptual framework, literature review, method, results and discussion, and conclusions. Reviewers often include suggestions for strengthening of the manuscript. Comments to the editor are in the nature of the significance of the work and its potential contribution to the literature.

3. The chief executive editor, in consultation with the Editor-in-Chief, examines the reviews and decides whether to reject the manuscript, invite the author(s) to revise and resubmit the manuscript, or seek additional reviews. Final acceptance or rejection rests with the Editor-in-Chief, who reserves the right to refuse any material for publication.

In rare instances, the manuscript is accepted with almost no revision. Almost without exception, reviewers' comments (to the author) are forwarded to the author. If a revision is indicated, the editor provides guidelines for attending to the reviewers' suggestions and perhaps additional advice about revising the manuscript.

4. The authors decide whether and how to address the reviewers' comments and criticisms and the editor's concerns. The authors return a revised version of the paper to the chief executive editor along with specific information describing how they have answered the concerns of the reviewers and the editor, usually in a tabular form. The author(s) may also submit a rebuttal if there is a need especially when the author disagrees with certain comments provided by reviewer(s).
5. The chief executive editor sends the revised paper out for re-review. Typically, at least one of the original reviewers will be asked to examine the article.
6. When the reviewers have completed their work, the chief executive editor in consultation with the editorial board and the Editor-in-Chief examine their comments and decide whether the paper is ready to be published, needs another round of revisions, or should be rejected.
7. If the decision is to accept, an acceptance letter is sent to all the author(s), the paper is sent to the Press. The article should appear in print in approximately three months.

The Publisher ensures that the paper adheres to the correct style (in-text citations, the reference list, and tables are typical areas of concern, clarity, and grammar). The authors are asked to respond to any minor queries by the Publisher. Following these corrections, page proofs are mailed to the corresponding authors for their final approval. At this point, **only essential changes are accepted**. Finally, the article appears in the pages of the Journal and is published on-line.

SUBMISSION OF MANUSCRIPTS

Owing to the volume of manuscripts we receive, we must insist that all submissions be made electronically using the **online submission system™**, a web-based portal. For more information, go to our web page and [click "Online Submission"](#).

Please do **not** submit manuscripts to the Editor-in-Chief or to any other office directly. All submissions or queries must be directed to the **Chief Executive Editor** via email to CEE.horizon@gmail.com

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DOI: <https://doi.org/10.37534>

Horizon Journal of
HUMANITIES & SOCIAL SCIENCES RESEARCH

JHSSR

Vol. 8 (S) Oct. 2026



An international peer-reviewed scientific journal published by BP Services



October 2026

Journal of Humanities and Social Sciences Research

An Open access Peer-reviewed Scholarly Journal

Recommended Citation

Horizon J. Hum. Soc. Sci. Res.

Available at: <https://horizon-jhssr.com/index.php>

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Do not raise the bar unnecessarily by exaggerating requirements for successful publication, but rather encourage young researchers to try and experiment. Researchers can raise their ambition level through gained experience.

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Office of the Director
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Cyber 10, Cyberjaya 63200
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Gen Enq.: INFO.jhssr@gmail.com

URL: www.horizon-jhssr.com

DOI: <https://doi.org/10.37534>



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Gen Enq.: INFO.jhssr@gmail.com

URL: www.horizon-jhssr.com

DOI: <https://doi.org/10.37534>



97726821409001



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Journal of Humanities and Social Sciences Research

Vol. 8 (S) Oct. 2026

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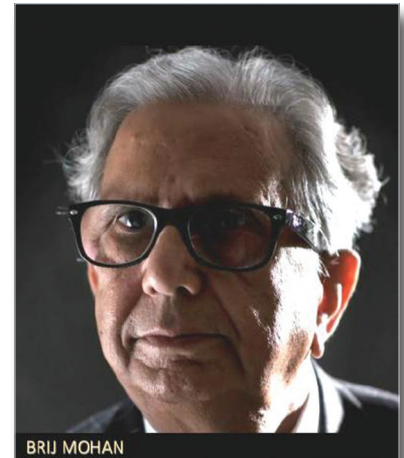
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From Fields to Futures: Reimagining Agribusiness for a Sustainable Asia

Foreword / The Global Lens

Agriculture has never been merely an economic activity. It is the foundation of food security, livelihoods, communities and human civilisation. In twenty-first-century Asia, however, agriculture is being asked to accomplish something considerably more demanding: to feed growing populations while conserving natural resources, responding to climate change, embracing technological transformation and creating dignified and resilient livelihoods.

It is against this backdrop that Horizon Journal of Humanities & Social Sciences Research presents this Special Issue, “Transforming Asian Agribusiness for a Sustainable Future: Economics, Entrepreneurship and Innovation.” The theme is timely because the future of agriculture can no longer be considered solely in terms of production. It must be understood through the wider systems of finance, technology, processing, logistics, markets, entrepreneurship, policy and community capability that determine how agricultural value is created and shared.



Dean Emeritus Prof. Brij Mohan
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Centurion University: A Distinctive Institutional Setting

The choice of Centurion University of Technology and Management (CUTM) as the institutional partner for this Special Issue is particularly meaningful. CUTM's distinctive orientation towards skill-based and experiential learning, employability, entrepreneurship, innovation and community engagement provides an appropriate setting for examining how universities can connect knowledge with practical capability and societal impact.

The University's educational philosophy is especially relevant to agribusiness. Agricultural transformation depends not only on scientific advances, but also on people who can apply knowledge, build enterprises, work with communities, understand markets and translate innovation into practical solutions.

Photo 1. Centurion University of Technology and Management: a campus landscape reflecting an ecosystem of learning, innovation and community engagement.





Photo 2. *The gateway to Centurion University of Technology and Management: an institutional commitment to opening pathways from knowledge to opportunity.*

Recognition of a Skill-Based Learning Model

CUTM's educational approach has also attracted significant institutional recognition. The Hon'ble Governor of Odisha, Dr. Hari Babu Kambhampati, who also serves as Chancellor of the State's Government Universities under the prevailing framework, recently directed the Vice Chancellors of Odisha's universities to visit CUTM and learn from its exemplary skill-based learning model. The subsequent meeting of 23 Vice Chancellors at CUTM on 13 August 2026 created an important platform for institutional exchange and reflection on the future of higher education.

Such recognition is important because the challenge facing universities is no longer simply to transmit knowledge. Higher education must increasingly help learners acquire practical competence, entrepreneurial confidence, technological awareness and the ability to address complex social and economic problems.

CUTM's distinctive character is also rooted in an institutional journey that has consistently sought to connect education with opportunity. From its origins in 1997 and its evolution into a university in 2010, CUTM has developed an educational model centred on hands-on, experiential and practice-oriented learning, supported by industry engagement and a strong commitment to sustainable livelihoods. Its presence across six campuses in Odisha, together with around 40 outreach centres, reflects an equally important commitment to widening access to education and skills, particularly among first-generation learners and communities in less-developed and tribal regions. This combination of learning-by-doing, social inclusion and community engagement offers an especially relevant foundation for rethinking how universities can contribute to the future of Asian agribusiness and rural development.

Sustainability with Measurable Global Visibility

CUTM's sustainability trajectory provides another important dimension to its profile. The supplied Times Higher Education Impact Rankings 2026 institutional material places CUTM in the global 101–200 band, compared with 601–800 in 2024 and 301–400 in 2025, and identifies CUTM as fifth in India. The same material reports particularly strong global positions in SDG 7, Affordable and Clean Energy (#26); SDG 13, Climate Action (#27); SDG 1, No Poverty (#43); SDG 2, Zero Hunger (#44); SDG 14, Life Below Water (#51); and SDG 15, Life on Land (#65). CUTM is reported as participating in 15 SDGs, excluding SDGs 6 and 16.

These results are especially relevant to the present Special Issue because sustainable agribusiness sits at the intersection of food security, poverty reduction, climate resilience, responsible production and ecosystem protection. The rankings therefore provide an institutional context in which CUTM's educational, research and community ambitions can be viewed alongside broader global sustainability priorities.

From Local Capability to Global Scholarship

CUTM's role is also reflected in its growing engagement with international scholarship. The University conducts international conferences that bring together researchers and practitioners and provide platforms for the dissemination of research. In the instance documented in the supplied conference photograph, proceedings were published by Taylor & Francis. It is an encouraging example of CUTM's aspiration to carry forward such internationally visible scholarly dissemination in future conference proceedings as well.

The deeper significance of these developments lies in the connections they create: between the university and community, learning and livelihoods, research and enterprise, and local challenges and international scholarship.

The future of Asian agribusiness will require precisely these connections. Farmers, entrepreneurs, researchers, policymakers, technology providers and universities must increasingly work within shared ecosystems rather than isolated sectors. Agricultural innovation must be economically viable, environmentally responsible, technologically accessible and socially inclusive.

I commend the leadership and academic community of Centurion University of Technology and Management, Prof. Rabi N. Subudhi, the editorial team of Horizon JHSSR and all contributing scholars for bringing this Special Issue to fruition. May the scholarship gathered here stimulate new research, strengthen partnerships and contribute to food systems that are productive, resilient and inclusive.

To secure a sustainable future, Asian agribusiness must pivot from a narrow focus on productivity toward systemic innovation. Navigating the modern agricultural landscape requires forward-thinking strategies that leverage the AI revolution, harness cross-cultural connectivity, and build resilience against climate change.



Dean Emeritus Prof. Brij Mohan

Editor-in-Chief, Horizon Journal of Humanities & Social Sciences Research
Louisiana State University, USA

CITE THIS ARTICLE

Brij Mohan. From Fields to Futures: Reimagining Agribusiness for a Sustainable Asia: Foreword- The Global Lens.

Horizon J. Hum. Soc. Sci. Res. **8 (S)**, xvii–xix (2026).

<https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id01S81.pxvii>

From Knowledge to Impact: Building Enterprises, Empowering Communities

Message from the President | The Institutional Vision

The transformation of agriculture is inseparable from the transformation of the people, enterprises and institutions that surround it. Across Asia, agriculture is being reshaped by climate pressures, digital technologies, changing markets, new consumer expectations and the growing importance of sustainable value chains.

For Centurion University of Technology and Management, this transformation reinforces a long-standing institutional conviction: education must be connected to capability, opportunity and social impact. Knowledge becomes most valuable when learners can apply it, communities can benefit from it and enterprises can convert it into sustainable livelihoods.



Prof. Mukti Kanta Mishra
President, CUTM

CUTM's journey has been one of purposeful transformation. From its beginnings in 1997 as the Jagannath Institute for Technology and Management (JITM), the institution evolved through a sustained commitment to expanding access, strengthening practical education and creating pathways from learning to livelihoods. In 2005, academics including Prof. Mukti Kanta Mishra and Prof. D. N. Rao took over the management of the institution and led its subsequent expansion, culminating in its transformation into Centurion University in 2010. This journey reflects a fundamental belief that higher education must extend beyond the classroom and create tangible opportunities for individuals and communities.

A University Built Around Capability

CUTM's emphasis on skill-based and experiential learning is particularly relevant to this agenda. Modern agribusiness requires professionals who understand not only agricultural production, but also technology,



Photo 1. Hon'ble Governor of Odisha, Dr. Hari Babu Kambhampati, during his engagement with Centurion University.



Photo 2. Vice Chancellors of Odisha's universities at CUTM, 13 August 2026: a shared conversation on the future of skill-based higher education.

finance, markets, entrepreneurship, supply chains and sustainability. It requires graduates who can move confidently between the classroom and the field, between ideas and implementation.

This approach has received notable recent recognition at the state level. The Hon'ble Governor of Odisha, Dr. Hari Babu Kambhampati, who also serves as Chancellor of the State's Government Universities under the prevailing framework, motivated the Vice Chancellors of Odisha's universities to visit CUTM and learn from its exemplary skill-based learning model. This was followed by a meeting of 23 Vice Chancellors at CUTM on 13 August 2026.

The importance of this development lies beyond recognition for the institution. It creates an opportunity for wider institutional learning. Universities must continually ask how education can become more responsive to the changing world of work and to the aspirations of young people. Skill-based learning, when integrated with academic knowledge, entrepreneurship and innovation, can help narrow the distance between education and meaningful employment.

Entrepreneurship as a Pathway to Empowerment

Agriculture presents a vast landscape for entrepreneurship—from input services and digital platforms to food processing, logistics, value addition, financial services, sustainable production and direct market access. Encouraging young people to see agriculture as an arena of enterprise can contribute to livelihood diversification and rural economic resilience.

The university therefore has a role beyond teaching. It can become a platform where students, researchers, entrepreneurs, industry partners and communities meet, experiment and co-create solutions. Such an ecosystem can turn ideas into prototypes, prototypes into enterprises and enterprises into sources of employment and community value.

From Campus to Community

CUTM's commitment to community engagement is important in this context. Agricultural transformation is meaningful only when innovations reach the people for whom they are intended. Capacity

building, agricultural extension and technology transfer are therefore essential companions to research and entrepreneurship.

The Special Issue of Horizon JHSSR is a valuable contribution to this broader conversation. Its focus on economics, entrepreneurship and innovation recognizes that sustainable agriculture requires a sustainable agribusiness ecosystem.

I congratulate the editors, contributors and the academic community associated with this Special Issue. May it encourage a new generation to regard agriculture not simply as a traditional sector, but as a field of knowledge, enterprise, innovation and human possibility.

When knowledge creates opportunity and opportunity creates social value, education becomes a force for transformation.



Prof. Mukti Kanta Mishra

President

Centurion University of Technology and Management (CUTM)

CITE THIS ARTICLE

Mukti Kanta Mishra. From Knowledge to Impact: Building Enterprises, Empowering Communities: Message from the President | The Institutional Vision. *Horizon J. Hum. Soc. Sci. Res.* **8 (S)**, xx–xxii (2026).

<https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id02S81.pxx>

Where Agriculture Meets Enterprise: Creating the Innovation Ecosystem of Tomorrow

Message from the Vice President | The Enterprise Lens

Agriculture is no longer an isolated sector operating at the beginning of a traditional production chain. It is increasingly part of a dynamic ecosystem connecting technology, finance, entrepreneurship, logistics, food processing, markets, consumers and sustainability. Across Asia, this transformation is creating new opportunities while simultaneously demanding new forms of knowledge, skills and enterprise.

The New Agribusiness Landscape

The future of agribusiness will therefore depend on our ability to look beyond production and understand agriculture as an interconnected value-creation system. Digital agriculture, agri-finance, precision technologies, climate-smart practices, resilient supply chains, food processing and direct-to-consumer markets are changing the way agricultural value is created, distributed and captured. These developments require people who can understand both the realities of the field and the possibilities of enterprise.



Prof. D. N. Rao
Vice President, CUTM

For universities, this changing landscape demands a fundamental shift in perspective. Agricultural education can no longer be confined to production techniques alone. Tomorrow's agribusiness professionals must be equally comfortable with technology, markets, finance, entrepreneurship, data, sustainability and the rapidly changing expectations of consumers. They must be able to move confidently between the classroom and the field, between ideas and implementation, and between local realities and global opportunities.

At Centurion University of Technology and Management, we believe that universities have a responsibility to help build this bridge between knowledge and enterprise. Education must equip learners not merely to seek employment, but also to identify opportunities, solve problems, develop innovations and create enterprises capable of generating sustainable livelihoods.

Entrepreneurship Beyond the Classroom

Entrepreneurship in agriculture must be understood more broadly than simply the creation of startups. It includes the ability of farmers to adopt new technologies, producer organisations to develop stronger market linkages, young professionals to create innovative services, and rural enterprises to participate more effectively in emerging value chains. The entrepreneurial mindset is ultimately about recognising possibilities where others see only constraints.

CUTM's approach seeks to create an environment in which this entrepreneurial mindset can develop through exposure to innovation, practical learning and real-world problem solving. Through its Centre for Innovators and Entrepreneurs, the University provides incubation support, prototyping facilities, mentorship and pathways to angel, venture capital and grant networks. Startups have been incubated across areas including

A CUTM academic gathering: connecting ideas, people and practice through shared learning.



agriculture, education, healthcare, waste management and renewable energy. Such an ecosystem can help transform ideas into practical solutions and practical solutions into sustainable enterprises.

This is particularly important for Asian agriculture, where many opportunities lie not only in what is produced, but in the services, technologies, processing systems, logistics, platforms and market connections that surround production. When young entrepreneurs are encouraged to identify these gaps and develop solutions for them, agribusiness becomes a pathway not only to economic growth, but also to employment, innovation and community development.

Innovation with Purpose

Innovation, however, must always be connected to purpose. For CUTM, the transformation of agribusiness must be supported by an ecosystem in which research, technology, skills and entrepreneurship reinforce one another. The University has developed specialised research centres spanning areas such as smart agriculture, genetics and genomics, aquaculture and fish processing, data science and machine learning, phytopharmaceutical research, design and manufacturing, and waste-to-wealth. Supported by industry-sponsored laboratories and a growing culture of innovation, such an ecosystem enables ideas to move beyond academic inquiry towards practical applications and solutions.

The challenges facing Asian agriculture, from climate variability and resource constraints to fragmented markets and changing consumer expectations, cannot be addressed through disciplinary silos. They require collaboration among agricultural scientists, technologists, economists, entrepreneurs, industry practitioners, policymakers and communities. The university can become the meeting point where these different forms of knowledge converge around problems that matter.

Such collaboration can transform the role of the university. A research idea can become a prototype; a prototype can become an enterprise; and an enterprise can become a source of employment, resilience and social value. This is the pathway through which research and innovation can contribute meaningfully to the transformation of agribusiness.

The Special Issue on *Transforming Asian Agribusiness for a Sustainable Future: Economics, Entrepreneurship and Innovation* is therefore particularly timely. It creates a platform for examining how economic thinking,

entrepreneurial action and technological innovation can come together to build more productive, resilient and sustainable agricultural systems across Asia.

The opportunity before Asian universities is much larger than producing technically qualified graduates. Universities can become platforms where knowledge is converted into capability, capability into innovation, and innovation into enterprise and social value. In this sense, the future of agribusiness will depend not only on what we grow, but on the innovation ecosystems we create around it.

The university of tomorrow must not simply prepare people for the economy; it must help create the economy of tomorrow.



Prof. D. N. Rao

Vice President

Centurion University of Technology and Management (CUTM)

CITE THIS ARTICLE

Damera Nageswara Rao. Where Agriculture Meets Enterprise: Creating the Innovation Ecosystem of Tomorrow: Message from the Vice President | The Enterprise Lens. *Horizon J. Hum. Soc. Sci. Res.* **8 (S)**, xxiii-xxv (2026).

<https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id03S81.pxxiii>

Cultivating Minds, Markets and Meaningful Innovation

Message from the Vice Chancellor / The Academic Lens

The most consequential transformations occur when knowledge crosses boundaries. Agriculture, economics, entrepreneurship, technology and sustainability may be studied as distinct fields, but the challenges confronting Asian food systems are inherently interdisciplinary.

This reality has important implications for higher education. Universities must prepare learners not simply to know, but to apply, collaborate, innovate and respond responsibly to complex problems.

Learning by Doing

CUTM's emphasis on skill-based and experiential learning is closely aligned with this changing educational landscape. In agriculture and agribusiness, practical competence is especially important because the distance between an innovation and its adoption can determine whether research produces meaningful social impact.

Students need opportunities to engage with real problems, real enterprises and real communities. They must learn to test assumptions, work across disciplines, communicate with stakeholders and translate ideas into workable solutions.

CUTM's academic ecosystem has been designed to support this philosophy across a broad range of disciplines. With more than 18 schools and programmes spanning engineering and technology, management, agriculture, life sciences, pharmacy, computing and data science, law, nursing and other professional areas, the University creates opportunities for learners to encounter perspectives beyond their immediate fields of study. More than 45 production labs further support its hands-on, practice-oriented approach to learning.

Research, Extension and Technology Transfer

Research is central to this process. It allows society to move from assumptions to evidence and from isolated interventions to scalable approaches. But research reaches its full value only when its insights can travel beyond academic boundaries.



Prof. Supriya Pattanayak
Vice Chancellor, CUTM

An aerial view of the CUTM campus: an ecosystem where learning, research and innovation converge.



Agricultural extension, capacity building and technology transfer therefore deserve sustained attention. The future agribusiness professional must be able to understand not only how an innovation works, but also why people adopt it, what barriers they face and how solutions can be made more accessible.

This requires an academic environment in which research is connected to application. CUTM's specialised research ecosystem encompasses areas including smart agriculture, genetics and genomics, aquaculture and fish processing, data science and machine learning, phytopharmaceutical research, design and manufacturing, and waste-to-wealth. Such interdisciplinary capacity creates opportunities for research findings to interact with technology, industry and community needs, strengthening the pathway from knowledge creation to practical impact.

Sustainability as an Academic Imperative

CUTM's strong performance in the Times Higher Education Impact Rankings 2026 provides a useful institutional context for this commitment. The supplied institutional material places CUTM in the global 101–200 band and fifth in India, with particularly strong global positions in SDG 7, Affordable and Clean Energy (#26), SDG 13, Climate Action (#27), SDG 1, No Poverty (#43), and SDG 2, Zero Hunger (#44). It also records strong positions in SDG 14, Life Below Water (#51), and SDG 15, Life on Land (#65).

These results reinforce an important principle: sustainability must not be treated as an isolated theme. It should inform curriculum, research, innovation, community engagement and institutional decision-making.

The Special Issue of Horizon JHSSR brings these concerns together through its focus on sustainable agribusiness, entrepreneurship, economics and innovation. I hope it will encourage scholars and students alike to think across conventional boundaries and to pursue research that is both intellectually rigorous and socially relevant.

To cultivate the future of agriculture, we must first cultivate the minds capable of imagining it.



Prof. Supriya Pattanayak

Vice Chancellor

Centurion University of Technology and Management (CUTM)

CITE THIS ARTICLE

Supriya Pattanayak. Cultivating Minds, Markets and Meaningful Innovation: Message from the Vice Chancellor | The Academic Lens. *Horizon J. Hum. Soc. Sci. Res.* **8 (S)**, xxvi–xxvii (2026).

<https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id04S81.pxxvi>

Beyond Production: Transforming Asian Agribusiness for a Sustainable Future

Editorial | The Scholarly Lens

Asia's agricultural future is at a defining crossroads. The region's food systems must respond simultaneously to changing consumption patterns, resource pressures, climate change, technological disruption, market complexity and the need for resilient livelihoods. The central question is therefore no longer simply how much food can be produced, but how agricultural value can be created and sustained across the entire food and livelihood system.

This question provides the intellectual foundation for the present Special Issue, *"Transforming Asian Agribusiness for a Sustainable Future: Economics, Entrepreneurship and Innovation."*

From Food Production to Food Systems

Agriculture today must be understood as part of a broader system connecting production with inputs, finance, technology, processing, storage, logistics, marketing, consumption and waste management. Sustainability depends upon the resilience and inclusiveness of these connections.

India's agricultural journey demonstrates how scientific research, policy intervention and technology dissemination can transform productivity and food security. The eastern region of India, including Odisha, has also benefited from the work of important agricultural research institutions. The original draft for this Editorial rightly draws attention to the National Rice Research Institute at Cuttack and the Central Institute of Freshwater Aquaculture at Bhubaneswar, as well as the "Bringing Green Revolution to Eastern India" experience.

Odisha as a Research and Innovation Setting

Odisha provides a particularly relevant setting for examining the relationship between agriculture, rural livelihoods, technology and enterprise. The presence of major agricultural and fisheries research institutions provides an important scientific backdrop; the next challenge is to connect research capability with entrepreneurship, market access, skills and community-level adoption.

This challenge is especially significant in a region where agriculture, fisheries, natural resources and rural livelihoods are closely interconnected. It calls for approaches that do not treat productivity, sustainability and livelihoods as separate objectives, but as dimensions of the same development challenge.

CUTM: Connecting Knowledge, Skills and Enterprise

It is within this landscape that Centurion University of Technology and Management assumes particular relevance. CUTM's emphasis on skill-based and experiential learning, entrepreneurship, innovation and community engagement provides an institutional environment in which agriculture can be approached not simply as production, but as an ecosystem of knowledge, enterprise and social value.

The University's role is especially important for a generation that will encounter agriculture through increasingly diverse pathways: climate-smart production, digital platforms, Agri-finance, food processing, supply-chain innovation, market access, value addition and technology-enabled entrepreneurship.

CUTM's research ecosystem further strengthens this orientation. The University has developed specialised research centres working across areas including smart agriculture, genetics and genomics, aquaculture and fish processing, data science and machine learning, phytopharmaceutical research, design and manufacturing, and waste-to-wealth. Supported by industry-sponsored laboratories, these capabilities create opportunities for research to move from academic investigation towards practical applications.

The breadth of this research activity is important because the most consequential agricultural challenges rarely belong to a single discipline. For example, the development of smarter agricultural practices may require the integration of biological knowledge, digital technologies, data analytics and economic decision-making. Likewise, aquaculture and fisheries require connections between scientific research, resource management, processing, markets and livelihoods. Such intersections illustrate why the future of agribusiness must be approached through interdisciplinary scholarship and innovation.

CUTM's community-oriented approach adds another important dimension. Its Community Action Learning Program enables students to work directly with local communities to address technical problems as part of their learning. Initiatives such as Project Atal, which focuses on improving the incomes of small and marginal farmers, and the Innovation Agriculture Project, which has provided training to farmers in tribal-dominated areas of South Odisha and North Coastal Andhra, demonstrate how skills, technology and community engagement can be connected to agricultural livelihoods.

Research with International Reach

CUTM's commitment to impactful research is also reflected in its international conference activities, which create platforms for researchers and practitioners to exchange knowledge. In the specific instance documented in the supplied photograph, the conference proceedings were published by Taylor & Francis. This is an encouraging example of internationally visible research dissemination, and CUTM hopes to carry forward this practice in other conference proceedings as well.

Photo 1. Connecting CUTM research with international scholarship: from right to left, Prof. Anita Patra, Registrar, CUTM; Prof. Supriya Pattanayak, Vice Chancellor, CUTM; Chief Guest Professor Moni Madaswamy (Former Director General at National Informatics Center, Government of India); and Prof. Rabi Subudhi, President, ORSI, Bhubaneswar, Odisha, at the inaugural function of an international conference whose proceedings were published by Taylor & Francis.



International dissemination is important because research achieves wider significance when ideas are exposed to scholarly dialogue beyond institutional and national boundaries. For Asian agribusiness in particular, comparative learning across countries and regions can help identify approaches that are adaptable to different ecological, economic and social contexts.

Agribusiness, Entrepreneurship and the SDGs

The future of Asian agribusiness is inseparable from the Sustainable Development Goals. Food security, poverty reduction, climate action, responsible production and the protection of terrestrial and aquatic ecosystems are interconnected. The Times Higher Education Impact Rankings 2026 material supplied for this Special Issue records CUTM at #44 globally for SDG 2, Zero Hunger; #43 for SDG 1, No Poverty; #27 for SDG 13, Climate Action; #65 for SDG 15, Life on Land; and #51 for SDG 14, Life Below Water. CUTM is reported as participating in 15 SDGs, excluding SDGs 6 and 16.

These results provide an institutional context for examining agriculture, entrepreneurship and innovation as mutually reinforcing components of sustainable development. The goal is not innovation for its own sake, but innovation that is adoptable, responsible and capable of creating durable value.

CUTM's research and innovation initiatives illustrate how this principle can be pursued in practice. Work involving smart agriculture, aquaculture, waste-to-wealth and other applied areas demonstrates the potential for university-based research to respond to environmental and livelihood challenges. The University's broader innovation ecosystem, including its Centre for Innovators and Entrepreneurs, further seeks to connect ideas with incubation, prototyping, mentorship and pathways towards enterprise creation.

For agribusiness, this connection between innovation and entrepreneurship is particularly significant. A technology that remains within a laboratory has limited social reach; when it becomes accessible, affordable and commercially or socially viable, its potential impact expands. Sustainable agribusiness therefore requires not only researchers and technologies, but also entrepreneurs, institutions and market systems capable of carrying innovations into communities.

Why This Special Issue Matters

The contributions brought together in this Special Issue respond to these emerging realities from different perspectives. Collectively, they examine dimensions of sustainable agribusiness, economics, entrepreneurship, innovation, technology, market access and agricultural transformation.

The proposition underlying this collection is simple but consequential: sustainable agriculture requires sustainable agribusiness ecosystems. Production must be economically viable; innovation must be environmentally responsible; technology must be accessible; markets must create opportunity; entrepreneurship must generate value; and research must ultimately contribute to stronger livelihoods and more resilient communities.

This requires interdisciplinary scholarship and collaboration across universities, industry, government, entrepreneurs and communities. It also requires universities to become more active bridges between knowledge and implementation.

The journey from farm to future will require more than higher yields. It will require better ideas, stronger institutions, responsible innovation and entrepreneurs willing to create value where society needs it most. That is the transformation this Special Issue seeks to advance.

Supriya Pattanayak, Ph.D.
Professor & Vice Chancellor



Anita Patra, Ph.D.
Professor & Registrar



Rabi N. Subudhi, Ph.D.
Professor



Guest Editors, CUTM-Horizon JHSSR 2026 Special Issue
Horizon Journal of Humanities and Social Sciences Research (JHSSR)

Centurion University of Technology and Management
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CITE THIS ARTICLE

Supriya Pattanayak et al. Beyond Production: Transforming Asian Agribusiness for a Sustainable Future: Editorial | The Scholarly Lens. *Horizon J. Hum. Soc. Sci. Res.* **8 (S)**, xxviii–xxxi (2026).

<https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id05S81.pxxviii>

EDITORIAL FOREWORD

Transforming Asian Agribusiness for a Sustainable Future: Economics, Entrepreneurship and Innovation

It is with great pleasure that I welcome readers to **Vol. 8 (S), October 2026**, a special issue of the *Horizon Journal of Humanities and Social Sciences Research* (Horizon JHSSR), eISSN 2682-9096. JHSSR is a peer-reviewed, open-access journal committed to delivering innovative research to both academia and practicing professionals. Independently owned and published by BP Services, we operate on a **not-for-profit** basis to benefit the global social science community. [Find out more here.](#)



The Human Face of Scholarly Excellence: JHSSR's Editorial Team with its Chief Executive Editor

This special issue, developed through the journal's academic collaboration with

Centurion University of Technology and Management (CUTM), India, brings together eighteen peer-reviewed contributions under the theme **"Transforming Asian Agribusiness for a Sustainable Future: Economics, Entrepreneurship and Innovation."**

Across approximately 200 pages, the issue presents a rich and deliberately interdisciplinary account of agribusiness as more than an economic activity. The contributions selected by the CUTM Guest Editors collectively reveal agribusiness as a social, institutional, technological, cultural and developmental system in which questions of livelihoods, gender, markets, identity, innovation, climate resilience and human capability are deeply interconnected. The eighteen contributions comprise **three Review Articles, ten Original Research Articles, three Conceptual Articles and two Case Studies**, with authors and scholarly perspectives represented across **India, Indonesia, Malaysia, Viet Nam and the United States of America.**

Particular appreciation is due to the **Guest Editors of this Special Issue**, whose untiring academic engagement, careful scrutiny and rigorous review of the submitted manuscripts have been central to the quality of this collection. From a total of 40 manuscripts received, only 18 were ultimately handpicked for publication in Horizon JHSSR, following detailed academic assessment and editorial consideration. This represents a **rejection rate of 55%**, with fewer than half of the submissions being selected for publication. The resulting collection therefore reflects not simply the breadth of contributions received, but a deliberate commitment to scholarly merit, relevance, originality and quality. The care exercised by the Guest Editors in undertaking this demanding process exemplifies the standards of academic selectivity and editorial responsibility that underpin the journal's continuing pursuit of internationally recognised scholarly excellence.

The significance of this collection lies precisely in its refusal to regard agricultural transformation as a purely technical or production-oriented undertaking. Contemporary agribusiness operates at the intersection of

economic opportunity and social responsibility. Its future depends not only upon productivity, technology and market efficiency, but also upon whether rural communities can participate meaningfully in the processes of change, whether women and young people can access emerging opportunities, whether indigenous knowledge is respected, whether institutions communicate effectively with communities, and whether technological innovation contributes to resilience rather than deepening existing inequalities.

This broader understanding provides the intellectual thread running through the present issue.

Several contributions place **women, rural communities and sustainable livelihoods** at the centre of agribusiness transformation. The systematic examination of women-led rural enterprises demonstrates that enterprise development in rural societies cannot be separated from questions of household security, livelihood diversification, access to finance, markets, technology and institutional support. Complementing this perspective, the examination of Self-Help Groups demonstrates that their significance extends well beyond savings and credit. SHGs can strengthen entrepreneurship, financial inclusion, skills, social networks, decision-making and access to markets, thereby positioning collective organisation as an important pathway towards women's economic empowerment.

Gender inclusion is also evident in the examination of sustainable fisheries in Odisha, where the *Mukhyamantri Matsya Jeevi Kalyan Yojana* is considered through the experiences of women and Self-Help Groups. Here, livelihood security, technological intervention, institutional support and the emerging Blue Economy converge. The contribution reminds us that sustainability acquires practical meaning only when environmental objectives are accompanied by opportunities for people whose livelihoods depend directly upon natural resources.

A second important strand of the issue concerns **institutions, policy communication and the organisation of markets**. The comparative study of India and Viet Nam demonstrates that sustainable agribusiness depends not merely on the formulation of sound policy, but on the institutional and communicative architecture through which policy reaches rural communities. Its analysis of policy documents brings attention to an often-neglected dimension of development: communication is not simply an administrative or public-relations function; it can become part of the infrastructure through which policy is translated into action.

The Indonesian contribution on local value-chain integration similarly moves the discussion from policy aspiration towards institutional design. By considering how smallholder farmers might be integrated more directly into the country's Free Nutritious Meal Programme, it highlights the relationship between procurement structures, rural institutions, food-system resilience and farmer empowerment. The proposed Direct Partnership model offers a useful reminder that sustainable development requires attention to the architecture of value creation, not merely to the volume of production.

Questions of **market access and collective economic agency** recur elsewhere in the issue. The analysis of Farmer Producer Organisations and their export potential consider how collective organisation, digital platforms, infrastructure, finance, certification and government support can enable small and marginal farmers to participate more effectively in domestic and international markets. The study of digital agribusiness adoption in Odisha provides complementary empirical evidence: access to digital platforms can expand sources of market information, buyer contacts and price realisation while reducing marketing costs. Yet these benefits are not automatic. Education, smartphone ownership, internet access, digital literacy, training and institutional membership remain important conditions of meaningful participation.

This tension between technological opportunity and unequal access is particularly important as **artificial intelligence and digital transformation** enter agricultural economies. The issue therefore moves beyond the familiar narrative that technology will inevitably solve rural development problems. One contribution examines Digital Performance Anxiety among young agripreneurs, drawing attention to the psychological dimensions of digitally mediated entrepreneurship. Another conceptual contribution considers AI-driven agri-FinTech ecosystems and sustainable career pathways, asking whether emerging forms of technologically enabled agricultural work will create meaningful and durable employment or reproduce new forms of precarity.

Such questions are central to the social sciences because technological transformation is ultimately a human process. Machines, platforms and algorithms do not operate in social vacuums. They interact with education, institutional capacity, financial inclusion, gender relations, labour markets, aspirations and cultural expectations. The contribution on smart agricultural innovation consequently reframes resource-efficient agricultural technology not simply as an engineering problem, but as a question involving entrepreneurship, finance, gender equity, economics and public policy.

The issue also confronts the increasingly urgent relationship between **agriculture, environment and climate risk**. The examination of climate-risk insurance in India draws attention to the vulnerability of small and marginal farmers to increasingly uncertain climatic conditions. At the same time, it cautions against technological optimism divorced from institutional realities: remote sensing, digital claims processing and advanced data systems can improve insurance delivery, but they cannot substitute for appropriate products, reliable data, affordable coverage, effective institutions and meaningful farmer participation.

The environmental dimension is developed further through contributions that place **indigenous knowledge, cultural imagination and rural livelihoods** in dialogue with sustainability. The exploration of ecological knowledge in Indian literary imagination demonstrates that environmental resilience cannot be understood solely through technological or institutional frameworks. Literature can provide another way of seeing the relationship between communities and ecosystems, reminding us that forests, rivers and agricultural landscapes are not merely economic resources but also repositories of memory, culture and lived knowledge.

The two case studies provide an especially valuable grounded dimension to these wider debates. The examination of rural and tribal micro-enterprises in Odisha illustrates how production assets alone cannot guarantee sustainable livelihoods: market access, quality, information, aggregation and buyer connectivity are equally important. Similarly, the Odisha Millet Mission in Koraput demonstrates how agricultural production can be connected with nutrition, environmental sustainability, social inclusion, institutional collaboration and the Sustainable Development Goals. Together, these cases show how broad policy ambitions acquire substance through local institutions and community participation.

The geographical breadth of the issue is equally significant. Contributions from **India, Indonesia, Malaysia, Viet Nam and the United States of America** demonstrate the increasingly international character of Horizon JHSSR and reinforce the value of comparative and cross-cultural scholarship. While the empirical settings are predominantly Asian, the questions addressed are global: how should rural economies respond to technological disruption? How can women and young people participate equitably in changing labour markets? How can agricultural communities withstand climate risk? How can digitalisation improve rather than restrict market access? And how can economic development remain compatible with social justice and environmental sustainability?

These are precisely the kinds of questions that define the intellectual mission of *Horizon JHSSR*. As a **peer-reviewed, open-access, broad-scope journal in the Humanities and Social Sciences**, we seek to provide a scholarly space in which established disciplinary boundaries can be crossed without compromising methodological or intellectual rigour. Our commitment is to research that is original, ethically conducted, transparently communicated and capable of contributing meaningfully to scholarly debate.

Every contribution published in the journal is subject to rigorous editorial assessment and **double-blind peer review**, supported by an international editorial and advisory structure. We regard publication ethics, research integrity, originality, responsible authorship and appropriate disclosure of the use of emerging technologies as fundamental scholarly obligations rather than procedural formalities. Our open-access model is intended to extend the reach of credible scholarship beyond institutional and geographical boundaries, enabling researchers, educators, practitioners and policy communities to engage with research without unnecessary barriers to access.

The international collaborations represented in this special issue further reflect our belief that scholarly publishing is strengthened when institutions, researchers and disciplinary communities work across borders. Our continuing academic partnerships, international editorial participation and support for emerging scholars are part of a wider commitment to building a research culture in which knowledge is shared, critically examined and developed collectively.

I therefore record my sincere appreciation to the **eighteen author teams**, whose scholarship gives this special issue its substance; to the **CUTM Guest Editors**, whose academic stewardship and selection of contributions helped shape this collection; to the reviewers whose critical assessments strengthened the manuscripts; and to the members of the **Editorial Board and Advisory Board** for their continued scholarly guidance. I also acknowledge the dedication of the JHSSR Editorial Office and our institutional partners, whose often unseen work makes responsible scholarly communication possible.

The present issue arrives at a moment when agribusiness is undergoing profound transformation. Digitalisation, artificial intelligence, climate uncertainty, changing consumer expectations, new forms of entrepreneurship and evolving rural demographics are simultaneously creating opportunities and exposing vulnerabilities. The challenge for scholarship is therefore not simply to describe transformation, but to understand **whose interests it serves, who participates in it, who may be excluded from it, and how it can be directed towards more equitable and sustainable outcomes**.

That is the larger conversation to which this special issue seeks to contribute.

I hope that readers will encounter within these pages not merely eighteen individual studies, but a connected body of scholarship that encourages dialogue between economics and society, technology and humanity, enterprise and livelihood, policy and community, and innovation and responsibility. It is through such conversations that interdisciplinary research acquires its greatest value.

As Horizon JHSSR continues its journey towards the highest standards of international scholarly publishing and its continuing pursuit of **SCOPUS-quality publishing**, our aspiration remains clear: to provide a credible, ethical and intellectually open platform for scholarship that crosses disciplinary and national boundaries while remaining firmly grounded in research integrity and academic excellence.

As we settle into Q2 of the 21st Century, there seem to be many factors at play, from trust in science and research integrity, to consolidation of publishers and service providers and the continual evolution of Journal models. These are playing out alongside major disruptors like artificial intelligence (AI) and vast global policy shifts. Against this backdrop, it has become harder to predict what will happen next or to hypothesise a linear direction of research!

I warmly invite researchers, scholars, practitioners and emerging academics from around the world to continue this conversation with us through future submissions, collaborations and scholarly exchanges.

The horizon of knowledge is never fixed. It expands whenever rigorous scholarship enables us to see familiar challenges from new perspectives. So, watch this space. Our first few posts will address the rise of AI in academic publishing, research security, peer review and more. We hope you will join us!

Best regards,

Chief Executive Editor

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Oct. 2026.

ISSN 2682-9096 Online

DOI: doi.org/10.37534



PUBLISHED: 2026-10-15.

CITE THIS ARTICLE

Kanwal, Nayan D.S. Foreword from the Chief Executive Editor. *Horizon J. Hum. Soc. Sci. Res.* 8 (S), 1–5 (2026).

<https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id0020.p1>

Digital Narratives, Cultural Identity and Sustainable Agribusiness: A Conceptual Comparative Literature Review of Vietnam and India

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ARTICLE INFO

Article history

RECEIVED: 16-Aug-26

REVISED: 18-Sep-26

ACCEPTED: 25-Sep-26

PUBLISHED: 15-Oct-26

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Citation: Trần Thị Vân Dung and Nayan Deep Singh Kanwal (2026). Digital Narratives, Cultural Identity and Sustainable Agribusiness: A Conceptual Comparative Literature Review of Vietnam and India. Horizon J. Hum. Soc. Sci. Res. 8 (S), 6–19. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1390.p6>



ABSTRACT

Purpose: Digital transformation is reshaping Asian agribusiness by changing how agricultural products, sustainability practices and cultural values are communicated to consumers and markets. This paper examines digital communication not merely as a marketing instrument but as a social space in which trust, cultural identity and sustainable value are constructed and negotiated. It comparatively reviews the relationship between digital communication, cultural identity and sustainable agribusiness in Vietnam and India. **Methodology:** The study adopts a conceptual comparative literature review and thematic analysis of scholarly and institutional literature concerning digital agriculture, agribusiness communication, cultural identity, sustainability, entrepreneurship and rural development in Vietnam and India. The analysis is organised around cultural resources, digital narrative construction, socio-economic value creation and sustainable development outcomes. **Findings:** The review identifies a broad similarity between the two countries: both possess rich agricultural and cultural heritage and increasingly use digital platforms and narrative strategies to communicate sustainable values. The literature nevertheless suggests differences in dominant narrative tendencies. Vietnamese examples more frequently emphasise local ecological characteristics, regional heritage, place-based identity and community relationships, whereas India's highly diverse linguistic, cultural and religious environment encourages communication across multiple cultural registers and scales. These differences are not treated as fixed national characteristics. Rather, they illustrate how cultural and institutional contexts shape digital agribusiness communication. The analysis further indicates that culturally grounded digital narratives can connect product identity with agribusiness value creation, entrepreneurship, market access and consumer trust, with possible implications for rural development and community participation. **Implications:** The paper develops a conceptual framework in which digital communication functions as a socio-economic mechanism linking cultural identity with sustainable agribusiness outcomes. It argues that cultural narratives create development value only when they remain credible, participatory and connected to substantive sustainability practices. The framework offers a practical reference for enterprises developing

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cross-cultural communication strategies while highlighting the risks of cultural commodification and unequal distribution of value.

Keywords: Agribusiness; Cultural Identity; Digital Communication; Entrepreneurship; India; Sustainable Development; Vietnam

1. INTRODUCTION

Agriculture across Asia is being reshaped by digital technologies that affect production, information, communication and commercialisation. Mobile applications, social media, digital marketplaces, online payments and traceability systems increasingly connect producers with information, enterprises with consumers, and agricultural products with domestic and international markets. Digitalisation is therefore part of wider value-chain restructuring rather than a narrowly technical intervention (Klerkx et al., 2019; Wolfert et al., 2017).

The transformation also has social and cultural dimensions. Agricultural products are embedded in traditions, landscapes, local knowledge, community relationships and historical experience, which can influence perceptions of quality, authenticity and sustainability. Communication about sustainable agribusiness therefore involves the construction and negotiation of meaning, not merely the transmission of technical information.

This is especially relevant where agriculture remains connected with rural communities and cultural heritage. Digital platforms can make local identities visible by showing product origins, producers, practices and links between traditional knowledge and contemporary sustainability objectives. In Vietnam, OCOP-related digitalisation and national policy explicitly connect agricultural products with digital sales, traceability and e-commerce (Dao & Hoang, 2025; Government of Vietnam, 2020).

Visibility, however, does not guarantee sustainable development. Heritage may be simplified for commercial purposes, communities may be represented without meaningful participation, and sustainability claims may become promotional devices detached from practice. Cultural identity in agribusiness consequently raises questions of authenticity, trust, ownership, representation and distribution of economic benefits.

Vietnam and India offer useful comparative contexts because both combine agricultural heritage with expanding digital economies, but their institutional and cultural settings differ. The Vietnamese evidence considered here gives particular attention to place,

ecological conditions and regional products, while the Indian evidence must account for extensive linguistic, regional, cultural and social plurality. Recent Indian digital-agriculture initiatives likewise emphasise the scale and diversity of the national agricultural system (Ministry of Agriculture and Farmers Welfare, 2026; NITI Aayog, 2025).

The comparison is not intended to construct fixed national identities or imply that all enterprises in either country communicate similarly. It identifies tendencies reported in the selected literature and examines how social, cultural and institutional contexts shape digital agricultural narratives.

The central argument is that digital communication can function as a socio-economic mechanism through which cultural identity is converted into credible market value. This conversion is conditional on authentic representation, meaningful community participation, credible sustainability practices and equitable distribution of resulting value.

The paper therefore places digital communication within the Humanities and Social Sciences dimensions of agribusiness transformation, connecting identity and meaning with entrepreneurship, market access, consumer trust, rural development and community participation.

The paper addresses three questions:

1. How are cultural identities and meanings incorporated into digital communication concerning sustainable agribusiness?
2. What comparative tendencies can be identified in the literature concerning Vietnam and India?
3. How can culturally grounded digital communication contribute to agribusiness value creation, entrepreneurship, market access, consumer trust, rural development, community participation and sustainable development?

The paper contributes by integrating literature often separated across digital agriculture, cultural identity, entrepreneurship and sustainability. Its comparative framework treats digital cultural communication as a mechanism linking cultural resources with socio-economic value creation and development outcomes.

2. BACKGROUND AND LITERATURE CONTEXT

2.1 Digital transformation of agriculture and agribusiness

Digitalisation is an important component of contemporary agricultural innovation. Digital technologies can improve information access, support production decisions, facilitate transactions and increase product visibility (Fabregas et al., 2019; Wolfert et al., 2017). Their effects extend across agricultural organisations and value chains.

Klerkx et al. (2019) emphasise that digital agriculture is also a social-scientific issue because technological change interacts with institutions, skills, organisations and innovation systems. Responsible digital transformation also requires attention to diversity, inclusion and the consequences of technological change (Klerkx & Rose, 2020). Access to digital opportunity depends on infrastructure, literacy, finance and organisational capability.

For agribusinesses, digital platforms may reduce geographical and informational barriers, support direct consumer contact and enable differentiated product identities. Benefits are nevertheless uneven where producers lack connectivity, skills or resources. Indian policy discussions similarly recognise the need to address capability and social-capital gaps alongside technological infrastructure (ICTworks, 2026; Ministry of Agriculture and Farmers Welfare, 2026).

Agribusiness transformation should therefore be understood as socio-economic change. Digital technologies reorganise relationships among producers, intermediaries, enterprises and consumers, while communication helps shape those relationships.

2.2 Digital communication as a social process

Digital platforms provide opportunities for direct and interactive communication among enterprises, consumers and other stakeholders. Websites, social media, video, online marketplaces and digital communities allow agricultural businesses to present products, production processes and social or environmental attributes.

Communication is not one-way: consumers can comment, review and share content; producers can respond; and communities can participate in representing their practices. Agricultural identity can consequently be constructed and reconstructed through interaction.

This matters for sustainable agribusiness because many production characteristics are difficult for consumers to observe directly. Digital content can make provenance, production methods, certification and community involvement more visible.

Photographs, videos, producer profiles, certification information and traceability systems can reduce information asymmetry by connecting claims with evidence. Vietnam's digital-transformation policy explicitly identifies traceability and e-commerce as mechanisms for strengthening agricultural value (Government of Vietnam, 2020).

Greater visibility does not necessarily produce trust. Digital environments also enable selective or misleading representation. Sustainability communication must therefore be judged by credibility and consistency with practice, not by reach alone.

2.3 Culture, cultural identity and symbolism

A central distinction is needed among culture, cultural identity and symbolism.

Culture refers broadly to shared meanings, practices, knowledge, values and forms of social expression. Cultural identity concerns how individuals and communities understand and represent relationships to these meanings and practices. Symbolism refers to particular signs, images, objects, rituals or references through which cultural meanings may be expressed.

These concepts are related but not interchangeable. A traditional agricultural practice may form part of cultural heritage; a community's understanding of it may contribute to cultural identity; and an image, food, landscape or ritual used in advertising may function as a cultural symbol.

The use of a symbol does not reproduce the culture from which it originated. Enterprises may select culturally recognisable imagery for commercial purposes, but the representation can become detached from the social practices and values that give it meaning.

Cultural identity is therefore better treated as a social resource than as a collection of decorative marketing symbols. Responsible communication can connect products, places, communities and consumers; symbolic appropriation can generate attention without equivalent community benefit.

Cultural identity is therefore best treated as a social resource rather than a collection of decorative marketing symbols. Where agricultural enterprises communicate cultural identity responsibly, they can create connections between products, places, communities and consumers. Where they simply appropriate symbols, the communication may generate commercial attention without contributing meaningfully to community development.

2.4 Cultural identity, authenticity and trust

Authenticity matters when agricultural products are associated with tradition, geographical origin or cultural

heritage. Consumers may value products perceived as genuinely connected to particular places or production practices (Beverland, 2005; Autio et al., 2013).

Authenticity can arise from geographical origin, recognised production methods, community association or a transparent production history. Digital platforms can strengthen these connections by showing production environments, identifying producers and explaining product histories.

Traditional imagery alone does not establish authenticity. A digital advertisement may display a landscape or heritage motif without demonstrating that the product is actually produced through the represented practices. Credibility depends on the relationship between representation and practice.

Trust is therefore central to the framework. Cultural narratives may attract attention, but durable consumer trust depends on consistency between what an enterprise communicates and what it does.

2.5 Sustainability communication

Sustainable agribusiness has environmental, economic and social dimensions: responsible resource use, viable enterprises and livelihoods, and equity, participation and community welfare.

Digital communication can connect these dimensions by showing sustainable practices and explaining their implications for producers and communities. Digital narratives can make abstract sustainability claims more concrete by linking them to people, places and practices.

The same process creates risks of overstatement. Cultural imagery used to imply environmental responsibility without evidence may resemble greenwashing, while claims of community benefit without meaningful participation may misrepresent social sustainability.

The credibility of sustainable agribusiness communication therefore rests on alignment among narrative, evidence and practice.

The credibility of sustainable agribusiness communication therefore depends on the relationship between narrative, evidence and practice.

2.6 Entrepreneurship and digital agribusiness

Entrepreneurship is central to converting cultural and ecological resources into economic value. Agricultural entrepreneurship extends beyond production to processing, branding, digital commerce, tourism, logistics and direct consumer engagement.

Digital platforms can lower some barriers to entrepreneurial entry by allowing small enterprises to establish a presence, communicate directly with

consumers and test market responses without the infrastructure of large-scale advertising.

Cultural identity can provide distinctive entrepreneurial resources when products are associated with particular places, traditions, ecological characteristics or community practices. The opportunity is realised when these resources are integrated into a viable enterprise model rather than simply appropriated.

The entrepreneurial process can be viewed as identifying a cultural or ecological resource, translating it into a credible product proposition, and connecting that proposition with a market through digital communication.

Value may arise through differentiation, premium or niche positioning, processing, tourism linkages, direct-to-consumer sales and local value addition. Digital communication is therefore one component of entrepreneurial value creation rather than a substitute for production and organisational capability.

2.7 Rural development and community participation

Digital communication does not automatically generate rural development. Rural development also requires livelihoods, capabilities, infrastructure, services, enterprise opportunities and social inclusion.

When differentiated products obtain better market access, digital communication may help enterprises capture more value from local resources. The developmental effect depends on ownership, participation and the distribution of that value.

If local people contribute production or cultural knowledge but have little influence over representation or commercial returns, digitalisation may reinforce rather than reduce inequality.

Community participation is therefore both an ethical and developmental principle. Communities should have meaningful opportunities to shape representation and, where appropriate, participate in the economic activities and benefits arising from their cultural resources.

3. METHODOLOGY

3.1 Research design

The paper adopts a conceptual comparative literature review supported by thematic analysis. This design synthesises existing knowledge and develops a conceptual explanation rather than testing statistical hypotheses or reporting primary fieldwork.

The review integrates literature on digital agriculture, agribusiness communication, entrepreneurship, cultural identity, authenticity, sustainability and rural development, with particular attention to sources

illuminating cultural and socio-economic dimensions of agricultural value creation.

3.2 Review scope

The review was structured around eight conceptual search domains: digital agriculture and digital agribusiness; agricultural digitalisation and innovation; digital communication and storytelling; cultural identity and authenticity; sustainable agriculture and food systems; agricultural entrepreneurship; rural development and community participation; and Vietnam or India in relation to these themes.

- digital agriculture and digital agribusiness;
- agricultural digitalisation and innovation;
- digital communication and storytelling;
- cultural identity and authenticity;
- sustainable agriculture and food systems;
- agricultural entrepreneurship;
- rural development and community participation;
- Vietnam and India in relation to these themes.

The literature search was systematically conducted using Scopus and Web of Science and covered publications from 2015 to 2026, capturing the principal period of agricultural digitalisation examined in this review. Searches used the Boolean combination [“digital agribusiness” OR “digital agriculture”] AND [“cultural identity” OR “narrative”] AND [“Vietnam” OR “India”]. The search produced an initial pool of 412 records, which was refined through the stated inclusion criteria to 58 core peer-reviewed studies and institutional reports for thematic analysis. The search and selection protocol is documented in Appendix A, which also identifies key institutional and policy sources used to substantiate comparative claims in Section 4.

3.3 Inclusion and exclusion principles

Priority was given to peer-reviewed research and authoritative institutional literature addressing digital transformation, agricultural-market communication, cultural identity or heritage, entrepreneurship and value creation, sustainability, or Vietnam and India as substantive contexts.

1. digital transformation in agriculture or food systems;
2. communication and consumer relationships in agricultural markets;
3. cultural identity, heritage or authenticity in food and agricultural contexts;
4. entrepreneurship and value creation associated with agricultural products;

5. social, economic or environmental dimensions of sustainability;
6. Vietnam or India as substantive contexts.

Purely technical studies without meaningful implications for agricultural organisations, markets, communities or social outcomes were given lower analytical priority. Generic digital-marketing discussions were likewise excluded unless they helped explain communication’s socio-economic role in agribusiness.

3.4 Comparative analytical procedure

The selected literature was analysed thematically across four dimensions: (1) cultural resources, including heritage, ecological characteristics, local knowledge and place identity; (2) digital narrative construction, including storytelling, social media, platforms, e-commerce and traceability; (3) socio-economic value creation, including differentiation, entrepreneurship, market access and consumer trust; and (4) development outcomes, including rural livelihoods, community participation, social inclusion and sustainable development.

Cultural resources: heritage, traditions, ecological characteristics, local knowledge, community practices and place identity.

Digital narrative construction: storytelling, social media, digital platforms, multimedia communication, e-commerce and forms of traceability.

Socio-economic value creation: differentiation, value addition, entrepreneurship, market access and consumer trust.

Development outcomes: rural livelihoods, community participation, social inclusion and sustainable development.

Vietnam and India were compared across these dimensions. The comparison identifies tendencies reported in the literature rather than single national communication cultures, while considering differences in cultural plurality, geography, agricultural organisation and market environments.

3.5 Conceptual synthesis

The final step synthesised the comparative themes into a conceptual framework. Cultural identity and digital communication are treated as interacting inputs whose interaction produces culturally grounded digital narratives.

These narratives can influence agribusiness value creation, entrepreneurship, market access and consumer trust, which can contribute to rural development and community participation and ultimately to sustainable agribusiness and sustainable development.

Authenticity, community participation and equitable value distribution are treated as cross-cutting conditions. Without them, cultural communication may generate commercial value without corresponding developmental benefits.

3.6 Limitations of the review

As a conceptual comparative review, the study does not claim statistical representativeness. The evidence base is heterogeneous across countries and sub-sectors, and digital communication changes rapidly.

The framework is therefore a conceptual proposition requiring empirical testing. Future studies should use digital-content analysis, consumer research, entrepreneur interviews and community-level case studies.

4. FINDINGS AND DISCUSSION

4.1 Cultural resources as foundations of digital agribusiness narratives

The comparative literature indicates that cultural resources can become components of digital agricultural communication. These include food traditions, agricultural knowledge, regional landscapes, ecological characteristics, community practices and product histories.

Their commercial significance lies partly in differentiation. Where products compete on standardised attributes, credible cultural and geographical associations can provide an additional basis for identity and value, consistent with the idea that agricultural products can be socially and ecologically embedded in their contexts (Morris & Kirwan, 2011).

Digital communication expands the potential audience for such narratives, but cultural resources do not become economic assets simply by being placed online. Value depends on interpretation, credibility, consumer response and enterprise capacity.

However, cultural resources do not become economic assets simply because they are placed online. Their conversion into value depends on interpretation, credibility, consumer response and the capacity of enterprises to organise production and distribution.

4.2 Vietnam: place-based and ecological tendencies

Selected Vietnamese literature and policy sources provide evidence that place, ecological conditions,

regional products and community relationships can contribute to agricultural product identity. The OCOP context is particularly relevant because digital-platform use is associated with continued sales of local agricultural products (Dao & Hoang, 2025), while national digital-transformation policy prioritises traceability and e-commerce (Government of Vietnam, 2020).

These sources should not be read as evidence that Vietnamese agribusiness is uniformly local or traditional. Vietnam also contains technology-oriented, nationally scaled and internationally oriented enterprises. The analytical point is that place-based cultural resources can provide commercially useful material for selected digital narratives.

For entrepreneurs, products can be differentiated through narratives connecting characteristics with place, community and production practices. This can support value addition when the narrative corresponds to a viable enterprise model.

Such positioning may enable competition through identity and perceived authenticity rather than commodity price alone. Its rural-development implications depend on whether value-added activity remains connected to local producers and how returns are distributed.

4.3 India: plurality and multiple cultural registers

The Indian case requires similar caution because of extensive linguistic, regional, cultural and social plurality. National digital-agriculture initiatives operate at a scale that requires adaptable digital systems and broad institutional coordination (Ministry of Agriculture and Farmers Welfare, 2026).

Selected Indian policy and development sources indicate that digital agriculture increasingly combines technology, governance and market-facing functions. NITI Aayog's frontier-technology agenda connects AI and related technologies with agricultural transformation, while policy commentary highlights social-capital and inclusion gaps (NITI Aayog, 2025; ICTworks, 2026).

Traditional, philosophical or religious symbolism may occur in particular communication contexts, but it should not be treated as evidence that Indian agribusiness is inherently traditional or spiritual. It is one possible communicative resource among many.

The more useful observation concerns plurality. Enterprises addressing diverse markets may need to adapt messages to different audiences while retaining a coherent product and sustainability proposition. Digital media can facilitate such experimentation and segmentation (NEXT IAS, 2026).

This environment also increases the risk of superficial representation because cultural symbols can

carry different meanings across groups. Responsible communication therefore requires cultural knowledge, contextual sensitivity and evidence rather than recognisable imagery alone.

4.4 Comparative synthesis without national stereotyping

The Vietnam-India comparison is best expressed as a comparison of narrative and institutional tendencies rather than national characteristics.

In the selected Vietnamese literature, place, ecological identity, regional heritage and community relationships are prominent resources. In selected Indian literature and policy contexts, plurality and multiple scales of identity allow regional, linguistic, civilisational, technological and commercial narratives to coexist (Dao & Hoang, 2025; Ministry of Agriculture and Farmers Welfare, 2026; NITI Aayog, 2025).

The analytical value lies not in ranking the countries but in showing that digital cultural communication is shaped by social and institutional context.

For cross-cultural agribusiness, communication should begin with the relevant community and market rather than apply a universal template.

Translation of words alone may be insufficient when cultural meanings differ. The substantive sustainability proposition can remain stable while the cultural explanation is adapted to the audience.

4.5 From cultural narrative to agribusiness value creation

Agribusiness value creation is the first major socio-economic pathway in the framework.

Cultural identity can differentiate agricultural products, especially where physical characteristics are difficult to distinguish. A credible story of origin, production and community can provide consumers with additional reasons to choose one product.

Value creation can also occur through processing, packaging, branding and market positioning around cultural or geographical characteristics. Digital communication then becomes part of a broader value-chain strategy.

The relationship can be represented as:

Cultural resource → credible narrative → differentiated identity → consumer recognition → potential value creation.

The chain is conditional: recognition does not necessarily become trust or repeat purchase unless the narrative is credible and supported by practice.

4.6 Entrepreneurship as the connecting mechanism

Entrepreneurship explains how cultural resources can move from meaning to economic opportunity.

Entrepreneurs may identify local products, traditional processing methods, ecological characteristics or community knowledge as resources for new ventures and innovation. Digital communication can help develop online identities, test demand and reach buyers.

This supports product, communication, business-model, organisational and market innovation, including value-added goods, storytelling, direct-to-consumer sales, community-based enterprise and niche or international markets.

This can support several forms of innovation:

- Product innovation through value-added agricultural goods;
- Communication innovation through storytelling and digital content;
- Business-model innovation through direct-to-consumer sales;
- Organisational innovation through community-based enterprise; and
- Market innovation through niche and international segments.

The conceptual importance of entrepreneurship is that it provides the bridge between cultural identity and economic activity. Yet digital opportunity depends on capital, skills, infrastructure and market access, so rural enterprises may remain disadvantaged without enabling capabilities.

However, entrepreneurship should not be romanticised. Digital entrepreneurial opportunities depend upon access to capital, skills, infrastructure and markets. Small rural enterprises may remain disadvantaged if digitalisation increases competitive pressures without providing the capabilities needed to respond.

4.7 Market access

Digital communication can reduce geographical barriers between agricultural enterprises and consumers.

Online platforms can extend local enterprises beyond immediate production areas and introduce unfamiliar products to international audiences. In Vietnam, OCOP-related digital sales illustrate the relevance of continued platform engagement for local agricultural products (Dao & Hoang, 2025). In India, large-scale digital-agriculture programmes indicate expanding infrastructure for agricultural information and market coordination (Ministry of Agriculture and Farmers Welfare, 2026).

Cultural narratives can be useful where consumers have limited prior knowledge because they communicate not only what a product is but why it is distinctive.

Market access should not be equated with market success. Digital visibility cannot guarantee logistics, quality, affordability or reliable supply; communication must be integrated with production and distribution capabilities.

4.8 Consumer trust and authenticity

Consumer trust is a critical mediating process.

Cultural narratives may create an initial perception of authenticity, but trust develops when representations are consistent with observable or verifiable practice. Transparency, traceability and credible evidence are therefore important components of digital communication.

Enterprises can provide information about producers, production locations, processing methods, certification and environmental practices. These signals help consumers assess whether cultural and sustainability claims have substantive foundations.

Trust matters because consumers often cannot directly observe production conditions. Credible communication can reduce uncertainty, whereas unsupported emotional narratives can weaken credibility.

4.9 Cultural commodification

Cultural commodification is central because cultural practices, meanings and identities can become resources for market exchange.

In agribusiness, commodification may involve traditional foods, knowledge, landscapes, rituals or community identities being translated into commercial narratives. It can generate income and recognition, but problems arise when commercial value becomes detached from community interests. This reflects broader concerns about how cultural meanings become incorporated into market-oriented branding (Holt, 2002).

Commodification is not necessarily negative. Economic recognition of cultural resources can create income, encourage preservation and provide communities with new opportunities.

The concern arises when commercial value becomes disconnected from community interests.

These risks explain why authenticity, participation and equitable value distribution are necessary conditions rather than optional ethical additions.

4.10 Community participation

Community participation changes the relationship between cultural communication and sustainable development.

When communities help define how identity is represented, digital communication can provide recognition and voice. Community members may contribute stories, knowledge, practices and interpretations of heritage.

Participation also affects economic outcomes. Ownership or meaningful involvement in enterprises based on cultural resources can help retain a greater share of value locally.

This provides a direct connection between digital communication and rural development.

The key question is not whether a community appears in a digital narrative, but whether it has agency in constructing the narrative and shares in resulting value.

4.11 Rural development

Rural development is an outcome of interacting processes rather than a direct consequence of digital communication.

Culturally grounded communication may support rural development when it strengthens value creation and entrepreneurship, improves market access and allows a greater share of value to remain within rural economies.

Potential benefits include income, employment, skills, enterprise formation and stronger local value chains, as well as recognition of local knowledge and cultural continuity.

There may also be less directly measurable cultural benefits. Increased recognition of local knowledge and agricultural traditions can contribute to cultural continuity.

Risks include demand exceeding local capacity, pressure to alter traditional practices, exclusion of local consumers and capture of gains by external firms.

Sustainable rural development therefore requires institutional mechanisms linking market opportunity with inclusive participation and value sharing.

4.12 Sustainable development

Sustainability is the final stage of the framework, combining economic viability, social inclusion and environmental responsibility.

Digital communication can make sustainable practices visible and connect them with consumer demand, but communication alone cannot make an agribusiness sustainable.

However, communication alone cannot make an agribusiness sustainable.

Storytelling cannot substitute for environmentally responsible production, and featuring rural communities

does not establish social sustainability. Communication is an enabling mechanism, not a substitute for substantive practice.

The framework therefore treats communication as an enabling socio-economic mechanism, not as a substitute for substantive sustainability.

4.13 The proposed conceptual framework

The comparative evidence supports the framework presented in Figure 1. Cultural identity and digital communication are interacting starting domains: identity provides heritage, place-based meaning, knowledge and values, while digital communication provides channels through which these meanings are selected, interpreted and shared.

Cultural identity provides heritage, traditions, place-based meaning, community knowledge and values. Digital communication provides the channels through which these meanings can be selected, interpreted and communicated.

Their interaction produces culturally grounded digital narratives.

These narratives connect with four immediate socio-economic processes:

1. **Agribusiness value creation**, through differentiation and value addition;

2. **Entrepreneurship**, through new ventures, innovation and rural enterprise;
3. **Market access**, through expanded consumer reach and domestic or international market engagement;
4. **Consumer trust**, through transparency, authenticity and credible sustainability claims.

Together, these processes can contribute to rural development and community participation, including income, livelihoods, capability formation, collective action, local voice and recognition of local knowledge.

Three conditions cut across the framework: authenticity, meaningful community participation and equitable value distribution. When these are weak, cultural communication may create commercial value without corresponding social or sustainability benefits.

The framework therefore proposes an interconnected pathway rather than deterministic causality: digital communication and cultural identity shape narratives; narratives can support value creation, entrepreneurship, market access and trust; these processes can contribute to rural development and participation; and the resulting conditions can support sustainable development.

Figure 1 illustrates that cultural identity and digital communication interact to generate culturally grounded digital narratives. These narratives connect to

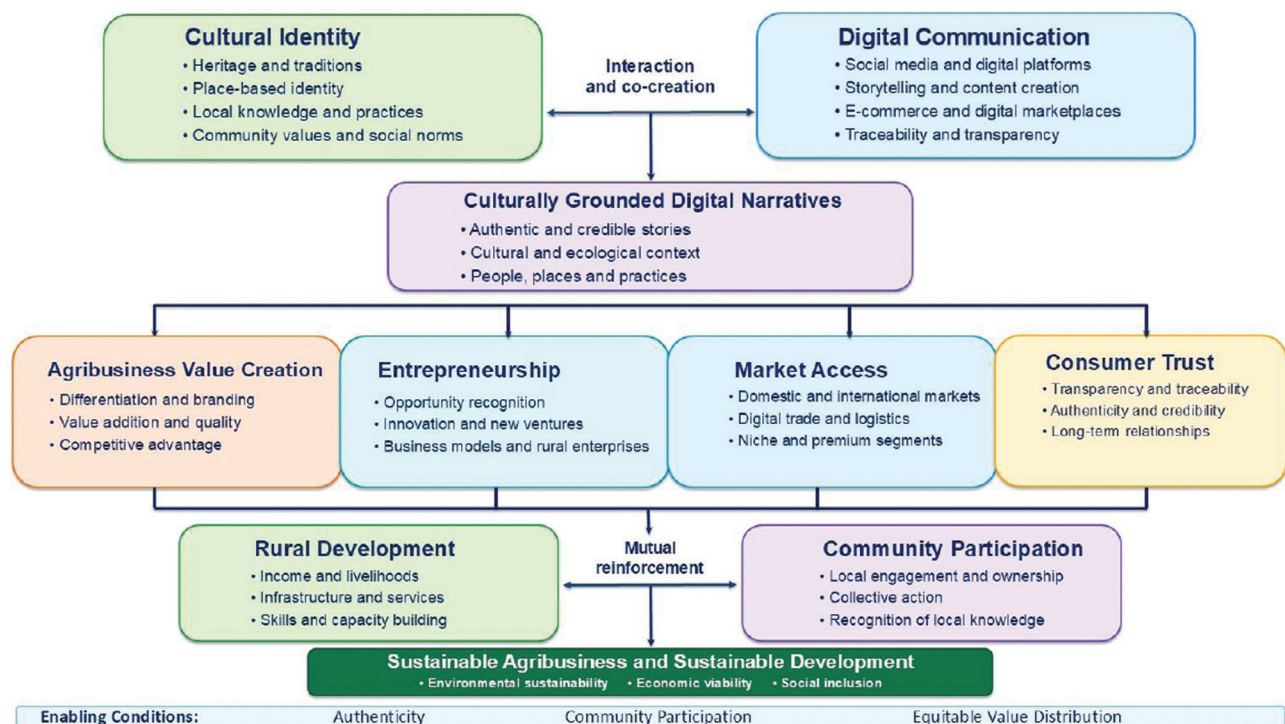


Figure 1. Conceptual Framework for Culturally Grounded Digital Communication in Sustainable Agribusiness

Note. Author-developed framework based on the comparative synthesis of the literature. Arrows represent proposed relationships rather than tested causal effects

agribusiness value creation, entrepreneurship, market access and consumer trust, which can influence rural development and community participation and ultimately contribute to sustainable agribusiness and sustainable development. Authenticity, community participation and equitable value distribution condition these relationships.

4.14 Implications for agribusiness enterprises

The framework offers practical implications for enterprises. First, identify cultural resources that genuinely distinguish the product rather than importing cultural symbolism for promotion. Second, link cultural and sustainability claims to evidence. Third, adapt communication to the intended audience without altering the substantive sustainability proposition.

Fourth, consider who benefits from cultural value creation. Where communities provide knowledge or identity, participation and benefit-sharing can strengthen ethical legitimacy and long-term sustainability.

Fifth, integrate digital communication with entrepreneurial and operational strategy because narrative appeal cannot compensate for weak production quality, supply reliability or distribution.

Third, communication should be adapted to the intended audience. The comparison of Vietnam and India illustrates why a single narrative cannot necessarily be transferred unchanged across cultural environments.

4.15 Implications for policy and development institutions

The findings also have policy implications. Digital-agriculture programmes should complement connectivity and technical capability with communication, entrepreneurship and cultural-representation skills.

Training can include digital storytelling, branding, market research, consumer engagement and responsible cultural representation. Producer organisations and cooperatives can be supported in developing collective digital identities and market channels.

Policies supporting geographical indications, cultural heritage, sustainable certification and community-based enterprises can strengthen credibility. Development institutions should also monitor value distribution so that increased product value does not accrue mainly to external actors.

4.16 Implications for cross-cultural market engagement

Cross-cultural communication should not rely on literal translation alone. Cultural meanings are embedded in social contexts and may be interpreted differently across markets.

Enterprises should distinguish the core sustainability proposition from the cultural narrative used to communicate it. The substantive practice should remain consistent while its explanation is adapted to context.

The comparison suggests a principle of culturally informed consistency: stable substantive commitments combined with context-sensitive communication. This avoids both universalised messaging and excessive adaptation for short-term commercial appeal.

5. CONCLUSIONS AND FUTURE DIRECTIONS

This conceptual comparative literature review examined digital communication, cultural identity and sustainable agribusiness through selected literature concerning Vietnam and India. The comparison identifies a common foundation of agricultural and cultural resources alongside different contextual tendencies in digital communication.

In the selected Vietnamese literature, place, ecological identity, regional heritage and community relationships are prominent resources. In selected Indian literature and policy contexts, extensive plurality allows regional, linguistic, civilisational, technological and commercial narratives to coexist. These are tendencies in the reviewed evidence, not fixed national characteristics.

The conceptual contribution lies in connecting digital cultural communication with a broader socio-economic pathway: agribusiness value creation, entrepreneurship, market access and consumer trust can, under appropriate conditions, contribute to rural development, community participation and sustainable development.

Culture does not become sustainable value merely because it is represented online. Cultural symbolism is not equivalent to cultural identity, digital visibility is not equivalent to market success, and sustainability narratives do not constitute sustainability unless supported by substantive practice.

Cultural commodification remains central. Commercial use of cultural identity can generate income and recognition, but can also simplify meaning, detach symbols from communities and concentrate value outside the communities whose knowledge and identity generate it.

Authenticity, community participation and equitable value distribution should therefore be treated as conditions for sustainable cultural communication.

Digital communication can function as a socio-economic mechanism through which cultural identity is converted into credible market value, but its contribution to sustainable development depends on authenticity, community participation and equitable distribution of resulting value.

This proposition extends digital-agriculture discussion beyond technology adoption by placing communication within the social and economic transformation of agribusiness. It also positions cultural identity as a potentially productive resource while recognising the responsibilities involved in its commercialisation.

For entrepreneurs, the framework highlights differentiation, value addition and market development; for rural communities, it highlights agency and benefit-sharing; for consumers, credible information and authenticity; and for policymakers, digital capability, cultural knowledge, entrepreneurship, market access and inclusive value distribution.

Future research should empirically test the framework through comparative digital-content analysis, consumer studies, rural-entrepreneur interviews and community-level research. Such work could examine whether culturally grounded narratives influence authenticity perceptions, sustainability assessments, purchase intentions, enterprise formation and actual distribution of value.

Research should also examine digital inequality because unequal access to technology, skills and markets may allow better-resourced enterprises to benefit disproportionately.

Comparative work in Indonesia, Malaysia, Thailand, the Philippines and other Asian economies could further test whether the framework travels across different cultural and institutional contexts.

Transforming Asian agribusiness for a sustainable future requires more than technological modernisation. It requires viable enterprises, inclusive rural development, credible environmental practices and meaningful producer-consumer relationships. Digital communication can support these relationships when it makes the cultural, social and environmental dimensions of agricultural value visible and credible.

The challenge is therefore not simply to communicate sustainability more effectively, but to create communication systems in which cultural identity, entrepreneurial opportunity, market value, community participation and sustainable practice reinforce rather than undermine one another.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used generative AI and AI-assisted technologies in a limited editorial capacity, primarily for language refinement, grammar correction, and clarity. These technologies were not used to develop the research questions, theoretical framework, research propositions, substantive arguments, interpretation, or conclusions. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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Appendix A

Institutional and Policy Frameworks Supporting Digital Agribusiness Narratives

Table A1 provides a synthesis of institutional and policy frameworks that substantiate the comparative socio-economic and cultural contexts discussed in Section 4. The table is complemented by a record of the literature-search and selection protocol used for the review.

Table A1. Summary of Regional Institutional Contexts.

Country	Institutional framework / programme	Relevance to cultural identity and digital agribusiness	Source
Vietnam	One Commune One Product (OCOP) Programme	Emphasises place-based identity, local ecological characteristics and regional heritage; digital-platform activity can support the market visibility of local agricultural products.	Dao & Hoang (2025)
Vietnam	National Digital Transformation Programme to 2025, oriented to 2030 (Decision 749/QĐ-TTg)	Prioritises agricultural digitalisation, including smart farming, traceability and e-commerce, with implications for the value of localised agricultural products.	Government of Vietnam (2020)
India	Digital Agriculture Mission (AgriStack) and Farmer Registry	Develops a national digital-agriculture ecosystem at large scale and requires adaptable systems capable of operating across India's linguistic, cultural and regional diversity.	Ministry of Agriculture and Farmers Welfare (2026); NEXT IAS (2026)
India	Frontier Technology-Led Agricultural Transformation	Connects frontier technologies such as AI and IoT with agricultural transformation while highlighting the need to address social-capital and inclusion gaps.	NITI Aayog (2025); ICTworks (2026)

Note. The institutional sources substantiate contextual and policy claims; they are not treated as empirical proof of a single national communication pattern.

Table A2. Literature Search and Selection Protocol.

Protocol element	Specification
Databases	Scopus and Web of Science
Publication period	2015–2026
Boolean search phrase	["digital agribusiness" OR "digital agriculture"] AND ["cultural identity" OR "narrative"] AND ["Vietnam" OR "India"]
Initial records	412
Final analytical corpus	58 core peer-reviewed studies and institutional reports
Selection basis	Relevance to digital agriculture/agribusiness, communication, cultural identity or heritage, entrepreneurship/value creation, sustainability, and Vietnam or India as substantive contexts
Analytical method	Thematic synthesis across cultural resources; digital narrative construction; socio-economic value creation; and development outcomes

Note. The reported record counts and search parameters are author-provided elements of the review protocol. The review is presented as a conceptual comparative literature review, not as a systematic review with statistical meta-analysis.

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Women-Led Rural Enterprises and Sustainable Livelihood Development: A Systematic Review of Enablers, Constraints and Transformative Pathways

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 21-Sep-26

ACCEPTED: 29-Sep-26

PUBLISHED: 15-Oct-26

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Citation: Nibedita Mishra, Swapnamay Ghosh, Sai Kumar Periginji and Harshitha Chikene (2026). Women-Led Rural Enterprises and Sustainable Livelihood Development: A Systematic Review of Enablers, Constraints and Transformative Pathways. Horizon J. Hum. Soc. Sci. Res. 8 (S), 20–30. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1391.p20>



ABSTRACT

The establishment of women-headed rural enterprises is seen as an option for livelihood diversification, poverty alleviation, empowerment and local economic development. In this systematic review, recent multidisciplinary literature is critically analyzed to uncover the asset bases, institutions, and market structures that facilitate the conversion of enterprise participation into sustainable livelihood outcomes. It is established that credit and training are necessary but not sufficient. Enterprise success will depend on women's agency, productive assets, capabilities, inclusion in technology and finance, collective institutions, infrastructure, remunerative markets and public support. Collective organizations can help women gain access to finance, information, self-confidence, negotiation skills and institutions, but limiting social norms, care work, weak service delivery, and the small size of finance and value chains will trap women in low-income activities. Sustainability requires the continuation of the enterprise, diversified income, resilience, well-being, benefit ownership, and environmental responsibility. This review provides a ladder of sustainability consisting of mobilisation and opportunity recognition, capability building, market access, and business growth, culminating in resilience.

Keywords: Agripreneurship, Microfinance, Rural enterprises, Self-help groups, Social capital, Sustainable entrepreneurship, Sustainable livelihoods, Women empowerment.

1. Introduction

The rural economy has been reconfigured by land fragmentation, uncertain climate conditions, mobility and changes in the food systems. Women-owned farm and non-farm enterprises have the potential to diversify income and generate value locally, but entrepreneurship is neither empowering nor sustainable by itself. The

key research question has changed from whether rural women can become entrepreneurs to how soon their business operations become sustainable and empowering (Aggarwal & Johal, 2021; Franzke et al., 2022; Barrachina Fernández et al., 2021). In India, self-help groups (SHGs) constitute a significant institutional base for savings, credit, leadership, and livelihood promotion (Yadav et

al., 2024), while sustainable livelihood analysis highlights aspects of assets, vulnerability, institutions, and adaptive capacity. Green transformation includes environmental efficiency and climate resilience into the traditional business metrics (Gawel et al., 2024; Raman et al., 2022). The following review will synthesize fragmented findings on empowerment, microfinance, capabilities, markets, social capital, and the sustainability of women-led enterprises.

2. Review Approach and Analytical Framework

A systematic literature review was conducted on peer-reviewed articles on women-led rural enterprises, entrepreneurship, SHGs, microfinance, social capital, digital inclusion, markets, livelihood resilience, and sustainability. The evidence base is multidisciplinary and covers research on entrepreneurship, development, agricultural extension, gender and sustainability. The literature was contrasted based on context, mechanism, enterprise outcome, livelihood implication and constraint identified in the study. The analytical framework considers five levels that are interrelated: women's agency and assets; collective and financial institutions; enterprise capabilities; markets and financial institutions; and sustainable livelihood development.

enterprise capabilities; the market and institutional ecosystem; and livelihood outcomes across multiple dimensions. The separation of enterprise participation from business quality is necessary due to the risk of low-profit, insecure self-employment. The sustainability of enterprises is estimated based on their sustainability and profitability, household and women's assets, decision-making power and well-being, and environmental management. Thus, the following framework prevents the common mistake of considering credit access, training attendance and enterprise participation as the final outcomes of the process. Figure 1 illustrates the pathway of the relationship between women-led enterprises and sustainable livelihood development.

Interpretation of the synthesis prioritises the empirical findings that associate a specified mechanism with an enterprise or livelihood outcome, while theoretical and review papers help to refine the pathway. Due to the diversity of geographical contexts, industries, and study designs in the included literature, results should be considered as patterns of association and potential mechanisms rather than a single pooled estimate.

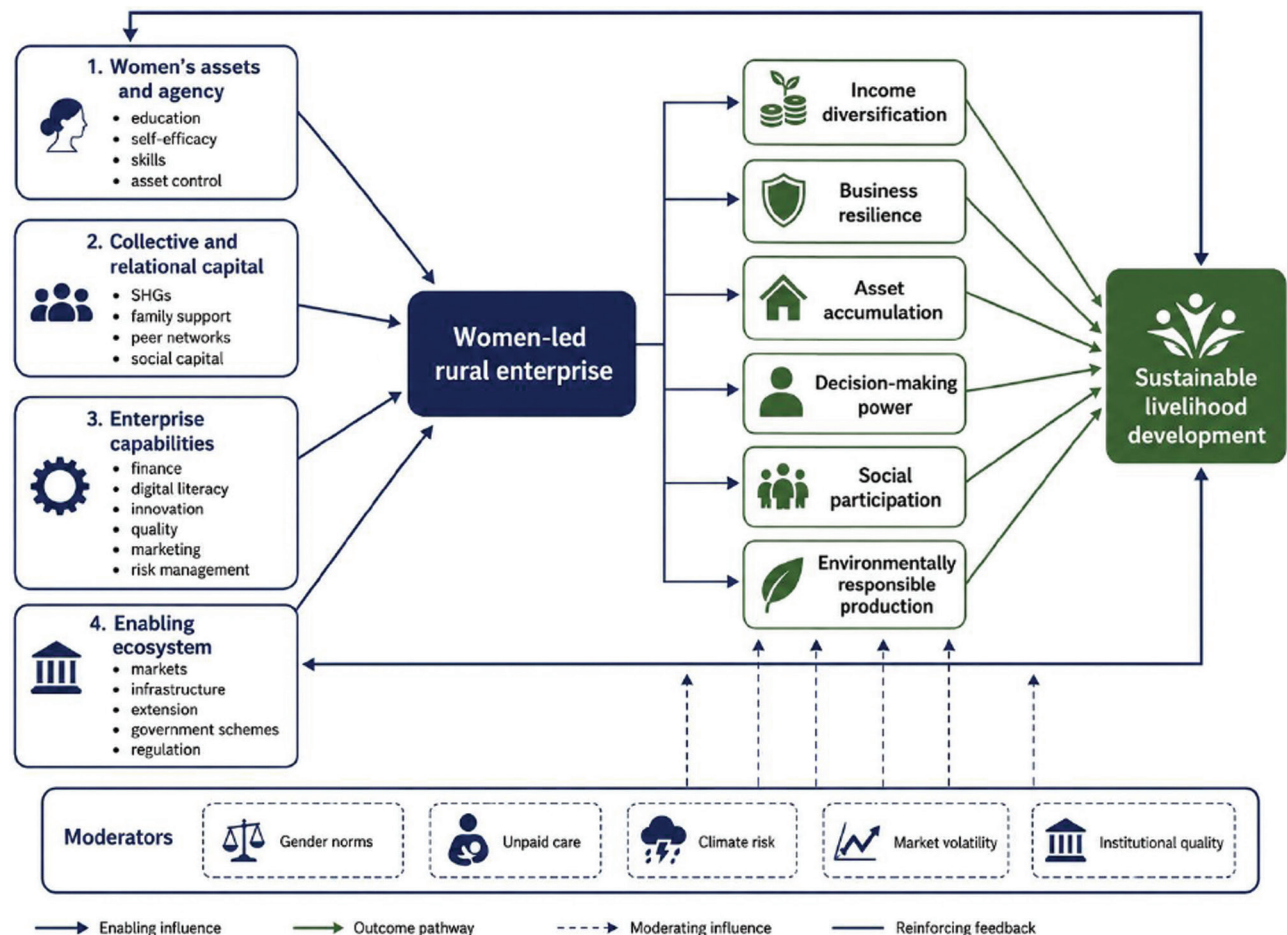


Figure 1. Integrated pathway from women-led rural enterprise to sustainable livelihood development

3. Rural women's enterprises as a livelihood strategy

Rural women's enterprises are mostly driven by necessity, opportunity, and household livelihood strategies. These enterprises can help stabilise consumption, utilise local skills and resources, provide employment opportunities, and reduce dependence on uncertain farm income. Nevertheless, diversification becomes transformative only when these activities generate sufficient net income, productive assets, and resilience, rather than simply distributing risk across a number of low-productivity activities. Table 1 contains the main analytical themes and mechanisms.

Support from family members, personal capabilities, and business experience affects the continuity of enterprises (Vasumathi et al., 2025), whereas agribusiness innovation broadens women's participation in production, processing, services, and marketing (Pooja, 2024). The condition of the sector is also important – agricultural and food enterprises have to operate amid climate risks, perishability, land scarcity, and post-harvest issues, whereas service and craft enterprises might face other constraints. Resilience also depends on multiple exposures to business, household and agricultural risks of women (Kitole & Genda, 2024; Matharu & Juneja, 2024).

Therefore, the analysis of livelihood has to consider net income, survival, diversification, assets, workload and control over net income, and not just the number of enterprises.

It is also important to take into account the quality of diversification, which is influenced by the relationship between an enterprise and the household livelihood portfolio. An enterprise can complement farming activities by processing output, utilising seasonal labour, or providing local services; however, it may compete for

women's time and funds during the most intensive period of agricultural activities.

4. Collective Institutions, Microfinance and Social Capital

SHGs serve as key institutions that facilitate connections among rural women, finance, and livelihoods. Savings, social control and bank linkage can mitigate exclusion, yet there is no empirical evidence that microcredit alone translates into empowerment of women. The effectiveness of microfinance depends on women's use of loans and appropriate services (Patel & Patel, 2020; Abebe & Kegne, 2023; Samineni & Ramesh, 2023). Participation and retention of women in microfinance are uneven, particularly for poor women (Ahmad et al., 2020), as evidenced by heterogeneous labour market impacts of large-scale livelihood interventions (Deshpande et al., 2024). Social capital accounts for the better performance of women. Bonding ties foster trust and mutual assistance; bridging ties connect women to markets and information; linking ties help establish connections with banks and the government (Mahato et al., 2022; Kille et al., 2022; Kawane & Shaw, 2024). Networks have the potential to empower women in entrepreneurship, wellbeing and collective action (Mahato & Jha, 2024; Behera et al., 2026; Zavaleta Cheek & Corbett, 2024). Figure 2 illustrates the potential of participation in SHGs to foster sustainable entrepreneurship and highlights that finance without competencies, markets, and agency can sustain low-profit activity.

Another advantage of collective institutions is the lowering of transaction costs through bulk purchasing of inputs, sharing of equipment, processing facilities, marketing, and certification. The significance of these

Table 1. Major analytical themes linking women-led rural enterprise and sustainable livelihoods

Theme	Core mechanism	Principal livelihood implication	Illustrative study
Collective institutions and empowerment	SHGs, group participation, public decision-making	Income control, credit decisions, collective voice, socio-cultural empowerment	Kumar et al. (2021)
Finance and microenterprise	Microfinance, bank linkage, working capital	Entry into enterprise, investment, decision-making; strongest when bundled with services	Pandhare et al. (2024)
Social capital	Bonding, bridging and linking networks	Information, trust, market connections, entrepreneurial orientation and livelihood improvement	Mahato & Jha (2024)
Family–enterprise interface	Family support, enrichment and labour sharing	Enterprise continuity, confidence and growth	Vasumathi et al. (2025)
Digital capability	Technology adoption and digital finance	Market reach, information access, transactions and opportunity recognition	Chatterjee et al. (2020)
Government and institutions	Schemes, extension, regulation and public support	Lower transaction costs and stronger enterprise performance when access is effective	Gochhayat & Rout (2025)
Sustainable entrepreneurship	Social innovation, environmental orientation and sustainability knowledge	Business performance, well-being and intergenerational livelihood value	Kanth & Sinha (2026b)

functions increases as enterprises evolve from subsistence markets. At the same time, delivery through groups hides unequal participation, with better-connected members benefiting from acquiring information, leadership, or business connections. In this respect, accurate record-keeping, rotation of leaders, grievance procedures, and the inclusion of marginalised women are necessary components for translating group membership into opportunities for entrepreneurship.

5. Capabilities, Digitalisation, Markets and the Enabling Ecosystem

Enterprise sustainability depends on the process of transforming resources into capabilities. This kind of support thus requires production expertise combined with costings, accounting, quality assurance, negotiation, risk management and mentoring. The use of technology and an entrepreneurial orientation could improve performance, provided that the technology and tools are relevant to women's environment and constraints (Chatterjee et al., 2020). Digital inclusion finance could expand access and entrepreneurship, but device ownership, connectivity, literacy levels, the risk of fraud, and household control could introduce new inequalities (Shao et al., 2023). Self-efficacy, sustainability attitude, and social norms would determine whether intentions translate into actions (Kanth & Sinha, 2026a), and government support would affect the extent to which capabilities translate into business performance (Kanth & Sinha, 2026b; Gochhayat & Rout, 2025). Market access is crucial because oversupplying local markets, poor

aggregation, poor transportation systems, and a lack of buyers' information reduce profitability (Chandra et al., 2026). Extension could support women as producers, processors, and market actors through gender-responsive personnel and advisory services (Saha et al., 2024, 2026). Greening and sustainable procurement could be encouraged where they reduce resource consumption and improve market access (Rahayu, 2024; Atarah et al., 2024). Thus, an enabling ecosystem should coordinate capabilities, finance, infrastructure, standards and market demand.

Capability development should be phase-wise. New entrants would require opportunity assessment and basic financial controls; operating enterprises would require troubleshooting, productivity improvement, and quality assurance; while growth-seeking businesses would need certification, branding, logistics, and negotiation. Digital tools should be used to perform business tasks rather than become goals in themselves. Therefore, evidence generation should include reducing transaction time, facilitating price discovery, increasing repeat customers, improving record-keeping, and achieving financial independence, along with addressing fraud, indebtedness, and exclusion from digital platforms.

6. Sustainable Entrepreneurship, Livelihood Resilience and Transformative Outcomes

The ability of an organisation to survive is key to its sustainability and requires capital, net gains, flexibility, and reinvestment potential. Women's social entrepreneurship involves not only business viability

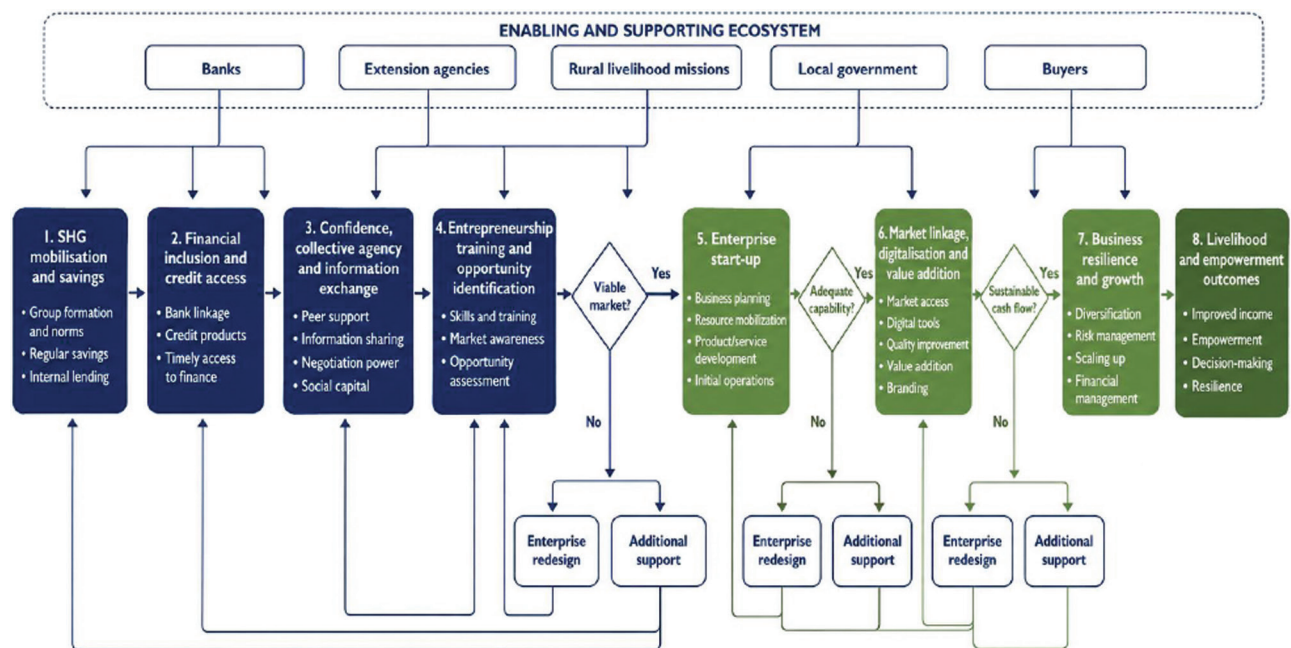


Figure 2. From SHG participation to sustainable women-led enterprise

but also mission awareness, networking, stakeholder engagement, and organisational effectiveness (Agarwal et al., 2020). However, income growth is not the only result. Sustainable livelihood development is connected with saving money, productive assets, food security, resilience, decision-making capacity, mobility, well-being, and reduced vulnerability. Socially oriented entrepreneurship linked to self-help groups can positively impact women's empowerment and development (Ghosh et al., 2024; Pandhare et al., 2024; Dash & Das, 2025). Social capital and entrepreneurship education may contribute to sustainable well-being if performance and agency feed into each other (Kanth & Sinha, 2025). Environmental sustainability is particularly important for enterprises that depend on soil, water, biological diversity and energy, while climatic vulnerability makes diversification and resource efficiency essential (Mishra et al., 2026). Enterprises operating in rural areas can create local multiplier effects by using local resources, labour, and services. However, the expansion of the enterprise can lead to an increase in unpaid work or a loss of control for women. Therefore, transformative results require women's control over benefits and skilful overcoming of institutional barriers in the formal and informal spheres (Karami et al., 2024; Chen & Barcus, 2024).

A focus on resilience affects both the enterprise design and assessment. Seasonal savings, insurance, multiple customers, diversified products, and liquidity can be much more useful for vulnerable families than quick growth through borrowing. Environmental considerations should also be relevant to sectoral risk, including water and energy efficiency, reduced waste, safer inputs and climate-resilient sources. Such strategies will be sustainable if they ensure resource protection without passing on overly burdensome compliance responsibilities to women microenterprises.

7. Major Constraints and Why Conventional Interventions Underperform

Traditional interventions fall short due to the interplay of constraints. Capability gaps in technical, financial, and marketing expertise remain common among agripreneurs (Das et al., 2025). Productivity measures without market study may result in oversupply, depressed prices and unsold produce (Chandra et al., 2026). Limited or inadequate loans cannot cover equipment, certification, and working capital; multiple agencies apply repeated procedures and conflicting recommendations. Poor transport, storage, connectivity and childcare facilities increase transaction costs and gender disparities. Domestic pressure, movement limitations, care work and lack of asset control influence any other constraints

(Rahman, 2023; Aravamudhan et al., 2024). Women in remote areas, tribals, and those with few assets face distinct opportunity structures, while livelihood security depends on local combinations of assets (Ghosh et al., 2025; Saha et al., 2026). Constraints and corresponding interventions are shown in Fig. 3, and the priorities are outlined in Table 2. A loan will not help access the market, and general training does not address oppressive norms or infrastructure gaps. Proper programmes should include sequenced interventions according to enterprise development stage, sector and social setting.

Therefore, intervention sequencing is crucial. Prior to finance, there should be an opportunity and demand assessment; with investments, capability building should take place; before extending production, market linkages should be established. Social protection and household involvement should be continuous, rather than separated, awareness-raising components. Programs also have to include exit and redesign criteria, so that non-viable enterprises would not survive due to repeated loans. It protects women from debt burdens and rechannels resources toward more realistic wage-based, cooperative, or diversified livelihood solutions.

8. Policy and Practice Agenda

From promoting entrepreneurship through credit alone, the policy should shift to a coordinated system of livelihood ecosystems. First, collective institutions need governance that is clear, inclusive, and federated, as well as services. Finance needs to be enterprise-oriented in terms of cycles and scale, encompassing savings, credit, insurance, and working capital. Capability development should replace training with technical, managerial and digital mentoring of enterprise-based activities. Market development should precede any form of replication through value chain analysis, aggregation, quality systems, buying relationships and public procurement where applicable. Digital inclusion should be assessed by women's independent and productive use of applications. Gender-responsiveness needs to cater for mobility, childcare, workload, asset ownership and control over proceeds. Extension and rural advisory services need to provide enterprise, climate and market services, while incentives should be used to encourage resource-efficient technologies and sustainable procurement. Table 3 outlines the proposed progression path and its indicators. Not all SHGs' members need to become entrepreneurs, and enterprises should not remain micro-scale throughout. Policy needs to enable progression from collective mobilisation to profitable, scalable enterprises (Bihari et al., 2024; Ramos Farroñán et al., 2024; Saavedra, 2024).

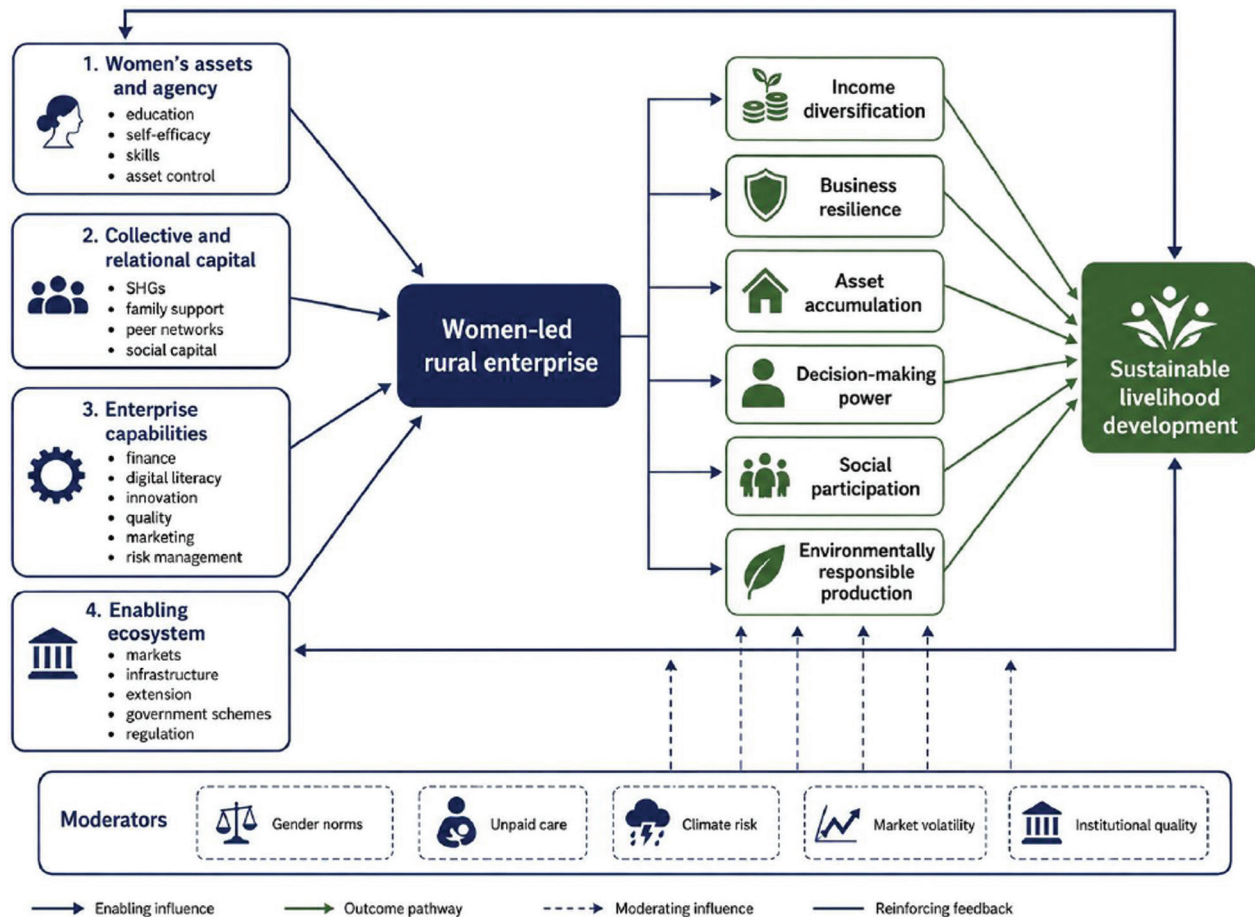


Figure 3. Constraint–intervention matrix for women-led rural enterprises

Table 2. Recurrent constraints and corresponding intervention priorities

Constraint domain	Typical manifestation	Priority response	Illustrative study
Financial	Insufficient loan size, collateral, seasonal cash-flow mismatch, repayment pressure	Stage-specific finance, guarantees, working-capital products, insurance	Abebe & Kegne (2023)
Capability	Weak business planning, accounting, marketing, quality management and digital skills	Repeated mentoring and enterprise-specific capability development	Das et al. (2025)
Market	Local saturation, low prices, weak bargaining power, poor buyer access	Demand-led enterprise selection, aggregation, branding, buyer linkage	Chandra et al. (2026)
Gender and family	Mobility limits, unpaid care, weak bargaining power, lack of male support	Care support, household engagement, leadership and agency building	Aravamudhan et al. (2024)
Infrastructure	Transport, power, storage, connectivity and workspace deficits	Rural logistics, common facilities, reliable digital and physical infrastructure	Kitole & Genda (2024)
Institutional	Fragmented schemes, documentation, weak last-mile facilitation	Convergent service delivery and accountable enterprise handholding	Gochhayat & Rout (2025)
Environmental/ climate	Resource degradation, climate shocks and supply disruption	Green technology, diversified sourcing, insurance and climate-resilient enterprise models	Mishra et al. (2026)

Monitoring systems need to track women and enterprises over the longer term rather than the annual output of programmes. Useful indicators include net rather than gross incomes, business survival rate, repeat purchases, productive assets, loan stress, shock recovery period, independent digital transactions, decision-making,

workload and control over proceeds. Such indicators need to be disaggregated by social category, geographic area and enterprise stage. Programmes need to adjust their finance, mentoring, or marketing strategies based on feedback from women.

Table 2. Proposed progression pathway and monitoring indicators

Stage	Key support requirement	Expected transition	Indicative monitoring metrics
Enterprise entry	Agency, opportunity identification, SHG mobilisation	Women identify viable enterprise options and control basic financial decisions	SHG participation; opportunity screening; confidence
Enterprise establishment	Finance + technical and business skills	Enterprise launches with adequate working capital and production capability	Capital adequacy; training completion; record keeping
Market integration	Quality, aggregation, branding, digital and buyer linkage	Enterprise moves beyond saturated local demand	Repeat buyers; market radius; digital sales
Resilience	Savings, insurance, diversification, networks and adaptive capacity	Enterprise withstands shocks without distress liquidation	Income variability; emergency liquidity; enterprise survival
Livelihood transformation	Control over income, assets, voice and sustainability practices	Enterprise improves household security and women's agency	Net income; productive assets; decision-making; well-being

9. Evidence Gaps and Future Research Needs

Many gaps in the evidence exist. More longitudinal analysis is needed to differentiate between temporary income gains and survival, assets, agency, and resilience. More experimental and quasi-experimental studies, in addition to more qualitative research, are needed to explain the mechanisms and unintended consequences of the intervention beyond simple matching (Kumar et al., 2021). Measuring the effects of interventions should cover net returns, productivity, market diversification and survival, livelihood assets, food security, resilience to shocks, time use, and decision-making and control over the benefits. Analysis should break down findings by women who are members of tribes, landless, young, widows, migrants, or who live in remote areas. Future research needs to cover the impacts of SHG federations, producer companies, cooperatives, banks, and extension systems on enterprise upgrading. Comparative research needs to identify combinations of finance, mentoring, digital tools, and market linkages that can effectively support enterprise development at different levels. Finally, research should investigate how women-led enterprises impact climate resilience, the green transition, and multiplier effects (Gurung et al., 2024; Gawel et al., 2024).

10. Conclusion

Women-led rural enterprises can enhance sustainable livelihoods, but enterprise creation alone does not empower or sustain women in their enterprises. This evidence demonstrates that sustainable development occurs when productive assets and women's agency are combined with collective structures, finance, capabilities, digital inclusion, infrastructure, remunerative markets, and government support. The effects of the intervention should be measured in terms of business viability, diversified income sources, assets, sustainability, well-being, environmental sustainability, and control over

the benefits women derive from enterprises. Programs based solely on credit and separate training programs fail to recognise the multiple constraints of intervention. Progression-oriented, gender-sensitive ecosystems provide a better framework for moving from participation to sustainable enterprises and collective bargaining.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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Self-Help Groups as Pathways to Sustainable Rural Livelihoods and Women's Economic Empowerment

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 21-Sep-26

ACCEPTED: 29-Sep-26

PUBLISHED: 15-Oct-26

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Citation: Alka Kumari, Amritesh Kumar Amar, Nibedita Mishra and Ajay Kumar Prusty (2026). Self-Help Groups as Pathways to Sustainable Rural Livelihoods and Women's Economic Empowerment. Horizon J. Hum. Soc. Sci. Res. 8 (S), 31–40. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1392.p31>



ABSTRACT

Self-help groups (SHGs) have transformed from a savings-and-credit association to a financial-inclusion platform, a collective-action platform, a livelihood-promotion platform, and a public-service delivery platform. This review has been prepared by bringing together 50 peer-reviewed studies to consider the role of SHGs in promoting sustainable rural livelihoods and women's economic empowerment and why results are mixed. There is evidence that savings, credit and social networks can enhance financial access, information, mobility, household decision making, enterprise participation and resilience. But membership and credit are insufficient to secure lasting empowerment, however. Enhanced results occur when finance is integrated with skills, market linkages, accountable group governance, digital inclusion, gender-responsive extension, and institutional convergence. Small loans, limited market access, unpaid care burdens, and restrictive norms and unequal participation continue to limit the impacts. Through an integrated pathway, the group formation process creates social capital, financial and human skills facilitate diversified livelihoods, market and institutional linkages allow for accumulation of assets and collective agency increases women's control, voice and resilience.

Keywords: DAY-NRLM; Entrepreneurship; Financial Inclusion; Rural Development; Self-Help Groups; Social Capital; Sustainable Livelihoods; Women's Economic Empowerment.

1. Introduction

SHGs for women are among the most conspicuous and prominent institutions at the grassroots level in rural India. They can also make a big difference in livelihood missions, but beyond the number of groups, bank accounts, and loans, the assessment needs to look at more than that. Empowerment is defined as

control over income and assets, mobility, bargaining power, voice and the power to pursue valued choices (Brody et al., 2015; Anand et al., 2020; Quisumbing et al., 2022, 2023). Likewise, sustainable livelihoods rely on co-dependent financial, human, social, physical, and natural assets, as well as shock resistance. There is therefore mixed evidence across the various stages of

change, such as increased credit access before enterprise performance, or increased participation before return control. This review questions how SHGs contribute to livelihood sustainability, the conditions under which participation leads to economic empowerment, and why outcomes are heterogeneous depending on institutional conditions. It sees SHGs as a microfinance instrument and a potential link between households, markets, and public institutions.

2. Review Approach and Analytical Lens

The 50 peer-reviewed studies that directly address SHGs, livelihood security, financial and social inclusion, entrepreneurship, agriculture, resilience and women's empowerment are aggregated and synthesised using a structured approach. Conceptual, Qualitative, Quantitative, and Review studies were compared based on the following criteria: Intervention mechanism, Outcome Domain, Context, and Limitation. The analytical lens brings together multidimensional empowerment and sustainable livelihood capitals. It distinguishes between resources and access and agency and achievement, and longer-term resilience, and doesn't presume that participation means control or well-being. This is especially true in gendered agrarian systems, where norms, workloads, and access to resources impact women's outcomes (Islam et al., 2024; Kanyagui et al., 2024; Tavenner & Crane, 2022). There can also be collective participation, which involves bringing agency from domestic (private) decision-making to public decision-making (Zavaleta Cheek & Corbett, 2024).

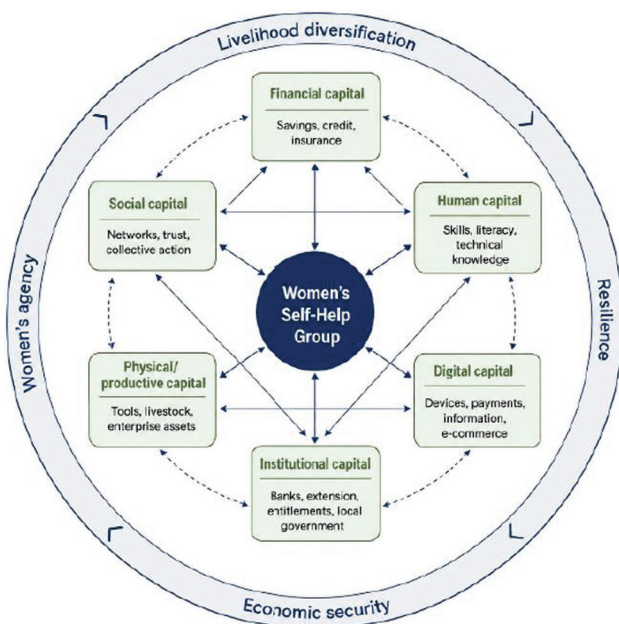


Figure 1. Sustainable livelihood capitals strengthened through SHGs

3. SHGs as Financial Institutions and Gateways to Economic Agency

Regular saving can foster discipline, liquidity and a collective financial record, and internal lending and bank linkage lessen reliance on informal lenders. Access does not equal control, however. Use of financial access under India's National Rural Livelihoods Mission has helped to empower women in some household decisions, but the impact varied by loan use and by women's control over loan repayment and returns (Kochar et al., 2022). In the same vein, critical microfinance work also moves beyond a binary understanding of the credit to a continuum between financial access and holistic programming that includes finance, capabilities and social change (Dulhunty, 2022). Membership is also significant, as poorer women can participate, but there remains variation in participation and retention (Ahmad et al., 2020). Large-scale assessments generally result in a small increase in expenditure, assets, or livelihood activities, rather than a uniform transformation (Deininger & Liu, 2013; Datta, 2015; Raghunathan et al., 2023; Siwach et al., 2022). Finance is thus best viewed as an enabling resource that requires productive opportunities, decision-making power, and complementary support for its value.

4. Social Capital, Collective Agency and the Expansion of Opportunity

SHGs create a network of women that goes beyond kinship and neighbourhood, providing frequent interaction, trust, information sharing, and mutual support. The involvement of the microcredit group has broadened poor rural women's social networks (Davidson & Sanyal, 2017); even low-strength ties have helped group members access new information and opportunities (Deshpande & Khanna, 2021). Collective spaces may also enhance mobility and political participation, and engagement with local institutions (Kumar et al., 2019; Desai & Joshi, 2014; Desai & Olofsgård, 2019). The 'power with' dimension assists women in negotiating gendered isolation through solidarity and friendship (Dulhunty, 2020). But social capital is not necessarily participatory – the voices of some members are louder than others, and hierarchy and caste can influence whose voices are heard (Sharma & Pathak-Shelat, 2025; Silveru & Sankineni, 2025). In this context, Nichols (2021) claims that the relationship is what allows SHGs to operate as platforms for development, but not just during meetings.

5. Household Decision-Making, Agricultural Agency and Women's Empowerment

Economic empowerment is evident when women hold economic power and influence the use of loans,

income, assets, and labour throughout the loan process, not just in repayment. While participation in SHG has positively impacted access to information, agricultural practices, and some household decisions, the effects vary across domains and contexts (Raghunathan et al., 2019; Padmaja et al., 2023). Collective actions can improve bargaining power and confidence, but norms can still be entrenched in favour of men in control of major assets and markets. Evidence from South Asian agriculture, therefore, calls for multidimensional, gender-responsive measurement rather than a one-dimensional income indicator (Quisumbing et al., 2022, 2023). Convergence of policies is also crucial: agricultural and livelihood interventions can send conflicting signals or fail to account for structural barriers (Lauton et al., 2024). Programmes need to keep records of who decides, who does more work, who controls rewards and whether women are able to turn new resources into choices.

6. Livelihood Diversification, Entrepreneurship and Market Integration

SHGs are more actively engaged in helping grow farm and non-farm businesses via pooled resources, training groups, and collective marketing. Entrepreneurship can enhance income and recognition, but the performance is dependent on identifying the opportunities, technical competence, technical costing, quality control, working capital, buyer relationship and risk management (Pandhare et al., 2024; Ghosh et al., 2024). The relationship between financial capital and skills is bi-directional, especially for rural youth and vulnerable producers (Ghosh et al., 2026). Local livelihood structures also influence the potential for diversification; in tribal and paddy farming settings, livelihood combinations and constraints are location and context-specific (Ghosh et al., 2025; Saha et al., 2026). Value chain interventions can boost profits, but if they do not focus on addressing market power and control over

benefits, women can stay locked in low-profit activities (Malhotra et al., 2024). Therefore, enterprise promotion should start with an analysis of demand and the value chain, rather than with training in general production or setting credit targets.

7. Resilience, Welfare and the Sustainability of Livelihood Gains

Sustainable livelihoods need to be able to withstand shocks without distress sales, harmful borrowing, or loss of essential consumption. SHGs played a significant role in distributing information, credit and mutual support during the COVID-19 pandemic and could be considered as locally embedded response institutions (Sinha & Chattopadhyay, 2024). Social capital can mitigate financial vulnerability in households by creating a wide base of support and facilitating access to support (Biju & Tanta, 2024). Besides, the ability of SHGs to serve as scalable platforms for health and nutrition interventions (Hazra et al., 2020; Kumar et al., 2024; Raghunathan, Kannan, & Quisumbing, 2023) suggests that awareness alone does not necessarily lead to sustained health and nutrition practices or better health outcomes. The main linkages between SHGs, livelihoods, and empowerment are summarised in Table 1. The evidence presented here indicates that financial buffers, reciprocal support, reliable services, and diversified income sources work together to create resilience; relying on SHGs as temporary delivery channels reduces the likelihood of achieving resilience.

8. Inclusion, Digital Access and Institutional Convergence

The adoption of digital finance, mobile banking, e-commerce, online extension, and digital identity can further lower transaction costs and information gaps, though who has and owns which devices, what access to the internet or phones they have, and whether they

Table 1. Major pathways linking SHGs with sustainable rural livelihoods and women's economic empowerment

Pathway	Immediate mechanism	Potential livelihood outcome	Empowerment outcome	Key condition
Financial inclusion	Savings, internal lending, bank linkage	Liquidity, productive investment, consumption smoothing	Control over finance and credit decisions	Adequate loan size and suitable repayment
Human capital	Training, peer learning, extension	Productivity and enterprise capability	Confidence and recognised competence	Quality and relevance of training
Social capital	Networks, trust, reciprocity	Information, mutual support, lower transaction costs	Collective efficacy and mobility	Inclusive group norms and mature institutions
Market linkage	Aggregation, value chains, digital marketing	Higher margins and diversified income	Economic visibility and bargaining power	Buyer access, quality, logistics and working capital
Institutional linkage	Entitlements, banks, extension, local government	Risk protection and service access	Public participation and claims-making	Convergence and responsive institutions
Resilience	Savings, mutual aid, diversified activities	Shock absorption and recovery	Reduced dependence and greater adaptive agency	Insurance, social protection and diversified assets

know how or feel comfortable doing so can lead to a reproduction of exclusion. SHGs can facilitate peer learning and provide assisted access, enabling participants to perform digital transactions and assess information safely (Saha et al., 2024). Institutional convergence is also crucial: banks should provide coordinated pathways with extension agencies, local government, training providers, and buyers, rather than disjointed schemes. Saha et al. (2026) can enhance access to trusted advisory services and gender responsiveness through women extension personnel. Basak and Roy Chowdhury (2024) and Al-Kubati and Selvaratnam (2023) connect SHGs to a broader concept of inclusion and the SDGs, which requires outcome evidence. Digitalisation should therefore be assessed based on women's independent, secure, and non-dependent use of digital tools, not on the number of partnerships, but on the level of service quality and livelihood outcomes achieved; convergence should be assessed based on service quality, not on the number of partnerships.

9. Critical Constraints and Why Impacts remain Heterogeneous

There is a mixed response in the literature. Small loans, or loans for consumption, may not bridge the gap in credit-productivity; poor infrastructure or limited access to buyers can limit returns on the enterprise; and the economic activity can increase women's domestic labour without partition. Restrictive norms may limit mobility, asset ownership and control over earnings. Group quality also suffers from irregular meetings, poor record-keeping, elite capture, dominant leadership, and a lack of transparency. Benefits are also differentiated by social position for Dalit, tribal, landless, and younger and older women (Silveru & Sankineni, 2025; Kanyagui et al., 2024). The impact of the large livelihood programmes

on labour markets may thus have been relatively limited or uneven (Deshpande et al., 2024). Furthermore, SHGs can be overburdened, and livelihood priorities can be displaced if they are routinely used for delivery tasks unrelated to their livelihoods. The outcome patterns and recurrent limitations are summarised in Table 2. The appropriate conclusion is not that the impact of SHGs is always positive or negative, but that programme design, local opportunity structures, and group governance and gender relations shape the impact (Tamang & Chattopadhyay, 2025; Vasishta & Singla, 2025).

10. Toward an Integrated SHG–Livelihood–Empowerment Framework

The evidence supports an integrated sequence, not a simple credit-to-income sequence. When the group is formed, an institutional space and social capital are created. Savings and credit increase financial access, and training, information, and confidence enhance human capacity. Technology, infrastructure, extension, market intelligence, and contacts are required to enable productive investment. Stable returns can underpin assets, resilience and bargaining power, which in turn can assure greater control over resources and institutional responsiveness through collective voice. This graduation model is presented in Figure 2. Local resources and a community-based economy can help minimise reliance on distant markets (Saha & Kasi, 2022); however, many businesses still need to ensure positive integration into the value chain. Group governance, flexible business strategies and consideration of sustainability conditions (Nath et al., 2026; Vasishta & Singla, 2025) are therefore critical to long-term performance. Empowerment and better institutions are critical, as are feedback mechanisms to enhance future livelihood choices, while debt, exclusion and heavy workloads can block the trajectory.

Table 2. Evidence pattern: outcomes, strength of support and recurrent limitations

Outcome domain	General evidence pattern	Typical indicators	Recurrent limitation
Financial inclusion	Consistently positive	Savings, borrowing, bank use	Loan size may be too small for enterprise transformation
Women's agency	Generally positive but heterogeneous	Credit decisions, control over income, group participation	Household norms may constrain conversion of resources into agency
Social capital	Strong evidence of network expansion	Non-kin ties, collective action, efficacy	Internal hierarchy and exclusion can weaken benefits
Livelihood/income	Positive but often modest	Expenditure, assets, livestock, self-employment	Market constraints and low-return activities
Agricultural decisions	Positive in several studies	Input, seed, sales and farm decisions	Effect varies with intervention type and knowledge
Resilience	Promising evidence	Coping, emergency finance, mutual aid	Debt obligations can intensify stress during systemic shocks
Enterprise sustainability	Conditional	Business survival, margins, market reach	Weak value-chain integration and working capital

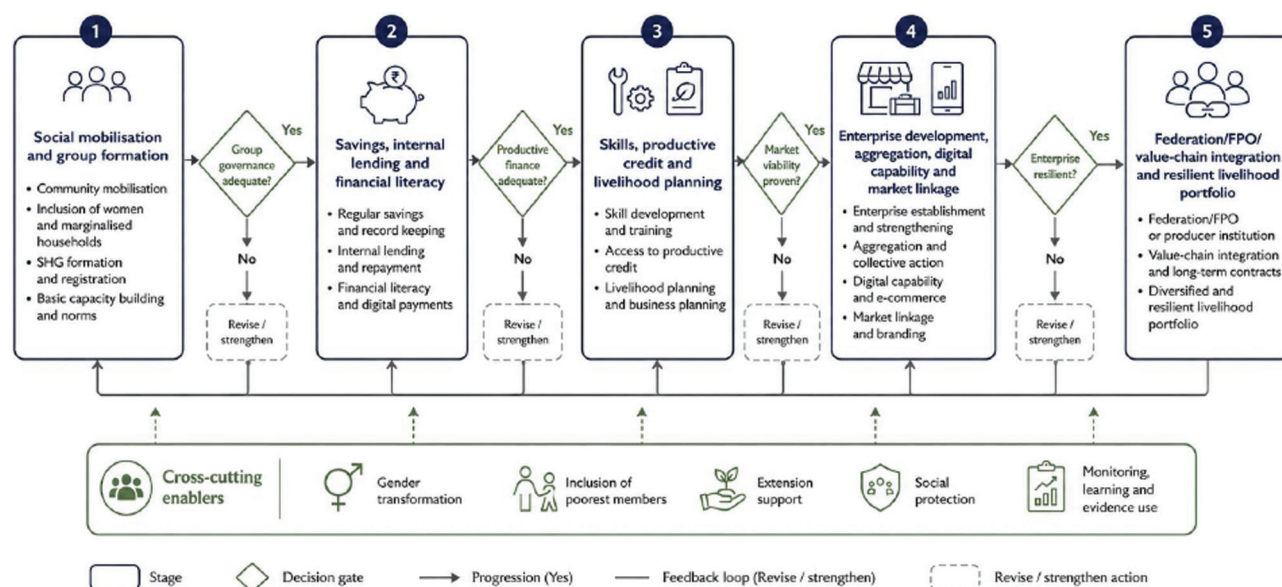


Figure 2. SHG graduation model from mobilisation to sustainable enterprise

Table 3. Priority agenda for strengthening SHGs as sustainable livelihood institutions

Priority area	Current weakness	Recommended shift	Suggested indicator
Finance	Small, uniform loans	Graduated and purpose-linked finance	Productive loan size, working-capital adequacy
Skills	One-off generic training	Competency-based mentoring	Enterprise competency and application rate
Markets	Production-first approach	Buyer- and value-chain-led planning	Share of sales outside local spot markets
Digital inclusion	Leader-dependent use	Member-level digital capability	Independent use of payments and platforms
Gender transformation	Income as proxy for empowerment	Track agency, control and time use	Decision-making, control over income, workload
Group governance	Recovery-centred monitoring	Institutional health monitoring	Attendance, rotation, transparency, inclusion
Resilience	Credit after shocks	Savings, insurance, diversification and entitlements	Recovery time and income diversification
Research	Cross-sectional average effects	Longitudinal, intersectional and mechanism studies	Member-level trajectories by social group

11. Gaps in research and future directions

There are certain gaps that do not provide grounds for making definite conclusions. Longitudinal and mixed research is needed to identify whether short-term access leads to durable control, asset accumulation, and resilience. In addition, the comparison of SHG models and intervention packages must be made without assuming equality of groups, implementation intensity, governance quality, or market context. Income measures should be complemented by time use, backlash, and control-over-proceeds measures. The importance of intersectionality in revealing the risk of exclusion in the average effect should be emphasised. Attention should be paid to average effects for non-members and to attrition to avoid hiding any exclusion. Data collection should involve linking social and human capital to

livelihoods and examining how digital access transforms into independence and safety. The effectiveness of gender-responsive extension and the role of women extensionists should be evaluated. Finally, consistent multidimensional measures, causal assumptions and cost-effectiveness analysis are required to assess scalability (Brody et al., 2015; Siwach et al., 2022). Such an approach will not only show whether or not SHGs work, but also how, why and for whom.

12. Policy and Program Implications

Policy has to shift from grouping people and lending money to establishing sustainable livelihood institutions. Financing has to be coordinated with enterprise cycles and supplemented by demand assessment, technical and managerial training, quality systems, working capital

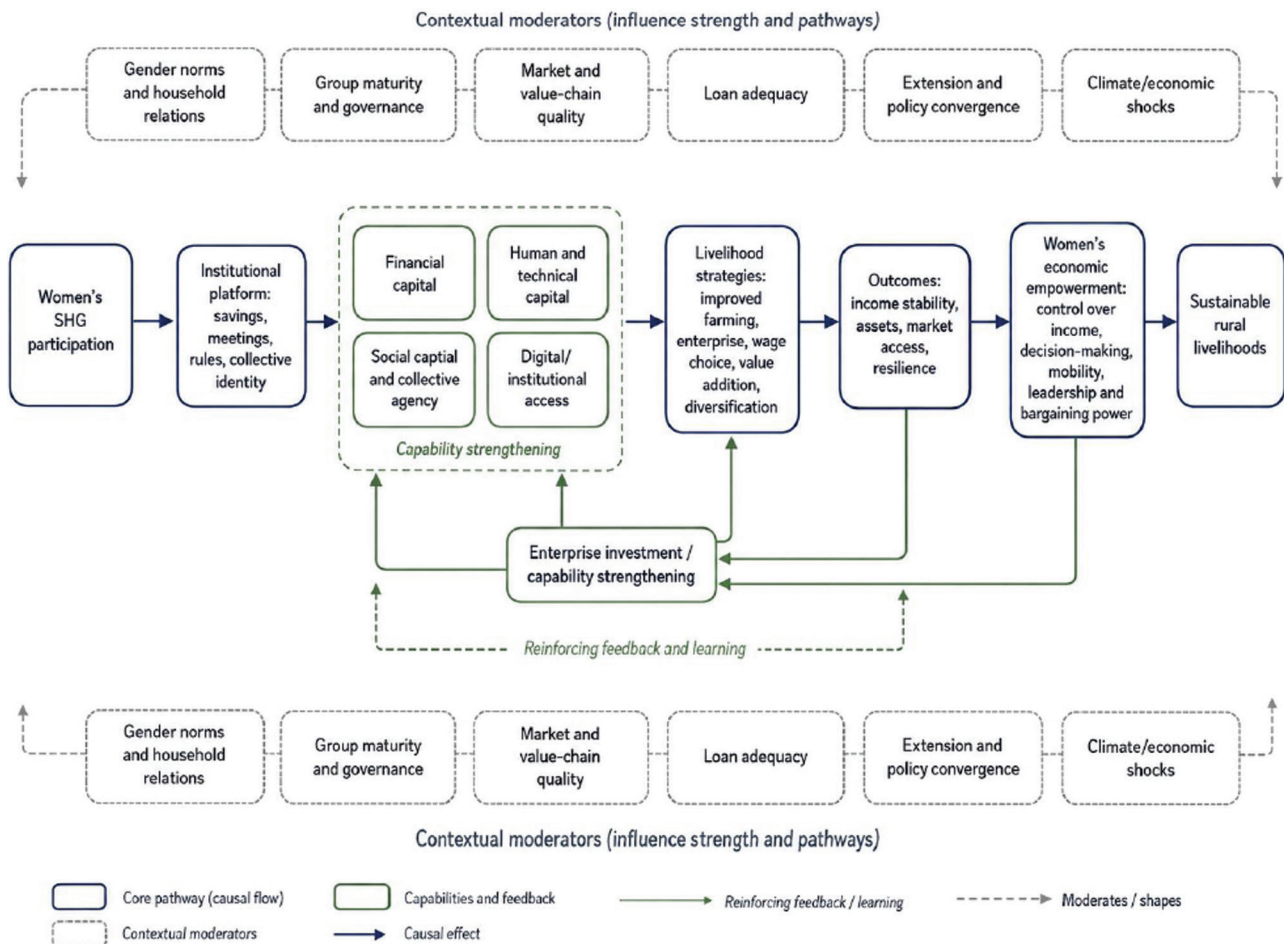


Figure 3. Integrated SHG–livelihood–empowerment pathway

development and buyer development. Federations or producer collectives can merge inputs, processing and branding and scale up in negotiations. Governance support has to be institutionalised through transparent record-keeping, leadership rotation, a grievance system, and the participation of marginalised members. Programs should monitor income generation, asset building, mobility, time and decision-making at home, repayment, and enterprise turnover. Digital capability should be considered a vital part of livelihood assets (local capabilities) and complemented by facilitated learning, fraud awareness, and pathways to self-directed use. Local accountability in convergence should be achieved through livelihood missions, banks, extension services, local governments, social protection, and markets. Table 3 presents the priority agenda, and Figure 3 synthesises financial, social, human, and institutional mechanisms into a single livelihood-empowerment pathway. Persistent concern with collective voice and restrictions on norms is required because economic participation without agency can result in growing inequality.

13. CONCLUSION

SHGs can contribute to sustainable livelihoods and women's empowerment, yet this potential is neither guaranteed nor constant. The most convincing examples pertain to enhanced access to financial services, networks, and information, as well as some aspects of agency; progress in stable entrepreneurship, assets, and labour market performance is rather conditional. Access to credit is transformational when it goes hand in hand with skills, market connections, appropriate institutions, accountability, and female ownership of resources. It is important for programs to assess the entire chain from involvement to empowerment, livelihood impacts, resilience and voice.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

From Policy Messages to Rural Markets: Institutional Communication and Sustainable Agribusiness in Vietnam and India

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 22-Sep-26

ACCEPTED: 29-Sep-26

PUBLISHED: 15-Oct-26

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Citation: Cao Thị Thuyết and Trần Thị Vân Dung (2026). From Policy Messages to Rural Markets: Institutional Communication and Sustainable Agribusiness in Vietnam and India. Horizon J. Hum. Soc. Sci. Res. 8 (S), 41–58. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1393.p41>



ABSTRACT

Sustainable agribusiness depends not only on the quality of agricultural policies but also on the institutional and communication systems through which those policies are interpreted, disseminated, implemented, and adapted at the grassroots level. This study examines the relationship between policy communication and institutional frameworks for sustainable agribusiness through a comparative analysis of Vietnam and India. Drawing on the Institutional Analysis and Development (IAD) framework and Strategic Communication Theory, the study employs Strategic Policy Discourse Analysis (SPDA) of a defined corpus of 45 primary policy documents issued between 2015 and 2025, comprising 23 Vietnamese and 22 Indian documents. The corpus is organized into three analytical groups: macro-level strategic and legislative frameworks; climate-smart agriculture and bio-economy directives; and dissemination networks, digitalization, and agricultural extension mechanisms. A four-dimensional communication matrix examines Source Authority, Message Framing, Dissemination Channels, and Feedback Mechanisms. The analysis identifies a structural divergence between the two countries. India has developed a comparatively decentralized and digitally enabled communication architecture, including e-NAM, digital agriculture initiatives, farmer-oriented information platforms, and Farmer Producer Organization mechanisms, thereby expanding the potential reach of policy information while remaining exposed to digital exclusion and institutional fragmentation. Vietnam combines formal governmental authority with comparatively cohesive socio-political and agricultural organizations, particularly the Vietnam Farmers' Union and community agricultural extension structures, enabling locally embedded dissemination while creating risks of predominantly one-directional communication. The study argues that policy communication should be understood as implementation infrastructure rather than as a supplementary public-relations function. It proposes an Institutional-Communication Framework (ICF) that integrates policy authority, institutional translation, multi-channel dissemination, agribusiness action, and upward feedback. The framework provides a comparative basis for strengthening policy implementation, rural entrepreneurship, institutional learning, and sustainable agribusiness resilience in emerging Asian economies.

Keywords: Agricultural policy; Agribusiness; Institutional communication; Policy implementation; Sustainable development; Vietnam and India.



1. INTRODUCTION

Agriculture occupies a distinctive position in the economic, social, environmental, and political development of emerging Asian economies. It provides livelihoods, supplies food and industrial inputs, supports rural communities, and increasingly functions as a site for entrepreneurship, technological innovation, environmental management, and value-chain development. Yet contemporary agricultural transformation cannot be understood solely in terms of production technologies or farm-level productivity. Sustainable agribusiness requires institutional arrangements capable of connecting national policy objectives with the decisions and capacities of farmers, producer organizations, entrepreneurs, extension agents, markets, and rural communities.

This challenge is particularly significant as agricultural policies become more complex. Contemporary policy agendas increasingly combine productivity, market access, and income with climate resilience, organic production, circular-economy principles, digitalization, resource efficiency, environmental protection, and inclusive rural development (Food and Agriculture Organization of the United Nations [FAO], 2017, 2022). These objectives require not simply that policies exist, but that their meanings, expectations, opportunities, responsibilities, and implementation procedures reach relevant actors in forms that can be understood and acted upon.

Policy communication therefore represents more than the transmission of official information. It is part of the institutional process through which public policy acquires practical meaning. A national agricultural strategy may establish ambitious sustainability objectives, but those objectives become economically and socially consequential only when institutional actors translate them into accessible messages, programmes, incentives, procedures, market opportunities, technical guidance, and mechanisms through which rural actors can communicate their experiences and concerns back to decision makers. Communication is therefore embedded within implementation rather than positioned outside it.

The institutional dimension is equally important. Institutions shape the rules, incentives, information structures, and collective-action arrangements within which economic actors operate (North, 1990; Ostrom, 2005). Agricultural producers do not encounter policy as abstract legislation. They encounter it through ministries, local governments, extension services, cooperatives, farmer organizations, digital platforms, markets, financial institutions, producer organizations, and other intermediary structures. The architecture connecting these institutions can determine whether a policy

message becomes actionable knowledge or remains a distant administrative directive.

Vietnam and India provide useful comparative cases because both have pursued major agricultural transformation while confronting climate change, rural inequality, market restructuring, technological transition, and the need for sustainable production. Both countries have developed extensive policy frameworks concerning agriculture, climate adaptation, organic production, digitalization, rural development, market reform, and agricultural innovation. Their institutional architectures, however, differ considerably.

India's agricultural policy environment combines national programmes with a highly plural and decentralized institutional system. Digital platforms such as e-NAM, *Kisan Suvidha*, *mKisan*, and wider digital agriculture initiatives seek to expand information access and connect farmers with markets and public services. Farmer Producer Organizations and other collective arrangements provide additional institutional channels through which agricultural actors can engage with markets and public programmes. At the same time, India's scale and institutional diversity create challenges involving uneven digital access, differences in state-level implementation, information asymmetry, and fragmentation.

Vietnam presents a contrasting configuration. National agricultural and sustainability policies are supported by a comparatively cohesive institutional structure involving central government, provincial and local authorities, agricultural ministries and agencies, agricultural extension structures, cooperatives, and the Vietnam Farmers' Union. Such arrangements can facilitate coherent dissemination and institutional coordination. However, institutional cohesion does not automatically guarantee effective two-way communication. Where policy messages primarily move downward through established organizational channels, opportunities for systematic upward feedback may remain comparatively limited.

The central argument of this article is therefore that sustainable agribusiness policy becomes economically and socially meaningful only when institutional systems allow policy messages to travel in both directions: from public authorities to rural actors and from rural actors back to institutions. The argument does not imply that communication alone determines policy outcomes. Rather, communication is treated as one component of the institutional infrastructure that conditions whether policy objectives can be interpreted, adopted, adapted, and sustained.

The study addresses three questions:

1. How do Vietnam and India structure policy communication for sustainable agribusiness through their institutional frameworks?
2. What differences emerge in Source Authority, Message Framing, Dissemination Channels, and Feedback Mechanisms?
3. What institutional-communication architecture can strengthen the translation of sustainability policy into rural economic and agribusiness action?

The study contributes in three ways. First, it places communication within the institutional analysis of agricultural policy rather than treating it as a peripheral dissemination activity. Second, it develops a structured comparative interpretation of two major Asian agricultural economies. Third, it proposes an Institutional-Communication Framework that connects policy authority with institutional translation, dissemination, action, and feedback.

2. BACKGROUND AND LITERATURE CONTEXT

2.1 Sustainable agribusiness as an institutional problem

Agribusiness extends beyond agricultural production to encompass input supply, production, aggregation, processing, logistics, marketing, finance, technology, entrepreneurship, and consumption. This broader perspective makes agricultural sustainability an institutional problem because value creation depends upon coordination among multiple actors and organizations.

Barrett et al. (2001) demonstrated the importance of market participation and commercialization for rural development, while Devaux et al. (2009) emphasized the role of institutional arrangements in linking small producers to markets. Belcher and Schreckenberg (2007) similarly showed that commercialization and sustainability require attention to the institutional conditions within which local economic activities occur.

Sustainable agribusiness consequently involves more than introducing environmentally desirable production techniques. Farmers and rural entrepreneurs must know what is expected, understand available incentives, access appropriate technologies, identify markets, establish credible relationships with buyers, and navigate regulatory requirements. Institutions mediate each of these processes.

Climate-smart agriculture illustrates this complexity. Climate adaptation may require changes in production practices, crop choices, water management, insurance, infrastructure, market organization, and information

use. Similarly, organic and circular agriculture require standards, certification, knowledge, market differentiation, consumer trust, and institutional support. Policy communication connects these components by making policy objectives interpretable and operational.

FAO (2017) emphasizes that long-term transformation of food and agricultural systems involves interacting economic, social, technological, and environmental pressures. More recent attention to automation and digital transformation further demonstrates that technological change can reshape the organization of agrifood systems, while its benefits depend upon institutional capabilities and access (FAO, 2022). An entrepreneur cannot build a sustainable rural enterprise simply because a government policy declares sustainability a priority. The entrepreneur needs institutional access to knowledge, finance, infrastructure, markets, networks, and regulatory information.

The resulting analytical question is therefore not merely whether governments communicate policy, but how institutional structures shape the movement of policy information and meaning across the agricultural system.

2.2 Institutions and collective action

Institutional analysis provides an appropriate theoretical foundation for examining this process. North (1990) conceptualized institutions as the rules and constraints that structure human interaction, while Ostrom (2005) emphasized institutional diversity and the importance of understanding rules-in-use governing collective action.

The IAD framework is particularly relevant because agricultural policy implementation involves multiple actors operating within institutional settings characterized by formal rules, informal norms, information structures, incentives, and decision-making processes. The same policy statement may produce different practical effects depending upon the institutional context through which it is interpreted.

Collective organization is especially important in rural economies. Producer organizations, cooperatives, extension groups, and farmer associations can reduce transaction costs, aggregate information, strengthen bargaining power, and facilitate market participation. Collective action can also support innovation in agricultural value chains when organizations provide mechanisms for coordination and knowledge exchange (Devaux et al., 2009).

Collective organization is especially important in rural economies because social relationships, trust and shared norms can influence the capacity of communities to

manage resources and coordinate economic activity. Social capital can therefore complement formal institutional arrangements by facilitating cooperation, information exchange and collective problem-solving (Pretty, 2003). Producer organizations, cooperatives, extension groups, and farmer associations can consequently function not only as economic intermediaries but also as communication intermediaries.

Such organizations function as communication intermediaries. The institutional question therefore extends beyond the existence of organizations. It concerns their position within communication flows. An organization may disseminate government information effectively while providing limited opportunities for rural actors to influence policy interpretation. Conversely, decentralized digital systems may expand information access without necessarily producing meaningful institutional dialogue.

This distinction between reach and reciprocity is central to the present comparison.

2.3 Policy communication and message framing

Strategic Communication Theory contributes a second analytical dimension. Policy communication involves decisions about what information is communicated, how it is framed, through which channels it travels, and how audiences are positioned in relation to policy.

Entman (1993) demonstrated that framing influences which aspects of an issue are emphasized, interpreted, and prioritized. Agricultural sustainability can consequently be framed as productivity enhancement, environmental protection, climate resilience, economic opportunity, rural modernization, food security, or social inclusion. Different frames can influence how farmers and entrepreneurs understand policy relevance.

The distinction is important because policy messages do not reach rural actors in a vacuum. Intermediaries translate policy language into practical terms. A climate strategy, for example, may become a recommendation concerning water management, crop diversification, insurance, or low-emission production. A digitalization policy may become a mobile application, market platform, registration procedure, or electronic transaction mechanism.

Communication therefore has both a semantic and an institutional dimension. It determines not only what is said but also how policy meaning is translated into practical action.

Policy change also involves learning. Hall (1993) demonstrated how policy paradigms and social learning influence the way governments define problems and adjust policy instruments. This insight is relevant

to sustainable agribusiness because institutional communication should not terminate once a policy has been disseminated. Feedback from implementation can contribute to policy learning and subsequent adjustment.

2.4 Communication channels and digital transition

Digitalization has transformed the potential geography of agricultural communication. Digital platforms can reduce information-search costs, connect producers with markets, facilitate transactions, distribute extension content, and provide access to public services. Klerkx et al. (2019) argue that digitalization is reshaping agricultural innovation systems by altering relationships among actors, knowledge flows, and innovation processes.

The wider literature on rural development in the digital age similarly emphasizes that digital technologies can reshape access to information, markets, services and economic opportunities, while their developmental effects remain dependent on institutional and socio-economic conditions (Ma et al., 2023). Digitalization should therefore be understood not simply as the introduction of technological tools but as a transformation of the relationships through which agricultural knowledge, services and market information circulate.

The digital transformation of rural and agricultural development also involves changes in skills, institutional capacity, and access to information (Liu et al., 2026; Ma et al., 2023). Technology can therefore expand communication possibilities without eliminating the social and institutional conditions required to use those possibilities effectively.

India provides a particularly important example of this transition. The policy corpus includes e-NAM, digital agriculture initiatives, the India Digital Ecosystem of Agriculture and AGRISTACK consultation framework, *Kisan Suvidha*, *mKisan*, and other digital mechanisms. These initiatives indicate an institutional shift toward digitally mediated agricultural communication and service delivery.

Digital reach, however, is not equivalent to universal accessibility. Differences in connectivity, digital literacy, language, device ownership, trust, affordability, and institutional capacity can influence who can use digital systems effectively. A digitally enabled communication architecture may therefore democratize information for some groups while reproducing exclusion for others.

The issue is consequently not whether digital communication should replace traditional agricultural communication. Rather, the question is how digital and interpersonal channels can complement one another.

2.5 Local organizations and social embeddedness

Vietnam provides a contrasting institutional configuration in which formal government communication operates through comparatively embedded organizational structures. The Vietnam Farmers' Union represents a significant institutional intermediary within the agricultural system, while agricultural extension groups provide localized channels for knowledge and programme dissemination.

Such structures can increase trust, contextual relevance, and organizational cohesion. Social embeddedness is particularly important where agricultural decisions depend upon community relationships, collective practices, and locally shared knowledge. Pretty (2003) highlights the significance of social capital and collective relationships in enabling communities to coordinate the management of shared resources.

However, strong institutional mediation can also produce vertical communication patterns. A channel that efficiently carries information downward may not automatically provide equally effective mechanisms for transmitting information upward. Participation therefore needs to be distinguished from dissemination.

Arnstein's (1969) classic participation framework remains relevant here. Participation involves more than receiving information. It implies opportunities for affected actors to influence decisions. Although Arnstein's typology was developed in a different institutional context, its distinction between information and meaningful participation provides a useful conceptual lens for examining policy communication.

2.6 From communication to implementation

The literature suggests that effective policy implementation requires institutional coordination, usable information, credible incentives, and mechanisms for learning. Hall (1993) emphasizes the importance of policy paradigms and institutional settings in shaping policy change, while Teece (2010) highlights dynamic capabilities for adaptation and innovation.

Applied to sustainable agribusiness, these perspectives imply that communication should be understood as an institutional capability. Institutions must be able to communicate policy clearly, translate it into practical opportunities, coordinate different actors, receive feedback, and adapt programmes based on experience.

Agricultural innovation similarly depends upon interactions among farmers, researchers, extension services, entrepreneurs, public agencies, markets, and technology providers. The World Bank (2012)

conceptualizes agricultural innovation systems as networks through which knowledge, institutions, and actors interact to produce and apply innovation. Communication is therefore a capability of the innovation system itself.

The central proposition developed in this article is:

Policy communication functions as implementation infrastructure when it connects policy authority with institutional translation, accessible dissemination, rural action, and feedback-based institutional learning.

This proposition guides the empirical analysis.

3. METHODOLOGY

3.1 Research design

The study employs a qualitative comparative policy-analysis design. Vietnam and India were selected because both represent major Asian agricultural economies experiencing simultaneous pressures for agricultural modernization, sustainability, climate adaptation, digital transformation, market integration, and rural development.

The research does not attempt to measure farmer adoption rates or establish causal relationships between individual policies and agricultural outcomes. Instead, it examines the institutional communication architecture represented in primary policy documents. The unit of analysis is therefore the policy communication structure embedded in the documentary corpus.

The analysis combines the Institutional Analysis and Development framework with Strategic Communication Theory. IAD provides the institutional lens through which authority, rules, actors, and implementation arrangements are interpreted. Strategic Communication Theory provides the communication lens through which Source Authority, Message Framing, Dissemination Channels, and Feedback Mechanisms are examined.

3.2 Corpus construction and Appendix documentation

The study draws on a defined corpus of **45 primary policy documents issued in Vietnam and India between 2015 and 2025**. The corpus comprises **23 Vietnamese documents and 22 Indian documents**.

The documents were selected to capture the institutional progression from strategic and legislative authority to sustainability-oriented interventions and, finally, dissemination, digitalization, and agricultural extension. The corpus is organized into three analytical groups:

1. Macro-level Strategic and Legislative Frameworks
2. Climate-Smart Agriculture and Bio-Economy Directives
3. Dissemination Networks, Digitalization and Extension

Appendix A provides the complete Vietnam inventory, while **Appendix B** provides the complete India inventory. Each entry identifies the issuing organization, document number or title, year, and official source. The appendices therefore function as the documentary audit trail of the study and provide transparency concerning the underlying corpus.

The Vietnam corpus includes legislation and strategic instruments concerning crop production, animal husbandry, environmental protection, agricultural and rural development, green growth, agricultural restructuring, organic agriculture, circular economy, climate adaptation, agricultural standards, digital transformation, farmer organizations, and community extension. The India corpus includes legislation and strategic instruments concerning agricultural markets, contract farming, agricultural exports, sustainable agriculture, organic and natural farming, climate action, irrigation, insurance, digital agriculture, e-NAM, farmer information services, Farmer Producer Organizations, and agricultural infrastructure.

The documentary inventory is not treated as a simple list of equivalent instruments. Different documents perform different institutional functions. Some establish authority or legal rules, some define strategic objectives, and others establish operational mechanisms or communication channels.

3.3 Strategic Policy Discourse Analysis

The study applies Strategic Policy Discourse Analysis (SPDA) to the documentary corpus. SPDA is used here as a structured qualitative approach for identifying how

policy documents construct problems, define institutional responsibilities, frame desired behaviours, and establish mechanisms for communicating and implementing policy.

Four analytical questions were applied:

1. Who possesses or represents policy authority?
2. How are sustainability and agribusiness objectives framed?
3. Through which institutional or technological channels are policies communicated?
4. What mechanisms exist for feedback, participation, monitoring, or institutional learning?

The purpose is not to treat policy language as a direct representation of implementation outcomes. Instead, discourse is examined as evidence of institutional design and communication intent.

3.4 Four-dimensional communication matrix

To operationalize SPDA, the study developed a four-dimensional communication matrix integrating insights from the IAD framework and Strategic Communication Theory. The matrix examines not only what policy institutions communicate, but also how policy messages are framed, through which institutional and technological channels they are disseminated, and whether mechanisms exist for feedback from rural stakeholders to policy and implementing institutions. The four dimensions provide a common analytical structure for comparing the Vietnamese and Indian policy corpora. The four dimensions and their corresponding analytical questions are presented in Table 1.

Table 1 establishes the analytical logic used throughout the comparative analysis. Source Authority captures the institutional location of policy communication and identifies who possesses formal authority to define policy priorities. Message Framing examines how those

Table 1. Four-Dimensional Communication Matrix Used for Strategic Policy Discourse Analysis

Dimension	Analytical question	Principal focus
Source Authority	Who communicates policy and with what institutional authority?	Government, ministries, political institutions, farmer organizations and implementing bodies
Message Framing	How are policy objectives communicated and justified?	Sustainability, productivity, climate resilience, markets, modernization and rural development
Dissemination Channels	Through which institutional or technological mechanisms does policy information travel?	Extension, farmer organizations, digital platforms, programmes and intermediary institutions
Feedback Mechanisms	How can information, experience, concerns, or responses move back toward institutions?	Participation, consultation, monitoring, organizational representation and institutional learning

Note. The matrix was developed for the present study by integrating the institutional perspective of the IAD framework with concepts from Strategic Communication Theory. The dimensions were applied consistently to the 45-document comparative corpus.

Source. Authors' analytical framework based on the study's documentary corpus and theoretical framework.

priorities are translated into policy narratives and implementation expectations. Dissemination Channels shifts attention from policy content to the institutional and technological pathways through which information reaches intended beneficiaries and intermediaries. Finally, Feedback Mechanisms assess whether communication extends beyond one-way transmission by providing channels through which rural actors can communicate information, concerns, experiences, and implementation needs to institutions.

Taken together, these dimensions allow the study to distinguish between the existence of a policy communication mechanism and the quality of the institutional communication architecture supporting implementation. The presence of digital platforms, extension networks, or organized stakeholder channels does not, by itself, demonstrate effective participation or policy adoption. The matrix therefore provides the basis for examining institutional conditions under which policy communication may facilitate sustainable agribusiness development while avoiding claims about actual farmer behaviour that cannot be established from documentary evidence alone.

3.5 Comparative interpretation

The analysis proceeded in three stages. First, documents were interpreted within their national institutional context. Second, recurring communication characteristics were identified across the four dimensions. Third, the resulting patterns were compared between Vietnam and India.

The comparative analysis emphasizes structural characteristics rather than ranking one country as categorically superior. The purpose is to identify complementary strengths and vulnerabilities and to determine what lessons may be transferable across institutional contexts.

Because the study is documentary, conclusions about communication architecture should not be interpreted as direct evidence of actual farmer behaviour. The corpus establishes how policy systems are designed to communicate and implement agricultural objectives. It does not independently establish whether farmers receive every message, understand it in the intended manner, adopt recommended practices, or experience particular economic outcomes.

4. FINDINGS AND DISCUSSION

4.1 Structural divergence in communication architecture

Analysis of the 45-document corpus reveals a marked difference in the institutional architecture through which

policy communication is designed to reach agricultural actors.

Vietnam's policy architecture combines centralized policy authority with comparatively cohesive intermediary structures. The documentary corpus moves from national legislation and government strategies to agricultural directives, extension arrangements, digital transformation programmes, Farmers' Union instruments, and community agricultural extension groups. This configuration creates a relatively identifiable institutional chain between national policy and local agricultural actors.

India's architecture is more plural and distributed. Its corpus combines parliamentary legislation, national strategies, ministry guidelines, mission-based programmes, digital platforms, market systems, farmer-oriented information services, and collective producer organizations. Communication therefore occurs through multiple institutional and technological channels.

The difference can be characterized as institutionally cohesive communication in Vietnam versus institutionally plural and digitally distributed communication in India. Neither configuration should be interpreted as inherently superior. Cohesion can improve consistency and organizational reach, while plurality can improve flexibility, choice, and access to diverse channels. Each also produces distinctive vulnerabilities.

4.2 Source Authority

The first dimension concerns the institutional source of policy messages.

In Vietnam, source authority is strongly visible in national laws, Central Committee resolutions, Prime Ministerial decisions, government decrees, and ministry directives. The policy corpus demonstrates a clear vertical architecture of authority. Strategic agricultural and rural objectives are translated into specific sectoral and implementation instruments.

This arrangement can support policy coherence. Where multiple levels of government and associated organizations work within a common policy framework, policy messages can be communicated with relatively clear institutional legitimacy.

The Vietnam Farmers' Union adds an important organizational layer. Its national resolutions and institutional role indicate that farmer representation is embedded within the wider policy communication structure rather than existing entirely outside it. The presence of community agricultural extension arrangements further strengthens the connection between formal policy and local agricultural actors.

India also demonstrates strong central policy authority, particularly through Parliament, national

ministries, NITI Aayog, and centrally designed agricultural programmes. However, the Indian system distributes communication across a broader range of instruments and institutional channels.

The result is greater communication plurality but potentially more complexity. A farmer may encounter agricultural policy through a ministry programme, digital platform, market mechanism, producer organization, extension service, or other institutional interface. The breadth of channels can increase access but may also create inconsistent levels of awareness, interpretation, and implementation.

Thus, Vietnam's relative strength lies in institutional coherence, whereas India's lies in institutional plurality and scalability.

4.3 Message Framing

The second-dimension concerns how sustainable agribusiness is represented in policy discourse.

The Vietnamese corpus frames sustainability through an interconnected vocabulary involving agricultural restructuring, environmental protection, climate resilience, organic agriculture, circular economy, green growth, rural development, and low-emission agricultural production. Instruments concerning organic agriculture, climate adaptation, circular economy development, and the one-million-hectare high-quality, low-emission rice initiative illustrate the increasing integration of environmental and economic objectives.

This framing is significant because it places sustainability within agricultural transformation rather than presenting it solely as environmental regulation. Sustainability becomes associated with production quality, market positioning, resilience, and rural development.

The Indian corpus similarly connects sustainability with natural farming, organic farming, climate action, irrigation, crop insurance, renewable energy, infrastructure, market reform, and digital agriculture. Its policy architecture therefore frames sustainable agriculture through a broader portfolio of programmes and missions.

A major difference is the degree of institutional integration. Vietnam's policy sequence presents sustainability within a relatively coherent strategic framework. India's sustainability discourse is distributed across numerous schemes and operational guidelines.

From the perspective of agribusiness, both approaches have advantages. A coherent policy narrative can improve understanding of long-term objectives, while a diverse programme architecture can create multiple entry points for farmers and entrepreneurs.

4.4 India: digital reach and unequal access

India's communication architecture demonstrates a pronounced movement toward digitalization.

The inclusion of e-NAM, the Digital Agriculture Mission, the IDEA/AGRISTACK consultation framework, PM-KISAN operational guidelines, *Kisan Suvidha*, and *mKisan* demonstrates that digital communication is not an isolated technological intervention. It is becoming embedded within agricultural policy infrastructure.

e-NAM is particularly relevant because it connects policy communication with market participation. Digital information concerning markets can potentially affect decisions concerning where and when agricultural products are sold. Digital platforms can consequently connect communication with economic value creation.

The broader literature supports this interpretation of digital agriculture as a transformation in relationships among rural actors, information, markets, and institutions (Klerkx et al., 2019; Ma et al., 2023). Digital transformation may also alter the skills required by agricultural actors and the institutional capacity required to support effective participation (Liu et al., 2026).

The Digital Agriculture Mission and associated digital ecosystem initiatives indicate a broader transformation in the relationship between farmers, data, public administration, and agricultural services. Information can potentially move faster and across greater geographical distances than through exclusively interpersonal extension systems.

However, digital reach must not be confused with universal access. The rural digital divide can involve connectivity, device ownership, digital literacy, language, affordability, and trust. Institutional fragmentation can further complicate the user experience.

This produces a central paradox:

The more communication is digitized, the greater its potential scale, but scale does not automatically produce inclusion.

Evidence concerning digital development in rural Vietnam similarly illustrates that technology's economic effects depend upon actual access and use, rather than technological availability alone (Nguyen et al., 2023). Research on digital agricultural extension further reinforces the importance of adoption conditions and intermediary support (Uy et al., 2025).

For sustainable agribusiness, the implication is that digital systems should complement rather than simply replace local institutional communication. Digital information becomes more actionable when supported by trusted intermediaries capable of explaining, contextualizing, and adapting it to local circumstances.

4.5 Vietnam: institutional cohesion and one-way communication

Vietnam's policy corpus demonstrates a different strength. The combination of government policy, agricultural extension, Farmers' Union structures, and community-level organizations creates a comparatively embedded communication system.

The Vietnam Farmers' Union is particularly significant because it provides an organizational bridge between national agricultural priorities and farmers. Community agricultural extension groups similarly create mechanisms for local interaction and knowledge dissemination.

Such arrangements can reduce communication distance. Policy messages can be translated through organizations that understand local agricultural contexts, thereby reducing the gap between formal policy language and practical action.

The Vietnamese evidence should likewise be interpreted with caution. Digital agricultural communication can expand access to information, but adoption is shaped by farmers' capabilities, access conditions, and the suitability of digital extension approaches to local circumstances. Evidence on smallholder farmers in Vietnam indicates that digital technology adoption has implications for the design of agricultural extension strategies, reinforcing the need to consider adoption conditions rather than assuming that the availability of a digital channel guarantees effective use (Uy et al., 2025).

Nevertheless, institutional cohesion can also create a communication asymmetry. Where organizations are strongly integrated into formal policy structures, their capacity to transmit official messages may exceed their capacity to transmit critical feedback upward.

This distinction is important. Effective dissemination is not the same as effective participation.

A communication system can achieve high levels of message consistency while still providing limited opportunities for farmers to shape policy interpretation or implementation. The challenge is therefore to transform institutional networks from predominantly transmission mechanisms into two-way learning systems.

4.6 Communication versus participation

The comparison reinforces the distinction between information and participation.

Information provides actors with knowledge of policy. Participation provides opportunities for actors to influence decisions. Arnstein (1969) demonstrated why the distinction matters: communication can remain tokenistic if affected communities have no meaningful influence over outcomes.

This does not mean that every agricultural policy decision must be collectively negotiated with every farmer. Rather, sustainable agribusiness requires institutional mechanisms through which local knowledge, implementation barriers, market experiences, and unintended consequences can enter policy-learning processes.

India's consultation-oriented digital ecosystem initiatives demonstrate the potential for broader information exchange, while producer organizations create collective mechanisms for aggregation and representation. Vietnam's Farmers' Union and community extension structures offer established organizational channels for farmer interaction.

The policy challenge in both systems is to move beyond the simple question of whether information reaches farmers toward the more demanding question of whether institutional systems learn from farmers.

Kumar and Basu (2022) make this issue particularly relevant to India's agri-digital transition by emphasizing the importance of end-user feedback in the policy landscape. The implication for the present comparison is that digital platforms should not be evaluated only according to the quantity or speed of information disseminated. Their institutional value also depends upon whether users can communicate problems, needs, and experiences back into policy processes.

4.7 Information versus institutional asymmetry

Information asymmetry is a longstanding issue in agricultural markets. Farmers may lack information about prices, buyers, standards, technologies, finance, or policy eligibility, while governments and market actors may lack timely information about local constraints and farmer experiences.

Digitalization can reduce some forms of information asymmetry. Market platforms can increase price visibility, while digital government systems can improve access to programme information. Yet digitalization can also create new asymmetries when data, technological skills, and platform access are unevenly distributed.

Institutional intermediaries can therefore remain important even in digitally advanced agricultural systems.

The Vietnamese model demonstrates the value of organizational embeddedness, while the Indian model demonstrates the value of technological reach. Combining these strengths may offer a more robust communication architecture than relying exclusively on either.

The issue is also relevant to social inclusion. Rural populations are internally differentiated by gender, age, education, income, landholding, location, market orientation, organizational membership, and digital

access. Communication systems designed around a technologically connected or commercially oriented “average farmer” may therefore leave significant groups underserved.

4.8 Communication as an agricultural innovation-system capability

Agricultural innovation depends upon interactions among farmers, researchers, extension services, entrepreneurs, public agencies, markets, and technology providers. The World Bank (2012) conceptualizes agricultural innovation systems as networks through which knowledge, institutions, and actors interact to produce and apply innovation.

From this perspective, communication is not merely an information-service function. It is a capability of the innovation system itself.

A new technology becomes an innovation only when it is understood, adapted, used, and embedded within economic and social practice. This requires communication across institutional boundaries.

The same principle applies to circular agriculture. Circularity involves new relationships among producers, processors, waste streams, energy systems, consumers, and regulators. Policy communication must make these relationships intelligible and coordinate expectations.

The Vietnamese and Indian cases therefore illustrate two dimensions of innovation-system communication. Vietnam demonstrates the potential of institutional embeddedness and organizational coordination. India demonstrates the potential of digital scalability and diversified channels.

The analytical significance is that technological innovation and institutional innovation cannot be separated. Digital platforms may expand reach, but organizational arrangements determine how information is interpreted and acted upon. Conversely, strong intermediary institutions may provide trust and contextualization but require scalable channels to reach increasingly diverse rural populations.

4.9 Agribusiness entrepreneurship and communication

Entrepreneurship is frequently discussed in terms of opportunity recognition, innovation, risk-taking, and value creation (Mair & Martí, 2006). In rural environments, however, entrepreneurial opportunity is partly dependent upon institutional information.

A farmer or rural entrepreneur may identify an opportunity in organic products, low-emission production, digital marketing, processing, aggregation, renewable energy, or value-added food products. Turning that

opportunity into an enterprise requires knowledge about standards, markets, finance, infrastructure, technology, and policy incentives.

Communication therefore affects entrepreneurship at several stages.

First, policy communication can make entrepreneurs aware of new opportunities. Second, institutional intermediaries can translate technical or regulatory information into practical business decisions. Third, market communication can connect producers with buyers. Fourth, feedback from entrepreneurs can reveal implementation barriers and opportunities for policy refinement.

The communication architecture should therefore be assessed not only by how efficiently it disseminates policy but also by whether it reduces uncertainty for rural entrepreneurs.

This is particularly important for value-chain development. Commercialization does not occur automatically when policy encourages market participation. Producers require institutional mechanisms that connect production with aggregation, processing, logistics, market information, finance, and buyers (Barrett et al., 2001; Belcher & Schreckenberger, 2007). Collective action can further support market-chain innovation by enabling producers to coordinate resources and information (Devaux et al., 2009).

4.10 Social inclusion and the “average farmer”

A further concern is the tendency of policy communication to imagine an “average farmer.” Rural communities are heterogeneous. Farmers differ in age, gender, education, landholding, market orientation, connectivity, income, location, and organizational membership.

A communication mechanism that works for a commercially oriented, digitally connected farmer may not work for a smallholder with limited connectivity or digital literacy.

India’s multiple communication channels create potential opportunities for segmentation but also create risks of exclusion. Vietnam’s organizational channels can support social embeddedness but may similarly fail to capture all forms of rural diversity if institutional representation is incomplete.

The inclusion issue also extends to value chains and entrepreneurship. Interventions designed to strengthen market participation may distribute benefits unevenly across social groups. Evidence from value-chain interventions suggests that gender and other dimensions of social position can influence the distribution of economic opportunities (Malhotra et al., 2024).

Sustainable agribusiness communication should therefore be designed as a multi-channel architecture rather than a single communication pipeline. Digital systems, extension, producer organizations, community institutions, training, and interpersonal communication should operate as complementary components.

4.12 The Institutional-Communication Framework

The comparative findings lead to the proposed Institutional-Communication Framework (ICF).

The framework contains **five** connected layers:

Layer 1: Policy Authority

National political institutions, governments, ministries, and other authorized bodies establish policy direction, legal requirements, strategic objectives, and institutional responsibilities.

Layer 2: Institutional Translation and Mediation

Policy objectives are interpreted and translated by ministries, local administrations, extension services, farmer organizations, cooperatives, producer organizations, universities, and other intermediaries.

Layer 3: Multi-Channel Dissemination

Information reaches rural actors through digital platforms, agricultural extension, farmer organizations, market systems, mobile communication, community groups, training, and interpersonal networks.

Layer 4: Agribusiness Action

Farmers and entrepreneurs interpret information and make decisions concerning production, investment, marketing, innovation, organization, and sustainability.

Layer 5: Feedback and Institutional Learning

Experiences, barriers, market signals, local knowledge, and unintended effects move back through intermediary institutions toward policy authorities, enabling adaptation and institutional learning.

The framework can be represented as:

Policy Authority → Institutional Translation → Multi-Channel Dissemination → Agribusiness Action → Feedback → Institutional Learning → Policy Adaptation

The circular rather than linear structure is deliberate. Sustainable agribusiness requires policy systems capable of learning from implementation.

The ICF combines the complementary strengths revealed by the comparison. Vietnam illustrates the importance of institutional mediation and organizational embeddedness. India illustrates the possibilities created by digital scalability and plural communication channels. The framework does not seek to reproduce either national architecture in another context. Rather, it identifies institutional functions that can be combined according to local conditions.

4.12 Comparative synthesis

Table 2 synthesizes the principal differences identified across the four communication dimensions. The comparison indicates that Vietnam's principal institutional strength lies in organizational cohesion and local embeddedness, whereas India's principal strength

Table 2. Comparative Institutional-Communication Architecture of Vietnam and India

Dimension	Vietnam	India	Principal implication
Source authority	Strongly centralized and institutionally cohesive	Strong national authority combined with plural and distributed channels	Cohesion supports consistency; plurality supports flexibility
Message framing	Integrated sustainability, rural development, climate resilience and agricultural transformation	Sustainability distributed across missions, schemes, market and digital initiatives	Integrated framing may improve coherence; diversified framing creates multiple entry points
Dissemination channels	Government structures, Farmers' Union, extension and community groups	Digital platforms, market systems, extension, schemes and producer organizations	Vietnam demonstrates embeddedness; India demonstrates scalability
Digitalization	Increasingly integrated into rural development and agricultural systems	Strong and highly visible component of agricultural policy architecture	Digitalization can expand reach but requires inclusion mechanisms
Feedback	Organizational and institutional channels exist but may remain comparatively vertical	Consultation, digital and producer-organization mechanisms create opportunities for broader feedback	Both systems need stronger systematic upward learning
Agribusiness implication	Institutional coordination and local embeddedness	Market connectivity, digital reach and institutional plurality	Complementary strengths can inform hybrid policy architecture

Note. The comparison summarizes patterns identified through analysis of the 45-document corpus. It represents institutional communication architecture rather than measured farmer behaviour, adoption rates, or causal policy effects.

Source. Authors' analysis of the Vietnam and India policy corpora documented in Appendices A and B.

lies in communication plurality, digital reach, and market connectivity. Neither configuration is sufficient by itself. The findings instead point toward the value of combining institutional mediation with scalable and reciprocal communication mechanisms.

The comparison suggests that neither country provides a complete model. Vietnam's strength is its ability to connect policy with organizational structures. India's strength is its ability to create multiple and scalable communication pathways.

The most productive comparative lesson is therefore not to choose between centralized and decentralized communication but to combine institutional trust, local mediation, digital reach, market connectivity, and reciprocal feedback.

4.13 Toward a two-way policy communication architecture

The central conceptual contribution of the study is the proposition that agricultural policy communication should be evaluated through two directional flows.

The first is the **downward flow**:

Government → Institutions → Intermediaries → Farmers and Entrepreneurs

This flow concerns authority, clarity, interpretation, dissemination, and implementation.

The second is the **upward flow**:

Farmers and Entrepreneurs → Intermediaries → Institutions → Government

This flow concerns experience, feedback, market signals, implementation barriers, innovation, and policy learning.

A sustainable communication architecture requires both.

The comparison suggests that India has developed considerable potential for expanding downward reach through digital systems, while Vietnam possesses comparatively strong organizational structures for institutional mediation. Each can learn from the other's strengths.

The significance of the two-way architecture is that communication becomes part of an adaptive policy system. Downward communication provides coordination; upward communication provides learning. Without the former, policy objectives may not reach intended actors. Without the latter, institutions may have limited capacity to identify how policies operate in diverse rural settings.

5. IMPLICATIONS FOR SUSTAINABLE AGRIBUSINESS

5.1 Implications for policymakers

Policymakers should treat communication architecture as part of policy design rather than as a post-policy dissemination exercise.

Every major agricultural policy should identify:

1. intended audiences;
2. institutional intermediaries responsible for translation;
3. multiple dissemination channels;
4. accessibility requirements;
5. feedback mechanisms; and
6. indicators for assessing communication effectiveness.

This approach would make communication measurable as an implementation capability.

Policy design should also distinguish between information delivery and institutional learning. A digital platform that distributes information but does not capture meaningful user feedback may improve reach without improving policy responsiveness.

5.2 Implications for rural entrepreneurship

Rural entrepreneurship benefits when policy communication reduces uncertainty. Entrepreneurs require timely information concerning markets, standards, finance, technology, incentives, infrastructure, and regulatory procedures.

Digital systems can improve access, but local institutional intermediaries remain important for interpretation and trust. A hybrid communication model could therefore combine digital information with extension support, producer organizations, universities, cooperatives, and local business networks.

Such an approach is particularly relevant where entrepreneurship involves new sustainability-related opportunities. Organic production, low-emission agriculture, circular enterprises, renewable energy, processing, and digital market services all require entrepreneurs to interpret multiple forms of institutional information.

5.3 Implications for agricultural innovation

Innovation requires interaction. Governments should therefore strengthen mechanisms connecting farmers, researchers, entrepreneurs, extension agents, technology providers, and markets.

Universities can play an important role as knowledge brokers. Their contribution should extend beyond research

production to policy translation, capacity development, innovation incubation, and evidence-based feedback.

Agricultural innovation systems are particularly dependent upon communication across institutional boundaries because knowledge must be translated between scientific, administrative, commercial, and local contexts (World Bank, 2012). Strengthening these connections can improve the likelihood that technological innovations become usable innovations.

5.4 Implications for sustainability

Environmental sustainability becomes more likely to generate durable economic value when it is communicated as part of a broader value proposition.

Organic production, low-emission agriculture, circular-economy initiatives, climate adaptation, renewable energy, and resource-efficient production should be connected with market opportunities, entrepreneurship, resilience, and rural livelihoods.

Communication should consequently avoid presenting sustainability solely as compliance. It should also communicate opportunity.

This is consistent with the broader transformation of agrifood systems described by FAO (2017, 2022), in which environmental, economic, social, and technological considerations increasingly interact.

5.5 Implications for universities and knowledge institutions

Universities occupy an important intermediate position between policy, knowledge, markets, and communities.

They can contribute by:

- translating technical research into accessible policy information;
- evaluating communication effectiveness;
- developing agricultural entrepreneurship programmes;
- supporting digital literacy;
- facilitating farmer-researcher interaction;
- documenting grassroots innovations;
- creating evidence-based feedback mechanisms.

For universities engaged with rural development, communication should therefore be treated as a component of knowledge transfer and institutional engagement.

6. CONCLUSIONS

This study examined the relationship between policy communication and institutional frameworks

for sustainable agribusiness through a comparative documentary analysis of Vietnam and India.

Analysis of the 45-document corpus indicates that both countries have developed substantial policy architectures addressing agricultural transformation, sustainability, climate resilience, rural development, market integration, digitalization, and agricultural extension. Yet the institutional pathways through which policy meaning is communicated differ substantially.

Vietnam demonstrates comparatively strong institutional cohesion. National policy authority is connected to agricultural ministries and agencies, extension systems, farmer organizations, and community-level structures. This architecture can support consistent dissemination and local mediation. Its principal vulnerability is the possibility that strong vertical communication may not be matched by equally systematic upward feedback.

India demonstrates comparatively broad institutional and technological plurality. Digital agriculture, e-NAM, farmer information platforms, producer organizations, and national programmes provide multiple routes through which information can reach agricultural actors. Its principal vulnerabilities include the rural digital divide, differences in institutional capacity, and fragmentation across programmes and channels.

The comparison demonstrates that communication should not be treated as a secondary activity occurring after policy formulation. It is part of the institutional infrastructure through which policy becomes actionable.

The study's principal conceptual contribution is the Institutional-Communication Framework, which links five stages:

Policy Authority → Institutional Translation → Multi-Channel Dissemination → Agribusiness Action → Feedback and Institutional Learning

The framework shifts attention from the question "Was the policy communicated?" toward more consequential questions: Was the policy understandable? Was it accessible? Could actors act upon it? Could they respond? And did institutions learn from implementation?

The implications extend beyond Vietnam and India. Many emerging economies face similar challenges involving agricultural modernization, climate change, digital transformation, rural entrepreneurship, and institutional fragmentation. The comparative lesson is not that one communication model should replace another. Rather, effective sustainable agribusiness policy requires the complementary strengths of institutional coherence, local mediation, digital reach, market connectivity, and reciprocal feedback.

The study nevertheless has an important limitation. Because it is based on documentary analysis, the findings describe policy communication architecture and institutional design rather than actual farmer behaviour or measured adoption outcomes. The analysis cannot independently establish whether individual policy messages reached particular farmers, how they were interpreted, or whether they produced specific economic or environmental effects.

Future research should therefore complement documentary analysis with field-based evidence. Surveys, interviews, focus groups, digital-platform analytics, case studies of producer organizations, and longitudinal assessments could test whether the communication structures identified here translate into actual changes in knowledge, adoption, entrepreneurship, market participation, and sustainable agricultural practice.

Ultimately, sustainable agribusiness requires more than sustainable policy. It requires institutions capable of communicating sustainability, actors capable of acting upon it, and governance systems capable of learning from those actions. Policy communication becomes transformational when it ceases to function as a one-way transmission of government intentions and becomes an institutional process of shared learning between policy systems and the rural economies they seek to transform.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used generative AI and AI-assisted technologies in a limited editorial capacity, primarily for language refinement, grammar correction, and clarity. These technologies were not used to develop the research questions, theoretical framework, research propositions, substantive arguments, interpretation, or conclusions. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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Appendix A.

Primary Policy Documents of Vietnam (2015–2025)

Group I. Macro-level Strategic and Legislative Frameworks

No.	Issuing organization	Document number and title	Year	Official source
1.	National Assembly	Law on Crop Production (No. 31/2018/QH14)	2018	Cổng TTĐT Chính phủ
2.	National Assembly	Law on Animal Husbandry (No. 32/2018/QH14)	2018	Cổng TTĐT Chính phủ
3.	National Assembly	Law on Environmental Protection (No. 72/2020/QH14)	2020	Cổng TTĐT Chính phủ
4.	Central Committee of CPV	Resolution No. 19-NQ/TW: On agriculture, farmers, and rural areas to 2030	2022	Báo Điện tử Đảng Cộng sản
5.	Government (Prime Minister)	Decision No. 150/QĐ-TTg: Strategy for Sustainable Agriculture and Rural Development	2022	Cổng TTĐT Chính phủ
6.	Government (Prime Minister)	Decision No. 1658/QĐ-TTg: National Green Growth Strategy (2021–2030)	2021	Cổng TTĐT Chính phủ
7.	Government	Resolution No. 120/NQ-CP: Sustainable and Climate-Resilient Development of the Mekong Delta	2017	Cổng TTĐT Chính phủ
8.	Government (Prime Minister)	Decision No. 255/QĐ-TTg: Restructuring the Agricultural Sector (2021–2025)	2021	Cổng TTĐT Chính phủ

Group II. Climate-Smart Agriculture and Bio-Economy Directives

No.	Issuing organization	Document number and title	Year	Official source
9.	Government (Prime Minister)	Decision No. 1490/QĐ-TTg: Scheme on 1 million hectares of high-quality, low-emission rice	2023	Cổng TTĐT Chính phủ
10.	Government (Prime Minister)	Decision No. 687/QĐ-TTg: Scheme on Circular Economy Development in Vietnam	2022	Cổng TTĐT Chính phủ
11.	Government (Prime Minister)	Decision No. 885/QĐ-TTg: Scheme on Organic Agriculture Development	2020	Cổng TTĐT Chính phủ
12.	Government	Decree No. 109/2018/ND-CP: On Organic Agriculture	2018	Cổng TTĐT Chính phủ
13.	MARD	Decision No. 431/QĐ-BNN-KH: Action Plan for Climate Change Adaptation in Agricultural Sector	2021	Cổng TTĐT Bộ NN&PTNT
14.	MARD	Circular No. 18/2018/TT-BNNPTNT: Guiding Good Agricultural Practices (VietGAP)	2018	Cổng TTĐT Bộ NN&PTNT
15.	MARD	Directive No. 8084/CT-BNN-KHCN: Promoting bio-circular economy in agriculture	2020	Cổng TTĐT Bộ NN&PTNT
16.	Government (Prime Minister)	Decision No. 340/QĐ-TTg: Strategy for Collective Economy and Cooperatives	2021	Cổng TTĐT Chính phủ

Group III. Dissemination Networks, Digitalization and Extension

No.	Issuing organization	Document number and title	Year	Official source
17.	Government	Decree No. 83/2018/ND-CP: On Agricultural Extension	2018	Cổng TTĐT Chính phủ
18.	Government (Prime Minister)	Decision No. 749/QĐ-TTg: National Digital Transformation Programme	2020	Cổng TTĐT Chính phủ
19.	Government (Prime Minister)	Decision No. 924/QĐ-TTg: Digital Transformation in New Rural Development Programme	2022	Cổng TTĐT Chính phủ
20.	Central Committee of CPV	Resolution No. 46-NQ/TW: Upgrading the quality of operations of the Vietnam Farmers' Union	2023	Báo Điện tử Đảng Cộng sản
21.	Vietnam Farmers' Union	Resolution of the 7th National Congress of Vietnam Farmers' Union (2018–2023)	2018	Cổng TTĐT Hội Nông dân
22.	Vietnam Farmers' Union	Resolution of the 8th National Congress of Vietnam Farmers' Union (2023–2028)	2023	Cổng TTĐT Hội Nông dân
23.	MARD	Decision No. 3444/QĐ-BNN-KN: Consolidating Community Agricultural Extension Groups	2022	Cổng TTĐT Bộ NN&PTNT

Note. The appendix constitutes the documentary audit trail for the Vietnam component of the 45-document corpus. It records the issuing organization, document number or title, year, and official source. The documents are organized according to the three analytical groups used in the study.

Appendix B.**Primary Policy Documents of India (2015–2025)****Group I. Macro-level Strategic and Legislative Frameworks**

No.	Issuing organization	Document number and title	Year	Official source
24.	Parliament of India	The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act	2020	The Gazette of India
25.	Parliament of India	The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act	2020	The Gazette of India
26.	Parliament of India	The Essential Commodities (Amendment) Act	2020	The Gazette of India
27.	MoA&FW	Model Agricultural Produce and Livestock Marketing (APLM) Act	2017	Department of Agriculture and Farmers Welfare
28.	NITI Aayog	Strategy for New India @ 75 (Agriculture Chapter)	2018	NITI Aayog Portal
29.	Ministry of Commerce & Industry	National Agriculture Export Policy	2018	Ministry of Commerce
30.	MoA&FW	Model Contract Farming Act	2018	Department of Agriculture and Farmers Welfare

Group II. Climate-Smart Agriculture and Bio-Economy Directives

No.	Issuing organization	Document number and title	Year	Official source
31.	MoA&FW	National Mission for Sustainable Agriculture (NMSA) Operational Guidelines	2015	NMSA Portal
32.	MoA&FW	Paramparagat Krishi Vikas Yojana (PKVY) Guidelines for Organic Farming	2015	PKVY Portal
33.	MoA&FW	National Mission on Natural Farming (NMNF) Guidelines	2022	NMNF Portal
34.	MNRE	PM KUSUM (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan) Guidelines	2019	Ministry of New and Renewable Energy
35.	MoA&FW	PM Fasal Bima Yojana (PMFBY) Operational Guidelines (Crop Insurance)	2016	PMFBY Portal
36.	MoA&FW	PM Krishi Sinchayee Yojana (PMKSY) Guidelines (Sustainable Irrigation)	2015	PMKSY Portal
37.	MoA&FW	National Action Plan on Climate Change (NAPCC), Agriculture Component Framework	2018	Department of Agriculture and Farmers Welfare

Group III. Dissemination Networks, Digitalization and Extension

No.	Issuing organization	Document number and title	Year	Official source
38.	MoA&FW	e-NAM (National Agriculture Market) Operational Guidelines	2016	e-NAM Portal
39.	MoA&FW	Digital Agriculture Mission (2021–2025) Framework	2021	Department of Agriculture and Farmers Welfare
40.	MoA&FW	India Digital Ecosystem of Agriculture (IDEA) / AGRISTACK Consultation Paper	2021	Department of Agriculture and Farmers Welfare
41.	MoA&FW	PM-KISAN (Pradhan Mantri Kisan Samman Nidhi) Operational Guidelines	2019	PM-KISAN Portal
42.	MoA&FW	Formation and Promotion of 10,000 Farmer Producer Organizations (FPOs) Guidelines	2020	Department of Agriculture and Farmers Welfare
43.	MoA&FW	Agriculture Infrastructure Fund (AIF) Operational Guidelines	2020	AIF Portal
44.	Ministry of Electronics & IT / MoA&FW	<i>Kisan Suvidha</i> App Development Framework	2016	Digital India
45.	MoA&FW	<i>mKisan</i> SMS Portal Guidelines	2015	<i>mKisan</i> Portal

Note. The appendix constitutes the documentary audit trail for the India component of the 45-document corpus. It records the issuing organization, document number or title, year, and official source. The documents are organized according to the three analytical groups used in the study.

Abbreviations:

MoA&FW = Ministry of Agriculture and Farmers Welfare, India; MARD = Ministry of Agriculture and Rural Development, Vietnam; CPV = Communist Party of Vietnam; MNRE = Ministry of New and Renewable Energy; NMSA = National Mission for Sustainable Agriculture; PKVY = Paramparagat Krishi Vikas Yojana; PMFBY = Pradhan Mantri Fasal Bima Yojana; PMKSY = Pradhan Mantri Krishi Sinchayee Yojana; e-NAM = National Agriculture Market; FPO = Farmer Producer Organization; AIF = Agriculture Infrastructure Fund.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Farmers' Perception towards Agricultural Development in Southern Odisha

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 22-Sep-26

ACCEPTED: 30-Sep-26

PUBLISHED: 15-Oct-26

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Citation: Payal Mishra, Satarupa Modak, Chitrasena Padhy, Nibedita Mishra and Sai Kumar Periginji (2026). Farmers' Perception towards Agricultural Development in Southern Odisha. Horizon J. Hum. Soc. Sci. Res. 8 (S), 59–67. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1394.p59>



ABSTRACT

The study examined farmers' attitudes towards agricultural extension services, perceptions of organisational support, and willingness to participate in agricultural development activities in the tribal-dominated districts of Gajapati and Rayagada, Odisha. Using an ex-post-facto design, 120 respondents were randomly selected from six blocks and interviewed through a structured schedule. Data were analysed using frequency, percentage, mean, standard deviation, correlation, and multiple regression. Most respondents exhibited moderately favourable attitudes towards extension services (57.5%), perceived moderate organisational support (60%), and demonstrated moderate willingness to participate (40%). Attitude was significantly associated with age, education, organisational membership, housing condition, annual income, outside contact, and economic motivation. Participation willingness was significantly influenced by cropping pattern, landholding, outside contact, and information-seeking behaviour. Inadequate irrigation, low productivity, limited access to agricultural innovations, and climate variability emerged as major constraints. Decentralised extension delivery, climate-resilient interventions, improved irrigation, and farmer-centred capacity building are therefore essential for agricultural development in tribal Odisha.

Keywords: Agricultural development, Agricultural extension, Farmers' attitude, Organisational support, Southern Odisha, Willingness to participate.

1. INTRODUCTION

According to Moseley and Malcolm (2003) and Ahmad (2023), rural development is a process that addresses the economic welfare and overall development of people

residing in relatively remote and sparsely populated areas. Agricultural development is an important part of rural development, involving a multidimensional process of enhancing the material and social welfare of

agricultural communities through improved production methods, extension services, infrastructure, and market linkages (Terzo, 2024). Given that India has a majority of its population in rural areas. It relies heavily on the agriculture sector; strengthening agriculture is a key priority in the national development strategy (World Bank, 2023).

With the third-highest Scheduled Tribe population in the state, Odisha faces unique challenges in the tribal-dominated southern districts (Routray & Mishra, 2022). The rain-fed farming system remains dominant in Gajapati and Rayagada districts. At the same time, farmers have limited access to markets and limited exposure to modern technologies, institutional extension services, and practices (Kumar et al., 2022). Recent studies from Gajapati and Rayagada districts have similarly identified limitations related to technical knowledge, training, market access, communication behaviour, and institutional support as important constraints affecting agricultural development in Southern Odisha (Das et al., 2025). To develop extension strategies that are locally responsive and not generically top-down, one needs to understand farmers' perceptions of ongoing development activities, their attitudes towards extension services, their perceptions of organisational support, and their willingness to participate (Bahubalendra et al., 2023).

In the last few years, there has been an increasing number of studies examining farmers' attitudes towards extension and development interventions across various Indian and South Asian settings. Moderate to positive attitude of rice farmers towards Good Agricultural Practices (Hoque et al., 2024), towards ICT-based extension services in West Bengal (Mukherjee et al., 2022), towards regulated markets in Odisha (Behera & Modak, 2022) and towards national horticulture missions in Haryana (Kaur et al., 2023) have been reported. The socio-economic and institutional factors which influence farmers' involvement in development and financing programmes have also been discussed in complementary studies (Kan et al., 2022; Zhou & Ding, 2022), and other studies have identified structural barriers to agricultural production such as irrigation, transportation and market access in similar tribal and hilly regions (Pruthviraj et al., 2022; K Ravi, 2023). Although recent studies have examined livelihood security, agripreneurial constraints, and communication behaviour among farming communities in Southern Odisha, comparatively less attention has been given to the combined assessment of farmers' attitudes towards extension services, perceptions of organisational support, and willingness to participate in agricultural development activities (Ghosh et al., 2025). In this backdrop, the present study aims to fulfil three specific objectives as follows: (i) to study the attitude of

farmers towards agricultural development in Southern Odisha; (ii) to understand the willingness of farmers towards agricultural development in Southern Odisha, and (iii) to identify the problems faced by farmers and to suggest some remedies for agricultural development in the region.

2. MATERIALS AND METHODS

The study was carried out in Gajapati and Rayagada districts of Southern Odisha, India, in 2023-24. Three blocks were selected randomly from each district, namely R. Udayagiri, Gumma and Rayagada from Gajapati district and Rayagada, Gunupur and Muniguda from Rayagada district, which have predominantly tribal and agriculture-dependent populations (Nayak & Bhuiyan, 2022). Data were collected from 3-4 villages, each selected from the three chosen blocks.

The research design adopted was the ex-post-facto design because the phenomena studied (farmers' attitudes, perceptions, and willingness) had already occurred and could not be manipulated. The total number of respondents was 120 farmers (60 from each district), selected through simple random sampling.

A pretested structured interview schedule was used; data were collected through direct personal contact with respondents. Standardised measurement scales were adapted from previously developed scales in extension research with a few modifications. Twenty six independent variables were included, socio personal: age, gender, educational qualification, religion, caste, family type, marital status, socio economic: land holding, annual income, household expenditure, borrowing pattern, communication and institutional contact: mass media exposure, information seeking behaviour, outside contact, personal visit by development personnel, social participation, need related: need perceived and need fulfilled across ten agricultural operations. Three dependent variables were measured: attitude of the farmers towards extension services, their perception of the change (or not) of the farmers caused by the organisational support, and their willingness to participate in activities within the agricultural development of the village.

Collected data were coded, tabulated, and analysed using descriptive statistics (frequencies, percentages, means, and standard deviations) to describe the sample and its perceptions. The bivariate relationships between the independent and dependent variables were examined at the 1% and 5% levels of significance using the Karl Pearson correlation coefficient, and the combined relationship of the independent variables with each dependent variable was assessed using multiple linear regression analysis.

3. RESULTS AND DISCUSSION

3.1 Socio-Demographic and Farm Profile

The majority of respondents were middle-aged farmers (35-50 years; 63%), whereas young farmers (up to 35 years) accounted for 22% and older farmers (above 50 years) for 15%. Men represented 62% of the respondents. Literacy levels were low, with 55% of respondents having completed only primary education and 17% being illiterate, similar to the low literacy rate reported in tribal blocks in Odisha (Routray & Mishra, 2022). Most of the respondents (96%) were Hindu, 56% were from the Scheduled Caste category, and 59% lived in joint families. When asked about farming background, 71% of the respondents had 0-10 years' experience with allied farming behaviour. In comparison, 88% of respondents were engaged in monocropping, which is correlated with the low level of implementation of diversified or integrated farming systems reported elsewhere in similar agro-climatic zones (Kumar & Sharma, 2022). Landholdings were also low, with 85% of farmers having 0-5 acres, and people were generally living in thatched housing, with 67% of farmers.

3.2 Communication, Institutional Contact, and Economic Profile

The level of institutional involvement was mostly sporadic and infrequent. The involvement with specialised extension bodies was weak: 62.5% of respondents visited

KVK/ATMA occasionally; 86.7% had not joined any farmers' club; 79.2% had not visited any cooperative society; and 59.2% had not visited any NGO or Farmer Producer Organisation, with the Department of Agriculture staff visiting once a month. The limited participation in formal extension and collective institutions is consistent with other studies on weak farmer-institution linkages in other Indian contexts (Bahubalendra et al., 2023; Masanja et al., 2023). Similar communication patterns have recently been reported among tomato growers in Southern Odisha, where mobile phones and television were frequently used while extension publications and several conventional information channels were less frequently accessed (Amar et al., 2025). The analysis revealed that input dealers were the most important source of information for the smallholders (80% of the respondents) compared with newspapers (14.2%) and mobile phones (25.5%), which, as in other underserved regions, continue to be important information sources for smallholders (Mukherjee et al., 2022). The relatively limited use of mobile phones observed in the present study also highlights the scope for strengthening digital extension channels, as digital technologies can facilitate more timely access to agricultural information when farmers and rural intermediaries have adequate connectivity, digital competence, and access to suitable platforms (Masso & Prusty, 2026). More broadly, evidence from tribal farming communities in Odisha indicates that agricultural information transfer is influenced by farmers' socio-personal and experiential characteristics, reinforcing the need for locally adapted communication strategies (Saha et al., 2026). Financially, 79.2% of the farmers had availed loans from financial institutions; 87% reported

Table 1. Socio-demographic and farm profile of respondents (n = 120)

Variable	Category	Frequency (f)	Percentage (%)
Age	Young (≤35 yrs)	26	22
	Middle (35–50 yrs)	76	63
	Old (>50 yrs)	18	15
Gender	Male	74	62
	Female	46	38
Education	Illiterate	20	17
	Primary level	66	55
	High school level	34	28
Religion	Hindu	115	96
Caste	Scheduled Caste	67	56
Family type	Joint family	71	59
Farming experience	0–10 years	85	71
	11–20 years	44	37
Cropping pattern	Monocropping	106	88
Land holding	0–5 acres	102	85
Housing	Thatched house	80	67

Table 2. Institutional contact, information sources, and economic profile (n = 120)

Indicator	Category	Percentage (%)
Market visit	Visited (any frequency)	76.7
KVK/ATMA visit	Occasional	62.5
Farmers' club membership	Never joined	86.7
Cooperative society visit	Never visited	79.2
NGO/FPO visit	Never/rarely visited	59.2
Dept. of Agriculture visit	Monthly (personnel visit)	53.3
Primary information source	Input dealers	80
Information source	Mobile phones	25.5
Information source	Newspapers (regular)	14.2
Borrowing	Borrowed from financial institutions	79.2
Annual income/ expenditure	≤ Rs. 50,000	87
Economic motivation	Medium level	55

income and expenditure in the range of ₹50,000 or less per year; and 55% of the farmers showed a medium level of economic motivation.

3.3 Attitude towards Extension Services

The majority of the respondents (57.5%) had a moderate attitude towards agricultural extension services, 17% had a very high attitude, and 16.6% had a very low attitude. The prevalence of a moderate attitude is consistent with that of farmers in Bangladesh who grow aromatic rice and their attitudes towards Good Agricultural Practices (Hoque et al., 2024) as well as farmers in Haryana growing horticultural crops and their attitudes towards the national horticulture mission interventions (Kaur et al., 2023), which indicates a largely consistent attitude of farmers towards extension programming across South Asian smallholder contexts. The results of multiple regression analysis showed that the independent variables explained 45.3% of the variance in attitude ($R^2 = 0.4529$). The results indicated that age, educational qualification, organisational membership, housing condition, annual income, outside contact, and economic motivation were significant positive predictors. At the same time, applied-activity experience, social participation, and participation in extension activities were significant negative predictors. This finding may be interpreted as farmers with exposure to extension services having extensive experience with service quality issues and gaps, making them more negative.

3.4 Perception of Organisational Support

60% of respondents had a moderate perception of the changes induced by organisational support, 25% a low perception, and 15% a high perception. The independent variables accounted for the most variance in the regression outcome ($R^2 = 0.5685$), while the other two had explanatory power of 53.9% ($R^2 = 0.5393$) and 48.9% ($R^2 = 0.4885$). This result aligns with evidence indicating that farmers' perceptions of institutional value are closely associated with the accessibility and responsiveness of institutional support. Evidence from tribal communities in Odisha further shows that social capital, local leadership, community trust, cultural sensitivity, and participatory governance can substantially influence institutional effectiveness (Masanja et al., 2023; Rout et al., 2026).

3.5 Willingness to Participate in Agricultural Development

The willingness of the farmers to participate in agricultural development activities at the village level was mostly moderate (40%), low (33%), or high (27%). The independent variables accounted for 30.6% of the

variance in willingness ($R^2 = 0.3056$), the lowest among the three models, suggesting that unmeasured contextual and psychological factors may have a relatively greater impact on willingness to participate. Family type, organisational membership, cropping pattern, landholding, outside contact, information-seeking behaviour, and input availability were significant positive predictors. In contrast, age, gender, educational qualification, housing condition, and annual income were significant negative predictors of willingness. These findings broadly support recent evidence that the drivers of farmers' willingness to engage in collective agricultural activities extend beyond mere demographic characteristics to encompass socio-economic endowments and institutional connectedness (Kan et al., 2022; Zhou & Ding, 2022). Recent evidence from tribal farmers in South Odisha likewise demonstrates that livelihood outcomes are shaped by interacting socio-economic and behavioural characteristics rather than by isolated demographic factors alone (Ghosh et al., 2025).

Table 3. Distribution of respondents by level of attitude, perception, and willingness (n = 120)

Dependent variable	Low (%)	Moderate (%)	High (%)
Attitude towards extension services	16.6	57.5	17
Perception of organisational support	25	60	15
Willingness to participate in development	33	40	27

Table 4. Summary of multiple regression analysis for the three dependent variables

Dependent variable	R ² value	Variance explained (%)	Key significant predictors
Attitude towards extension services	0.4529	45.3	Age, education, membership, housing, income, outside contact, economic motivation (+); applied-activity experience, social participation, extension participation (-)
Perception of organisational support	0.5685	56.9	Cropping pattern, activity experience, housing, income, outside contact, social participation, extension participation, economic motivation, input availability, need perceived/fulfilled (+)
Willingness to participate	0.3056	30.6	Family type, membership, cropping pattern, land holding, outside contact, information-seeking behaviour, input availability (+); age, gender, education, housing, income (-)

3.6 Problems Faced by Farmers

The farmers' constraints, ranked by mean score, were: irrigation facilities, production and productivity, agricultural innovations, climate variability, transportation, availability of resources, marketing facilities, electricity supply (joint rank), land facilities, and school and education problems (rank X, with the lowest mean score). Recent evidence from vegetable growers in South Odisha similarly indicates that agricultural enterprise development is constrained by interconnected institutional, financial, technological, input-related, and market factors, including untimely input availability, inadequate credit and training, and unfavourable market conditions (Chandra et al., 2026). Irrigation emerged as the most significant constraint, since most cultivations are rainfed and only a few farmers have access to motor pumps or sprinkler sets, forcing them to draw water from lakes or canals, which are rarely available during non-monsoon periods. Likewise, continued reliance on traditional cultivation practices, farmer-saved seed without any treatment, and imprecise use of fertilisers and pesticides were closely associated with low productivity, similar to the productivity constraints documented for smallholders in other rainfed tribal regions in eastern India (Kumar et al., 2022; Pruthviraj et al., 2022). Comparable constraints have been reported among farmers in Odisha, including inadequate knowledge of recommended production technologies, insufficient technical training, and limited knowledge concerning appropriate fertiliser and pesticide practices (Prusty & Mohapatra, 2021). However, limited adoption of agricultural innovations has been blamed on the infrequent visits by extension personnel. Previous research in Odisha has also demonstrated the importance of extension-led training for improving farmers' knowledge of improved agricultural technologies and recommended production practices (Prusty et al., 2020).

Table 5. Problems faced by farmers, ranked by mean score (n = 120)

Rank	Problem	Mean score
I	Irrigation facilities	2.40
II	Production and productivity	1.96
III	Agricultural innovations	1.90
IV	Climate variability	1.71
V	Transportation problem	1.66
VI	Availability of resources	1.59
VII	Marketing facilities	1.55
VIII	Electricity supply	1.55
IX	Land facilities	1.45
X	School and education problems	1.42

The physical distance between KVK/ATMA centres and many villages, and the impact of climate variability on both yield and pest and disease incidence were reported, in line with the broader evidence on the production risks faced by Indian smallholders due to climate variability (Ray & Pullabhotla, 2023).

3.7 Strategies for Agricultural Development

Based on the problem ranking and literature review, several directions are suggested for the study area. The most critical need is the expansion of decentralised irrigation infrastructure, such as minor irrigation, groundwater recharge, and low-cost drip/sprinkler systems, which is especially important given the first constraint: irrigation. The productivity gap can be directly addressed through soil-health-card-based nutrient management, quality seed replacement, and conservation agriculture practices. In contrast, climate-smart farming practices such as agroforestry, short-duration crop varieties, and optimised sowing dates can help farmers adapt to climate variability (Asim et al., 2024). Greater reach and frequency of last-mile access to KVK, ATMA and other National Agricultural Research and Extension System (NARES) institutions through field visits, demonstrations and farmer training would help improve farmers' access to agricultural innovations and technical knowledge (Prusty et al., 2020; Nag et al., 2023). Conventional field-based extension can also be complemented by digital decision-support systems. Evidence from Odisha demonstrates substantial farmer exposure to AI-enabled pest advisories under the National Pest Surveillance System, although the gap between advisory receipt and actual compliance indicates that digital information provision alone may not ensure adoption (Kumar et al., 2025). In the short term, structured extension training for input dealers and retailers on the existing package of practices can significantly increase the impact of extension knowledge, particularly for input dealers, who are the most important source of information for farmers (Mukherjee et al., 2022). Targeted investment in roads, storage facilities and market linkages in rural areas, along with empowering Farmers Producer Organisations and strengthening co-operatives, would further enhance farmers' bargaining power and minimise post-harvest losses. Such interventions are consistent with recent recommendations from South Odisha emphasising improved market regulation, flexible credit systems, post-harvest infrastructure, farmer organisation, and stronger institutional support for sustainable agricultural enterprises (Chandra et al., 2026). Capacity-building interventions should also integrate technical skill development, access to finance, market information and expert advisory support, as these have been identified as

Table 6. Problem-linked strategies for agricultural development

Priority problem	Recommended strategy
Irrigation facilities	Minor irrigation and groundwater recharge schemes; low-cost drip/sprinkler systems for hilly terrain; mulching and contour farming to retain soil moisture
Production and productivity	Soil health cards, quality/treated seed replacement, balanced fertiliser use, and conservation agriculture practices
Agricultural innovations	More frequent KVK/ATMA field visits, localised demonstrations, and Cluster Frontline Demonstrations under NARES institutions
Climate variability	Agro-forestry and climate-smart agriculture; short-duration crop varieties; adjusted sowing and harvesting schedules; intercropping
Transportation and marketing	Rural road and storage infrastructure; cold chains and food-processing units; strengthened FPOs and cooperatives for collective bargaining
Information access	Structured training of input dealers/retailers as extension multipliers, given their role as farmers' dominant information source

important requirements for overcoming agripreneurial constraints in Gajapati and Rayagada districts (Das et al., 2025).

4. CONCLUSION

This study on farmers' perceptions of agricultural development in Gajapati and Rayagada districts of Southern Odisha shows that farmers are neither apathetic nor convinced by the existing agricultural extension and development activities, as most farmers have a moderate attitude, perceive organisational support, and are willing to participate in agricultural development. They are moderate orientations that emerge from a specific set of socio-economic, institutional, contact, and information availability conditions that can, in principle, be influenced by policy. The key constraints that emerged as dominant are: irrigation, productivity, limited access to innovation and climate variability, and suggest a set of practical priorities: increasing irrigation infrastructure adapted to the hilly area, improving the effectiveness of last-mile extension services, creating farmer capacity through demonstrations and training, and introducing climate-resilient practices into local farming practices. In conclusion, the psychological, cultural, and trust-building aspects of farmer participation that are not captured by the study's socio-economic and institutional dimensions would benefit from further investigation in future studies. The overall results indicate that a mix of physical infrastructure investments and ongoing, locally based extension engagement is likely to be most effective for tribal agricultural development projects in Southern Odisha.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Adoption of Integrated Farming System (IFS) Components by Farmers in the Northern Districts of Andhra Pradesh

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 22-Sep-26

ACCEPTED: 30-Sep-26

PUBLISHED: 15-Oct-26

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Citation: Dinesh Kumar Nimmaka, Ajay Kumar Prusty, Ashok Kumar, Nibedita Mishra and Sai Kumar Periginji (2026). Adoption of Integrated Farming System (IFS) Components by Farmers in the Northern Districts of Andhra Pradesh. Horizon J. Hum. Soc. Sci. Res. 8 (S), 68–77. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1395.p68>



ABSTRACT

Integrated Farming Systems (IFS) offer smallholders a resource-efficient alternative to mono-cropping, yet their adoption remains inadequately documented in North Coastal Andhra Pradesh. An ex-post-facto study assessed farmers' attitudes, adoption of IFS components, and constraints among 120 IFS farm families from Srikakulam and Parvathipuram Manyam districts. Data were analysed using descriptive statistics, correlation, Garrett ranking, and multiple regression. Most farmers held favourable attitudes, although 68.33% had a medium attitude level. Agriculture and horticulture were universally adopted (adoption index = 1.000), followed by dairy (0.700), while adoption of other enterprises remained lower. Farm size, market orientation, and extension contact significantly influenced adoption and attitude, explaining 54.8% and 57.4% of their variation, respectively. High production costs, inadequate remunerative prices, and climatic vulnerability were the major constraints. Enterprise-specific training, accessible credit, improved price realisation, and stronger extension support are needed to translate favourable attitudes into greater IFS adoption.

Keywords: Adoption, Attitude, Constraints, Climatic Vulnerability, Integrated Farming System, Smallholder farmers

1. INTRODUCTION

The majority of people in North Coastal districts of Andhra Pradesh and the wards of Srikakulam, Vizianagaram, Parvathipuram Manyam and

Visakhapatnam are still engaged in agriculture for earning their livelihoods and jobs. Rice remains the dominant crop of the Kharif season, while pulses, millets, oilseeds, and horticultural crops such as cashew, coconut, mango,



and banana provide diversified income and nutritional security to smallholder households (Prabhakar et al., 2023; Duraisamy et al., 2018). Farming systems in the region range from rainfed and irrigated cropping to mixed crop-livestock systems and, among tribal communities of the hilly tracts, shifting (podu) cultivation (Tripathy and Das, 2020). Against this backdrop, Integrated Farming Systems (IFS) are increasingly being promoted as a means of optimising resource use, increasing productivity, and reducing production and market risks by diversifying farm enterprises (Nienkerke et al., 2025; Rashid, 2024).

IFS is conceived as a sustainable agricultural approach that integrates crop production with livestock, poultry, aquaculture, agroforestry and horticultural enterprises on the same farm, thereby recycling farm by-products, minimising external inputs, and diversifying household income (Shanmugam et al., 2024). Historically rooted in traditional Indian mixed-farming practices, IFS lost ground during the Green Revolution era owing to the spread of input-intensive mono-cropping, but has since been revived with renewed support from the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities, and national initiatives including the National Mission for Sustainable Agriculture (NMSA) and *Rashtriya Krishi Vikas Yojana* (RKVY) (Mishra et al., 2023). The system is credited with enhancing resource-use efficiency, biodiversity, climate resilience, and household nutrition while stabilising farm income (Sudha et al., 2021; Ghosh et al., 2025).

For the North Coastal districts, IFS is particularly relevant because of the predominance of small and marginal landholdings, degrading soil health, and increasing water scarcity (Kumar et al., 2025). The region's tropical climate, proximity to the Nagavali and Vamsadhara rivers, and varied topography of coastal plains and upland tracts make it agro-ecologically suited to combinations such as rice-fish farming, coconut- and cashew-based agroforestry, and multi-cropping systems (Gangaiah et al., 2015). IFS has also been shown to support sustainable livelihoods in coastal regions by reducing dependence on any single enterprise and cushioning farm households against climatic and market shocks (Kumar et al., 2025).

Despite these advantages, adoption of IFS across Andhra Pradesh, and in the North Coastal belt in particular, remains modest (Chandana et al., 2021; Liu et al., 2023). There are ongoing initiatives by the government like the NMSA and Paramparagat Krishi Vikas Yojana (PKVY), which promote organic and integrated production practices, but researchers have noted that the uptake of these methods has been limited due to a range of factors, including awareness, technical skills, initial capital investment, fragmented land ownership, market access, and climate change vulnerabilities (Fatima et al., 2023;

Kumar et al., 2022). The study was therefore designed to address the gap between institutional promotion of IFS and its actual field-level uptake. Only limited empirical evidence is available on farmers' attitudes to IFS, the uptake of individual IFS components, and the constraints encountered by adopters in the agro-climatic and socio-economic context in Srikakulam and Parvathipuram Manyam districts (Karthik et al., 2024; Raghavendra et al., 2024).

Understanding these dynamics is necessary for aligning extension interventions and policy support with farmers' actual circumstances, to build climate resilient and diversified farming and to support the national objective of raising farm income through resource efficient farming (Ponnusamy and Devi, 2017). Accordingly, the study pursued three specific objectives: (i) To examine farmers' attitudes toward IFS; (ii) To study the level of farmers' uptake of the components of IFS; (iii) To determine farmers constraints in the uptake of IFS in North Coastal districts of Andhra Pradesh.

2. Materials and Methods

Fieldwork covered two districts in northern Andhra Pradesh, namely Srikakulam and Parvathipuram Manyam, which together represent contrasting agro-ecological settings within the North Coastal zone. An ex-post-facto design was selected, as the phenomena under study - the adoption of IFS and its associated attitudes - had already occurred prior to the investigation, without any experimental manipulation by the researcher. Respondents were selected through a multistage sampling procedure. In the first stage, both districts were chosen purposively to represent the canal-irrigated coastal belt (Srikakulam) and the rainfed, tribal-dominated upland tract (Parvathipuram Manyam). In the second stage, three mandals were chosen in each district, and within these mandals, twelve villages (six per district) were covered. From each of the twelve villages, ten IFS-practising farm families were selected at random, producing a final sample of 120 respondents - 60 from Srikakulam (drawn from Kotturu, Tekkali, and Seethampeta mandals) and 60 from Parvathipuram Manyam (drawn from Kurupam, Gummalaxmipuram, and Jiyyammavalasa mandals). Primary information was obtained in face-to-face interviews with a pre-tested structured schedule.

Sixteen independent variables were chosen because of their theoretical and empirical relevance to IFS adoption: age, level of education, gender, farm size, farming/IFS experience, occupation, annual income, extension contact, exposure to mass media, risk orientation, innovativeness and economic motivation, achievement motivation, scientific orientation, social participation, and training received. Each variable was

operationalised using standard scoring procedures or multi-item scales adapted from earlier extension research, and respondents were then grouped into low, medium and high categories using cut-off points derived from the mean and standard deviation.

The dataset was coded and tabulated before descriptive and inferential analyses were performed. Category-wise distributions were summarised with frequencies and percentages. Means and standard deviations were calculated to represent central tendency and variability, and to derive category boundaries for the independent and dependent variables. Pearson's product-moment correlation was applied to assess associations of selected profile characteristics with the extent of IFS adoption and with farmers' attitude, tested at the 5 per cent and 1 per cent levels of significance. Multiple linear regression was used to estimate the comparative contribution of the explanatory variables to variation in adoption and attitude scores. Perceived constraints were prioritised using Garrett's ranking method and the suggestions offered for improving IFS performance; the percent position for each rank was calculated as Percent position = $(R_{ij} - 0.5)/N_j \times 100$, where R_{ij} is the rank given to the i -th item by the j -th respondent and N_j is the number of items ranked, with percent positions converted to scores using Garrett's conversion table and averaged to obtain the final ranking. Bar graphs and pie charts were used for graphical presentation, prepared in Microsoft Excel.

3. Results and Discussion

The results are organised around the study objectives, beginning with the socio-economic and psychological characteristics of IFS farmers, farmers' attitude towards IFS, the component-wise extent of IFS adoption, the relationship between profile characteristics and both adoption and attitude, and the constraints experienced by farmers.

3.1 Socio-economic profile of IFS farmers

In both districts, the largest share of respondents fell within the middle-age group (36-50 years), representing 45.83 per cent of the combined sample; the older group followed (>50 years, 36.67%), while young farmers (<36 years) formed only 17.50 per cent. This age profile shows that experienced farmers are the backbone of the IFS management system within the study area, a pattern comparable with observations reported by Paramesh et al. (2022) who identified middle-aged farmers as key operators of integrated farming systems due to their skills and ability to manage risks, and with Raghavendra et al. (2024) and Md et al. (2025) who reported that

these farmers might be losing their competitiveness in agriculture because of migration and the alternative livelihood options of the young. Chandana et al. (2021) reported a similar type of adopter profile for Andhra Pradesh, and Behera and France (2016); Kerutagi et al. (2019) noted that IFS adoption generally requires continued commitment from the farmer's management and thus favours farmers who have other livelihood responsibilities.

The overall reliance on farming on the region is extremely high as 94.17 per cent of the respondents have reported their only occupation as farming, which makes them more vulnerable to farming production and market risk (Paramesh et al., 2022; Raghavendra et al., 2024). The predominance of marginal landholdings (up to 1 ha): 75.00 per cent in Parvathipuram and 67.50 per cent in Srikakulam, reflects the broader smallholder structure of Indian agriculture, where enterprise diversification through IFS is often a coping mechanism for smallholder constraints (Sekaran et al., 2021; Dash et al., 2015; Md et al., 2025). In terms of experience, there was a mixture of low (41.67%), medium (20.83%) and high (37.50%) experience respondents, with a similar distribution for IFS adopters in Andhra Pradesh found by Chandana et al. (2021), and consistent with the learning by doing effects identified by Gupta et al. (2020).

The farmers were more oriented towards the market and more exposed to mass media (67.50% and 65.83% respectively) indicating that farmers actively interact with market and mass media, but market and media

Table 1. Summary of the socio-economic and communication profile of IFS farmers in Parvathipuram Manyam and Srikakulam districts.

Category	Parvathipuram (n=60) f (%)	Srikakulam (n=60) f (%)	Pooled (n=120) f (%)
Age: Young (<36 yrs)	12 (20.00)	9 (15.00)	21 (17.50)
Age: Middle (36-50 yrs)	27 (45.00)	28 (46.67)	55 (45.83)
Age: Old (>50 yrs)	21 (35.00)	23 (38.33)	44 (36.67)
Education: Illiterate	12 (20.00)	14 (23.33)	26 (21.67)
Education: Secondary (8-10)	15 (25.00)	16 (26.67)	31 (25.83)
Education: Graduate & above	10 (16.67)	9 (15.00)	19 (15.83)
Occupation: Farming as sole profession	56 (93.33)	57 (95.00)	113 (94.17)
Farm size: Marginal (≤ 1 ha)	30 (75.00)	27 (67.50)	57 (71.25)
Market orientation: Medium	39 (65.00)	42 (70.00)	81 (67.50)
Mass media exposure: Medium	37 (61.67)	42 (70.00)	79 (65.83)

interaction is limited because of poor market system and small farm size (Dhavale et al., 2022; Ponnusamy and Devi, 2017). Mobile phones turned out to be the most popular mass media channel (89.66% overall), followed by newspapers (81.03%), magazines (78.45%) and television (14.66%) a pattern also reported by Raghavendra et al. (2024), who observed that mobile phones were being used rapidly for agricultural advice deliverance in rural India. Extension participation was largely medium (44.17%), with group farm meetings the most frequently attended activity (56.11% regular participation) while study tours were the least attended (59.45% never participated), and the majority of farmers exhibited medium economic motivation (70.83%) but low risk orientation (48.33%), indicating a generally cautious approach to enterprise diversification in agreement with constraints documented by Bhutia et al. (2017) and Sabharwal and Sharma (2024).

3.2 Attitude of farmers towards IFS

Farmers expressed an overwhelmingly positive attitude towards IFS. Among twenty-two statements evaluated on a five-point scale, the highest-ranked perceptions were that IFS offers multiple sources of income (mean = 4.91, Rank I), guarantees a supply of balanced and nutritious food to the family (mean = 4.90, Rank II), and ensures sustainable income throughout the year through multiple enterprises (mean = 4.81, Rank III). Reduction of climate-related vulnerability (mean = 4.67), efficient land utilisation (mean = 4.60), by-product recycling (mean = 4.44), and effective use of natural resources (mean = 4.14) were also strongly endorsed. Conversely, farmers largely rejected commonly cited barriers, disagreeing that IFS increases resource competition (mean = 2.89), that mechanisation is difficult (mean = 2.20), that IFS causes environmental pollution (mean = 2.05), that it is suitable only for skilled persons (mean = 1.72), that it is socially incompatible (mean = 1.66), or that labour requirements and initial investment are excessive (means of 1.00 and 1.24, respectively).

This overwhelming perception is in line with the literature of IFS reported benefits, which have been consistently positive with respect to income stability, household food security and livelihood resilience (Manjunatha et al., 2014; Ponnusamy and Devi, 2017; Gupta et al., 2020). The high rating assigned to climate-risk reduction is consistent with evidence that diversified enterprises provide protection to households from weather and market shocks (Paramesh et al., 2022; Sekaran et al., 2021) while the rejection of perceived barriers like high investments and excess labour (although documented to be barriers elsewhere, Md et al., 2025; Dhavale et al., 2022; Sabharwal and Sharma, 2024)

indicates that personal experience with IFS reduces farmer apprehension over time and hence they value demonstration-based extension (Chandran et al., 2023; Chandana et al., 2021). Overall, the attitude of the respondents was in the medium level, 68.33 per cent in both districts, while 15.83 per cent fell in the high-attitude category and another 15.83 per cent in the low-attitude category. This medium concentration indicates a middle ground where awareness of the benefits of IFS is strong, but full conviction has not yet been achieved, as also noted in earlier studies, including Dhavale et al. (2022) and Khushbu et al. (2024) (in Sabharwal and Sharma, 2024), who attribute this gap to ongoing uncertainty surrounding the market, credit constraints, and managerial complexity. Repeatedly, sustained exposure, demonstration and training are mentioned as the levers to take farmers from medium to high attitude category (Dash et al., 2015; Chandran et al., 2023).

3.3 Extent of adoption of IFS components

All 120 respondents adopted agriculture and horticulture with adoption index 1.000, followed by dairy farming with adoption index 0.700 and joint Rank III, as it is well established as an income stabilising business and was found to be effective in recycling the crop residues and by-products (Ponnusamy and Devi, 2017; Manjunatha et al., 2014). This was followed by significant drops in adoption of other technologies, such as poultry (0.233, Rank IV units), sheep/goat rearing (0.150, Rank V units), vermicomposting (0.108, Rank VI units), mushroom cultivation (0.108, Rank VI units), aquaculture (0.025, Rank XI units) and biogas (0.008, Rank XI units).

This trend is consistent with literature that indicates that most IFS models are based on crop enterprises, which provide food security and primary income (Behera and France, 2016; Gupta et al., 2020) with the comparatively

Table 2. Component-wise extent of adoption of IFS components (n = 120)

Component	Units adopting	Adoption index	Rank
Agriculture	120	1.000	I
Horticulture	120	1.000	I
Dairy	84	0.700	III
Poultry	28	0.233	IV
Sheep/goat rearing	18	0.150	V
Vermicompost	13	0.108	VI
Mushroom unit	13	0.108	VI
Sericulture	9	0.075	VIII
Apiculture	8	0.067	IX
Aquaculture	3	0.025	X
Biogas	1	0.008	XI

low adoption rates of specialised enterprises indicating widely reported barriers including restricted credit access, insufficient technical know-how, weak market infrastructure and limited training opportunities (Suman et al., 2025; Md et al., 2025; Sabharwal and Sharma, 2024; Dhavale et al., 2022; Nababan and Regina, 2021). Meanwhile, these low adoption businesses – vermicomposting, sericulture, apiculture, aquaculture, and biogas – are always cited as high potential ventures for better income, employment and sustainability when they receive institutional support (Paramesh et al., 2022; Sekaran et al., 2021; Chandran et al., 2023; Bolorunduro et al., 2023).

3.4 Relationship between profile characteristics and extent of IFS adoption

Farm size ($r = 0.362$), market orientation ($r = 0.338$) and extension contacts ($r = 0.312$) were also highly significantly and positively related to IFS adoption. Experience IFS ($r = 0.294$), education ($r = 0.271$), risk orientation ($r = 0.269$), extension participation ($r = 0.245$), mass media exposure ($r = 0.228$) and economic motivation ($r = 0.211$) showed significant positive associations with the extent of IFS adoption. Age, occupation and social participation showed negative but non-significant associations ($r = -0.182$, $r = -0.109$, and $r = -0.091$, respectively). Multiple linear regression validated these trends: The twelve profile characteristics explained 54.8 per cent of the variance in adoption ($R^2 = 0.548$; Adjusted $R^2 = 0.503$; $F = 12.18$, $p < 0.001$), with farm size ($\beta = 0.312$, $p < 0.01$), market orientation ($\beta = 0.279$, $p < 0.01$) and extension contact ($\beta = 0.251$, $p < 0.01$) showing the largest standardised effects, followed by experience in IFS, education, extension participation, mass media exposure, economic motivation and risk orientation (all significant at 5%), while age, occupation and social participation were not significant.

These results echo Behera and France (2016) and Sekaran et al. (2021), who identify larger holdings as offering greater flexibility for enterprise diversification, and Ponnusamy and Devi (2017) and Dhavale et al. (2022), who link market orientation to farmers' motivation to diversify for profitability. The importance of extension contacts and participation reaffirms the role of advisory services in building technical competence and reducing adoption uncertainty (Dash et al., 2015; Chandran et al., 2023; Suman et al., 2025), while the significance of education, experience, and risk orientation reflects the cognitive and behavioural foundations of adoption described by Akshitha and Dolli (2020) and Meshram et al. (2021). The non-significant effect of age and social participation suggests that access to information and institutional support outweighs demographic background in shaping adoption decisions.

3.5 Relationship between profile characteristics and attitude towards IFS

The corresponding analysis for attitude indicated that experience in IFS ($r = 0.340$), extension contact ($r = 0.325$), and mass media exposure ($r = 0.310$) showed the strongest correlations, followed by education ($r = 0.315$), market orientation ($r = 0.290$), extension participation ($r = 0.280$), farm size ($r = 0.258$), and economic motivation ($r = 0.240$); age ($r = -0.145$), occupation ($r = -0.095$), social participation ($r = -0.050$), and risk orientation ($r = -0.133$) were negatively but non-significantly related. The regression model indicated that these characteristics jointly accounted for 57.4 per cent of the variance in attitude ($R^2 = 0.574$; Adjusted $R^2 = 0.531$; $F = 13.32$, $p < 0.001$), with experience in IFS ($\beta = 0.298$), extension contact ($\beta = 0.271$), mass media exposure ($\beta = 0.256$), and education ($\beta = 0.241$) as the strongest determinants, alongside market orientation, extension participation,

Table 3. Correlation and standardised regression coefficients (β) of selected profile characteristics with extent of IFS adoption and attitude towards IFS. *Significant at 5%; **Significant at 1%.

Profile characteristic	r with extent of adoption	r with attitude	β (adoption model)	β (attitude model)
Age	-0.182	-0.145	-0.104	-0.096
Education	0.271*	0.315*	0.176*	0.241**
Farm size	0.362**	0.258*	0.312**	0.197**
Experience in IFS	0.294*	0.340**	0.198*	0.298**
Market orientation	0.338**	0.290*	0.279**	0.214**
Mass media exposure	0.228*	0.310**	0.162*	0.256**
Extension participation	0.245*	0.280*	0.181*	0.206**
Extension contact	0.312**	0.325**	0.251**	0.271**
Economic motivation	0.211*	0.240*	0.154*	0.189**
Risk orientation	0.269*	-0.133	0.169*	-0.073

farm size, and economic motivation, all significant at the 1 per cent level.

The pre-eminence of experience, extension contact, and mass media exposure in shaping attitude corroborates evidence that practical experience combined with sustained technical guidance strengthens farmer confidence in IFS through visible improvements in income and resource efficiency (Manjunatha et al., 2014; Chandana et al., 2021; Dash et al., 2015). The non-significant, and in the case of risk orientation negative, association with several demographic variables suggests that even risk-averse or older farmers can develop favourable attitudes once they observe the stabilising benefits of diversified income and resource recycling (Gupta et al., 2020; Meshram et al., 2021). Overall, both the adoption and attitude models point to a common set of levers - farm size, market orientation, extension contact, education, and experience - as the key entry points for extension intervention.

3.6 Constraints experienced by IFS farmers

Garrett's ranking technique ranked high production cost as the leading constraint (mean Garrett score = 78.30, Rank I), followed closely by lack of remunerative prices for farm produce (76.10, Rank II) and natural calamities and climate change (70.20, Rank III), reflecting the region's exposure to cyclones and erratic rainfall (Gangaiah et al., 2015; Paramesh et al., 2022). Non-availability of quality

inputs on time (60.50, Rank IV), high initial investment (59.00, Rank V), marketing difficulties across multiple enterprises (56.80, Rank VI), insufficient government incentives (53.20, Rank VII), land constraints (50.60, Rank VIII), labour scarcity (42.40, Rank IX), and high labour charges (41.80, Rank X) followed. Operational constraints - difficulty in time management (38.90), inadequate storage and value-addition facilities (35.70), inadequate extension support and training (32.10), and lack of awareness of improved practices (30.40) - were ranked comparatively lower, though still notable.

These findings confirm the broader IFS literature identifying high production costs, poor price realisation, and limited credit access as the most critical barriers to sustaining integrated systems (Md et al., 2025; Suman et al., 2025; Dhavale et al., 2022; Pandey et al., 2019). The prominence of climate-related constraints reflects growing weather-related production uncertainty even though IFS itself enhances resilience through diversification (Paramesh et al., 2022; Sekaran et al., 2021), while institutional limitations - including weak extension services, inadequate storage and value-addition facilities, and insufficient incentives - are comparable to those reported elsewhere calling for stronger policy backing and localised extension systems (Dash et al., 2015; Chandran and Chakravarty, 2022; Nababan and Regina, 2021; Bhutia et al., 2017). As a counter, the most common recommendations of farmers were provision of subsidised quality inputs at the right time (Rank I), easy access to credit facilities (Rank II), setting up local collection and marketing centres (Rank III), and providing climate resilient seeds and crop insurance schemes (Rank IV) which indicate that IFS adoption in the region is not farmer's willing but rather economic, institutional and infrastructural barriers (Kumar and Narayanagowda, 2017; Kumar et al., 2022).

4. Conclusion

Farmers in North Coastal Andhra Pradesh generally held favourable attitudes towards Integrated Farming Systems (IFS), although adoption remained concentrated in agriculture, horticulture, and dairy. Farm size, market orientation, and extension contact were the strongest determinants of adoption and attitude, indicating that resource availability and institutional support are more influential than demographic characteristics. High production costs, inadequate price realisation, and climatic vulnerability were the principal constraints. IFS improved productivity and livelihood diversification in canal-irrigated Srikakulam, while strengthening resilience among tribal and rainfed smallholders in Parvathipuram Manyam through efficient recycling of farm resources. Policy interventions should prioritise enterprise-specific

Table 4. Constraints reported by IFS farmers during establishment and maintenance of IFS units, ranked using Garrett's technique (n = 120).

Constraint	Garrett mean score	Rank
High cost of production	78.30	I
Lack of remunerative prices for farm produce	76.10	II
Natural calamities and climate change	70.20	III
Non-availability of quality inputs on time	60.50	IV
High investment in the initial stage	59.00	V
Marketing difficulties for produce from different enterprises	56.80	VI
Insufficient government incentives	53.20	VII
Land constraints	50.60	VIII
Labour scarcity	42.40	IX
High labour charges	41.80	X
Difficulty in time management for multiple activities	38.90	XI
Inadequate storage and value-addition facilities	35.70	XII
Inadequate extension support and lack of training	32.10	XIII
Lack of awareness of improved practices	30.40	XIV

training, accessible credit, cluster-based marketing, remunerative prices, climate-resilient inputs, insurance, and regular extension support. Stepwise, low-cost micro-IFS models could improve accessibility for smallholders. Future studies should evaluate long-term effects on soil health, water-use efficiency, carbon sequestration, market integration, and climate resilience.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Sustainable Fisheries and Gender Inclusion: Insights from the MMKY Initiative in Odisha, India

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 22-Sep-26

ACCEPTED: 30-Sep-26

PUBLISHED: 15-Oct-26

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Citation: Anita Patra and Sanju Saha (2026). Sustainable Fisheries and Gender Inclusion: Insights from the MMKY Initiative in Odisha, India. Horizon J. Hum. Soc. Sci. Res. 8 (S), 78–85. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1396.p78>



ABSTRACT

In Odisha, the fisheries industry supports more than 1.5 million people who rely on inland and marine resources for their food security, nutrition, and rural livelihoods. Low productivity and economic fragility result from the sectors continued limitations due to antiquated procedures, poor infrastructure, a lack of institutional finance and the effects of climate change. In order to tackle these issues, the Odisha government launched the *Mukhyamantri Matsya Jeevi Kalyan Yojana* (MMKY) or Chief Minister's Fishermen Welfare Scheme, in November 2023, allocating ₹2,239 crore for 2024–2029. Through combined financial, technological, and social initiatives aimed at inland farmers, women's self-help groups (SHGs), and traditional fishermen, this state-specific project aims to revitalise the industry. Financial support for boats, nets, and cold chain facilities, the promotion of sustainable aquaculture technologies like biofloc, training and capacity building and scholarships for fisher families are examples of core interventions. According to literature and policy assessments, MMKY represents a paradigm change by integrating female empowerment, sustainability and livelihood security into a single framework that is in line with the Blue Economy and Sustainable Development Goals. With an emphasis on SHG involvement, this article examines the schemes execution in the Gajapati area. It looks at the advantages that women have, especially in terms of improving their economic prospects, abilities, and social recognition, as well as the difficulties they face, such insufficient knowledge, bureaucratic hold-ups and structural obstacles.

Keywords: Rural Livelihoods; Self Help Groups (SHGs); Sustainable Development Goals and economic opportunities

1. INTRODUCTION

Gender mainstreaming and sustainable fisheries management are increasingly seen as interrelated concerns in the pursuit of equitable development. For millions of people, fisheries provide food, income, and a means of subsistence, but their long-term viability depends on governance that strikes a balance between protection and utilisation. The fact that women make up a significant portion of the working force in this industry is crucial (Chambon *et al.*, 2023; Galappaththi *et al.*, 2022).

According to Kelling *et al.* (2025) women make up around 40% of those working in small-scale fisheries globally, yet they have historically been excluded from fisheries governance. Women in the fishing industry often face unequal access to funding, training, and decision-making possibilities, according to research. Therefore, gender-blind policies might undermine long-term outcomes and perpetuate social inequities. The need of gender-inclusive approaches that integrate ecological sustainability and social justice for sustainable fisheries development

outcomes is becoming more widely acknowledged (Oloko *et al.*, 2024; Lawless *et al.*, 2021).

In fact, research indicates that a stronger focus on environmental stewardship and long-term ecosystem health is associated with women's involvement in resource management. Therefore, including gender considerations into fisheries governance is not just a social justice issue but also a tactical necessity to improve fishing communities' sustainability and resilience (Chambon *et al.*, 2023; Frangoudes & Gerrard, 2018). The coastal state of Odisha in eastern India provides a fascinating setting for investigating the connection between sustainable fishing and gender inclusion. The state has a 575-kilometer coastline, more than 7.1 lakh hectares of freshwater and 4.2 lakh hectares of brackish water, as well as a wealth of interior water resources, including biodiverse ecosystems like Chilika Lake and Bhitarkanika mangroves. These endowments have made fisheries an essential component of Odisha's economy and food chain (Patra *et al.*, 2020). (https://odishaforest.in/admin/data/documents/publication_file_1682200290.pdf). Between 2019 and 2024, the state's fish output increased from 8.2 to 11.2 lakh metric tonnes, indicating significant growth potential. This growth hasn't, however, entirely resulted in widespread sustainable development. There is room for efficiency improvements as Odisha's inland fish productivity (approximately 0.57 tons/ha) is still just about half of the national average. (<https://www.intellectap.com/unlocking-the-potential-of-freshwater-fisheries-in-odisha-a-blog-by-natural-resource-management-team-at-intellectap/>). The *Mukhyamantri Maschyajibi Kalyan Yojana* (MMKY), or Chief Minister's Fishermen Welfare Scheme, a flagship program that specifically combines gender-inclusive empowerment with sustainable fisheries development, was introduced by the Odisha government in 2024 in response to these issues. With a five-year implementation period (2024–2029) and a sizeable budget of ₹2,239 crore, the MMKY project seeks to help the fishing community holistically while integrating environmental stewardship and equitable principles. (<https://pmujwalayojana.in/odisha-mukhyamantri-maschyajibi-kalyan-yojana/>). The initiative is expected to support 14 lakh individuals, including 7.32 lakh women who are part of self-help groups (WSHGs) and around 6.67 lakh traditional fishermen. MMKY aims to expand women's involvement in the fisheries value chain and guarantee that they contribute to the sector's expansion by specifically focussing on women's collectives alongside fishermen. Key aspects of the fisheries industry, such as resource protection and economic livelihood assistance are addressed by the schemes 17 coordinated sub-schemes (Eurich *et al.*, 2026; Solano *et al.*, 2021).

2. OBJECTIVES OF THE STUDY

The objectives of this study are as follows:

- i. To evaluate the implementation and outreach of the Mukhyamantri Matsya Jeevi Kalyan Yojana (MMJKY) in Gajapati district with specific reference to women Self-Help Groups (SHGs).
- ii. **To assess the socio-economic benefits and capacity-building outcomes** experienced by fisherwomen engaged in MMJKY-supported activities such as financial support and training programs.
- iii. **To identify the major challenges and structural barriers** affecting effective participation of SHGs under MMJKY, and suggest policy measures to enhance sustainable fisheries development in the district.

3. METHODOLOGY

To conduct the study, data were collected through a survey method. Face to face discussions also were done with the District Fisheries Officer and the Assistant District Fisheries Officer. The list of the SHGs that worked with the DFO for the MMKY scheme was obtained. Further, from the list a sample of 16 SHGs were taken up for the survey. Two questionnaires were prepared for the purpose. One questionnaire was for the SHGs with regard to their participation in the MMKY scheme and to understand the benefits gained and the challenges faced by the SHGs. The researcher has covered 7 SHGs. The second questionnaire was for the SHG members to collect information regarding the socio-economic impact on the members by participating in the SHG and the MMKY scheme. Researchers have covered 66 number of SHG women.

4. RESULT AND DISCUSSION

The data collected were compiled (Microsoft excel) and analysed. The analysis is provided in two segments. One is about the SHG and their engagement in the MMKY scheme. Another segment is regarding the analysis of data related to the women members of the SHG.

4.1. SHG DATA ANALYSIS

The SHGs has taken up village ponds, with the consent of village panchayat, for pisciculture under the MMKY scheme which was provided to them by the DFO. The personnel from DFO provided them with training and support for the same.

The Mukhyamantri Matsyajibi Kalyan Yojana (MMKY) has made it easier for a number of Self-Help Groups (SHGs) working to improve livelihoods and sustainably fish

Table 1. SHG Profile

Sl. No	Name of the SHG	Established Year	Block	Member	Year in which entered MMKY scheme	Pond size (in hectares)	Reason for choosing the scheme and agreed to implement
1	Malika mahila manndal	2023	Gumma	10	2024	1.80 hectares	Income Generation
2	Sai Baba	1997	Gosani	11	2024	2.00 hectares	Income Generation
3	Sai Ram WSHG	2016	Gumma	10	2024	0.60 hectares	Income Generation
4	Ma Santoshi	2005	Gosani	11	2023	1.00 hectares	Income Generation
5	Sri Bira Hanuman SHG	2004	Gosani	10	2024	1.00 hectares	Income Generation
6	Maa swarasati SHG	2019	Gumma	10	2024	0.80 hectares	Income Generation
7	Sri Nivas Shakti	2002	Gosani	13	2024	0.40 hectares	Income Generation

Source: Authors, 2026

Table 2. Type of support was received

Sl. No	Name of the SHG	Types of support was received				
		Equipment	Training	Financial Aid	Fish Feed	Subsidy
1	Malika mahila manndal				✓	✓
2	Sai Baba	✓	✓		✓	✓
3	Sai Ram WSHG	✓	✓		✓	
4	Ma Santoshi	✓	✓		✓	✓
5	Sri Bira Hanuman SHG	✓	✓		✓	✓
6	Maa swarasati SHG	✓	✓		✓	
7	Sri Nivas	✓	✓		✓	✓

Source: Authors, 2026

in Gajapati district and its component blocks. Founded in 2023 under Gumma block, the Malika Mahila Mandal SHG has ten members and joined the MMKY scheme in 2024 with the primary goal of increasing household income through sustainable aquaculture-based enterprise. The eleven-member Sai Baba SHG, established in Gosani block in 1997, joined the scheme in 2024 in an effort to increase revenue generation and diversify its sources of livelihood. The Gumma block's Sai Ram Women Self-Help Group (WSHG), established in 2016 with 10 members, joined the MMKY scheme in 2024 with the intention of increasing economic resilience through fisheries-based activities. The eleven-member Ma Santoshi SHG, established in Gosani block in 2005, became part of the MMKY scheme in 2023, driven by the prospect of income augmentation and community-based fisheries management. The Sri Bira Hanuman SHG, founded in Gosani block in 2004 with 10 members, was brought into the scheme in 2024 to support financially viable ventures that follow sustainable aquaculture practices.

Established in Gumma block in 2019 with 10 members, the Maa Swarasati SHG joined the MMKY scheme in 2024 with the intention of improving women's participation in fisheries value chains and their quality of life. The thirteen-member Sri Nivas Shakti SHG of Gosani block, founded in 2002, was eventually brought

into the scheme in 2024 with a focus on establishing income-oriented fishing activities. By combining gender-responsive economic empowerment with sustainable fisheries development, these SHGs together embody MMKY's inclusive approach to empowering rural people, particularly women, in Odisha coastal and inland aquaculture sectors.

Table 2 outlines the types of support received by seven Self-Help Groups (SHGs) across five categories: equipment, training, financial aid, fish feed and subsidy. Fish feed emerges as the most universally received support, with all seven groups getting it, while equipment and training were provided to six out of seven groups all except Malika Mahila Mandal, which received only fish feed and subsidy. Notably financial aid stands out as the least accessed form of support, with none of the seven SHGs reporting having received it, suggesting a gap in direct monetary assistance despite other forms of support being relatively widespread. Subsidy was received by five groups, with Sai Ram WSHG and Maa Swarasati SHG being the exceptions that did not receive it.

Table 3 shows the types of fishery activities that each of the seven Self-Help Groups (SHGs) are involved in under the Mukhyamantri Matsyajibi Kalyan Yojana scheme, covering four categories: capture, culture, processing, and marketing. All seven SHGs—Malika Mahila Mandal,

Table 3. Type of fishery activity involved in the MMKY scheme

Sl. No	Name of the SHG	Type of fishery activity involved in MMKY Scheme			
		Capture	Culture	Processing	Marketing
	Malika mahila manndal	✓	✓	✓	✓
	Sai Baba	✓	✓	✓	✓
	Sai Ram WSHG	✓	✓	✓	✓
	Ma Santoshi	✓	✓	✓	✓
	Sri Bira Hanuman SHG	✓	✓	✓	✓
	Maa swarasati SHG	✓	✓	✓	✓
	Sri Nivas	✓	✓	✓	✓

Source: Authors, 2026

Table 4. Average hours per day/week spent in fisheries activities and yearly yield

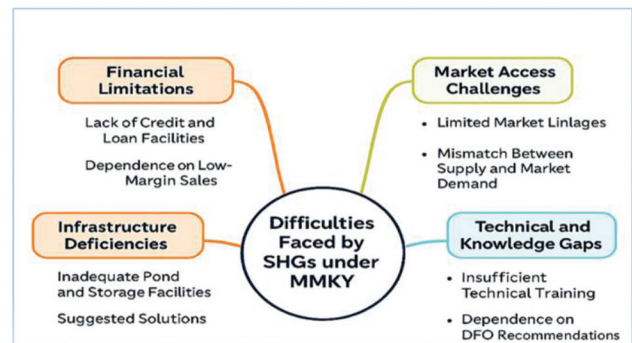
No.	Name of the SHG	Average hours per day/week spent in fisheries activities	Yield
1	Malika mahila manndal	10 hours/ week	1Quintal
2	Sai Baba	7-8 hours / week	1 st time
3	Sai Ram WSHG	2 hours per day	500-600kg
4	Ma Santoshi	3-4 hours per day	600kg
5	Sri Bira Hanuman SHG	2-3hours per day	1 st time
6	Maa swarasati SHG	2hours per day	10kg
7	Sri Nivas	3hours per day	1 st time

Source: Authors, 2026

Sai Baba, Sai Ram WSHG, Ma Santoshi, Sri Bira Hanuman SHG, Maa Swarasati SHG, and Sri Nivas are marked with checkmarks across all four activity types, indicating that every group is uniformly engaged in the complete fisheries value chain, from capturing and culturing fish to processing and marketing the produce, rather than specializing in only one or two activities.

Table 4 presents data on seven Self-Help Groups (SHGs) engaged in fisheries activities, showing their average time investment and yearly yield. Time commitment ranges from 2 to 10 hours, reported inconsistently as either daily or weekly figures across groups, while yields vary widely from 10 kg to 1 quintal (100 kg) among those with recorded harvests. Notably, three of the seven groups Sai Baba, Sri Bira Hanuman SHG and Sri Nivas are in their first cycle and have no yield data yet and there appears to be no clear correlation between hours invested and output, as seen with Ma Santoshi (3-4 hrs/day yielding 600 kg) versus Maa Swarasati SHG (2 hrs/day yielding only 10 kg), suggesting factors beyond time input influence productivity.

The Mukhyamantri Matsyajibi Kalyan Yojana (MMKY) assessment of the challenges faced by Self-Help

**Figure 1.** Challenges Faced by SHGs Women.

Source: Authors, 2026

Groups (SHGs) reveals several interrelated institutional, technical and financial constraints that nevertheless affect the long-term sustainability of community-based fishing enterprises. According to the Malika Mahila Mandal SHG, restricted market access is the primary barrier to ensuring fair pricing and consistent demand. Members stressed the necessity of financing support to enhance market connections and transportation. The Sai Baba SHG requested loan facilitation to increase procurement capacity after reporting problems getting a dependable range of high-quality fish saplings (Kau machha), which affected both productivity and profitability. The variety Kau is being encouraged by the DFO because it grows and multiplies (Breeding) very fast. But the same variety is not in demand in the regional market and hence cannot sell at a good price. In similar lines, Ma Santoshi SHG, Sri Bira Hanuman SHG and Sri Nivas Shakti SHG all identified a lack of infrastructure as a major constraint, specifically in the areas of pond management, storage and post-harvest handling. They suggested credit-based interventions to improve production efficiency and construct tangible assets. The Maa Swarasati SHG emphasised the need for financing support to grow its fishing activities (working capital), even though it did not name a specific operational

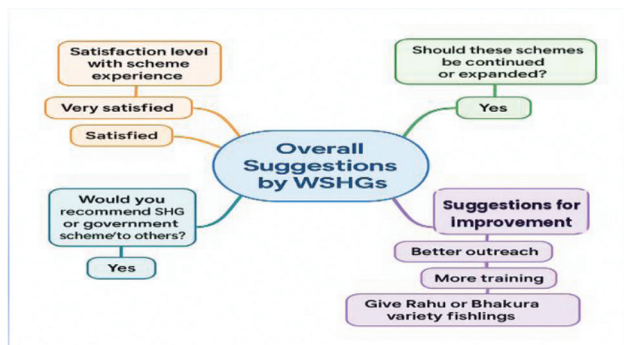


Figure 2. Overall Suggestions by SHGs.

Source: Authors, 2026

concern. When taken as a whole, these observations show that the main issues facing SHGs backed by MMKY are restricted market access, poor infrastructure, a lack of technical expertise and credit limitations. In Odisha rural aquaculture sector, addressing these through more training in simple and vernacular language, mandatory training for the members of the SHGs, skill development, input supply support (fish variety) and infrastructure development would be crucial to achieving the twin objectives of gender-inclusive economic empowerment and sustainable fisheries management.

The Mukhyamantri Matsyajibi Kalyan Yojana (MMKY) Self-Help Groups (SHGs) have contributed an overall recommendation analysis that provides a detailed and accurate understanding of beneficiary satisfaction, future ideas and suggested improvements for effective implementation. The Malika Mahila Mandal SHG expressed its delight with the government initiative and said it would firmly support its continuation and extension. It also proposed better outreach to let more rural women and communities to benefit from similar chances. Although the Sai Baba SHG reported a neutral level of satisfaction and agreed to promote the program to others, they recommended further technical training, faster benefit processing, and the availability of fish species known as Rahu and Bhakura, which are more in demand and yield better market returns. All of the Sai Ram WSHG, Ma Santoshi SHG, Sri Bira Hanuman SHG, Maa Swarasati SHG and Sri Nivas Shakti SHG expressed satisfaction with their experiences with the scheme, confirmed that they would be willing to suggest MMKY to other SHGs and unanimously agreed that it should be extended to reach more fisher communities. Together, these SHGs recommended more regular and hands-on training sessions to improve their technical proficiency in aquaculture management and marketing, as well as improved outreach and quicker administrative and financial processing. All things considered, the answers show that beneficiaries view MMKY as a successful

program for promoting sustainable fisheries, women empowerment and livelihood production. To further improve the program's effectiveness, inclusivity and long-term impact in Odisha rural aquaculture industry, they all underlined the need for more awareness, capacity-building initiatives and prompt administrative reaction.

Table 5. Consolidated frequency and percentage table of individual respondents (N = 66)

Category	Count	Percent
<i>Age</i>		
Young (20–39)	17	25.76%
Middle (40–59)	37	56.06%
Old (60+)	12	18.18%
Total	66	100.0%
<i>Household Income</i>		
30 – 50 thousand	23	34.85%
51 – 70 thousand	29	43.94%
Above 70 thousand	14	21.21%
Total	66	100.0%
<i>Caste</i>		
General	11	16.7%
OBC	35	53.0%
SC	12	18.2%
ST	8	12.1%
Total	66	100.0%
<i>Education</i>		
Graduate	2	3.0%
Higher Secondary	8	12.1%
Secondary	23	34.8%
Illiterate	33	50.0%
Total	66	100.0%
<i>Marital status</i>		
Married	51	77.3%
Widowed	15	22.7%
Total	66	100.0%
<i>Role in SHG</i>		
Member	54	81.8%
President	6	9.1%
Secretary	6	9.1%
Total	66	100.0%
<i>Leadership status</i>		
Member	54	81.8%
Leader	12	18.2%
Total	66	100.0%
<i>Training received</i>		
Yes	13	19.7%
No	53	80.3%
Total	66	100.0%

Category	Count	Percent
<i>Engaged in income-generating activity (SHG)</i>		
Yes	66	100.0%
No	0	0.0%
Total	66	100.0%
<i>Loan taken through SHG</i>		
Yes	17	25.8%
No	49	74.2%
Total	66	100.0%
<i>Decision-making power compared with before</i>		
Increased	63	95.5%
Remained same	3	4.5%
Decreased	0	0.0%
Total	66	100.0%
<i>Governance/community meeting participation</i>		
Regular	25	37.9%
Occasionally	41	62.1%
Never	0	0.0%
Total	66	100.0%
<i>Public speaking confidence</i>		
High	14	21.2%
Moderate	52	78.8%
Low	0	0.0%
Total	66	100.0%
<i>Respondents by SHG</i>		
Ma Santoshi	11	16.7%
Maa Swarasati SHG	10	15.2%
Malika Mahila Mandal	6	9.1%
Sai Baba SHG	6	9.1%
Sai Ram SHG	10	15.2%
Sri Nivas	13	19.7%
Sri Veena Hanuman SHG	10	15.2%
Total	66	100.0%

Source: Authors, 2026

The consolidated table shows that respondents come mainly from the OBC category (35; 53.0%), followed by SC (12; 18.2%), General (11; 16.7%) and ST (8; 12.1%). In terms of age, most respondents fall in the middle age group of 40–59 years (37; 56.06%), followed by the young age group of 20–39 years (17; 25.76%), while the smallest share (12; 18.18%) are aged 60 years and above. Household income is modest and concentrated in the middle bracket: 29 respondents (43.94%) earn ₹51–70 thousand, 23 (34.85%) earn ₹30–50 thousand, and only 14 (21.21%) earn above ₹70 thousand. Educational attainment is low: exactly half of the respondents (33; 50.0%) are illiterate, 23 (34.8%) have secondary education, 8 (12.1%) have higher secondary education, and only 2 (3.0%) are graduates. Most respondents are married (51; 77.3%) and the rest are widowed (15; 22.7%). Fifty-four respondents (81.8%) are ordinary members, while 12 (18.2%) are leaders, made up of 6 presidents and 6 secretaries (9.1% each). Support through the SHG is uneven: only 13 respondents (19.7%) received training and 53 (80.3%) did not (section F); all 66 (100%) are engaged in an income-generating activity through the SHG and only 17 (25.8%) took a loan while 49 (74.2%) did not. The empowerment indicators are largely positive: 63 respondents (95.5%) say their decision-making power has increased compared with before, 3 (4.5%) say it remained the same, and none report a decrease; 25 (37.9%) attend governance or community meetings regularly and 41 (62.1%) occasionally, with none never attending; and 14 (21.2%) have high public speaking confidence while 52 (78.8%) have moderate confidence and none have low confidence. The respondents belong to seven SHGs, the largest being Sri Nivas (13; 19.7%) and Ma Santoshi (11; 16.7%), followed by Maa Swarasati SHG, Sai Ram SHG and Sri Veena Hanuman SHG with 10 respondents

Table 6. Assessment of Impact before/after being a member of a SHG (1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Very High)

Statement	Number of members		Percentage	
	Before	After	Before	After
Overall quality of life (Level of personal income, Ability to save money, Frequency of financial contributions to household expenses, Confidence in participating in community meetings, Decision-making power in the family, Awareness of government welfare schemes, Participation in training programs.)				
Very Low	0	0	0	0
Low	29	0	43.94	0
Moderate	19	40	28.79	60.60
High	12	17	18.18	25.76
Very High	6	9	9.09	13.64
Total	66	66	100	100

Source: Authors, 2026

(15.2%) each, and Malika Mahila Mandal and Sai Baba SHG with 6 (9.1%) each. Overall, the table describes a group of respondents who are predominantly of middle age with modest, middle-bracket household incomes, mostly OBC and half of whom are illiterate, in which every respondent is engaged in an income-generating activity through the SHG and nearly all report increased decision-making power, with none reporting that they never attend meetings or have low public speaking confidence, although most rate their meeting participation and confidence only as occasional or moderate and training and credit reach relatively few.

The women members were asked to discuss how they felt their general quality of life has changed as a result of joining the SHG. They assessed a number of factors, including individual income, saving capacity, household income contribution, self-assurance in attending community meetings, family decision-making authority, knowledge of government programs and involvement in training initiatives. According to Table 15, the majority of SHG members stated that their quality of life had significantly improved and they credited their affiliation with the SHG for these improvements.

4. CONCLUSION

The Mukhyamantri Matsyajibi Kalyan Yojana (MMKY) is a significant intervention that has improved the sustainability and inclusivity of the fisheries sector in Odisha, according to the present study. The programs focus on integrating livelihood development and gender equality has resulted in social change and economic empowerment by enabling women's self-help groups (SHGs) to participate in worthwhile fishing related activities. The findings indicate that the majority of the participating women, who are primarily middle aged and come from socioeconomically challenged families, have profited from increased access to institutional loans, training, infrastructure, and market contacts. Their active involvement in all stages of the fisheries value chain, from capture and culture to processing and marketing, exemplifies the plans approach to achieving gender inclusion and sustainable fisheries management. Procedural delays in loan facilitation, limited access to high-quality inputs (fish variety), poor market linkage and limited infrastructure all continue to impede the achievement of program goals. Further, putting more of a focus on education, financial literacy and digital inclusion for fisherwomen would help the industry develop resilient and independent communities. The MMKY is a forward-thinking paradigm that operationalises the Blue Economy tenets and closely relates to the Sustainable Development Goals (SDGs) 5 and 14,

which deal with gender equality and life below the sea, respectively. Future research might concentrate on long-term evaluations of ecological results, institutional performance and income diversification in order to better assess the MMKY long-term effects on sustainable rural lives.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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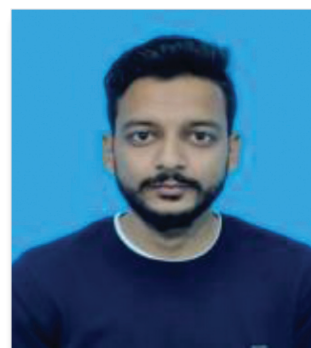


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RESEARCH ARTICLE

Peer-reviewed | Open Access

From Indigenous Wisdom to Environmental Resilience: Ecological Knowledge, Sustainable Livelihood and Indian Literary Imagination

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 23-Sep-26

ACCEPTED: 01-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Sitansu Sekhar Brahma and Girish Prasad Rath (2026). From Indigenous Wisdom to Environmental Resilience: Ecological Knowledge, Sustainable Livelihood and Indian Literary Imagination. Horizon J. Hum. Soc. Sci. Res. 8 (S), 86–91. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1397.p86>



ABSTRACT

This paper explores the tension between **environmental conservation** and the **livelihoods of communities** whose existence is connected to their ecological surroundings both in culturally and materialistic ways. Indian literary representations of forests, rivers, agricultural landscapes and the communities of the indigenous when seen through Eco critical perspective, the paper explores how the **traditional knowledge** offers a fresh perspective on sustainability. We cannot truly understand resilience by just focusing on technology and institutional policies. It is also necessary to consider the knowledge and daily practices of the communities living in these ecosystems. The Hungry Tide by Amitav Ghosh has a good relevance here as it portrays the Sundarbans in the way that highlights the balance between efforts to conserve, livelihoods of the locals, vulnerability towards the ecology and views on how to protect the environment. To highlight the point that one cannot really separate a community's livelihood and the deep understanding of the environment they live in. It's also important not to just paint romanticizing indigenous people but also to look at the challenges that fall heavily on them. Such as displacement, impact of modern development and environmental damage. This paper shows how Indian literature is a powerful tool to rethinking what **environmental resilience** really means, especially when it connects modern sustainability with indigenous wisdom. True sustainability needs more than just saving **ecosystems** but to actually consider the traditions and livelihoods of the communities than have deep roots in these landscapes.

Keywords: Eco-criticism, Indigenous Ecological Knowledge, Environmental Resilience, Sustainable Livelihoods, Human-Environment Relations, Conservation.

Introduction

The old idea of nature is something totally separate and different from us in what environmental writing is against of forest, river and wetland should not only seen as wild or empty places that are untouched by humans but in reality, they are filled with memory, culture, politics and livelihood (Huggan and Tiffin 2015). People relying directly on land and water to survive in the ecological fragile areas is where reality hits the hardest. It actually creates a debate between saving an ecosystem might

be essential by the method of protecting it can easily end up affecting the lives of the people who call it their home. The Hungry Tide by Amitav Ghosh holds this exact tension very well. The setting of Sundarbans, a landscape of mangroves, tides and mud flats where land and water constantly meet each other. It's a living force where the landscape itself decides how people move, work, survive and face danger (Ghosh 2004). The novel is so compelling because of the characters with completely different perspectives are tied to the land.



1. Piya Roy – American-trained marine biologist
2. Fokir - A local fisherman
3. Kanani Dutt – Urban Bengali outsider

Weaving all these people Ghosh creates and makes scientific studies, local wisdom and cultural memory collide and interact on equal grounds (Anand 2008). Ecocriticism provides us the perspective and puts in front of us an important question that is how do stories shape the relationship between us and the natural world? (Glottfelty and Fromm 1996) Early ecocriticism helped us put the physical environment on the literary map but postcolonial eco criticism made things deeper (Huggan and Tiffin 2015). It pointed out that one cannot talk about nature while ignoring poverty, colonial history and who in reality gets access to the resources. Now that perspective is necessary to understand *The Hungry Tide*. The Sundarbans is a lived in space that is shaped by human labour, migration, politics and deep-rooted culture (Panta 2024). Because of this to save the environment is not just an ecological issue but in reality, it is a social one. But how to protect such fragile ecosystem without damaging the lives of the people who rely entirely on it for survival is the question (Hussain and Bashir 2025). Fokir's knowledge is built over a lifetime amount of hands-on experience where he reads the tides, navigates the rivers and lives alongside river and the wildlife. But in contrast Piya's knowledge is formed through scientific training data and fax collection. Instead of just declaring only one way of experience is the best one, Ghosh makes both of them meet. The novel shows that understanding the world is not about finding one single truth but actually it's about the ecological knowledge can have more than one forms.

The title of the paper is not about replacing a so called outdated and primitive past with modern science but it's about expanding how and what we understand about the natural world. The ecological wisdom of the locals serves as the beginning point for the questions that the novel asks about sustainability and long-term survival. The term indigenous wisdom is to be used very carefully. This term here is used broadly to determine inherited and place based and practical environmental knowledge. The central argument comes down to 3 major ideas.

1. balanced ecological knowledge
2. Interconnected survival
3. Interconnected resilience

The major takeaway this paper highlights of the novel is ecological survival and human survival cannot be treated as different concerns.

Indigenous Wisdom and Ecological Knowledge

The relation between Piya and Fokir is the point where the novel explores different ways of understanding nature. Piya comes to Sundarbans with the perspective of a scientist. Everything she knows about dolphins are facts from marine observation, field work and tracking species the kind of knowledge that is backed up by the institutions. In contrast, Fokir's world works in a completely different way. He never read facts or any research but he knows the nature and the river in a completely different way. A way that Piya can only dream of at first. His perspective comes from years of experience of fishing, watching the water, steering boats and watching all seasons and leaving it each day. He himself belongs to the Sundarbans and is not just another man studying it. Ghosh does not just place modern science and local wisdom face to face against each other. Science still matters but local experience is irreplaceable.

Piya's training is not useless or outdated. The data she has is crucial if someone actually wants to study the dolphins but all the degrees that exist won't help Piya to safely read the water or navigate through the tricky tides without Fokir's practical guidance. Both the perspectives to see the world is necessary to understand the place (Ghosh 2004). Fokir's grasp about the environment isn't just textbook based knowledge, but it's actually built into his everyday life. It has originally developed from years of hands-on experience and not classroom. One cannot just replicate hands on experience with just abstract data. The informal oral understanding is also vital. Piya quickly realises the facts and data she has cannot go too far without Fokir's actual familiarity with the nature. He helps her to see the places that she would have completely missed by getting to the places that show how both are totally different in knowing the nature.

This particular approach points to something that's much vast than just the plot of the novel. Modern environment science is trying to catch up with the knowledge of the local communities that they have gained long time ago by relying on nature, who look at the tides, weather and the behaviour of the animals which a lab cannot simply reproduce. Although maintaining the characters importance and love for nature, Ghosh did not paint Fokir as a mystical guardian of the forest who reads the rivers out of romantic love for nature. He simply does it so that he gets food on his plate by the end of the day. Economic survival is the main reason he has built this kind of deep understanding of the environment. As all locals naturally are green and most of them assume all natural sciences as destructive the relationship between nature and humans is always shaped by the real material needs. Another important

and fascinating layer is added by the local legend Bonbidi. This does the job of clarifying that the power to understand nature does not just come from charts or hard experiences, but it lives in the folklore and the stories too. The myths surrounding Bonbidi a tool to fear and respect the dangers of the forest that in return helps to create a deep and strong bond between the people, forest the animals and the whole wildlife. This legend isn't some model to conserve the nature. Her powers are shown to show the bond between nature and humans is deeply cultural. People should not just treat the wild landscape just as a place to get the materialistic benefits but they inhabit the landscape through ancient rituals comma personal experience pieces, fears and religious benefits (Biswas and Channarayapatna 2022).

The entire world of the novel is built on these ways that have many layers of how the land is to be seen. Piya's perspective is based on science and facts full stops Fokir's is based on day on experience of hard labour and the act of survival. Nirmal tries to see the landscape through a political history and Bonbidi is included to offer a compass of cultural understanding and the very real dangers of the wild. All these perspectives have one thing in common. None of it can be considered entirely on its own. The mix of all these voices matters because the modern conservational politics made often goes hand in hand with the institutional authority. Who gets the authority to know the environment is an important question to be answered. This can be seen not only as philosophical but can also be looked upon as intensely political. It can also be stated that whoever holds the power that the authority recognises gets the chance to make a call on the rules of conservation, land rights, access to the resources and the development of the local. Ghosh here directly challenges the idea of legitimate wisdom that came from university or any governing agency. Fokir's view is as strong as concrete because it directly comes from mud, wild and the tides. Only by acknowledging the different forms of know how true environmental resilience can be built. The respect to nature alone is not enough here, the knowledge also has to be looked upon for the people's everyday survival. It would actually mean nothing if respecting the local wisdom does not support the ability of a community to eat, work and train which actually opens the plot's biggest challenge that is securing a livelihood that's sustainable.

Sustainable Livelihood and the Politics of Conservation

In the novel, the Sundarbans exist as both an ecosystem that's fragile and also as an essential human lifeline and this overlapping duality gives birth to the new

world's central political conflict. Although the landscape provides fish and home with resources and reverse and mangroves with land, the landscape is actually unstable and shifts a bit with every tide, cyclone and attacks from the wild animals. This conflict makes the question surface that when its ecosystem is what needs protection what would actually happen to the communities who are vulnerable and has nothing else to rely on to stay alive. The novel does not reject the idea of conservation. The tigers are endangered, the dolphins need protection and the mangrove forest is very fragile. But the novel also challenges the idea that the ecological Preservation can be separated from the economic state of the livelihood inhabiting it. The tension is clearly visible in the history of Morichjhapi. The state evicted when a low caste Bangladeshi refugee tries to settle in the Sundarbans in the late 70s under the umbrella of tiger conservation and Environmental Protection. The refugees were not simply inhabitants trying to settle in a new landscape but their presence became a part of a larger conflict that involved land, state authority and most importantly the political legitimacy.

This historical tragedy is used in the novel to actually expose so called green politics can be used as a weapon to displace the marginalized people. The settlers were desperate humans who were unfortunately caught between migration, state violence and ecological governance. This forces the readers to see the Sundarbans not only as a neutral natural park but as a deeply contested landscape. Although we should protect the fragile places but how this conservation can claim any legitimacy if its cost is human quietly dumped on to the most vulnerable margins. The Idea of sustainable living is not just an academic approach but it is an actual reality for the communities of the Sundarbans. It's not possible for a fisherman to stop fishing and a worker cannot walk away from the forest just because the ecosystem is weak. Without figuring out alternative ways for livelihood the strict Environmental Conservation politics directly has a heavy effect on the human survival. But unchecked exploitation can heavily destroy the system of the nature whose livelihood rely on. Sustainable livelihood can be achieved only with the balance between protecting the nature from heavy unchecked exploitation and meeting the basic needs of human lives. Fokir's relationship with the river it's not just spiritual but in reality, it's economic. Because his family totally depends upon the waters, he knows about it deeply. Both environmental knowledge and sustainable living are bound together. The dependence of the people is the very reason why people learn about nature. Moving forward in the novel not only romanticize the local life or to show survival as crime but

actually to create a balanced space where environmental care and human needs coexist.

The appearance of the tiger is a major symbol for this tension. Being an endangered animal that actually needs protection, it also is a predator that kills the villagers who enter the forest for work. Here the conflict is actually between two different vulnerabilities. The fisherman is vulnerable to physical danger and so is the tiger. It is actually vulnerable to extinction. Environmentalism not being biased should address both. An important question arises here: who should benefit from nature, who should carry the risk and who actually holds the power to make the decisions? Ultimately the history of the people displaced makes us remember that a sense of belonging is the most important factor that sustainable living requires. A landscape can have the rules of whom, workplace and also something that holds memory. A whole generational ecological knowledge often falls weak and fragile when people are subjected to displacement [Nixon 2011]. The support provided to human communities who live in such ecosystem and also preserving the natural resources is what can be called true sustainability.

Environmental Resilience and the Indian Literary Imagination

The environmental approach of the novel ultimately reaches a conflict that Ghosh narrates profoundly. That is, he brings down the duality to separate nature from culture and human survival from ecological vulnerability. The idea of painting Sundarbans as an untouched and pristine wilderness is what he rejects completely. He instead paints the landscape as a deeply lived landscape. Rivers are not just water bodies here but those actually are ways to commute and forest are not simple green spaces but they are actually high-risk workplaces. The animals are here presented as powerful cultural myths and also near biological species. Even the natural forces tide also act as a physical force that decides the rhythm of human existence. The core idea of resilience can be easily identified as adaptation. Human communities must follow the rule to keep constantly adapting to the unstable environment to survive. The Sundarbans itself survives because it also goes under constant changing and reshaping the islands and the waterways by shifting mud and water. But the adaptation also has limits which the novel remains the readers. When disaster strikes people with money and power can move or rebuild but the livelihoods who solely depend upon the very landscape are vulnerable and for them adapting is far more difficult. Resilience does not only go with toughness but actually it is a vast question of environmental justice.

This way of looking actually makes the novel an actual landmark in the environmental thought. The sustainability cannot be copied down from the western or so-called modern formulas but it has to have a connection to specific local histories. Sundarbans isn't any ordinary biodiversity reserve. It's a dense cultural landscape. Natural species has always been shaped by human hands through agriculture, religious rituals, migration or caste relation. The separation of human society and nature is not what's real. It's actually the ways of how people live in these Environments. The survival of a dolphin actually depends upon the local ecosystem but it is tracked by international science labs as endangered. The mangroves being some local community's backyard matters highly in global climate models. The Bengal tiger is a terrifying situation to cross paths with but it is also a Global Icon for conservation. This intersection is exactly what literature brings, proving only science simply cannot contribute enough to the Environmental Conservation. Because the erosion rates, the salinity levels or the quantity of species going down can be measured, the scientific data is crucial but literature fills the gap to capture what these changes actually feel like to the people who live Through these situations is where science struggles. Literature gives voice to the human feelings. It does not just maintain the count of people who came face to face with the tiger but it makes us feel the raw fear of how it would feel of looking a tiger in the woods. It makes us feel the grief one goes through after losing his home to the rivers or the trauma a whole community has to face because of the displacement and the hope people tend to cling upon to endure this particular pain.

Stories do what raw data simply cannot, it can make one feel the weight of the change. Amitav Ghosh in this novel did not use the nature or environment just as a backdrop for the human drama but instead he reminds us that the wild has a mind of its own. The tigers don't like to be managed by humans, the tides do not follow our plans and the dolphins love to exist entirely out of human interference. But human lives matter too because we deeply are tangled in the same system. The novel demands for a messy interdependence. This can clearly be stated when Piya and Fokir come together for work. It's not romanticizing the old school past but it's actually forging a future that respects the livelihood as much as the scientific data. This is why the book feels so crucial, especially as we face massive coastal erosion and climate change. But the real power lies in the questions like, who actually belongs to the landscape? Who gets the authority to speak? Every perspective is valid and has a conflicting claim. Every character has a fight of its own. The scientist is fighting for biodiversity, the fisherman for

his survival, the government for control and the displaced refugee for just a place he can call home (Princy and Natarajan 2026). But in contrast the nature is operating with the set of rules of its own and has no care for what falls in the favour of human interest. Literature is capable to catch these conflicting values under one umbrella and without searching for easy solution. Resilience it's not about who can win over the nature. The islands will always shift, the tides will always look for something to devour and the lives around will always be dangerously unpredictable. True sustainability is about learning how to live a responsible life and not about trying to eliminate the uncertainty.

Conclusion

The Hungry Tide offers a deep relationship between human, ecological knowledge and environmental resilience. It paints the landscape of the Sundarbans where both the human and natural world are fundamentally together but it also denies to accept the messy reality. This interdependence is always shaped by the power dynamics, economic conditions and the Haas vulnerability. When the dynamics between Piya and Fokir is looked upon, The blind spot of only relying purely on science comes forward. But Ghosh did not show Fokir as some mystical warrior who fights for the ecosystem. His deep connection with the water only exists only because he is under the responsibility to feed his family. The knowledge he has is a by-product of the necessity of earning a living rather than just romanticized harmony. The novel actually tries to redefine what resilience is. It's about a community trying to save its rights to work, remember and belong. It's not just mangrove forest in a storm. The Sundarbans is a cultural landscape that is alive, an economic engine for the locals and an archive with historical essence. Moving forward does not mean leaving one's tradition to attain modernity. But it is about knowing what are the pieces one needs to see the full picture. The cultural memory makes sure why the place actually matters and the practical map can be attained through the experience of the locals. A fence cannot be

drawn to lock vulnerable people out of their own homes. Ghosh ultimate takeaway on environmentalism is figuring out how humans and the natural world can survive and have a sustainable response towards each other.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

Not used.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Local Value Chain Integration in Indonesia's Free Nutritious Meal Program: A Comparative Literature Review on Smallholder Farmer Empowerment and Food System Resilience

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 23-Sep-26

ACCEPTED: 01-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Denny Aditya Dwiwarman and Astri Dwi Andriani (2026). Local Value Chain Integration in Indonesia's Free Nutritious Meal Program: A Comparative Literature Review on Smallholder Farmer Empowerment and Food System Resilience. Horizon J. Hum. Soc. Sci. Res. 8 (S), 92–104. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1398.p92>



ABSTRACT

Background: Nationally funded school and community meal programs have expanded rapidly worldwide, now reaching 466 million children and channeling an estimated US\$84 billion annually, with documented multiplier effects of up to US\$1 to US\$35 and 7.4 million jobs generated globally (World Food Programme [WFP], 2024). Indonesia's Free Nutritious Meal Program (Program Makan Bergizi Gratis, MBG) represents one of the largest such interventions, serving over 63 million beneficiaries with a disbursed budget of Rp88.15 trillion as of May 2026 (Kementerian Keuangan Republik Indonesia, 2026). However, with more than 60% of Indonesian farming households now classified as smallholders (*petani gurem*), concerns persist that fragmented procurement systems and intermediary (*tengkulak*) dominance may divert local economic multiplier effects away from rural producers (Fauzan, 2024; Sudrajat et al., 2022).

Purpose: This review examines how local value chain integration principles, evidenced in international best practice, most notably Brazil's *Programa Nacional de Alimentação Escolar* (PNAE), which mandates a minimum 30 to 45% direct procurement share from family farmers (Law No. 11,947/2009; Law No. 15,226/2025), and in comparable home-grown school feeding (HGSF) schemes across Sub-Saharan Africa (Andreozzi et al., 2025; Kamau et al., 2025), can inform smallholder-inclusive procurement governance within MBG.

Approach: Employing a narrative/critical literature review method (Grant & Booth, 2009; Snyder, 2019), this paper synthesizes peer-reviewed studies, institutional reports, and policy documents on Short Food Supply Chains (SFSC) and Food System Resilience frameworks, using Indonesia's Cianjur district as an illustrative contextual reference drawn from secondary sources.

Key Themes: The review identifies structural procurement barriers rooted in multi-layer intermediary chains (Fauzan, 2024; Idris et al., 2021), the theoretical case for direct farmer-kitchen partnerships grounded in SFSC theory (Renting et al., 2003; Kneafsey et al., 2013), the institutional role of existing farmer-group (*kelompok tani*) and village-enterprise (BUMDes)

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structures (Nuryanti & Swastika, 2016; Wulandari & Setiawan, 2026), and comparative regulatory lessons from Brazil and Sub-Saharan Africa.

Implications: The paper proposes a conceptual Direct Partnership (Production Cluster) Model to strengthen local agri-food system resilience and smallholder market access within Indonesia's nutrition program architecture.

Keywords: BUMDes; food system resilience; free nutritious meal program; local value chain integration; PNAE; procurement governance; short food supply chains; smallholder farmers

1. INTRODUCTION

Nationally led school and community meal programs have become one of the fastest-expanding social protection instruments in the world. According to WFP's *State of School Feeding Worldwide 2024* report, government-led programs now reach at least 466 million children globally, an increase of roughly 80 million beneficiaries since 2020, bringing global public investment in such programs to approximately US\$84 billion annually, nearly double the 2020 figure of US\$43 billion, with 99% of this funding now sourced from national budgets (World Food Programme [WFP], 2024). The same report documents multiplier returns of up to US\$35 for every dollar invested and estimates that delivering school meals at this scale generates approximately 7.4 million jobs across cooking, logistics, and farming sectors worldwide (WFP, 2024).

Among the most cited models for translating this fiscal scale into rural economic benefit is Brazil's *Programa Nacional de Alimentação Escolar* (PNAE). Since 2009, Law No. 11,947 has required that a minimum share of PNAE's federal transfers be used to directly procure food from family farmers, a mandate since strengthened, with the threshold raised from 30% to 45% effective January 2026 under Law No. 15,226/2025 (REDRAES, 2025). Empirical evaluations of this mandate report substantial income effects: Ipea's 2025 study found that supplying food to PNAE increased participating family farmers' income by 23% to 106%, with the largest gains concentrated among lower-income producers (Instituto de Pesquisa Econômica Aplicada [Ipea], as cited in REDRAES, 2025). Complementary econometric modeling by Oliveira et al. (2025) further confirms that PNAE's family-farming procurement rule generates measurable, if modest, positive effects on national GDP and employment, with the strongest gains accruing to family farming segments. Together, these cases demonstrate that structured, legally mandated local procurement can convert large-scale public feeding budgets into durable smallholder income gains rather than mere aggregate consumption, a pattern also documented across comparable home-grown school

feeding (HGSF) schemes in Sub-Saharan Africa, where farmer-based organizations have similarly functioned as the primary institutional conduit for translating school-feeding demand into smallholder market access (Andreozzi et al., 2025; Kamau et al., 2025).

Indonesia's own flagship nutrition initiative, the Free Nutritious Meal Program (Program Makan Bergizi Gratis, MBG), now operates at comparable scale. As of May 2026, the Ministry of Finance reported cumulative disbursement of Rp88.15 trillion, reaching 63.13 million beneficiaries through 29,679 operational Satuan Pelayanan Pemenuhan Gizi (SPPG) nutrition-fulfillment kitchens nationwide (Kementerian Keuangan Republik Indonesia, 2026). Yet this scale sits atop a structurally fragmented agricultural base: the 2023 Agricultural Census found that the proportion of smallholder (*petani gurem*) households rose from 50.33% in 2013 to 60.84% of all farming households nationally by 2023, underscoring both the demographic weight and the structural vulnerability of Indonesia's smallholder sector (Pusat Data dan Informasi Pertanian, as synthesized in Food and Fertiliser Technology Center, 2023). Preliminary regional evidence is beginning to suggest that MBG's local expenditure is already correlated with improved farmer and fisher terms of trade: a 2026 analysis of Bengkulu Province found that rising MBG contract value between the second and third quarters of 2025 was positively associated with both the regional Farmer Exchange Rate (Nilai Tukar Petani) and Fisher Exchange Rate, although the authors caution that the finding remains exploratory given the limited number of observations available (Mursalin et al., 2026).

Unlike PNAE, MBG's procurement architecture currently lacks a codified, mandatory minimum-share requirement for direct smallholder sourcing. Emerging Indonesian case literature on MBG's early implementation points to a mixed and locally uneven picture. Some district-level studies report that MBG has begun to absorb local commodities and open new market access for smallholders, as documented in Lebak Regency, West Java, where farmers supplying vegetables to a local SPPG

kitchen reported income gains even though, the authors note, farmer involvement remains partial rather than comprehensively integrated into the program's supply chain (Analisis Program Makan Bergizi Gratis Terhadap Pemberdayaan Petani Lokal di Kabupaten Lebak, 2025). Other regional studies caution that local procurement gains coexist with governance risks: in Aceh Tenggara, MBG was found to stimulate absorption of regional commodities such as rice and highland vegetables and to create new employment for village-level cooks and distributors, but vendor-selection mechanisms were also identified as vulnerable to political patronage by village elites, with the authors concluding that durable local economic benefit requires standardized procurement transparency and strengthened Village-Owned Enterprises (Badan Usaha Milik Desa, BUMDes) (Program Makan Bergizi Gratis (MBG) dan Implikasi Sosial, Ekonomi, dan Politik terhadap Masyarakat Kabupaten Aceh Tenggara, 2025). More broadly, Indonesia's smallholder sector continues to face longstanding structural barriers to market integration independent of MBG specifically, including reliance on multi-layered intermediary (*tengkulak*) chains that, while sometimes valued by farmers for the liquidity and convenience they provide, are also associated with price capture and constrained bargaining power (Fauzan, 2024).

This paper does not engage with the political or socio-political dimensions of MBG's rollout, nor does it evaluate program governance at the national policy level. Instead, it undertakes a narrative/critical literature review (Grant & Booth, 2009; Snyder, 2019) to examine how principles of local value chain integration, as theorized through Short Food Supply Chains (SFSC) (Renting et al., 2003; Kneafsey et al., 2013) and Food System Resilience frameworks (Tendall et al., 2015), and as operationalized through PNAE's direct-procurement mandate and comparable HGSP governance instruments, can inform a smallholder-inclusive procurement model for Indonesia's SPPG kitchens. Using secondary, publicly documented conditions in districts such as Cianjur, West Java, as an illustrative contextual reference, this review synthesizes the comparative and theoretical case for a direct farmer-kitchen partnership scheme, channeled through existing farmer-group (*kelompok tani*) and BUMDes institutions, with the aim of proposing a conceptual model to strengthen local food system resilience and smallholder market access within Indonesia's nutrition program architecture.

2. METHODOLOGY

2.1 Research Design

This study employs a narrative/critical literature review design, a method appropriate for synthesizing

heterogeneous bodies of evidence, spanning international institutional reports, peer-reviewed econometric studies, national policy documents, and theoretical literature, around a specific applied problem, rather than testing a single hypothesis through primary data collection (Grant & Booth, 2009; Snyder, 2019). Unlike a systematic literature review, which requires a fully pre-registered protocol and exhaustive database screening against rigid inclusion criteria, a narrative/critical review permits purposive, theoretically guided selection of sources while still requiring transparency in search strategy, source justification, and analytical synthesis (Baumeister & Leary, 1997; Grant & Booth, 2009). Snyder (2019) situates this approach within the broader family of semi-systematic reviews, which are designed for topics that have been conceptualized differently and studied across diverse disciplinary traditions, a description that fits the subject matter of this paper precisely, since local value chain integration in institutional feeding programs draws simultaneously on agricultural economics, public administration, development studies, and food system science. This design was selected because the objective of this paper is conceptual and comparative, namely to build an argument and a proposed governance model, rather than to exhaustively map the entire empirical literature on school or community feeding programs worldwide.

2.2 Search Strategy and Source Selection

Sources were identified through structured searches of Google Scholar, Scopus, and institutional repositories, including the World Food Programme, Brazil's Fundo Nacional de Desenvolvimento da Educação (FNDE) and Instituto de Pesquisa Econômica Aplicada (Ipea), Indonesia's Badan Pusat Statistik (BPS), Kementerian Keuangan Republik Indonesia, and Badan Gizi Nasional (BGN), using combinations of the following keyword clusters:

- "Free Nutritious Meal Program" OR "Makan Bergizi Gratis" AND "supply chain" OR "procurement"
- "Programa Nacional de Alimentação Escolar" OR PNAE AND "family farming" OR "smallholder"
- "home-grown school feeding" AND "smallholder farmers" OR "farmer-based organization"
- "short food supply chain" OR "food system resilience" AND "smallholder farmers"
- "tengkulak" OR "middleman" AND "smallholder" AND Indonesia
- "kelompok tani" OR "BUMDes" AND "market access" OR "institutional procurement"

The search was bounded to sources published between 2003, the year Renting et al.'s foundational SFSC framework was published, and 2026, with priority given to sources published from 2020 onward to ensure currency, given the rapid year-on-year evolution of both MBG's and PNAE's regulatory frameworks. Sources were included if they met at least one of the following criteria: (a) peer-reviewed empirical or theoretical work on institutional food procurement, smallholder market integration, or food system resilience; (b) official government or multilateral institutional reports containing primary statistical data, such as WFP, BPS, Kementerian Keuangan RI, or FNDE; or (c) theoretically foundational works establishing the SFSC or food system resilience frameworks central to this review's analytical lens. Sources were excluded if they were opinion pieces without an identifiable evidentiary basis, non-peer-reviewed blog commentary, or could not be independently verified against a traceable publication or institutional record, consistent with the journal's requirement that all in-text citations be traceable via Google Scholar and free of ghost referencing.

2.3 Analytical Approach: Thematic Synthesis

Given the qualitative and interpretive nature of a literature review, this paper adapts the interactive analysis logic of Miles and Huberman (1994), originally developed for primary qualitative fieldwork, as a structuring device for secondary source synthesis, rather than as a primary-data coding procedure. Three iterative stages were applied to the literature corpus:

1. **Data and source reduction.** Screening and narrowing the initial pool of retrieved sources to those directly relevant to local value chain integration, smallholder procurement governance, and food system resilience in the context of large-scale nutrition programs.
2. **Data and theme display.** Organizing retained sources into thematic clusters: (i) global school and community feeding scale and multiplier evidence, (ii) PNAE's and comparable HGSP programs' regulatory and socioeconomic evidence base, (iii) MBG's operational and structural procurement context, including district-level Indonesian case studies, and (iv) SFSC and food resilience theory, together with the institutional literature on farmer groups and BUMDes, to enable structured cross-case comparison.
3. **Conclusion drawing and verification.** Cross-checking emergent thematic patterns and comparative claims against multiple independent

sources per theme, triangulating institutional reports against peer-reviewed econometric studies and district-level qualitative case reports, before incorporating them into the comparative and discussion sections. This functions as a source-triangulation safeguard analogous to respondent triangulation in primary qualitative research, and it was applied with particular care to the emerging Indonesian MBG literature, where district-level findings (for example, from Lebak Regency and Aceh Tenggara) sometimes point in different directions regarding the consistency of local procurement benefit, a divergence that is itself treated as a substantive finding rather than resolved by selective citation.

2.4 Use of the Cianjur Context

Conditions in Cianjur Regency, West Java, where a substantial concentration of operational SPPG kitchens serves as a nationally representative node of MBG's rural procurement architecture, are used throughout this paper as an illustrative contextual reference drawn from secondary, publicly available sources, including government statistical releases, ministry press statements, and verifiable news reporting, rather than as a site of primary fieldwork, interviews, or direct observation. This distinction is stated explicitly and maintained consistently: no claims in this paper are attributed to original interview data, and no named individual informants are represented. This scope decision reflects the paper's design as a literature-based conceptual and comparative analysis rather than an empirical case study, and it is revisited explicitly in the Limitations section.

2.5 Methodological Limitations of the Review Design

As with any narrative review, source selection retains an element of researcher judgment, and the absence of a fully systematic, protocol-registered search process means this review does not claim exhaustive coverage of all existing literature on the subject. A further limitation specific to this topic is the asymmetry in evidentiary maturity between the Brazilian and Indonesian literatures: PNAE has been subject to over a decade of peer-reviewed econometric evaluation, whereas MBG, launched only in January 2025, is at the time of writing represented predominantly by descriptive, qualitative, or exploratory quantitative studies at the district level. This asymmetry is treated transparently throughout the Findings and Discussion sections rather than concealed, and its implications for the strength of the paper's

conclusions are revisited in the Limitations and Future Research section.

3. FINDINGS

Applying the thematic synthesis described in the Methods section, four recurring patterns emerged from the corpus of secondary sources: the scale and multiplier logic of large nutrition programs globally, PNAE's and comparable home-grown school feeding (HGSF) programs' regulatory mechanisms and documented socioeconomic outcomes, MBG's own procurement structure as reflected in emerging district-level Indonesian case evidence, and the comparative governance gap between systems with and without a codified direct-procurement instrument. These are presented below through three comparative tables and one structural figure.

3.1 Global Scale and Investment Patterns

Table 1 situates MBG within the global landscape of large-scale, government-led feeding programs, drawing on WFP's institutional reporting alongside Brazil's and Kenya's national and sub-national program data.

The table highlights a structural asymmetry: while MBG now operates at a scale comparable to or exceeding PNAE in absolute beneficiary count, and while sub-national Indonesian evidence is beginning to show positive correlation between MBG expenditure and farmer welfare indicators, the program still lacks the codified procurement mandate that PNAE has used since 2009, and just strengthened in 2026, to convert program scale into systematically measured smallholder income gains.

This asymmetry is not simply a matter of Indonesia lagging behind Brazil in time. Kenya's HGSFP experience

shows that even without a binding national quota comparable to PNAE's, a market-access effect can emerge organically once school-feeding demand is channeled through farmer-based organizations, although Kamau et al. (2025) also found that local procurement opportunities through these organizations remained substantially underutilized and recommended targeted capacity-building. Read alongside the Bengkulu finding that MBG contract value is already correlated with regional Farmer and Fisher Exchange Rates, albeit on an exploratory basis given limited observations (Mursalin et al., 2026), the comparative picture suggests that MBG possesses the underlying demand-side conditions for a PNAE-style or Kenya-style multiplier effect, but that the strength and consistency of that effect will depend heavily on whether procurement is channeled through organized, accountable intermediating institutions rather than informal ones.

3.2 Procurement Governance: MBG versus PNAE

Table 2 compares the two programs' procurement governance architecture directly, drawing out the specific mechanisms absent from MBG's current national design.

The comparative literature suggests that the core difference between the two systems is not program scale but procurement channel architecture: PNAE closes the gap between institutional demand and smallholder supply through a codified legal instrument, while MBG currently relies on the discretion and institutional maturity of individual SPPG kitchens and district administrations.

That discretion produces uneven outcomes, which the district-level Indonesian literature already documents even at this early stage of MBG's implementation.

Table 1. Comparative Scale and Investment in Large-Scale Public Nutrition Programs

Dimension	Global (WFP aggregate)	Brazil (PNAE)	Kenya (HGSFP)	Indonesia (MBG)
Beneficiaries reached	466 million children (2024)	~40 to 45 million students daily	Sub-national pilot coverage across multiple counties	63.13 million (as of May 2026)
Annual public investment	US\$84 billion	R\$5.5 billion (~US\$1 billion)	Not independently aggregated at national scale	Rp88.15 trillion disbursed YTD (~US\$5.4 billion)
Documented multiplier effect	Up to US\$1 to US\$35	Farmer income +23% to +106% (Ipea, as cited in REDRAES, 2025)	22.8% of smallholders and 37.5% of farmer-based organizations gained market access (Kamau et al., 2025)	Not yet independently studied at national level; regional exploratory evidence positive (Mursalin et al., 2026)
Legally mandated local-farmer procurement share	Not universally mandated	45% minimum (from January 2026; previously 30%)	No uniform national mandate; procurement channeled through farmer-based organizations	No codified minimum share
Employment generated	~7.4 million jobs (cooking, logistics, farming)	Positive but modest net GDP and employment gains (Oliveira et al., 2025)	Not independently quantified	5,704 new jobs and 804 local suppliers recorded in Bengkulu Province alone as of April 2026

Sources: WFP (2024); Oliveira et al. (2025); Ipea, as cited in REDRAES (2025); Kamau et al. (2025); Kementerian Keuangan Republik Indonesia (2026); Mursalin et al. (2026).

Table 2. Procurement Governance Comparison Between MBG (Indonesia) and PNAE (Brazil)

Governance dimension	PNAE (Brazil)	MBG (Indonesia)
Legal basis for local sourcing	Law No. 11,947/2009, amended by Law No. 15,226/2025	No dedicated national procurement law mandating smallholder share
Minimum direct-purchase requirement	45% of federal transfer (from January 2026)	None specified nationally
Priority supplier groups	Family farmers, land-reform settlements, traditional and quilombola communities, women's groups	Not formally differentiated by supplier type at national level
Procurement mechanism	Simplified "Public Call" (<i>Chamada Pública</i>), bidding-exempt for family farmers	Largely informal or ad hoc at SPPG-kitchen level, with district-level variation
Reported structural barrier	Uneven regional compliance (South and Southeast outperform other regions)	Continued reliance on multi-layer <i>tengkulak</i> intermediaries; continuity and quality-standard barriers for smallholders (Fauzan, 2024)
Evidence base on farmer income effect	Multiple peer-reviewed and institutional studies (23% to 106% income gain)	Emerging, geographically uneven district-level case evidence (Lebak, Aceh Tenggara, Bengkulu)

Sources: REDRAES (2025); Oliveira et al. (2025); Ipea, as cited in REDRAES (2025); Fauzan (2024); this review's synthesis of Indonesian district-level MBG case reporting.

Table 3. Summary of District-Level MBG Case Evidence on Local Procurement

Location	Method	Key finding	Source
Lebak Regency, West Java	Qualitative descriptive; key informant interview and secondary data	MBG has involved local vegetable farmers as suppliers and opened market access, though integration remains partial	Analisis Program Makan Bergizi Gratis Terhadap Pemberdayaan Petani Lokal di Kabupaten Lebak (2025)
Aceh Tenggara, Aceh	Qualitative; 10 key-informant interviews plus document review	MBG stimulates absorption of local commodities and employment but vendor selection is exposed to political patronage risk	Program Makan Bergizi Gratis (MBG) dan Implikasi Sosial, Ekonomi, dan Politik terhadap Masyarakat Kabupaten Aceh Tenggara (2025)
Bengkulu Province	Quantitative; monthly time series, OLS regression	MBG contract value positively correlated with Farmer and Fisher Exchange Rates and with MBG's share of regional GDP, though the sample remains exploratory	Mursalin et al. (2026)

Sources: as listed in the table above.

Studies in Lebak Regency report that MBG procurement has opened genuine market access for local vegetable farmers, even though farmer involvement remains partial rather than systematically integrated into the program's supply chain. In Aceh Tenggara, MBG was found to stimulate absorption of regional commodities and create new local employment, but the same study identified a governance risk specific to the absence of a standardized procurement mechanism: vendor-selection processes vulnerable to political patronage by village elites, with the authors explicitly recommending standardized procurement transparency and strengthened BUMDes as the remedy. Table 2's contrast between PNAE's *Chamada Pública* and MBG's largely informal, kitchen-level procurement helps explain why these two district cases produce different outcomes from the same national program: without a codified instrument, the quality of local procurement in any given SPPG kitchen depends on local institutional capacity and integrity rather than on a nationally guaranteed floor.

3.3 District-Level Evidence on MBG's Local Procurement Outcomes

Table 3 synthesizes the emerging, still-limited body of Indonesian district-level case evidence on MBG's local economic effects, which this review treats as a distinct evidentiary category from the national-scale figures reported in Table 1.

Read together, these three district cases converge on a cautious but consistent conclusion: where MBG procurement functions well, it functions through some form of organized local intermediation, whether an existing farmer-group relationship in Lebak, a BUMDes-strengthening recommendation in Aceh Tenggara, or the aggregate contract-and-exchange-rate relationship documented in Bengkulu, rather than through unmediated, purely informal market transactions.

At the same time, the Aceh Tenggara finding on patronage risk is a reminder that "local" procurement is not automatically equitable procurement; without a transparent selection mechanism, a formally local

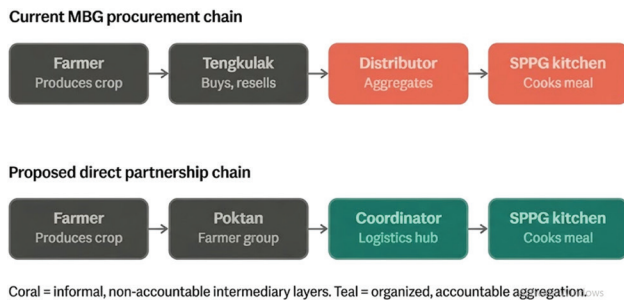


Figure 1. The Structural Gap: Value Chain Configuration

supply chain can still fail to channel benefit to the smallholder producers it is nominally designed to serve. This distinction, between procurement that is merely geographically local and procurement that is structurally accountable to smallholder producers, becomes the organizing concept for the comparative diagnosis developed in the remainder of this paper, and it directly motivates the structural contrast illustrated in Figure 1.

3.4 The Structural Gap: Value Chain Configuration

Figure 1 above illustrates this structural contrast directly, comparing the multi-intermediary chain characteristic of current, unmandated MBG implementation with the organized, accountable aggregation pathway associated with PNAE-style governance and with the better-performing Indonesian district cases described above.

The figure shows that both chains connect the same two endpoints, the smallholder farmer and the SPPG kitchen, but through structurally different intermediate configurations: the current chain routes value through a *tengkulak* and a distributor, two informal, non-accountable layers, while the proposed chain routes it through a Poktan (farmer group) and a coordinator function, both organized and, in principle, auditable. The literature indicates that each additional informal intermediary layer corresponds to documented risks: price capture by non-producer actors, delayed or inconsistent payment cycles reaching the farm level, and reduced traceability of the “smallholder share” of total procurement spending, precisely the risks that PNAE’s Public Call mechanism was designed to close (Oliveira et al., 2025; REDRAES, 2025) and precisely the risk that the Aceh Tenggara case study flags as a live governance concern within MBG today.

Taken together, these four sources of evidence support a consistent interpretation: Indonesia’s MBG possesses the fiscal scale and institutional infrastructure, 29,679 SPPG kitchens nationally serving over 63 million beneficiaries, to generate a PNAE-scale or Kenya-scale rural multiplier effect, and district-level evidence from

Lebak, Aceh Tenggara, and Bengkulu suggests that such effects are already beginning to emerge unevenly across the country. What the program currently lacks is not scale but a codified, nationally consistent procurement architecture capable of converting that scale into predictable, accountable, and broadly distributed smallholder income gains. This gap forms the empirical and theoretical basis for the Discussion section that follows.

4. DISCUSSION

4.1 Reading MBG’s Procurement Gap Through the Short Food Supply Chain Framework

The Short Food Supply Chain (SFSC) framework offers the clearest theoretical lens for interpreting the structural gap identified in the Findings section. Renting et al. (2003) define SFSCs not primarily by geographic distance but by the number of intermediary actors separating producer from consumer, and by the degree to which the product remains “embedded,” carrying traceable information about its origin and production conditions. Applying this lens to Table 2’s comparison, MBG’s current, unmandated procurement pattern of farmer, *tengkulak*, distributor, SPPG kitchen constitutes what Renting et al. (2003) would classify as a conventional, extended chain rather than an SFSC, despite the program’s stated developmental intent. Each intermediary layer in this configuration progressively disembeds the product from its producer-level origin, which, following Kneafsey et al.’s (2013) European Commission Joint Research Centre synthesis of SFSC policy evidence, is precisely the mechanism through which value and price-setting power migrate away from primary producers toward intermediary actors. Widianarko et al.’s (2025) recent institutional-model study of SFSC activation in Semarang City reaches a compatible conclusion from a different empirical setting, finding that successful short-chain activation in urban Indonesia depends on precisely the institutional conditions, farmer-group readiness, defined success parameters, and a clear organizing framework, that MBG’s current ad hoc kitchen-level procurement generally lacks.

Kneafsey et al. (2013) further note that SFSC-oriented policy interventions, such as PNAE’s Public Call mechanism, function best when they simultaneously address three conditions: a codified minimum-procurement obligation, simplified bureaucratic entry for smallholder suppliers, and an institutional buyer with predictable, recurring demand. MBG structurally satisfies the third condition already: SPPG kitchens represent exactly the kind of stable, high-frequency institutional demand that SFSC theory identifies as necessary for smallholder market integration, and the Bengkulu

evidence that MBG contract value correlates with regional Farmer Exchange Rates (Mursalin et al., 2026) suggests this demand effect is already materializing in at least some locations. What MBG currently lacks are the first two conditions, a codified obligation and simplified entry, a diagnostic gap rather than any deficiency in program scale or funding, which is exactly what Figure 1 visually contrasts: the same institutional endpoint, the SPPG kitchen, reached through structurally different chain configurations, and exactly what the Aceh Tenggara case study's patronage-risk finding illustrates in practice when that gap is left unaddressed at the district level.

4.2 Food System Resilience Implications

Tendall et al. (2015) define food system resilience as the capacity of a food system and its constituent units, across multiple scales, to continue providing sufficient and accessible food in the face of disturbance. Read through this framework, MBG's current reliance on multi-layer intermediary chains introduces a specific resilience vulnerability: because *tengkulak*-mediated procurement is typically informal, price-volatile, and non-contractual, even when farmers themselves report the relationship as convenient and low-cost in the short run (Sudrajat et al., 2023), SPPG kitchens' access to fresh ingredients remains exposed to localized shocks, seasonal price spikes, transport disruption, or opportunistic withdrawal of individual intermediaries, without the buffering effect that a formally contracted, cluster-based smallholder supplier base would provide. This diagnosis is consistent with the broader value chain governance literature on resilience in the Global South, which identifies formal coordination mechanisms and reduced power asymmetries between chain actors as the structural conditions under which agricultural value chains absorb external shocks without disrupting downstream food security (Building Resilient Agricultural Value Chains in the Global South Post COVID-19, 2025).

This is consistent with the broader finding from Brazil's experience: Oliveira et al. (2025) attribute part of PNAE's measured socioeconomic stability to the "institutional market" effect of guaranteed, legally mandated demand, which renders local agricultural production more predictable and investment-worthy for family farmers. A parallel institutional-market effect appears to be forming in Malawi's home-grown school feeding program, where Mainje et al. (2026) find that participating smallholders gain not only farm revenue but also significantly more extension advice and a higher farm-income share, evidence that a stable institutional buyer can generate resilience benefits that extend beyond the income channel alone. Applied to the Indonesian

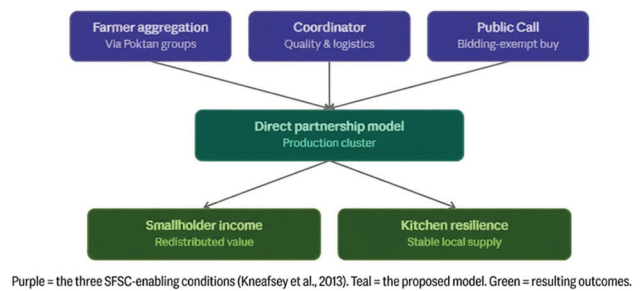


Figure 2. Conceptual Direct Partnership (Production Cluster) Model

case, a codified direct-procurement mechanism would not only redistribute income toward smallholders, the equity dimension emphasized in the Findings section, but would also strengthen MBG's own operational resilience as a program, reducing SPPG kitchens' exposure to intermediary-driven supply disruption. This reframes local value chain integration not merely as a rural-development side benefit of MBG, but as a food-system resilience requirement for the program's own continuity at scale.

4.3 Toward a Direct Partnership (Production Cluster) Model

Synthesizing the SFSC and food system resilience literatures with the comparative PNAE, Kenyan, and Malawian evidence and the district-level Indonesian case findings, this paper proposes a conceptual Direct Partnership (Production Cluster) Model, illustrated in the figure above.

The model rests on three components, each addressing one of the three SFSC-enabling conditions identified by Kneafsey et al. (2013) and each grounded in an existing Indonesian institutional form rather than requiring a new bureaucratic layer. The first component is farmer aggregation through existing *kelompok tani* (Poktan) structures. Rather than requiring SPPG kitchens to contract with individual smallholders, an administratively unrealistic proposition given typical smallholder landholding fragmentation, the model channels procurement through already-existing farmer group structures, mirroring PNAE's reliance on organized family-farming cooperatives and consistent with recent Indonesian evidence that farmer-group participation, while not transformative on its own, meaningfully improves productivity and market access when institutional support is adequate (Cogent Economics & Finance study on farmer-based organizations, 2026). The second component is a cluster coordinator function bridging quality, logistics, and payment. This function, which could be fulfilled by Poktan leadership, village-owned enterprises (BUMDes), or a dedicated regional

coordination body, absorbs the aggregation, quality-standardization, and logistics functions currently performed informally, and extractively, by *tengkulak* intermediaries, but under a transparent, accountable structure with documented pricing; a recent normative-juridical analysis of BUMDes and village-cooperative synergy specifically within MBG's supply chain concludes that local governments already possess the constitutional authority to establish exactly this kind of institutional linkage between state procurement demand and village production capacity without new national legislation. The third component is a simplified, bidding-exempt procurement instrument at the SPPG level, analogous to PNAE's *Chamada Pública* (Public Call) mechanism, which would allow SPPG kitchen managers to contract directly with the cluster coordinator without the bureaucratic tendering burden that currently favors established, better-documented distributors over informal smallholder suppliers, and which would directly address the vendor-selection patronage risk documented in the Aceh Tenggara case.

This model does not require MBG's national budget architecture to change; rather, it proposes a procurement-channel reconfiguration within existing fiscal parameters, consistent with this paper's scope, which brackets political and macro-budgetary questions in favor of supply-chain governance design. It is also, notably, not a purely theoretical proposal transplanted from Brazil: each of its three components already exists in some form in Indonesian rural institutions today, Poktan, BUMDes, and district-level procurement discretion, which suggests that the primary barrier to implementation is coordination and codification rather than the absence of foundational institutional capacity.

5. CONCLUSION

5.1 Conclusion

This review set out to examine, through a synthesis of international and national literature, how principles of local value chain integration can inform smallholder-inclusive procurement governance within Indonesia's Free Nutritious Meal Program (MBG). The evidence assembled across the Findings and Discussion sections converges on a consistent conclusion: MBG possesses the fiscal scale, institutional infrastructure, and recurring institutional demand, expressed through 29,679 operational SPPG kitchens serving over 63 million beneficiaries, to generate a rural economic multiplier comparable to, or exceeding, that documented for Brazil's PNAE and for comparable home-grown school feeding programs in Kenya and Malawi. What the program currently lacks is not scale but architecture. The comparative evidence

from PNAE demonstrates that a codified minimum direct-procurement mandate, a simplified bidding-exempt contracting mechanism, and organized farmer-group aggregation are the specific structural conditions under which large public feeding budgets translate into measurable smallholder income gains, of the magnitude documented by Ipea's finding of 23% to 106% farmer income increases attributable to PNAE participation (Ipea, as cited in REDRAES, 2025), and the Malawian evidence extends this by showing that a stable institutional buyer also generates resilience benefits, extension access and farm-income share, that extend beyond income alone (Mainje et al., 2026).

In the absence of comparable structural conditions at the national level, MBG's procurement architecture remains unevenly effective, as the district-level evidence from Lebak, Aceh Tenggara, and Bengkulu demonstrates: genuine but partial farmer inclusion in one district, a documented patronage risk in another, and an encouraging but still exploratory positive correlation between MBG spending and farmer welfare indicators in a third. This unevenness is itself the central empirical finding of this review. It indicates that MBG's local economic multiplier is neither absent nor yet reliably realized; it is present in a form that varies with local institutional quality rather than being guaranteed by program design, a pattern this review has represented structurally through the contrast between the current fragmented chain and the proposed Direct Partnership (Production Cluster) Model. The central contribution of this paper, therefore, is not a claim about what is empirically occurring inside any single SPPG kitchen, but a literature-grounded conceptual diagnosis and design proposal: local value chain integration in MBG should be understood as a governance and procurement-channel problem, addressable within existing fiscal parameters and largely through institutions Indonesia already has, Poktan and BUMDes, rather than as a byproduct requiring additional budget allocation or entirely new bureaucratic structures.

5.2 Implications of the Study

Theoretically, this review contributes to the Short Food Supply Chain and food system resilience literatures by extending their application beyond the European and Latin American contexts in which they have predominantly been developed and tested, into the distinctive institutional setting of a rapidly scaling Southeast Asian public nutrition program. Where Renting et al. (2003) and Kneafsey et al. (2013) originally theorized SFSCs primarily in relation to consumer-facing alternative food networks and European rural development policy,

this paper demonstrates that the same analytical logic, the number and function of intermediary actors, and the degree of product-origin embeddedness, applies with equal explanatory power to institutional, business-to-government procurement contexts such as school and community feeding programs. This suggests that SFSC theory's utility is not confined to voluntary, consumer-driven alternative food movements but extends naturally to mandated or quasi-mandated institutional procurement, a context in which the short chain is not a niche market choice but a deliberate governance design decision imposed on a large-scale public buyer. Similarly, this review extends Tendall et al.'s (2015) food system resilience framework by illustrating that resilience at the level of a single institutional buyer, an individual SPPG kitchen's exposure to supply disruption, can be meaningfully theorized as a microcosm of the broader food system resilience concept, linking household- and unit-level operational continuity to the macro-level goal of national food security infrastructure. The district-level Indonesian evidence surveyed in this review, particularly the Aceh Tenggara finding that geographic locality alone does not guarantee equitable procurement, further suggests a refinement worth pursuing in future theoretical work: that SFSC theory's embeddedness criterion may need to be disaggregated into a geographic dimension, is the supplier local, and a governance dimension, is the selection process accountable, since the evidence assembled here shows these two dimensions can diverge within a single program. Future theoretical work could productively formalize this link between institutional-buyer-level resilience and national food system resilience as a distinct analytical layer within the broader Tendall et al. framework, particularly in contexts where a single public program constitutes as large and as geographically distributed a demand shock as MBG does within Indonesia's domestic food economy.

For policymakers within Badan Gizi Nasional (BGN) and affiliated ministries, this review's findings suggest that closing MBG's procurement governance gap need not await a comprehensive national budget restructuring; rather, the PNAE comparison indicates that a targeted regulatory instrument, a minimum smallholder direct-procurement share, paired with a simplified, bidding-exempt contracting mechanism analogous to Brazil's Public Call, could be piloted within the existing SPPG operational structure without requiring new appropriations. The scale of MBG's current kitchen network, already comparable in reach to PNAE's decades-mature system, suggests that Indonesia is not starting from an infrastructural deficit but from a governance-design deficit, which is a materially faster and less costly gap to close than a capacity-building one. For provincial and district-level agricultural agencies,

particularly in smallholder-dense regions such as Cianjur, the proposed Direct Partnership Model implies a practical role for existing *kelompok tani* institutions as the primary organizing unit for MBG engagement, suggesting that capacity-building investments would be more efficiently directed toward strengthening Poktan-level aggregation, quality-standardization, and logistics coordination capacity than toward parallel new institutional structures, consistent with recent Indonesian evidence that farmer-group participation improves productivity most reliably where institutional support is already present rather than absent. For SPPG kitchen managers themselves, the model implies that current informal reliance on intermediary suppliers, while operationally convenient in the short term, represents an unaddressed continuity risk that a formalized cluster-coordination arrangement would mitigate, aligning the interests of kitchen-level operational stability with the program's broader rural development objectives. The Aceh Tenggara evidence adds a further, more urgent policy implication: absent a standardized procurement mechanism, MBG's local sourcing is exposed not only to informal-intermediary risk but to political-capture risk at the vendor-selection stage, which strengthens the case for BUMDes-mediated procurement as a transparency safeguard rather than merely an efficiency measure. Finally, for the design of MBG's ongoing monitoring and evaluation architecture, this review's finding that no independently published national-level evidence yet quantifies MBG's own smallholder income or multiplier effects, in contrast to the multiple peer-reviewed and institutional studies available for PNAE and to Kenya's and Malawi's more established HGSF evaluation literatures, points to an immediate and low-cost policy opportunity: commissioning a structured impact evaluation modeled on the Ipea (2025) and Oliveira et al. (2025) methodologies, and informed by the exploratory regression approach already piloted in Bengkulu (Mursalin et al., 2026), would allow Indonesian policymakers to establish an evidentiary baseline against which future procurement-governance reforms, including the model proposed in this paper, could be rigorously assessed.

5.3 Limitations and Recommendations for Future Research

This review is subject to several limitations inherent to its narrative/critical literature review design. First, because the search and source-selection process was purposive rather than exhaustively systematic, this review does not claim comprehensive coverage of all existing literature on institutional food procurement or smallholder market integration; a formally protocol-registered systematic review would provide a more exhaustive evidentiary base,

though at the cost of the interpretive and comparative flexibility this design required. Second, the analysis relies substantially on secondary institutional, journalistic, and early-stage academic reporting for MBG-specific procurement conditions, given the program's launch in January 2025 and the correspondingly nascent state of peer-reviewed empirical research on its supply chain; this asymmetry, a rich, decade-deep empirical literature for PNAE against a rapidly growing but still predominantly descriptive and district-level literature for MBG, necessarily constrains the strength of direct causal claims this review can make about MBG's actual national-level procurement outcomes, and the discussion in the Findings and Discussion sections should accordingly be read as a theoretically and comparatively grounded diagnosis rather than a confirmed empirical finding. Third, the use of Cianjur as an illustrative contextual reference, drawn exclusively from secondary sources, means this review cannot speak to the specific operational variation that likely exists across MBG's nearly thirty thousand SPPG kitchens nationally; the district-level contrasts already visible between Lebak, Aceh Tenggara, and Bengkulu in this review's own corpus confirm that procurement conditions plausibly differ substantially between regions in ways this literature-based approach cannot fully capture or reconcile into a single national estimate.

Future research should therefore prioritize primary qualitative fieldwork, structured interviews and direct observation with SPPG kitchen managers, *kelompok tani* leadership, and intermediary actors across a purposively sampled set of districts including Cianjur, to empirically test the structural diagnosis this review has proposed on theoretical and comparative grounds. Complementary quantitative and spatial research, employing input-output or econometric modeling approaches comparable to Oliveira et al. (2025) and extending the exploratory regression framework piloted by Mursalin et al. (2026) to a nationally representative sample of provinces, would further allow Indonesian researchers to quantify MBG's actual smallholder income and employment multiplier effects, providing the missing empirical counterpart to the extensive PNAE evidence base surveyed in this review. Given the divergent district-level findings on procurement governance quality specifically, future work should also prioritize comparative case designs that pair a district with documented governance vulnerabilities, such as Aceh Tenggara, against one with documented institutional strength, in order to isolate which BUMDes and Poktan capacity factors most reliably predict equitable local procurement outcomes. Finally, future research could productively pilot and formally evaluate the proposed Direct Partnership (Production Cluster) Model in a small number of SPPG sites, generating the kind of before-after

or comparative evidence that would allow policymakers to assess the model's feasibility and impact prior to any broader national rollout.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors did not use any AI technologies to develop the research questions, theoretical framework, research propositions, substantive arguments, interpretation, or conclusions. The authors remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Export Potential of FPOS in Indian Agriculture

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 23-Sep-26

ACCEPTED: 01-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Anita Patra and Mausumi Manjari Nayak (2026). Export Potential of FPOS in Indian Agriculture. Horizon J. Hum. Soc. Sci. Res. 8 (S), 105–116. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1399.p105>



ABSTRACT

Farmer Producer Organizations (FPOs) have emerged in India as a transformative institutional mechanism designed to address the persistent challenges faced by small and marginal farmers, including limited market access, inadequate finance, and weak bargaining power against intermediaries. Introduced as an alternative to traditional cooperatives following the 2002 amendment of the Companies Act and the 2013 Policy and Process Guidelines for FPOs, these organizations aim to strengthen farmers' collective participation in domestic and international markets. While India currently has more than 12,000 registered FPOs, only a small proportion are actively engaged in export activities, despite the country's considerable agricultural export potential in commodities such as fruits, vegetables, spices, millets, and organic products.

This paper examines the present status of FPOs in export activities, the extent of government support extended to them, and the role of technology and digital platforms in connecting farmers with global buyers. It further identifies the emerging opportunities available to FPOs in export markets and the key challenges that continue to constrain their participation, including inadequate storage and cold-chain infrastructure, limited access to timely finance, weak technological adoption, climate-related risks, and significant post-harvest losses. The study draws on a review of existing literature, government reports, and secondary data to build a structured understanding of these issues. Findings indicate that government initiatives such as the SFAC credit guarantee scheme, PM-KISAN, the 10,000 FPO Mission, and digital platforms including e-NAM, ONDC, and GeM have begun improving FPOs' market linkages and export readiness, though structural barriers persist. The paper concludes by offering practical suggestions, including capacity building, infrastructure development, digital awareness, financial support, market linkages, branding and certification, and cluster development, to enhance the export performance of FPOs and strengthen their contribution to farmer income and sustainable rural development in India.

Keywords: Agricultural cooperatives, APMC, FPO, Agri-business, Agri-export

1. INTRODUCTION

The current era, Agri-business is one of the fastest-growing industries. As per Provisional Estimates of National Income, 2022–23, released by the Ministry of Statistics and Program Implementation, during the last six

years, the Indian agriculture and allied sector has been growing at 4.4% per annum. In addition, according to World Bank statistics from 2023, the agricultural sector, which accounts for 4% of global GDP and up to 25% in the least developed nations, is crucial to economic

growth. Agriculture ultimately helps achieve sustainable development goals such as no poverty, zero hunger, good health and wellbeing, and decent economic growth. However, despite agriculture playing a vital role in countries' overall development, small and marginal farmers face various challenges in the agricultural sector, including climate change, inadequate financial support, ineffective marketing systems, and difficulties in securing a fair price for their produce. All these issues continue to limit agricultural productivity and farmer incomes and, therefore, require institutional mechanisms that empower farmers and improve their access to resources and markets. In response to the challenges faced by small and marginal farmers, the Indian government has implemented several innovative initiatives. The main one is "Agricultural cooperatives," which have long dominated farmer collectives and were founded by the Cooperative Credit Societies Act of 1904. However, the history of cooperatives exposes several barriers that prevent effective group action. In India, cooperatives did not have as much success due to their organizations' weak administration and organizational internal corruption, financial problems, and political meddling (Abraham et al., 2022). Then, the Agricultural Produce Marketing Committee (APMC) Act was modified in 2003. The APMC model is initiated to strengthen the marketing channels for farmers. However, it became an instrument for political traders' or mediators' monopolistic practices over time. This led to high marketing charges and poor market infrastructure. Excessive state control on APMCs discouraged free trade and private investment, creating long value chains and intermediaries (Saha et al., 2024). Since then, self-help groups, contract farming, and procurement sheds have all become widespread. However, these interventions did not fully deliver the expected benefits to farmers. Recognizing the need for a more efficient collective model, the Indian government introduced a new kind of collective called FPO as an alternative to traditional cooperatives. The FPOs aim to solve the problems encountered by small and marginal farmers, especially those about better access to capital, technical improvements, and efficient inputs and markets (Bikkina et al., 2018; Government of India, 2013; Hellin et al., 2009). A key milestone in this effort was that the Government of India amended the Companies Act 1956 in 2002 by introducing section IX A, establishing producer companies managed by primary producers that would function similarly to corporate organizations, following the recommendations of the Y. K. Alagh Committee. Further, the Department of Agriculture and Cooperation published a policy paper in 2013 called "Policy and Process Guidelines for FPOs" to encourage

the development of FPOs and to offer clear instructions for the establishment and administration of these organizations (Bikkina et al., 2018; Government of India, 2013). FPOs are among the most critical constitutional reforms for farmers and rural people's advancement, poverty alleviation, and empowerment (Nikam et al., 2019). While several FPOs were registered and operating effectively in their locality. Only a few have fully met their objectives (Bikkina et al., 2018). In recent years, several studies have examined different aspects of FPOs. The role of FPOs in facilitating smallholder farmers' access to market, finance, and technology has been thoroughly studied in the literature (Singh & Sharma, 2021). Governance mechanisms (Patil & Meena, 2020), financial transaction sustainability (Reddy et al., 2021), and the impact of government policies on FPO promotion (Sharma & Rao, 2019) have been the research focus. The academic research on the FPOs impact is also focussed on the impact on income generation and enhancement of rural livelihoods (Gupta & Verma, 2020). Although there has been growth in the number of FPOs in India, their efficacy in achieving their key objectives like financial sustainability, market participation and leadership is not evident. Previous research has focussed on various aspects of FPOs, but comprehensive and systematic reviews, covering both the historical context and the challenges and policy options of the present, are far from the norm. This is a gap that makes it difficult to have a picture of the FPO dynamics as a whole and develop strategies for sustainability. As a result, this study aims to offer a structured understanding of existing knowledge and emerging themes on FPO, analyzing status in terms of trends, gaps, thematic focus areas, challenges, and future directions. The study's implications will offer a more practical perspective on public policies. The paper is divided into various sections. Firstly, the literature on FPO sets the theoretical background of the research, with research questions followed by the methodology. Additionally, it continues with data collection and analysis procedures, followed by findings and results. Further, it elaborates on findings through discussion and discusses limitations and future research directions. Finally, the study sheds soe light on policy implications.

India, a developing country heavily reliant on the agricultural sector, has witnessed the emergence of farmer producer organizations (FPOs) as a transformative collective model for farmers as an alternative to traditional cooperatives. The FPOs aim to solve the problems encountered by small and marginal farmers, especially those about better access to capital, technical improvements, and efficient inputs and markets.

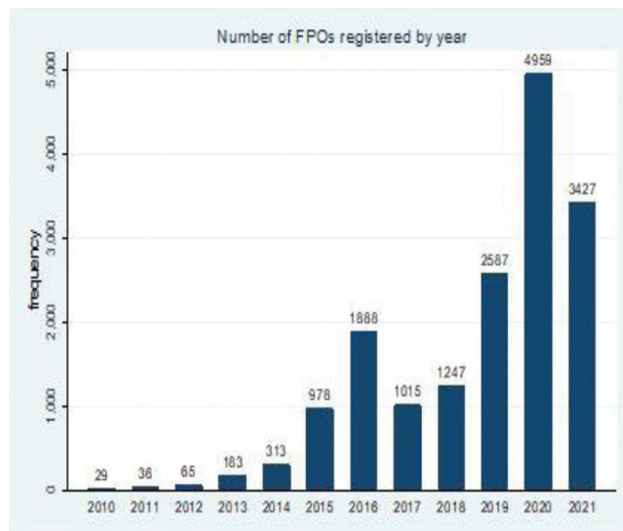


Figure 1. Number of FPOs registered in India by year - 2010–2021.

Source: Joshi (2022), Tata-Cornell Institute for Agriculture and Nutrition.

2. LITERATURE REVIEW

Farmer Producer Organizations (FPOs) have gained increasing attention in academic and policy research due to their potential to enhance farmers' participation in both domestic and international markets. Several studies highlight their role in improving export opportunities and strengthening agricultural value chains. A recent systematic review by Patil et al. (2025) describes how FPOs enable farmers to realize economies of scale, lower transaction costs, and enhance access to markets, all of which are crucial for strengthening export competitiveness. The study highlights the importance of collective action to enable small farmers to engage in high-value markets such as exports that they were unable to access otherwise.

Technology-based services like Information and Communication Technology (ICT), are important in supporting FPOs to disseminate market information, traceability and communication with buyers, Salokhe (2025) says. This technological development is especially significant for export markets, as quality standards and timely information are so important.

Pallavi et al. (2024) find that FPOs function as intermediaries in the agriculture system, as they bridge the gap between farmers and markets, institutions and farmers, and stakeholders and farmers. The study further suggests that most of the FPOs are still limited in their engagement in high value initiatives such as exports and are primarily engaged in input supply, showing a scope of possibilities yet to be tapped.

The export potential identified by the scoping study of FPOs revealed a tremendous scope in the agriculture

sector particularly in the natural and organic farming products from Indian agriculture. But farmers face some obstacles to take full advantage of these opportunities, including limited access to export markets, fear of production risk, and unaware.

The news media also reflects recent developments that provide evidence of export potential, in practice. It is noted that the farmers' income has improved significantly and they were able to tap into the international markets through FPOs and supported through training and infrastructure development programme in mango exports from India.

In India, as a developing nation, where agriculture is a significant economic activity, there is a growing trend of the emergence of farmer producer organisations (FPOs) which are an alternative method of farmer organisation to the classical cooperative model. The FPOs are expected to redress the issues of small and marginal farmers particularly with regard to access to capital, technology and efficient inputs and markets. Considering the speed at which FPO research articles are being published, it is necessary to conduct a thorough review of the literature on the subject. Scholars have published several review articles on FPO from different perspectives to tackle this issue. There are few published studies, however, illustrating FPO that provide a significant number of studies using bibliometric analysis. In the present study an attempt is made to study the FPO publications from bibliometric analysis. The methodology used in this study is Systematic Literature Review with research that was taken from 2002 to 2023. A total of 3796 research articles were identified from the Scopus database and 64 related studies were selected for the study. A publication analysis, a journal analysis, a country analysis, an author productivity analysis, analysis of the most cited documents, co-citation analysis, bibliographic coupling analysis and cluster analysis were used to analyze these papers. The results show that majority of the studies are limited to evaluating the performance of FPOs, and few studies have addressed the critical aspects such as institutional support, leadership and policy implementation. The cluster analysis results revealed that agricultural marketing, sustainable agriculture, the impact of membership on performance, women in agriculture, manufacturing, sustainability driving innovation, and technological efficiency of the food supply chain are the emerging themes in the literature. This paper offers a range of policy suggestions to address some of the major issues that are likely to be relevant to FPOs, including the streamlining of documentation, the improvement of market access, fair tax treatment, the right of fertilizer distribution and farmer-led leadership.

The implementation of Good Agricultural Practices (GAP) is an important factor in boosting the productivity of the farms, the safety of the food and the improvement of the market access of agricultural products, especially export crops such as chilli. This research examines the level of GAP adoption and its economics among chilli growers under three farming systems: Farmer Producer Organizations (FPOs), contract farming or non-contract farming. For comparative study an adoption index and Garrett's ranking technique were used and a total of 135 farmers were selected randomly in the three districts namely NTR, Prakasam and Kurnool. The findings showed that 73.33% of the FPO farmers had high degree of GAP adoption while the medium was more prevalent among the contract farmers (68.89%) and non-contract farmers (48.89%). Soil-climate suitability, market demand and better returns were the key determinants for chilli farming. On the other hand, high input costs and lack of knowledge were the main constraints to GAP adoption particularly for non-contract farmers. The FPOs were much more successful than other models in terms of compliance to certified inputs, integrated pest and crop management, and hygienic post-harvest handling. The results emphasize the need to promote GAP through institutional mechanisms and capacity development and support in policy structures to scale the chilli production of farmers economically and sustainably.

Farmer-producer organization (FPO) plays an important role in addressing the problems faced by individual farmers. In addition to its contribution to the proper management of FPOs, ICT can play a significant role in enhancing the performance and profitability of FPOs in order to contribute to the knowledge-based economy. The research method adopted in this study is literature review to get knowledge and realize the possibility of ICT in the management of FPO. The research revealed that the use of ICT applications like precision farming, farm management software and mobile technology is contributing to farming practices that have never been seen before. There is the potential for designing some ICT integration programmes that would enable farmers to use ICT more efficiently, and generate greater returns from their farming enterprises. Program activities can encompass capacity building, registration, business planning, business information systems (BIS) development, value chain linkages and administrative expenses and costs related to progress monitoring necessary to FPO development. The application of ICT enhances the performance and profitability of FPOs, demonstrating a promising future.

Farmer-producer organizations (FPOs) are vital for supporting agricultural communities by tackling individual farmers' challenges. Information and Communication

Technology (ICT) not only improves FPO management but also has the potential to significantly enhance the performance and profitability of these organizations, driving the knowledge-based economy. This study uses a literature review as the research methodology to understand and harness the potential of ICT in FPO management. The study found that ICT applications such as precision farming, farm management software and mobile technology are leading to unprecedented advancements in farming practices. Effective integration programs could be designed to help farmers incorporate ICT more efficiently and increase the returns from their farming businesses. These programmes can encompass capacity building, registration, business planning, development of MIS, linkages with the value chain, administrative costs and expenses for progress monitoring essentials for FPO development. The use of ICT, with its positive impact on performance and profitability of FPOs, holds a bright future.

Empirical evidence also shows that FPOs help in promoting value addition and export diversification. FPOs provide institutional support for processing, grading, packaging and branding agricultural products and thus support access to the international market, by bringing farmers in groups together. Value-added and processed products are found to have high market demand both in domestic and international markets which enhances their export potentiality.

However, literature also lists a number of issues that hinder the export potential of FPOs. These include limited institutional capacity, limited knowledge on export procedures, lack of infrastructure (storage and cold chain) and lack of finance. To overcome these challenges, policy support, capacity building, and the integration of digital technologies play a vital role in strengthening the contribution of FPOs in agricultural exports.

According to studies conducted by Small Farmers' Agribusiness Consortium (SFAC, 2020) FPO has proved to be an efficient institutional structure to connect small and marginal farmers into national and international markets. It emphasizes that the benefits of FPOs in terms of aggregation, grading and collective marketing are vital for making products export ready. It also highlights the vital role that export-oriented FPOs can play in maintaining the uniformity of the product and bulk supply, which is essential in the international trade.

The study conducted by National Bank for Agriculture and Rural Development (NABARD 2019) shows that by working with the farmers' organizations, the market access of farmers has improved and they are now less dependent on the intermediaries, which is increasing their income. The study states that those FPOs taking initiatives in value chain development (processing,

packaging, branding in case of high value commodities like fruits, spices, organic products etc.) are more likely to gain the opportunities of exports.

Farmer organisations are central to the involvement of smallholder groups with world trade chains (Food and Agriculture Organization, 2018). According to the report, collective farming organisations, such as FPOs can offer higher export standards more efficiently through quality control measures, certification systems and traceability management. This makes them more competitive in the arena of international markets.

According to Agricultural and Processed Food Products Export Development Authority (APEDA, 2021) India has huge potential in exporting rice, spices, fruits and vegetables back. The report indicates that the FPOs, as an export advocate can play a significant role in export promotion through coordinating farmers, compliance with international standards and direct engagement with exporters and buyers in the world market.

According to Trebbin (2014), elimination of middlemen through FPOs is a promising way to enhancing the Bargaining power and price realization of farmers. The study further underlines FPOs can be instrumental in improving institutional capacity and market linkages, both of which are important to get involved in export markets. It also identifies problems like poor systems of leadership and lack of monetary means.

Collective action through FPOs can involve the farmers in cutting the transaction costs and enhance production and marketing efficiency as found in the study by Singh and Singh (2013). The authors stress the importance of the economies of scale realised by FPOs for sale to export markets, particularly for bulk commodities.

The study conducted by BIRTHAL et al. (2019) has detailed that diversification towards high value agriculture such as horticulture, livestock products, etc. may provide a great opportunity for exporting. The study indicates that FPOs can make a significant contribution to this change by encouraging farmers to do value addition and connect them to export markets.

Additionally, World Bank 2020 study highlights the importance of enhancing farmer organism for making the agricultural competitiveness in developing countries such as India. The report says that FPOs can help expand the export potential by enhancing the supply chain efficiency, minimising the losses post production and by providing better price realization for the farmers.

There are also limitations, however, as outlined in the literature. Research shows that several FPOs are facing problem with export knowledge and lack of infrastructure facilities like cold storage, logistics,

finance, and market intelligence. For FPOs to achieve their full export potential, it is critical to address these challenges by using training, policy support, and digital tools.

3. OBJECTIVES

- Learn about the present status of the FPOs with regard to export and the government support given to FPOs for exports.
- To see how technology and online platforms help farmers reach global buyers.
- Find out what new opportunities that are available to the FPOs and the challenges FPOs face in exporting goods.
- To suggest simple ways to improve export performance of FPOs

4. PRESENT STATUS OF FPOS IN EXPORT

India currently has more than 12,000 FPOs, but only a small percentage are actively involved in exports. However, the trend is improving as more FPOs are entering international markets. FPOs are exporting products such as: Fruits (mango, grapes, pomegranate), Vegetables, Spices, Organic products, Millets. Government agencies like Agricultural and Processed Food Products Export Development Authority are supporting FPOs by linking them with international buyers and facilitating export procedures. Despite progress, the export contribution of FPOs remains limited due to lack of awareness, infrastructure, and export readiness.

4.1. Government Support for FPO Exports

The Government of India has launched several schemes to promote FPOs and enhance their export potential.

4.2. Key Initiatives

SFAC Scheme- Credit guarantee fund of ₹2,000 crore for FPOs

The Small Farmers' Agribusiness Consortium (SFAC) provides a credit guarantee fund to support FPOs in getting loans from banks. The government provides comfort to banks under this scheme, thereby putting at ease the risk faced by the banks. This will help banks making loans to FPOs easier, which subsequently will enhance their access to finance.

PM-KISAN- ₹6,000 annual direct benefit transfer to farmers

The PLGI aims to transfer to the farmers cash resources of ₹6000 per annum through PM-KISAN. The schemes of PLGI aim at cash transfer of ₹6000

annum to the farmers under PM-KISAN. PM-KISAN helps farmers get ₹6,000 per year directly in their bank accounts. This financial support enables farmers to cover their agricultural needs such as for seeds, fertilizers and water. It indirectly supports FPO members by enhancing their financials.

10,000 FPO Mission- Formation target by 2027-28 with ₹6,866 crore budget

The Government of India is on a mission to establish and promote 10,000 FPOs by 2027–28. The objective of this campaign is the grouping of farmers, better collective bargaining power and greater incomes from market access and support services.

Formation target by 2027-28 with ₹6,866 crore budget

The government has assigned a fund of ₹6866 crore for promoting and developing FPOs in this mission. This fund is made available for training and development of FPOs, infrastructure costs, administrative expenses and capacity building of FPOs.

Formation and Promotion of 10,000 FPOs Scheme

The focus of this scheme is to establish and develop FPOs. It has everything you need in terms of registration, training, management and business development. The aim is to make FPOs self-reliant and sustainable.

Support under Rashtriya Krishi Vikas Yojana

Under RKVY, the financial aid is given to states for the development of agriculture which includes the promotion of FPOs also. This encourages better infrastructure development, technology uptake and innovation on farming systems.

Financial assistance through equity grants and credit guarantee schemes

FPOs are awarded equity grants to build up their fundraising capabilities. They have credit guarantee schemes that enable them to obtain loans without being backed by solid collateral. This enhances their financial position and allows activities to be expanded.

Export incentives under Remission of Duties and Taxes on Exported Products

In this scheme, taxes and duties which are paid during production and transportation to the exporter are refunded. This lowers the total export costs and increases FPO products competitiveness in international markets.

5. ROLE OF APEDA

5.1. Role of APEDA in Promoting Export Potential of FPOs

Agricultural and Processed Food Products Export Development Authority (APEDA) is a statutory authority set up by Government of India under the APEDA Act, 1985. It plays an important role in promoting the export of agricultural and processed food products from India. It is also involved with export promotion, quality standard, packaging, market development, exporter registration, training and collection of export related statistics.

Connecting FPOs with international markets

The Farmer Connect platform is one of the vital initiatives APEDA has done for FPOs. It provides a digital link between FPOs/FPCs/cooperatives and exporters. FPOs can make profile and publish their produce available and exporters can make enquiries and find out the suitable supplier. This can help minimise the price differential between producers and international buyers.

Development of export-oriented agricultural clusters

APEDA classifies agricultural clusters and products in view of their export potential and engages state governments, exporters, experts and farmer organisations. This cluster strategy enables FPOs to focus on products with market demand in overseas markets.

Quality and standardisation

Agricultural products need to be produced to fulfill certain quality and safety standards, be graded, be packaged and be traceable for entry into the international markets. APEDA has responsibilities relating to standards and specifications, quality improvement and export-oriented production. These activities can help FPOs improve the quality and consistency of their products for export markets.

Capacity building and training

APEDA conducts capacity-building and training programmes for FPOs, FPCs, SHGs and exporters. These programmes can improve farmers' understanding of export procedures, quality requirements, packaging, market opportunities and export linkages. APEDA has also worked with organisations such as NABARD, NCDC, SFAC, NAFED and TRIFED to strengthen farmer groups and increase agricultural exports.

Promoting value addition and processing

FPOs can increase their export potential by moving beyond the sale of raw agricultural produce toward grading, processing, packaging and value-added products. APEDA's mandate covers a wide range of agricultural and processed products, including fruits and vegetables, cereals, groundnuts, dairy products, honey, processed foods and other scheduled products.

Export information and market intelligence

APEDA provides information on agricultural exports, export markets and commodities. Its Farmer Connect platform also provides information about buyer enquiries, sell offers, exporter directories and FPO/FPC directories, which can help FPOs identify potential business partners.

Promotion of organic exports

APEDA also plays an important role in India's organic export system through the National Programme for Organic Production (NPOP). It functions as the secretariat for accreditation of certification bodies under NPOP. This is particularly relevant for FPOs producing organic products because certification can help them access international markets.

Facilitating export value-chain integration

APEDA's initiatives have included integrating farmer groups into export value chains and facilitating the movement of fresh fruits, vegetables and regional rice to international destinations. It has also undertaken capacity-building programmes to link FPOs/FPCs/SHGs with exports and encourage entrepreneurs to become prospective exporters.

Importance for the export potential of FPOs

The role of APEDA can therefore be represented as:

FPOs → Aggregation → Quality & Grading → Processing & Packaging → APEDA Support/Certification → Exporter Linkage → International Market

This shows that APEDA can help FPOs overcome some of the major barriers to agricultural exports, particularly market access, quality compliance, information gaps, packaging, capacity building and exporter linkages.

6. ROLE OF TECHNOLOGY AND ONLINE PLATFORMS

Technology plays a crucial role in enabling FPOs to access global markets.

6.1 Important Platforms:

- National Agriculture Market
- Digital marketplaces and e-commerce platforms
- e-NAM (National Agriculture Market)
- ONDC (Open Network for Digital Commerce)
- GeM (Government e-Marketplace)
- Private agri-tech platforms
- Online export portals

6.2. Benefits:

- Direct interaction with buyers
- Transparency in pricing
- Access to real-time market information
- Digital payments and logistics tracking
- Online marketing and branding
- Reduced dependence on middlemen

Technology reduces dependency on intermediaries and allows FPOs to expand their reach beyond local markets.

7. OPPORTUNITIES FOR FPOS IN EXPORT**7.1. FPOs are beneficial to its members in following ways****Providing better market knowledge**

FPOs collect and share important information about domestic and international markets. They facilitate the alertness of farmers and their awareness of price trend, demand trends and quality expectation of export markets. This information can help farmers select better crops to be sold and thus elevated their earnings.

Providing opportunities of betterment of income

FPOs can secure better price for their produce by aggregating and selling in bulk. High-quality and organic products are frequently able to earn a better price in the export market. This directly contributes to the farmer's income.

Enabling to be integrated vertically

FPOs give farmers an opportunity to participate in various steps of the production, processing, packaging and sale of their produce. This decreases reliance on intermediaries and gets farmers more profit.

Development of buyer and market relationship

The FPOs develop a long-term relationship with exporters, wholesalers and retailers. Such relationships promote the regular demand, its

stability in prices, and trust in business relationships that in the long run benefits farmers.

High demand for organic and natural products

Worldwide, people are searching for chemical-free and environmentally friendly products. By adopting organic farming and adhering to the international standards, FPOs can promote organic farming along with securing higher prices in export markets.

Export of niche products (spices, millets, fruits, vegetables)

Spices, millets, fruits, vegetables and medicinal plants have high demand in the global markets. Unlike other agricultural marketing firms, FPOs can focus on these niche products and profit more because of their uniqueness.

Value-added products (processed foods, packaged goods)

FPOs can transform raw agricultural products into processed and/or value-added products such as packaged food, juices, pickles and spices powder. This helps to increase shelf life, quality and get better international price.

Direct farmer-to-buyer trade models

The FPOs provide a direct linkage between the farmers and exporters/buyers to cut down the number of middlemen. This creates fair pricing, transparency, and improved farmers' revenues.

Government push for "Make in India" and agri-exports

This is due to the help and support given by government initiatives, which include subsidies, training, export incentives, and financial support. These policies provide incentive to FPOs to venture into export activities and develop the size and scope.

Digital marketplaces expanding global reach

FPOs can easily gain access to international buyers through online platforms and e-commerce. Digitalization makes exports accessible in the areas of marketing, order management and price discovery.

Ensuring accessibility to market

Single farmers can't access big markets but FPOs enable the grouping of farmers to sell their produce. This will help to make it easy for them to export and sell domestically. This is because of the economies of scale that can be obtained.

Opportunities for benefits of economies of scale

The FPOs share resources and produce, which helps to minimise production, storage, and transportation

expenses. Bulk selling makes the export markets more efficient and competitive.

8. CHALLENGES FACED BY FPOS

The following are some of the obstacles, challenges and issues faced by the Farmer Producer Organizations (FPOs):

Distances form the market:

Most FPOs are situated in rural and remote areas away from the big markets and cities. The further this distance the higher transport expenses and lower profit margin for farmers. Perishable commodities, such as fruits and vegetables, can become less fresh and better, because of time of travel. Sometimes local traders or middlemen provide furniture to the farmers at a less desirable price, thus depriving the farmers of the benefit of negotiating price with them.

Lack of storage facilities or warehouse :

FPOs do not generally have adequate warehouses and cold stores to store produce. These facilities are essential for farmers to preserve food for an extended period, as otherwise they will have to sell immediately after harvest. This results in distress sales at a very low price particularly during the peak production period. Moreover, perishable materials go bad very quickly which results in tremendous losses.

Members not contributing properly :

For effective functioning of FPOs, active participation of all the members is necessary. But in many situations, it isn't even that members are attending meetings regularly or that they are contributing equally. Conflicts between members due to lack of trust, awareness and coordination. This compromises decision making and the efficiency and effectiveness of the organisation.

Problems of getting appropriate and timely finance:

Timely and adequate finance is one of the greatest problems of FPOs. You may have a low credit score or may not have enough assets to secure a loan from a bank. A bank may be hesitant to loan money because of poor credit history or because they don't feel they have enough collateral. However, delayed loan disbursement impacts farming activities such as acquisition of seed, fertiliser and farm implements even when loans are granted. High interest rates further deters borrowing.

Lack of owned office building:

FPOs lack basic infrastructure like office buildings, storage units, processing units and good roads. These facilities help to facilitate operation, storage and value addition, if not, it becomes difficult. Also, communication and transportation and the overall efficiency take a hit due to poor infrastructure.

Lack of transporting vehicle:

Typically, FPOs don't hold transport vehicles and it is challenging to transport produce from farms to markets. Hired vehicles make up the cost of transportation, which is a factor they must rely on. Rural roads offer little protection against damage or spoilage occurring during transport causing additional delays to transportation.

Lack of technology and upgradation:

While several FPOs are still using traditional methods, others are not even availed with modern Agricultural technologies. The level of machine and digital use and information systems is limited which impacts productivity and efficiency. The lack of awareness and training further cut down the use of new technologies.

Credit Access:

The other challenge faced by FPOs is institutional credit, although there are also difficulties in the financial sector but this includes a complexity of processes and a requirement to present documentation. They are also considered to be riskier borrowers for banks. Shortage of working capital hinders their growth and investment in infrastructure.

Climate Change:

Climate change has a significant impact on agriculture. Irregular rainfall, droughts, floods, and temperature variations cause unpredictable weather conditions, which impact crop production. This puts FPOs in a dilemma as well as financial risk and uncertainty for them to plan.

Water Scarcity:

Water shortage is a serious problem in many areas of agriculture. Irrigation facilities are lacking and reliance on the rain lowers crop production. Groundwater depletion exacerbates the situation, impacting on long-term agricultural sustainability.

Low Profitability:

Because of high input expenses (seeds, fertilizers, labor) and low market prices, FPOs often are

not profitable. Middlemen result in less farmers' margin in the final market price. Low bargaining power and lack of value addition also contribute to low income.

Post Harvest Losses:

Losses are high due to improper handling, storage and transportation after harvest. Poor quality of packaging and inadequate cold chain facilities leads to poor produce quality. This brings down the prices and incomes of the farmers.

9. SUGGESTIONS TO IMPROVE EXPORT PERFORMANCE

To enhance the export potential of FPOs, the following measures can be adopted:

Capacity Building:

Capacity building involves enhancing the knowledge and skills of the farmers and FPO members. Export procedures, quality standards, packaging and market requirements in the international market should be the subject of training. Farmers need to be educated in business management, communication and modern technologies as well. This ensures they are able to be competitive in the international arena.

Infrastructure Development:

Without proper infrastructure, exports will not work. Investment must be put into warehouses, cold storage units, grading units, packaging centres and transportation facilities. A good infrastructure contributes to maintaining product quality, limiting post-harvest losses and timely delivery for international markets.

Digital Awareness:

The use of digital platforms including e-commerce websites, mobile apps and online platforms should be encouraged in FPOs. Digital tools facilitate price discovery, direct marketing and global buyers. Enhancing efficiency through awareness of digital payments and online documentation.

Financial Support:

Easy access to credit and export finance is very important. Banks and other financial institutions should offer loans, with low interest rates and simple procedures. Government schemes and subsidy should be easily accessible. Support for FPOs in terms of funds is crucial to the development of infrastructure, technology, and expansion.

Market Linkages:

Exporters, wholesalers, retailers and international buyers are important stakeholders and need to be engaged in building a strong relationship with FPOs. Partnerships and contracts help to guarantee stable demand and improved prices. Expanding market reach can also be achieved through trade fairs, exhibitions and buyer-seller meets.

Branding and Certification:

The establishment of a strong brand identity and the acquisition of certifications, such as organic, fair trade and quality, adds value to the product. The products are more attractive in international markets if good packaging and labeling are used. Additionally, certification strengthens the trust of foreign buyers.

Cluster Development:

FPOs should concentrate on particular crops or product in line with the regional strength. Cluster-based development helps in achieving better quality, higher production, and specialization. It also makes the process of meeting large export orders and consistency much easier.

10. CONCLUSION

Farmer Producer Organizations (FPOs) can play a crucial role in boosting the agricultural export market in India, supporting the interests of small and marginal farmers and enhancing their market access. Though only small number of FPOs presently is involved in export, their active involvement is progressing gradually with support from the government, institutions and development of technology. Enhanced market linkages, digital platforms are improving the ability of FPOs to connect with international buyers. However, the growth of their business is still constrained by some challenges including poor infrastructure, lack of knowledge about export procedures, financial constraints and quality standard concerns. Solving these problems by strengthening capacities, upgrading infrastructure, providing financial assistance and simplifying export policies is crucial. With continuous support and strategic improvements, FPOs can play a crucial role in enhancing agricultural exports, increasing farmers' income, and ensuring sustainable rural development in India.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Rural Youth Migration from Farming in North Coastal Andhra Pradesh India

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 23-Sep-26

ACCEPTED: 01-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Sai Malluri, Ajay Kumar Prusty, Chitrasena Padhy, Nibedita Mishra and Sai Kumar Periginji (2026). Rural Youth Migration from Farming in North Coastal Andhra Pradesh India. Horizon J. Hum. Soc. Sci. Res. 8 (S), 117–125. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1400.p117>



ABSTRACT

This investigation examined how rural youth view agriculture, the extent and drivers of their migration, and support necessary to remain in farming in Srikakulam and Vizianagaram districts of North Coastal Andhra Pradesh. An ex-post-facto design was adopted, and information was obtained from 180 rural youth through a multistage random sampling procedure. Agricultural attitudes were concentrated in the medium and high categories, whereas migration behaviour was largely medium or high, indicating that favourable views of farming did not necessarily translate into continued participation. Education, economic motivation, self-reliance, farm size, and duration of residence emerged among the strongest correlates. Monotony of farm work, limited employment prospects, and repeated crop failure were prominent push factors. Inadequate remunerative prices, weak marketing connections, and insufficient market information were major constraints. The findings point to youth-focused extension, practical skill development, and enabling agricultural policies for improving the attractiveness and long-term demographic sustainability of farming.

Keywords: Attitude towards Agriculture, Empowerment needs, Market Linkage, Migration behaviour, Push-pull factors, Rural youth

1. INTRODUCTION

Young people throughout history have been on the leading edge of social and economic change, residing between the childhood and adulthood worlds, and experiencing greater social and economic independence in their lives (Bennell, 2007). The 2011 Census data shows

that around 130 million young people (or one-third) of the Indian population (aged between 15-29) were migrants with the primary reasons being employment, education and marriage (Census of India, 2011). In Andhra Pradesh, the migrant population rose from 25.2 million in 2001 to 38.36 million in 2011, with young people forming an

important component of this movement (Madhu and Uma, 2014). India is still a young country with more than half of its population aged below 25 years, and more than 65 per cent below 35 years of age (Census of India, 2011) and should be expected to reach a peak around the year 2030. However, millions of young people around the world, including India, are unable to find decent jobs, and youth unemployment has been on the increase in the last two decades (International Labour Organisation, 2012).

In this context, Indian agriculture is undergoing a rapid demographic transition. The numbers of farmers in the country have dropped by about 15 million since 1991, and it is reported that more than 2,000 farmers leave the profession every day, while a National Sample Survey Organisation poll revealed more than 40 per cent of farmers were willing to leave their profession if provided with an alternate livelihood (Sainath, 2013). Across successive survey periods in Andhra Pradesh, youth mobility has included both rural-to-urban and rural-to-rural streams, alongside a progressive diversification away from exclusively farm-based livelihoods towards non-farm and other non-agricultural sources of work (Madhu & Uma, 2014). Evidence from India further suggests that a sizeable share of rural youth in Andhra Pradesh contemplate urban migration in response to low agricultural productivity, inadequate educational and health services, and deficiencies in rural infrastructure (Radhakrishnan and Arunachalam, 2017).

This departure has a significant impact on the agricultural industry: loss of farm labour, loss of farm knowledge/skills because people don't come back to farming and weakening of rural communities because families are split up (Mbah et al., 2016; Naing et al., 2020). The problem of unemployment is also a greater concern among educated young population of the rural areas in comparison to that of the urban areas in the country as 13.9 per cent of educated rural youth were reported to be unemployed whereas educated urban youth were reported to be 7.6 per cent (Ministry of Labour and Employment, as cited in the source thesis). Economic diversification has also helped to increase employment opportunities in non-farm sectors, though at the same time it has increased the rural-urban migration of labour towards non-farm sectors, which may have consequences for agriculture and food security (Sharma and Bhaduri, 2005; DARE, 2012).

It is therefore important to understand the reasons why young people are moving out of farming and what conditions might make it more attractive to stay or come back into farming in order to ensure the continuity of Indian agriculture. Farm conditions, such as fluctuating farm income and frequent crop losses, and off-farm opportunities, such as greater employment opportunities,

higher wages and better living conditions (Kimaro et al., 2015; Bednarikova et al., 2016) influence migration decisions. Meanwhile, many of the rural youth have positive perspectives of agriculture, meaning technical capacity building, market linkages and improved infrastructure on the farm could further boost their commitment to the sector (Gangwar and Kameswari, 2016; Chachere et al., 2018). The evidence that has been gathered to date that connects the agricultural attitude with the migration behaviour, with the requirement for empowerment is limited, especially in AP North Coastal districts (Sujeetha and Anamica, 2017).

In this regard the study was focused on Srikakulam and Vizianagaram districts of North Coastal Andhra Pradesh and the three objectives of the study were: (1) to gauge the attitude of the rural youths towards farming, (2) to analyse the migratory pattern of the youths, and (3) to identify the modality of empowerment needed to promote their stay on or return to the agriculture sector. The results will guide youth-focused extension activities, agricultural policy and rural development planning that will help address the farm population's decline.

2. Materials and Methods

The investigation was conducted in two districts of the North Coastal region of Andhra Pradesh, namely Srikakulam and Vizianagaram. This explanatory characteristic had been observed and could not be controlled as an experimental variable and therefore an ex post facto design was used, following the recommendations of Kerlinger (1976). The sampling was done in a series of phases. Two mandals in each district – Amadalavalasa and Hiramandalam (Srikakulam) and Saluru and Dattirajeru (Vizianagaram) were selected first. In consultation with Department of Agriculture officials, six Gram Panchayats were identified – Korlakota in Amadalavalasa, Kothavalasa in Amadalavalasa, Tallapadu and Bugavalasa in Hiramandalam, Maripalle in Saluru, and Maradam in Dattirajeru. Then, rural youth aged 18-29 years were selected randomly in these panchayats. The final sample comprised 180 respondents, equally divided between the two districts, with 30 respondents from each of the six panchayats. Information was collected through face-to-face interviews using a structured schedule that had been pre-tested before the survey.

Selection of explanatory variables was guided by previous literature and expert consultation. The eighteen characteristics included age, education, occupation, farm size, farm-skill possession, farming experience, non-farm-skill possession, length of residence in the native place, distance or proximity to towns and cities, previous migration experience, annual income, economic motivation, achievement motivation, risk orientation,

self-reliance, self-confidence, income expectancy, and comfort expectancy. Three outcome domains were examined. Agricultural attitude was assessed with ten statements rated on a five-point response continuum and subsequently grouped into low, medium, and high categories by the cumulative-frequency approach. Migration behaviour was represented by a fourteen-component Migration Behaviour Index. Seven components described observed or direct aspects of migration - nature of migration, type of work, workplace distance, decision-making, migration network, family migration norm, and intention to remigrate - while seven captured perceptual dimensions, namely aspiration, creativity, occupational mobility, migration intention, social embeddedness, parental and peer influence, and remittances. Empowerment needs in agriculture were recorded through a checklist covering training and infrastructure requirements.

The coded and tabulated information from the survey was analysed descriptively and inferentially. The mean, median, range, standard deviation and coefficient of variation were used to present the distributional characteristics. The associations of each of the eighteen profile variables with the two main outcomes (attitude towards agriculture and migration behaviour) were tested using Pearson's product-moment correlation at the 5% and 1% significance levels. The effects of the explanatory variables, as well as their interactions, were then estimated with multiple linear regression ($Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \dots + \beta_nX_n + U$), and responses to migration push-pull factors, agricultural constraints, and empowerment needs were dichotomously codified and summarized in frequencies and percentages.

3. Results and Discussion

The results are discussed according to the study's goals starting with the respondent characteristics and then the agricultural attitude, migration behaviour and empowerment needs for continued involvement in agriculture.

3.1 Profile of rural youth

Respondents aged 21-25 years formed the largest group (55%), followed by those aged 26-30 years (30%) and 16-20 years (15%). The concentration in the younger age categories indicates that the decision on migration is particularly important at the time when people become more independent in their lives and activities. Similarly, Naing et al. (2020) found a high number of migrants aged 22-26 in their study. The level of education was also comparatively high with 64.4 per cent having college education, 18.9 per cent intermediate and 8.3 per cent higher education. This is a general trend that is similar

to that reported by Naing et al. (2020) who found that graduates made up a large proportion of migrants in their study.

Despite the fact that parents or other family members were still farming, there was a strong focus on wage work and other non-agricultural activities. Income gained from migration thus became a supplementary livelihood source for households. Similarly, Radhakrishnan and Arunachalam (2017) also observed that 61.66 per cent of the migrant youths were engaged in a range of occupations at the destination places. As to land, 42.6 per cent owned 0-1 acre, 34.4 per cent reported holdings of over 5 acres, and 30.6 per cent didn't have any land. Limited or inadequate access to cultivable land thus may push farmers into non-farm employment as means of livelihood to keep their household income, as reported by Mbah et al. (2016) on livelihood pressures related to fragmented holdings.

Of those who responded with skills acquired, 57.2% indicated they had acquired skills other than those associated with the farm, representing continued exposure to skills associated with home farming; 51.7% of respondents indicated they had acquired skills related to the farm. The current level of non-farm skill acquisition is higher than Sharma (2007) reported, indicating a higher level of occupational diversification for the current generation of rural youth. Experience in farming was limited, with 37.2 per cent who reported that they had no experience in farming, a situation generally consistent with a decrease in exposure to farming as noted by Bhuyasi Sarmah (2023). In addition, 59.4 per cent had lived in their native place for 11-14 years and 55.6 per cent reported that their villages were close to towns or cities. Such proximity can improve access to non-farm opportunities and may facilitate partial or complete

Table 1. Socio-economic characteristics of the rural youth surveyed in Srikakulam and Vizianagaram districts

Category	Frequency	Percentage
Age: 21-25 years	99	55.0
Age: 26-30 years	54	30.0
Education: College	116	64.4
Education: Intermediate	34	18.9
Occupation: Housewife	9	42.8*
Occupation: Working/labour	22	27.8*
Farm size: 0-1 acre	46	42.6
Farm skill: Possessed	93	51.7
Non-farm skill: Possessed	103	57.2
Years of stay in native: 11-14 years	107	59.4
Prior migration experience: Above 6 years	72	40.0
Annual income: ₹1-2 lakh	72	40.0

withdrawal from agriculture (Sharma, 2007). Previous migration was also common; 40 per cent had more than six years of migration experience. De Jong (2000) likewise observed that earlier migration can support subsequent mobility through the networks and experience accumulated by migrants.

With respect to psychological and motivational traits, economic motivation was predominantly medium (36.1%), achievement motivation predominantly low (35.6%), risk orientation predominantly low (36.1%), self-reliance predominantly low (37.8%), income expectancy predominantly high (38.9%), and comfort expectancy predominantly medium (38.3%). A combination of the motivational profiles indicates that rural youth want to earn more money, but at the same time they are not very risky, not very self-reliant, and this mix may be the reason for the presence of positive attitudes towards farming and the persistence of migration.

3.2 Attitude of rural youth towards agriculture

Agricultural attitude was assessed with the ten-item scale, after which respondents were grouped into low, medium, and high categories using the cumulative-frequency procedure. The medium category contained 37.8 per cent of respondents, 33.3 per cent were in the high category, and 28.9 per cent were in the low category. Thus, more than two-thirds of the sample exhibited medium-to-high favourability towards agriculture as a livelihood. This shows that overall, there is an existing positive attitude towards agriculture, but it is not likely to be translated into sustained participation unless there is a reduction in the major structural and economic constraints.

The economic motivation ($r = 0.568$, 1% level), education ($r = 0.451$, 1% level) and self-reliance ($r = 0.391$, 1% level) showed the strongest positive association with agricultural attitude. Length of residence in the native place ($r = 0.350$, 1%), non-farm skill ($r = 0.312$, 1%), and farming experience ($r = 0.305$, 1%) were also positively related. The variables age, occupation, farm size, farm skill, distance to towns/cities, migration experience, annual income, achievement motivation, self-confidence and income expectancy were significant at the 5 per cent level. No significant relationships were found for the risk

orientation ($r = 0.037$) or comfort expectancy ($r = 0.127$). The regression model with all eighteen explanatory variables explained 57.6 per cent of the variation in attitude ($R^2 = 0.576$), and particularly farm skill, economic motivation and education made very important positive contributions. This result is broadly comparable with Gangwar and Kameswari (2016) and Chachere et al. (2018), whose findings also linked educational and economic characteristics with favourable orientations towards agriculture and agricultural employment.

3.3 Migration behaviour of rural youth

A fourteen-component Migration Behaviour Index was used to represent respondents' migration behaviour. Seven components described direct aspects - migration type, work performed after migration, workplace distance, migration decision-making, migration network, family migration norm, and intention to remigrate. The other seven represented perceptual dimensions: aspiration, creativity, occupational mobility, intention to migrate, social embeddedness, parental influence, peer influence, and remittance behaviour. Among the direct measures, remigration intention recorded the highest mean score (3.02), followed by workplace distance (2.83) and migration network (2.48), whereas nature of work in the migrated area had the lowest mean (1.55). Within the perception measures, creativity (2.05) and remittances (2.02) obtained the highest mean scores, while parental and peer influence showed the lowest score (1.94).

The overall migration behaviour was characterized as medium (38.9 per cent), high (35.0 per cent) or low (26.1 per cent) migration propensity, with a substantially large share (73.9 per cent) showing medium to high migration propensity despite generally favourable attitudes towards agriculture, indicating that there are structural and economic factors that are influencing choice of migration, in addition to attitude. In the case of attitudes and behaviour pattern, Srikakulam showed relatively high positive attitudes and behaviour pattern (12%) as compared with the other study area Vizianagaram (9%).

Migration behaviour showed significant positive relationships with economic motivation ($r = 0.471$, 1%), education ($r = 0.424$, 1%), farm skill ($r = 0.411$, 1%), farm size ($r = 0.387$, 1%), and achievement motivation ($r =$

Table 2. Rural youths classified by level of attitude towards agriculture (n = 180)

Attitude category	Score range	Frequency	Percentage
Low	< 93.7	52	28.9
Medium	93.7 - 101.7	68	37.8
High	> 101.7	60	33.3

Table 3. Classification of respondents by overall level of migration behaviour (n = 180)

Migration behaviour category	Score range	Percentage
Low	< 27.6	26.1
Medium	27.6 - 29.1	38.9
High	> 29.1	35.0

Table 4. Most frequently reported push factors associated with rural youths' movement away from agriculture (n = 180)

Push factor	Respondents	Percentage
Monotony in agriculture	107	57.7
Lesser employment	102	56.6
Frequent crop failure	98	54.4
Small landholdings	96	53.3
Social discrimination	95	52.7
Lack of social amenities	95	52.7
Peer pressure	94	52.2
Unstable income	81	45.0

0.378, 1%). Age, farming experience, annual income, self-reliance, and self-confidence were significant at the 5 per cent level, whereas non-farm skill, risk orientation, and comfort expectancy were not significantly associated with migration behaviour. When the eighteen predictors were considered jointly, the regression model explained 63.9 per cent of the variation in migration behaviour ($R^2 = 0.639$). Farm size, farm skill, economic motivation, achievement motivation, income expectancy, and comfort expectancy were significant predictors in the model. The overall pattern is consistent with Danejo et al. (2015) and Tripathi et al. (2018), who emphasised socio-economic conditions, education, and economic motivation in rural-urban youth migration, and with Bednarikova et al. (2016), who identified agricultural education and economic aspirations as important migration motivations.

3.4 Push and pull factors influencing migration

Among factors pushing youth away from farming, monotony of agricultural work was reported most often (57.7%), followed by limited employment opportunities (56.6%) and recurring crop failure (54.4%). Debt (46.1%) and unstable income (45.0%) were also reported by substantial proportions of respondents. In contrast, the strongest attractions outside agriculture were better employment opportunities (53.3%), improved living standards (52.7%), and work involving less drudgery (52.7%). Better infrastructure (52.2%) and opportunities to acquire skills (50.5%) were also influential. These results are comparable with Kimaro et al. (2015) and Ampadu (2012), who highlighted the combined influence of low perceived status and arduous farm work on the one hand, and the attraction of wage employment outside agriculture on the other.

3.5 Empowerment priorities for retaining and re-engaging rural youth in agriculture

The constraints most commonly reported by respondents were insufficiently remunerative prices for

Table 5. Priority training and empowerment requirements reported by rural youth for continued engagement in agriculture (n = 180)

Empowerment need	Respondents	Percentage
Training on farm mechanisation	101	56.2
Training on access to agricultural marketing information	100	55.6
Training on market linkages	99	55.0
Training on farm diversification	95	52.3
Training on agricultural technologies	97	53.8
Training on effective farm management	92	51.1
Training on post-harvest technologies	84	46.6
Training on skill development	82	45.6

farm output (52.8%), weak marketing linkages (52.8%), inadequate market information (52.7%), limited storage facilities (51.7%), and lack of finance (52.3%). The answers suggest that it is not just a lack of interest in farming activities, but rather market access, infrastructure and institutional support that are the key factors preventing youth from being involved in agriculture on a consistent basis. Regarding capacity-building priorities, farm mechanisation training ranked highest (56.2%), followed by training to obtain agricultural market information (55.6%) and training related to market linkages (55.0%). Farm diversification (52.3%) and effective farm management (51.1%) were also identified as important areas for training.

These findings align closely with Sujeetha and Anamica (2017), who similarly identified training on mechanisation, marketing, and farm management as the highest-priority empowerment needs for retaining migrant rural youth in agriculture, and with Nnadi et al. (2012), who emphasised that comprehensive rural youth empowerment - encompassing skill development, market access, and infrastructure - is essential to reversing rural-urban drift. There is a consistency in the constraints identified and training needs prioritised by respondents which would suggest that a more well targeted and market-oriented extension strategy would have the potential to significantly help boost youth retention within the sector (Kitturmath et al., 2014; Rathod et al., 2017).

4. Conclusion

The results show that rural youth in North Coastal Andhra Pradesh generally hold medium-to-high favourable views of agriculture, yet a similarly strong tendency to migrate persists. Positive attitude, therefore, is not by itself sufficient to ensure continued engagement in farming. Education, farm size, farm skills, duration of residence in the native area, and economic motivation

were among the most important factors associated with the outcomes examined, while the regression models explained 57.6 per cent of the variance in attitude and 63.9 per cent of the variance in migration behaviour. The observed inclination to migrate appears to reflect dissatisfaction with the repetitive and uncertain character of farm livelihoods together with the attraction of more reliable employment and improved living conditions elsewhere, rather than a complete rejection of farming. Structural and institutional constraints were the most frequently mentioned ones by the respondents, such as low or non-remunerative prices, poor marketing linkages, lack of market information, and lack of storage. The trend indicates that unwillingness to engage in farming could be more related to the way farming is carried out than to a lack of motivation. These are the areas of intervention that are indicated by the accompanying demand for training of young people, particularly on mechanization, market information and market linkage. Extension services, skill-developing programmes, better market infrastructure and policies that directly focus young farmers' needs can then help to reinforce youth retention and also retain the knowledge base and demographic continuity of farming communities. Improved market-information services and direct marketing arrangements to enhance price realization, practical mechanisation skills, diversification of farming activities to lower reliance on a single crop, as well as youth clubs and field demonstrations for making agriculture visible as a viable career should be the main focus of policy and extension action. Future studies can be made on a larger sample size spread across a greater geographical region in the North Coastal Andhra Pradesh. However, longitudinal research is required to investigate the effects of migration on migrants and farm households and to determine the success of youth-oriented extension and skill-building programs for maintaining youth involvement in farming.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted

technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Digital Agribusiness Adoption and Market Performance among Smallholder Farmers in Odisha

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 24-Sep-26

ACCEPTED: 05-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Lakhan Lal Meena, Mayuri Singh Sardar, Mehazabeen A and Santosh D.T (2026). Digital Agribusiness Adoption and Market Performance among Smallholder Farmers in Odisha. Horizon J. Hum. Soc. Sci. Res. 8 (S), 126–134. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1401.p126>

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Content

ABSTRACT

Digital agribusiness platforms are increasingly seen as a tool to enhance the market access of smallholder farmers, market information and opportunities for profitable marketing. But there is limited empirical evidence of their economic impacts, especially in Odisha, India. The present study aimed to evaluate the determinants and economic impact of adopting digital agribusiness-platform by the smallholder farmers from district of Gajapati, Ganjam and Kalahandi in Odisha. 300 farmers (150 adopters and 150 non-adopters) were sampled for primary data collection. Descriptive statistics and binary logistic regression were used to describe patterns of platform adoption, and propensity score matching (PSM) was utilized to estimate the association between indicators of platform adoption and indicators of market access and economic performance. The users of digital platforms had higher number of market-information sources accessed (3.42 sources vs. 1.86 sources), more number of buyers contacted (3.74 buyers vs. 1.92 buyers) and higher price of farm-gate price (₹27.84 vs. ₹24.72 per kg) and lower marketing cost (₹2.86 vs. ₹3.38 per kg). The probability of adoption was significantly higher when considering education, smartphone ownership, Internet usage, access to information on digital markets, and FPO membership and digital agriculture training. The estimates show that adoption was related to increased net farm returns (ATT = ₹19,070 per ha), BCR (ATT = 0.33), MAI (ATT = 15.7 points) and price realization (ATT = ₹2.66 per kg); while the marketing cost decreased (ATT = -₹0.45 per kg). The results indicate the potential of digital agribusiness platforms for enhancing the participation in markets and economic performance of farms. Increasing digital capacity and literacy, farmer training, and digital marketing through FPOs and rural connectivity could be leveraged to promote inclusive digital market participation and support sustainable smallholder agricultural development.

Keywords: Digital agribusiness; market access; e-NAM; price realization; propensity score matching

Introduction

Smallholder farmers are still very much at the heart of food production and rural livelihoods but are constrained in their farm incomes and bargaining power by limited access to remunerative markets, and by the lack of reliable buyers, timely price information and efficient marketing channels. There is evidence that interventions

that enhance output-market access can boost farm sales, prices and farm returns, but that benefits can be context-specific, varying across low- and middle-income countries (LMICs) (Marion *et al.*, 2024). These challenges are directly linked to SDG 2 (Zero Hunger) and specifically SDG 2.3 (Improve the productivity and incomes of small-scale food producers by expanding access to markets

and resources) and also to SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure). Digital transformation can thus be a vital means to improve the inclusiveness and efficiency of agricultural markets.

The digital agribusiness platforms can help to overcome some of these challenges by offering market information, bringing together farmers and buyers, enabling price discovery, and reducing information and search costs. Despite the barriers of unequal connectivity, affordability and digital literacy, smallholders are adopting digital technologies to access agricultural information, market products, communicate with others, and market their products, as indicated by systematic evidence (Gumbi *et al.*, 2023). There is also more recent evidence that digital marketing and extension technologies can enhance access to information and markets, however, lack of connectivity, infrastructure and digital skills are the key constraints to wider use (Yuan and Sun, 2024). Therefore, digital agribusiness should not only be considered as a technology intervention, but as a tool that can affect the marketing decision of farmers, market connection, economic performance etc.

In response to the challenges faced by agriculture markets, India has introduced the Electronic National Agriculture Market (e-NAM), which aims to provide a platform for transparent price discovery through competitive online trading. As on 21st January 2026, 1.79 crore farmers and 1522 mandis were registered/integrated under e-NAM, which will also give market and price information and enable quality assaying and electronic trading. Some recent empirical studies have showed that the spatial price integration was better for certain commodities in the e-NAM market and farmers transacting through e-NAM mandis secured substantial price realization over farmers transacting in non-e-NAM mandis. But the evidence is not entirely favourable, there are ongoing concerns of low platform share in the overall APMC transactions and digital divide (Das *et al.*, 2024), and limited inter-state trade.

In the context of digital agricultural marketing, Odisha offers a welcome opportunity to explore these dynamics as the digital market has grown significantly in the state. All 66 Regulated Market Committees have been linked with e-NAM with 4.16 lakh farmers, 639 FPOs and 9,873 traders registered and e-NAM trading has been growing significantly from 2019-20 to 2023-24. (Government of Odisha, 2025). Such variations in farmers' involvement in the electronic agricultural markets have been observed in previous studies conducted in Odisha, showing that socio-economic and market-related factors affect digital-market participation. But it is not a guarantee that individual

smallholders will achieve better market access or economic returns.

There is a critical need for more research on e-NAM and digital agriculture. Research on awareness, adoption, participation and platform performance has mostly existed, while studies that simultaneously analyse market access, marketing costs, price realization and farm profitability among smallholders are relatively scarce. Furthermore, comparing adopters with non-adopters might be subject to systematic bias because digitally active farmers may not be the same in education, farm size, income, ownership of a smartphone, and/or their participation in various institutions. The present study thus focuses on the smallholder farmers of the Gajapati, Ganjam and Kalahandi districts of Odisha, with the aim to investigate the factors driving the adoption of digital agribusiness-platform and the relationship between adoption of the same and farmers' market access and economic performance using logistic regression and propensity score matching. The study thus offers empirical evidence on whether digital agribusiness involvement is a factor in improving the inclusivity and economic efficiency of agricultural marketing among smallholders.

Materials and Methods

The study was carried out in Gajapati, Ganjam and Kalahandi districts of Odisha, India which were purposively selected as representative districts of agriculturally important areas, where regulated agricultural markets exist and where farmers are exposed to digital agricultural marketing. Gajapati has regulated markets at Paralakhemundi for commodities like cashew, maize and cotton and Hinjilicut and Digapahandi have regulated markets for various agricultural commodities in the Gajapati district. The choice of Kalahandi was based on the availability of regulated market network established in the area which comprises of Bhawanipatana, Kesinga, Junagarh and Mukhiguda, with cotton, maize and horticultural products being some of the important products of the markets. The location of e-NAM connected markets in these districts offered an apt platform to explore the adoption of digital agribusiness, access to markets and economic outcomes.

To select households that were participating actively in the commercial production and marketization of farming activities, a multistage sampling technique was used. A total sample of 300 farmers was considered, 150 of which were digital-platform users, and 150 non-users. Digital-platform adoption was considered as the regular use of any one digital agribusiness service for agricultural marketing, such as the e-NAM, mobile based market platforms, FPO mediated digital marketing, digital price-information services or online buyer-seller

network. Primary data was gathered using a structured, pre-tested interview schedule, which included socio-economic characteristics, market-information sources, buyer contacts, marketing costs, selling prices, indicators of access to markets and farm-level economic returns of digital access and use. Market Access Index (0–100) was created by standardising market-information availability, alternative buyer access, price information, competitive marketing opportunities, transaction convenience and payment efficiency. The Marketing Decision Score was created based on the farmers' capability of price comparison, buyer identification, channel selection and negotiating selling conditions.

Firstly, descriptive statistics were used to describe the farmer characteristics. Independent sample t-test were used for continuous variables and χ^2 tests were used for categorical variables to compare differences between adopters and non-adopters. A binary logistic regression model was then estimated to determine factors associated with digital-platform adoption. Age, education, operational holding, farm income, smartphone possession, frequency of internet use, FPO/cooperative membership, digital-agriculture training and digital market-information access and distances to the regulated market were variables used as explanatory variables, whereas the dependent variable was coded as 1 for adopters and 0 for non-adopters. Estimated coefficients and standard errors are presented along with odds ratios. Propensity score matching (PSM) was used to minimize selection bias due to systematic differences between adopters and non-adopters. Propensity scores were modeled from the logistic model, and matched with observationally similar non-adopters using nearest-neighbour, caliper and kernel matching methods. Estimates of Average Treatment Effect on the Treated (ATT) for market-access and economic-performance outcomes were derived using PSM, which is based on

the potential-outcomes framework of Rosenbaum and Rubin (1983). The results were found to be the Market Access Index, the farm-gate price, marketing cost, net farm return, benefit–cost ratio, return on marketing expenditure, the payment realization period, and the price-realization index. The matching quality was examined using standardized mean differences, variance ratios and common-support diagnostics. The robustness of ATT was conducted by comparing estimation results obtained by using different matching methods. The level of statistical significance was 5% and 1% with all monetary values shown in Indian rupees (₹). Statistic software was used and the interpretation was done at the farm-household level.

Results and Discussion

The results are presented to evaluate the adoption and economic implications of digital agribusiness platforms among smallholder farmers in Odisha. Table 1 shows the socio-economic and digital attributes of 300 smallholders in Odisha, 150 of them using a digital platform and 150 who are not using digital platform. The age at which digital users used it (42.6 years) was lower than that of non-users (47.8 years), education level (9.7 years schooling) was higher than that of non-users (6.8 years schooling), the size of the holding (1.18 ha) was higher than that of non-users (0.96 ha), and the annual farm income (₹2.41 lakh) was higher than that of non-users (₹1.86 lakh). At $p < 0.05$ or $p < 0.01$, users showed significantly higher levels of ownership of the smartphones, mobile internet use, FPO/cooperative membership, access to formal credit, digital market-information, and digital-agriculture training than non-users.

The correlation of the higher digital participation of younger and better-educated farmers aligns with the studies that show that education and farm resources and access to digital devices are a driver for farmers to

Table 1. Socio-economic characteristics and digital agribusiness platform participation of sampled farmers in Odisha

Variable	Category	Digital users (n=150)	Non-users (n=150)	Overall (n=300)	χ^2/t value
Age (years)	Mean $\pm$ SE	42.6 $\pm$ 0.9	47.8 $\pm$ 0.9	45.2 $\pm$ 0.6	4.08
Education (years)	Mean $\pm$ SE	9.7 $\pm$ 0.4	6.8 $\pm$ 0.3	8.3 $\pm$ 0.3	5.78
Operational holding (ha)	Mean $\pm$ SE	1.18 $\pm$ 0.06	0.96 $\pm$ 0.05	1.07 $\pm$ 0.04	2.76
Annual farm income (₹ lakh)	Mean $\pm$ SE	2.41 $\pm$ 0.12	1.86 $\pm$ 0.10	2.14 $\pm$ 0.08	3.50
Mobile internet use	Yes (%)	91.3	63.3	77.3	35.21*
Smartphone ownership	Yes (%)	94.0	72.7	83.3	27.84*
Membership in FPO/cooperative	Yes (%)	48.7	28.7	38.7	12.29*
Access to formal credit	Yes (%)	58.7	43.3	51.0	7.06
Received agricultural market information digitally	Yes (%)	82.0	36.7	59.3	61.38*
Training on digital agriculture	Yes (%)	34.0	12.0	23.0	22.07*

Note: *Significant at 5%; **Significant at 1%. χ^2 was used for categorical variables and independent-samples t-test for continuous variables.

use agricultural service via their smartphone (Krithi, Varman 2026). The findings of this study in the state of Odisha further support that education and age have a significant impact on participation in an electronic agriculture market (Khandagiri and Kannan, 2022). Findings from Bihar indicate that digital agricultural tools are limited by accessibility of the platform, connectivity, digital literacy, and the ability to interpret information, especially for less educated and resource-constrained farmers, corroborating the strong relationship between the use of the platform and smartphone and internet access. Likewise, smartphone availability and education are significant proxies of farmers' digital preparedness, and linked to digital agricultural services (Fabregas *et al.*, 2019) in India.

The high participation of users in institutional networks, like FPOs, and in trainings on digital-agriculture further indicate that institutional networking and capacity building can help towards digital inclusion; the recent evidence on e-NAM adoption also highlights digital literacy, education and social participation as important factors for participation. This is especially true of Odisha, with all 66 RMCs being connected to e-NAM, and 4.16 lakh farmers and 639 FPOs registering on the platform, resulting in significant institutionalization of digital agricultural marketing across the state. Hence, facilitating digital agribusiness in Odisha should be focused on platform availability along with digital-literacy training, facilitation through FPOs, and cost-effective connectivity and farmer-oriented support instead of just technology access. More recent studies also highlight the need for local training, the cost of internet and digital literacy. The need for local training, affordable internet and digital literacy are also highlighted by recent evidence to overcome the agricultural digital divide.

There are significant differences in market-access and marketing performance between digital-platform

users and non-users that are evident in Table 2. Digital users reported using more market-information sources (3.42 vs. 1.86), had more buyers per season (3.74 vs. 1.92) and sold a higher percentage of their produce competitively (61.8% vs. 43.6%) than non-users ($p < 0.01$). They also earned a higher average farm-gate price (₹27.84 vs. ₹24.72 per kg), lower marketing costs (₹2.86 vs. ₹3.38 per kg), had a shorter post-harvest waiting period (2.1 vs. 3.4 days), and a greater producer share in the consumer price (68.4% vs. 57.2%). Digital users then had significantly higher scores on both the Market Access Index (67.8 vs. 49.6) and on the Marketing Decision Scores (14.8 vs. 10.9) with all differences statistically significant at $p < 0.01$. The results presented here suggest that the integration of digital platforms was linked with greater buyers' access, better price realization and more efficient marketing transactions.

Digital-platform users' superior market performance relative to their non-digital counterparts can be attributed to the digital technologies' capacity to lower farmers' information asymmetry and increase their capacity to reach alternative buyers and market prices. Reddy and Mehjabeen (2019) found that better market information and electronic price discovery are among the key mechanisms that can strengthen agricultural marketing with e-NAM implementation but requires effective coordination of stakeholders in India. Meena *et al.* (2019) also found that digital platforms like e-NAM can enhance market access, transparency, and price realization, and minimize reliance on intermediaries. The higher farm-gate price among users in the present study is also consistent with the evidence on e-NAM, which revealed a positive, and statistically significant, impact on the wholesale price, but with the caveat that market-information interventions do not necessarily lead to lower transaction costs, which calls for the need to consider the platform design and local implementation conditions.

Table 2. Effect of digital agribusiness platform use on market access and marketing performance

Indicator	Digital users (n=150)	Non-users (n=150)	Difference (%)	t-value
Number of market information sources used	3.42 ± 0.12	1.86 ± 0.09	83.9	10.62*
Distance to principal buyer/market (km)	18.6 ± 1.1	24.8 ± 1.3	-25.0	3.58*
Buyers contacted per season (number)	3.74 ± 0.18	1.92 ± 0.12	94.8	8.47*
Share of produce sold through competitive channels (%)	61.8 ± 2.1	43.6 ± 1.9	41.7	6.36*
Average farm-gate selling price (₹/kg)	27.84 ± 0.61	24.72 ± 0.56	12.6	3.74*
Marketing cost (₹/kg)	2.86 ± 0.10	3.38 ± 0.12	-15.4	3.35*
Post-harvest waiting period (days)	2.1 ± 0.2	3.4 ± 0.3	-38.2	3.67*
Producer's share in consumer price (%)	68.4 ± 1.5	57.2 ± 1.7	19.6	4.85*
Market-access index (0–100)	67.8 ± 1.4	49.6 ± 1.6	36.7	8.53*
Marketing decision score (0–20)	14.8 ± 0.3	10.9 ± 0.3	35.8	9.11*

Note: Mean ± SE. *Significant at 5%; **Significant at 1%.

Communication and information infrastructure is also shown to be important by Negi *et al.* (2018), who have found that poor transportation and communication infrastructure limit farmers' range of profitable marketing channels, and can contribute to reduced producer prices in India. The findings of higher competition channel share and producers' share among users, respectively, is therefore indicative of potential gains in farmers' negotiating power from the digital platforms where they can make themselves more visible and less dependent on a few local intermediaries. This is in line with the evidence of alternative and institutionalized marketing channels having the potential of lowering farmers' exposure to distress selling and bettering farmers' marketing outcomes in India.

Table 3 shows the binary logistic regression results of factors associated with adopting digital agribusiness platforms among the 300 sampled farmers. The model was statistically significant (LR $\chi^2=118.47$, $p<0.01$) and had a 78.7% correct classification accuracy, with an acceptable goodness of fit (Hosmer–Lemeshow $p=0.449$). Education was a significant and positive factor (OR=1.202, $\beta=0.184$, $p<0.01$), meaning that for every additional year of education, the odds of adoption increased by around 20.2%. Internet-use frequency, smartphone ownership and access to digital market information also significantly affected the likelihood of adoption (OR>1, $p<0.01$). Operational holding size (OR=1.523) and farm income (OR=1.374) were positive and significant at the 5% level and age (OR=0.965) had a negative association with adoption, while FPO/cooperative membership (OR=1.978) and digital-agriculture training (OR=2.394) were positive and significant at the 5% level. Distance to regulated market was negative and significant at the 5% level (OR=0.972). Hence, the chances of participation in adoption were higher in the case of farmers who were better educated, more connected with digital networks,

more involved in digital-markets institutions, and more exposed to digital-markets information, while older age and greater market distance decreased the likelihood of farmers participating in adoption.

Positive effect of education, ownership of smart phone, Internet use shows that human capital and digital readiness are key factors in the uptake of digital agribusiness. This result aligns with the studies conducted by smallholders in India where it was established that education, mobile phone ownership, farm assets, landholding characteristics are among the factors that affect adoption of digital agricultural extension services (Nwangwu *et al.*, 2024). The influence of smartphone ownership in the current study (OR=2.494) reaffirms recent Indian findings that education and income along with access to digital devices greatly impact farmers access to agricultural services through smartphones (Abbas *et al.*, 2024). The positive correlation of FPO membership and digital-agriculture training with adoption further suggests that institutional exposure and capacity building can facilitate the adoption of digital agriculture as well; recent evidence on e-NAM adoption reinforces education, digital literacy and social participation as drivers for participation, and recommends awareness and capacity building programmes. In the same way, Raghavendra *et al.* (2023) identified farm size and distance to market as factors that significantly affect participation in e-marketing and highlighted the importance of awareness and capacity development as strategies to raise the participation of farmers in e-marketing.

The negative distance-to-regulated-market coefficient indicates that spatial accessibility continues to be relevant even if digital platforms are used, which may relate to different physical market infrastructures, digital awareness, and/or distances to transactions completion costs. This is in line with recent studies which have found that distance from markets continues to be significant

Table 3. Determinants of farmers' adoption of digital agribusiness platforms: binary logistic regression

Explanatory variable	Coefficient (β)	SE	Odds ratio	z-value
Age (years)	-0.036	0.014	0.965	-2.57
Education (years)	0.184	0.049	1.202	3.76*
Operational holding (ha)	0.421	0.186	1.523	2.26
Annual farm income (₹ lakh)	0.318	0.127	1.374	2.50
Smartphone ownership (1=yes)	0.914	0.354	2.494	2.58
Internet-use frequency (times/week)	0.126	0.041	1.134	3.07*
FPO/cooperative membership (1=yes)	0.682	0.286	1.978	2.38
Digital-agriculture training (1=yes)	0.873	0.341	2.394	2.56
Market-information access (1=yes)	0.795	0.298	2.214	2.67*
Distance to regulated market (km)	-0.028	0.013	0.972	-2.15
Constant	-3.914	1.026	—	-3.82*

Table 4. Effect of digital agribusiness platform adoption on farm economic performance

Outcome variable	Mean adopter	Matched non-adopter	ATT	SE	% effect
Market-access index (0–100)	67.8	52.1	15.7*	2.84	30.1
Farm-gate price (₹/kg)	27.84	25.18	2.66*	0.73	10.6
Marketing cost (₹/kg)	2.86	3.31	−0.45*	0.14	−13.6
Net farm return (₹/ha)	74,940	55,870	19,070*	4,820	34.1
Benefit–cost ratio	2.03	1.70	0.33*	0.09	19.4
Price realization index	72.6	61.4	11.2*	2.51	18.2

for small farmers' market participation in India (Paul *et al.*, 2021). The negative correlation with age also implies a possible "digital generation effect" but must be viewed with caution, as age could also be influenced by education and familiarity with and digital literacy of the smartphone. The most recent study on digital innovations in agriculture in India also suggests that digital literacy, cost, connectivity, and language are key barriers, especially for older and less-educated farmers.

Table 4 shows the estimated impact on economic performance of adoption of a digital agribusiness platform by a farmer, after matching a farmer with a farmer in the control group who is observationally similar to the farmer in the treatment group. Adoption of digital-platforms increased the net farm return by 34.1% to ₹19,070/ha and the improvement coefficient of the benefit–cost ratio by 19.4% to 0.33. The price-realization index (ATT = 11.2 points; $p < 0.01$) was also higher and the marketing cost (ATT = −₹0.45/kg; $p < 0.01$) was lower for all the adopters. The estimated ATT for the market-access index was 15.7 points, which suggests that market-access index matched adopters had a lot more access to agricultural markets. The positive impact on farm-gate price (₹2.66 per kg) and higher ROI on marketing expenditure also point towards increased economic efficiency among the digital-platform users.

The positive ATT estimates suggest that the involvement of digital agribusiness can bring economic advantages due to better market access and better price information, and the better ability of farmers to find alternative buyers. There is recent evidence from India that the use of digital platforms in agriculture, like e-NAM, can enhance market access, transparency, and market price realization, but the magnitude of the benefits can differ by commodity and market (Praneeth *et al.*, 2023). The current evidence of improved price realization is corroborated by a Difference-in-Differences analysis from Andhra Pradesh, which has shown that the e-NAM participants in turmeric and dry chilli markets experienced significant price gains compared to their non-participants, indicating that digital trading could enhance price discovery and reduce information asymmetry (Venkatesh *et al.*, 2021). Moreover, the results from studies

conducted in Rajasthan revealed that adoption of e-NAM led to a rise in farmers' prices or market quantity, but other efficiency gaps were noted as the need for further improvement. The low marketing cost as reported in the present study is significant as the problem of high search, negotiation and transaction cost is often faced by small holders and can limit access to remunerative marketing channels (Sharma *et al.*, 2025). Empirical evidence from the recent past in Tamil Nadu also suggests that the use of mobile technology can help lower search and negotiation costs and enhance market access and livelihoods for smallholders.

The benefit–cost ratio and improvement in net farm returns also indicate that the economic value of digital platforms could be more than just price improvement, because the benefit may be a greater contribution to marketing efficiency. This interpretation is also confirmed by the recent study conducted in the East India demonstrating the positive linkages between utilization and farm income outcomes of digital agricultural services such as the study in Odisha. However, the size of the present estimates needs to be treated with caution as PSM controls only for observed characteristics and other unobserved factors like entrepreneurial ability, digital literacy, and motivation and pre-existing buyer relationships may also have an impact on the adoption rates and economic outcomes. This restriction highlights the need for matching diagnostics to be reported and, if feasible, an IPW or alternative specification to be carried out as a robustness check.

Conclusion

The study findings show that digital agribusiness platforms can make a significant impact on improving the economic performance and market access of smallholder farmers in Odisha. Digital-platform adopters also had more sources of market information they used (3.42 vs. 1.86) and contacted more buyers (3.74 vs. 1.92), and had a higher percentage of competitive-channel sales (61.8% vs. 43.6%) than non-adopters. They also obtained higher farm-gate prices (₹27.84 vs. ₹24.72 per kg), lower marketing costs (₹2.86 vs. ₹3.38 per kg) and

higher producer-price shares (68.4% vs. 57.2%). Logistic regression also revealed that education, smart phone ownership, use of internet, access to information in digital markets, membership of FPO were associated with higher probability of platform adoption while age and distance to the regulated market had negative association. Most importantly, propensity score matching showed a positive association of digital adoption with net farm returns (ATT = ₹19,070 per ha), benefit–cost ratio (ATT = 0.33), market-access index (ATT = 15.7 points) and price realization (ATT = ₹2.66 per kg), while marketing costs declined by ₹0.45 per kg. Based on these findings, it is recommended that digital literacy, the availability of smart phones, digital marketing through farmer pro-orgs, and farmer training and strengthening rural connectivity should be enhanced to boost the benefits of digital agribusiness. These interventions can help to make agriculture better and more inclusive, as well as helping to achieve SDG 2, SDG 8 and SDG 9. These estimates of the PSM, however, are conditional associations and should not be viewed as fully causal effects when there is unobserved heterogeneity.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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RESEARCH ARTICLE

Peer-reviewed | Open Access

Digital Performance Anxiety among Young Agripreneurs: Examining the Role of AI Literacy and Entrepreneurial Communication

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ARTICLE INFO

Article history

RECEIVED: 16-Aug-26

REVISED: 24-Aug-26

ACCEPTED: 05-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Dayashree Kajulima and Girish Prasad Rath (2026). Digital Performance Anxiety among Young Agripreneurs: Examining the Role of AI Literacy and Entrepreneurial Communication. Horizon J. Hum. Soc. Sci. Res. 8 (S), 135–140. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1402.p135>



ABSTRACT

The rapid digital transformation of agribusiness has created new opportunities for young entrepreneurs to access markets, communicate with customers, promote agricultural products, and adopt artificial intelligence (AI)-enabled tools. The increasing expectation to perform effectively in digital environments may also generate psychological challenges, particularly among young agripreneurs who are required to communicate, present, market, and make business decisions through digital platforms. While existing research has examined technology adoption and digital entrepreneurship, limited attention has been given to the psychological dimension of digital performance, particularly Digital Performance Anxiety (DPA). This study examines the nature and determinants of DPA among young agripreneurs, with particular emphasis on AI literacy, digital self-efficacy, and entrepreneurial communication. DPA is conceptualised as anxiety experienced when individuals are required to perform, communicate, present, or be evaluated in digitally mediated entrepreneurial contexts. A quantitative, cross-sectional research design is employed among young agripreneurs engaged in digitally enabled agricultural and allied enterprises in India. The study contributes to the emerging literature on the human and psychological dimensions of digital transformation in agribusiness, examining whether AI literacy and digital self-efficacy function as protective factors against DPA, and whether entrepreneurial communication competence is associated with greater confidence in digitally mediated business environments. Findings are expected to inform inclusive digital entrepreneurship and capacity-building strategies for young agripreneurs, contributing to more inclusive, resilient, and sustainable agribusiness ecosystems.

Keywords: Digital Performance Anxiety; Young Agripreneurs; Digital Self-Efficacy; Entrepreneurial Communication; Digital Transformation; Sustainable Agribusiness

1. Introduction

Digital transformation has fundamentally reshaped how agricultural enterprises are conceived, marketed, and managed. Young agripreneurs increasingly rely on digital platforms as e-commerce marketplaces, social media, mobile applications, and AI-enabled decision-support tools to access markets, engage customers, and

manage business operations. Government-led digital agriculture initiatives in India, along with the proliferation of smartphone-based Agri-tech platforms, have accelerated the expectation that young entrepreneurs must be digitally visible, responsive, and competent. The requirement constantly performs through live-streamed sales, video-based marketing, digital pitching to investors

or buyers, and public-facing social media engagement which may generate a distinct form of anxiety that has received limited empirical attention in agribusiness research. Drawing on the broader psychological literature on performance anxiety, communication apprehension, and technology anxiety, this study introduces and examines the construct of Digital Performance Anxiety (DPA) among young agripreneurs.

While prior research has extensively documented drivers and barriers of digital technology adoption in agriculture, and a growing body of work addresses entrepreneurial well-being more broadly, the specific psychological experience of being evaluated, watched, or required to perform digitally in an entrepreneurial agricultural context remains under-theorised. This gap is particularly significant given that young agripreneurs often lack formal training in digital communication and AI tools, are frequently first-generation entrepreneurs, and operate in rural or semi-urban contexts where digital infrastructure and literacy support are uneven. This study addresses three inter-related questions: (1) What is the nature and prevalence of DPA among young agripreneurs engaged in digitally enabled enterprises? (2) Do AI literacy and digital self-efficacy act as protective factors that reduce DPA? (3) Does entrepreneurial communication competence explain or mediate the relationship between digital capability and DPA?

2. Objectives of the Study

1. To conceptualise and empirically examine Digital Performance Anxiety (DPA) as a distinct construct among young agripreneurs.
2. To examine the relationship between AI literacy and DPA.
3. To examine the relationship between digital self-efficacy and DPA.

The study contributes theoretically by proposing and operationalising a new construct i.e. DPA which is situated at the intersection of entrepreneurship, psychology, and digital transformation literature. It offers evidence to inform training institutions, agricultural extension services, incubators, and policymakers seeking to design digital and AI capacity-building programmes that address not only skill deficits but also the psychological barriers that may inhibit young agripreneurs from fully engaging with digital markets.

3. Literature Review

Digital transformation in agriculture has been characterised by the growth of e-commerce, mobile-based advisory services, social media marketing, digital

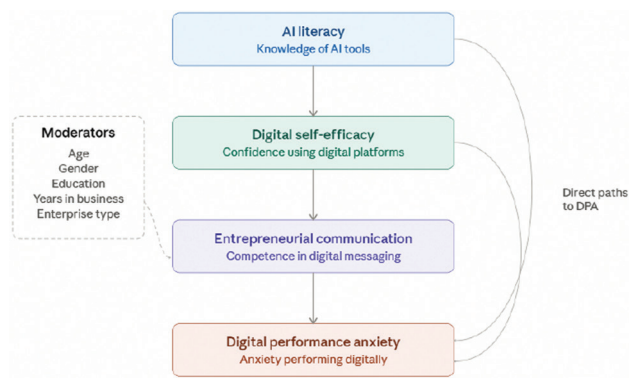
payment systems, and increasingly, AI-enabled tools for crop advisory, pricing, and customer engagement (Trendov et al., 2019). Young entrepreneurs are positioned as key adopters of these technologies given their relatively higher digital exposure, yet studies also note substantial heterogeneity in digital readiness across rural youth populations (FAO, 2022). The psychological literature distinguishes several related constructs: performance anxiety (apprehension associated with being evaluated during a task), communication apprehension (fear or anxiety associated with real or anticipated communication with others), and computer/technology anxiety (discomfort or fear associated with using digital technologies) (McCroskey, 1984). DPA draws on and extends both constructs to the entrepreneurial context, denoting anxiety specifically triggered by the requirement to perform, present, market, or be evaluated through digitally mediated entrepreneurial channels such as live commerce, video-based marketing, digital pitching, or AI-assisted decision-making visible to stakeholders. AI literacy, defined by Long and Magerko (2020) as the set of competencies that enable individuals to critically evaluate AI technologies and use them effectively across every day and work contexts, has been linked in emerging research to greater user confidence and self-management when interacting with AI systems (Carolus et al., 2023), though empirical work connecting AI literacy specially to anxiety outcomes among entrepreneurs remains limited. Digital self-efficacy builds on Bandura's (1997) social cognitive theory, in which self-efficacy refers to an individual's belief in their capacity to organise and execute the courses of action required to produce a given attainment; applied to computing context, computer self-efficacy has been shown to shape user's affective reactions, anxiety, and persistence in technology use (Compeau & Higgins, 1995).

4. Research Gap

Despite growing attention to digital entrepreneurship and technology adoption in agriculture, the psychological dimension of digital performance, specifically anxiety arising from the requirement to perform and be evaluated digitally which has not been systematically conceptualised or measured among young agripreneurs. This study addresses this gap by introducing DPA as a distinct construct and empirically situating it within a nomological network of AI literacy, digital self-efficacy, and entrepreneurial communication competence.

5. Conceptual Framework and Hypotheses

Drawing on social cognitive theory, communication apprehension theory, this study proposes a conceptual model in which AI literacy and digital self-efficacy act as



Solid arrows: hypothesised direct and sequential effects (H1-H3). Dashed arrow: moderation (H6)

Figure 1. Conceptual Framework

Table 1. Hypotheses

Hypothesis	Statement
H1	AI literacy is negatively associated with Digital Performance Anxiety (DPA) among young agripreneurs.
H2	Digital self-efficacy is negatively associated with DPA among young agripreneurs.
H3	Entrepreneurial communication competence is negatively associated with DPA among young agripreneurs.
H4	Digital self-efficacy mediates the relationship between AI literacy and DPA.
H5	Entrepreneurial communication competence mediates the relationship between AI literacy and DPA.
H6	Socio-demographic factors (age, gender, education, years in business, type of enterprise) moderate the relationship between AI literacy/digital self-efficacy and DPA.

protective (anxiety-reducing) factors, entrepreneurial communication competence acts as both a direct protective factor and a mediating mechanism, and DPA is the focal outcome variable. Socio-demographic and enterprise characteristics are modelled as moderating factors.

6. Methodology

Research Design

This study adopts a quantitative, cross-sectional survey design, appropriate for examining associations among psychological and behavioural constructs across a defined population at a single point in time.

Population and Sample

The target population comprises young agripreneurs (typically aged 18–35 years) engaged in digitally enabled agricultural and allied enterprises (e.g., agri-produce marketing, agri-input retail, farm-based value addition,

Table 2. Sample profile (n = 40)

Characteristic	Category	% (n = 40)
Gender	Male	57.5% (23)
	Female	42.5% (17)
Education	Undergraduate	62.5% (25)
	Postgraduate	22.5% (9)
	Diploma/Certificate	15.0% (6)
Location	Semi-urban	37.5% (15)
	Urban	32.5% (13)
	Rural	30.0% (12)
Enterprise type	Agri-input retail	27.5% (11)
	Farm-based value addition	22.5% (9)
	Agri-produce marketing	15.0% (6)
	Dairy/Poultry allied enterprise	15.0% (6)
	Organic farming	12.5% (5)
	Agri-tech start-up	7.5% (3)
Age (years)	M = 26.33, SD = 4.94 (range 18–35)	
Years in business	M = 3.55, SD = 2.14 (range 1–7)	

agri-tech start-ups) in India. A purposive-cum-snowball sampling strategy is proposed, supplemented by outreach through agricultural incubators, Krishi Vigyan Kendras (KVKs), start-up cells, and farmer producer organisations (FPOs), given the absence of a single comprehensive sampling frame for this population.

Instrumentation

A structured questionnaire was used comprising: (i) socio-demographic and enterprise profile; (ii) a 5-item Digital Performance Anxiety scale; (iii) a 5-item AI Literacy scale; (iv) a 5-item Digital Self-Efficacy scale; and (v) a 5-item Entrepreneurial Communication Competence scale, each measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Ethical Considerations

The study sought to follow standard ethical protocols: voluntary participation, informed consent, anonymity, and secure data storage. For the full study, institutional ethics approval should be obtained prior to data collection.

7. Results

The pilot sample (n = 40) had a mean age of 26.33 years (SD = 4.94) and average business experience of 3.55 years (SD = 2.14). The sample was 57.5% male and 42.5% female, predominantly undergraduate-educated (62.5%), and fairly evenly spread across semi-urban, urban, and rural locations. Agri-input retail (27.5%) and farm-based value addition (22.5%) were the most represented enterprise types. Table 3 presents descriptive statistics

Table 3. Descriptive statistics for study variables

Variable	M	SD	Min	Max
Digital Performance Anxiety	2.91	0.61	1.20	3.80
AI Literacy	3.39	0.56	1.80	4.40
Digital Self-Efficacy	3.26	0.62	1.80	4.80
Entrepreneurial Communication Competence	3.24	0.58	2.20	4.60

Table 4. Correlation matrix

Variable	1	2	3	4
1. DPA	—			
2. AI Literacy	-0.250	—		
3. Digital Self-Efficacy	-0.553**	0.277	—	
4. Entrepreneurial Communication	-0.403*	0.273	0.332*	—

* $p < .05$, ** $p < .01$

Hypothesis Testing — Direct Effects (H1–H3)

for the four study variables. Mean DPA was 2.91 (SD = 0.61) on the 5-point scale, indicating a moderate overall level of digital performance anxiety in the sample; 75% of respondents fell in the “Moderate” DPA category, 17.5% “Low”, and 7.5% “High”. Mean AI literacy (M = 3.39), digital self-efficacy (M = 3.26), and entrepreneurial communication competence (M = 3.24) were all slightly above the scale midpoint.

Table 4 presents Pearson correlations among the study variables. DPA was significantly and negatively correlated with digital self-efficacy ($r = -0.553$, $p < 0.01$) and entrepreneurial communication competence ($r = -0.403$, $p < 0.05$), but not significantly correlated with AI literacy ($r = -0.250$, $p = 0.119$). AI literacy was positively, though not significantly, associated with both digital self-efficacy ($r = 0.277$, $p = 0.083$) and entrepreneurial communication competence ($r = 0.273$, $p = 0.088$). Digital self-efficacy and entrepreneurial communication competence were significantly positively correlated ($r = 0.332$, $p < 0.05$).

Simple linear regressions were conducted to test H1–H3 (Table 5). Digital self-efficacy significantly and negatively predicted DPA ($\beta = -0.550$, $p < 0.001$), explaining 30.6% of variance, supporting H2. Entrepreneurial communication competence also significantly and negatively predicted DPA ($\beta = -0.422$, $p = 0.010$), explaining 16.2% of variance, supporting H3. AI literacy showed a negative but non-significant association with DPA ($\beta = -0.275$, $p = 0.119$), and H1 was therefore not supported in this sample.

A multiple regression with all three predictors entered simultaneously (Table 7) explained 36.3% of the variance in DPA ($R^2 = 0.363$, $F(3,36) = 6.83$, $p = 0.001$). Digital self-efficacy remained a significant unique predictor ($B =$

Table 5. Simple regression results (H1–H3)

Predictor → DPA	β (unstd.)	t	p	R ²
AI Literacy (H1)	-0.275	-1.58	0.119	0.063
Digital Self-Efficacy (H2)	-0.550*	-4.03	<0.001	0.306
Entrepreneurial Communication (H3)	-0.422*	-2.68	0.010	0.162

Table 6. Multiple regression results (simultaneous entry)

Predictor	B	SE	t	p
(Constant)	5.413	0.640	8.45	<0.001
AI Literacy	-0.065	0.155	-0.42	0.677
Digital Self-Efficacy	-0.456	0.143	-3.18	0.003
Entrepreneurial Communication	-0.245	0.151	-1.63	0.113

Table 7. Bootstrapped mediation analysis

Path	a	b	a×b (indirect)	95% Bootstrap CI (5,000 resamples)
H4: AI Literacy → Digital Self-Efficacy → DPA	0.307*	-0.521*	-0.160	[-0.314, -0.030] — significant
H5: AI Literacy → Entrepreneurial Comm. → DPA	0.286	-0.379*	-0.108	[-0.272, 0.015] — not significant

-0.456, $p = 0.003$), while AI literacy ($B = -0.065$, $p = 0.677$) and entrepreneurial communication competence ($B = -0.245$, $p = 0.113$) did not retain significance once shared variance was accounted for consistent with digital self-efficacy acting as a more proximal driver of reduced DPA.

Bootstrapped mediation analysis tested whether digital self-efficacy and entrepreneurial communication competence mediate the relationship between AI literacy and DPA (Table 7). The indirect effect of AI literacy on DPA through digital self-efficacy was significant ($ab = -0.160$, 95% CI [-0.314, -0.030], excluding zero), supporting H4: AI literacy appears to reduce DPA primarily by strengthening digital self-efficacy, rather than through a direct effect. The indirect effect through entrepreneurial communication competence was not significant ($ab = -0.108$, 95% CI [-0.272, 0.015], including zero), so H5 was not supported.

Interaction terms and subgroup comparisons were used to test whether socio-demographic and enterprise-related variables moderate the predictor–DPA relationships (Table 8). None of the tested interactions (gender, age, years in business) or subgroup differences (education, enterprise type, gender) reached statistical significance in this pilot sample. H6 was therefore not supported, though this may reflect limited statistical

Table 8. Moderation and subgroup analyses

Interaction term	B (interaction)	p	Result
Digital Self-Efficacy × Gender	0.288	0.312	Not significant
AI Literacy × Age	-0.049	0.110	Not significant
Digital Self-Efficacy × Years in Business	-0.092	0.195	Not significant
DPA by Education (ANOVA)	F = 1.28	0.290	Not significant
DPA by Enterprise Type (ANOVA)	F = 0.85	0.523	Not significant
DPA by Gender (t-test)	t = -0.38	0.708	Not significant

power given the small sample size ($n = 40$) rather than the absence of true moderation effects.

8. Discussion

The pilot findings suggest that Digital Performance Anxiety among young agripreneurs is more strongly rooted in a lack of confidence in one's own ability to act digitally (digital self-efficacy) and in weaker communication competence, than in a lack of technical knowledge about AI tools. AI literacy's effect on DPA appears to operate indirectly through building digital self-efficacy, rather than directly, as shown by the significant mediation result for H4 and the non-significant direct effect for H1. This pattern is consistent with social cognitive theory's emphasis on self-efficacy, rather than raw knowledge, as the proximal driver of behaviour and affect in performance contexts. The non-significant mediation via entrepreneurial communication competence (H5) suggests that communication skill may operate somewhat independently of AI literacy, as a parallel rather than sequential protective factor consistent with its significant direct effect on DPA (H3) even though it was not driven by AI-related knowledge in this sample. The absence of significant moderation effects (H6) should be interpreted cautiously. With a sample of 40, statistical power to detect moderate interaction effects is limited; larger, more diverse samples particularly with greater representation of older, less-educated, or newer entrepreneurs may be needed to properly test whether socio-demographic and enterprise characteristics condition these relationships.

9. Conclusion

This study introduced Digital Performance Anxiety (DPA) as a construct relevant to young agripreneurs navigating increasingly digital and AI-enabled business environments, and examined its relationship with AI literacy, digital self-efficacy, and entrepreneurial communication competence. Pilot findings indicate that

digital self-efficacy and entrepreneurial communication competence are significant protective factors against DPA, while AI literacy's protective role appears to operate indirectly, through digital self-efficacy, rather than as a direct effect. Socio-demographic and enterprise characteristics did not significantly moderate these relationships in this small sample. Subject to replication with a larger, genuinely collected dataset, these findings suggest that inclusive digital capacity-building strategies for young agripreneurs should emphasise confidence-building, hands-on digital practice and communication skills training, not instead of technical AI literacy instruction, in order to support more resilient and psychologically sustainable digital entrepreneurship in agribusiness.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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Sustainable Career Pathways in Digital Agriculture: Conceptualizing AI-Driven Agri-FinTech Ecosystems

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 24-Sep-26

ACCEPTED: 05-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Namrita Das, Swetalina Mishra and Prakash Chandra Dash (2026). Sustainable Career Pathways in Digital Agriculture: Conceptualizing AI-Driven Agri-FinTech Ecosystems. Horizon J. Hum. Soc. Sci. Res. 8 (S), 141–152. <https://doi.org/10.37534/bp.jhssr.2026.v8.n5.id1403.p141>



ABSTRACT

Purpose-The purpose of this conceptual paper is to theorize the development of sustainable career pathways for artificial intelligence (AI) and financial technology (FinTech) in the context of digital agriculture, and to develop a theoretical framework of the skills, roles and institutional design required for sustainable, resilient careers in AI-enabled Agri-FinTech environments.

Design/methodology/approach-The paper adopts a conceptual approach, drawing on sustainable careers theory and literature on digital agriculture, career sustainability, financial technology and human capital development, and presents this in a person -context-time framework using a narrative review of secondary sources and industry reports, and based on the success of the case studies.

Findings-The paper ideates the nature of hybrid roles that are required to meet the need of multidisciplinary skillsets in the field of agronomy, data science, and financial risk management, within the context of AI in Agri-FinTech. The key elements for sustainable career pathways include continuous worker upskilling, policy supportive linkages between the education system and industry, and governance flexibility to overcome digital divides in smallholder and rural settings.

Research Limitation/Implications-The framework is a conceptual paper and thus needs to be empirically validated in different geographic and socioeconomic contexts, preferably with longitudinal and cross-sectoral data to evaluate the career sustainability of AI-Agri-FinTech practice. Practical Implication- The model provides guidance for policymakers, educational institutions and agribusiness companies to create training, reskilling and organizational structures which remain relevant to the rate of agricultural finance change.

Social Implication-Inclusive access to digital skills and financial technologies are crucial to promote equitable rural development and economic resilience, while reducing technological marginalization. Originality/ Value- This paper integrates the existing seminal theory of career sustainability into the AI-FinTech-agriculture nexus, an under-explored topic, and lays the groundwork for further empirical and policy studies in this space.

Keywords: Agriculture, Agri-FinTech, Artificial intelligence, Digital Agriculture, Sustainable Careers, Workforce Development

1. Introduction

There has been a fourth agricultural revolution, in which sensors, satellites, robotics and artificial intelligence (AI) are merging with mobile connectivity to transform the production, financing and marketing of food and agricultural products (Klerkx et al., 2019). In this transformation, Agri-FinTech companies leverage AI-based data analytics, data sources, and mobile technologies to provide credit, insurance, and payment services to farmers who have been traditionally excluded from formal financial systems (Köster et al., 2025; Mahbubi et al., 2024). The role of Agri-FinTech in the digital agriculture transition is becoming more and more recognized as an infrastructural precondition, as access to capital is a key constraint on the transition to sustainable agriculture (Köster et al., 2025). Alongside this change, the human aspect of agricultural change has been the subject of relatively scant systematic and theoretical reflection. Digital agriculture is not just automating jobs; it is generating new types of jobs across the agri-food value chain (AFVC), such as data-driven agronomists, agri-fintech enabled rural entrepreneurs, agri-finance credit officers and drone-data technicians, which barely existed a decade ago (Khanna et al., 2024). Despite this, it remains a challenge to theorise how such change relates to sustainable, durable careers, especially in the smallholder and rural setting where most of the world's agricultural labour resides (Food and Agriculture Organization (FAO) 2021. This gap is significant for 4 reasons. Firstly, agriculture continues to be a key source of employment in low- and middle-income countries (LMICs), and digital transformation is likely to have a tangible impact on livelihoods and out-migration from rural areas (Solutions for Youth Employment (S4YE) 2021. Second, access is also extremely uneven the digital and financial infrastructure that supports AI-based farming practices are far less accessible for smallholder farms than for large commercial farms, meaning that the same technologies that provide employment for one farm may be absent for another (Mehrabi et al., 2021). Third, sustainable careers theory, which was developed mainly in urban and organisational, knowledge-economy environments, has not been transferred to contexts where production of the context involves a technological infrastructure, financial intermediaries, and agricultural institutions, but not a single employer (De Vos et al., 2020; Van der Heijden & De Vos, 2015). Fourth, the hybrid positions this literature comes with can just as well give

rise to new precarious arrangements (gig-like; see Rani & Furrer, 2021; Wood et al., 2019), as to careers that last. Fourth, neither should the hybrid positions that this literature is beginning to identify be seen as uniformly good in and of themselves, nor should they be dismissed as nothing more than precarious arrangements. In this paper, the gaps are addressed by focusing on a single theoretical lens: sustainable careers theory (De Vos et al., 2020; Van der Heijden & De Vos, 2015) to bring together the fields of digital agriculture and Agri-FinTech scholarship and the career literature. The paper does not appeal to an alternative ecosystem theory, but rather considers the technological and financial environment of AI-based agriculture as an elaboration of the part of the context dimension in the sustainable careers theory, in which the context is not just an organization but the result of the joint work of several technological and institutional actors, and is still described within the same person context time language as in the previous theory. Career pathways are, therefore, considered as the product of technology, financial context and individual competency (person) and time (continuous re-skilling), aligning with the original formulation by De Vos et al. (2020). The paper makes three contributions. First, it adapts the theory of sustainable careers to a technologically mediated agriculture context, breaking up the context dimension into four structural conditions that are specific to the use of AI in Agri-FinTech, and keeps the subjective, meaning-making heart of the theory. Second, it offers operationalized propositions, and a typology of hybrid occupational roles to inform empirical studies, curriculum design, and policy. Thirdly, it incorporates the risk and critique literature (algorithmic bias, gig-ification, and gendered exclusion), which allows for the model's social implications to be considered as a governance dependent issue rather than a foregone conclusion.

1.1 Sustainable Careers Theory

The paper uses the sustainable careers theory as its only theoretical approach. According to Van der Heijden and De Vos (2015), sustainable career can be seen as a series of career experiences, which are evident in patterns of continuity over time, span across multiple social spaces, are enacted in an individual's field of action, and give meaning to the person. De Vos et al. (2020) discuss such careers on three interdependent levels: person (individual attributes, resources, and agency), context (structural, organizational, and institutional context where careers

develop), and time (accumulation of a person's career experiences over time and their long-run outcomes).

One point easily missed when using this structure in structural contexts, like De Vos et al (2020), is that sustainability is not an objective quality of a job but one that is judged by the individual based on their values and situation. Two employees in the same hybrid position (for instance, an agri-fintech agent working in the community) might have different opinions about whether a hybrid position is truly a viable career choice based on income-variability tolerance and the value they place in the job. This paper's model therefore posits the contextually preconditions that render subjectively sustainable careers more or less likely, without making the assumption that a well-specified context of its own nature becomes sustainable.

In previously, the context dimension of the theory is usually filled with one employing organization, or labor market. The paper's approach is to demonstrate how, in the context of AI in agriculture, context is not a mere product of one actor, but the result of a collective effort by various actors, including infrastructure providers, AI-model developers, FinTech firms, training institutions, and regulators, none of which can create a career pathway without the others. This multi-actor context is broken down in Section 3 into four structural conditions, but without a second theory, instead the conditions populate the context dimension.

Context conditions are important to the person dimension because a complementary construct, employability the person's ability to recognize and pursue work opportunities according to their attributes is provided (Fugate et al., 2004). Skills for employability become more about judgment, adaptability, and interpreting the results of algorithms to make local decisions as AI takes over routine measurement and calculation tasks. Later extensions focus on the career's life span and the cross-over in various life areas, influenced by globalization and the fast pace of technological change (Van der Heijden et al., 2020) which is exacerbated by digital access gaps between rural and urban populations and different generations in Agri-FinTech.

1.2 Digital Agriculture as an emerging Career Context

Digital agriculture is the use of sensors, Internet of Things, robotics, remote sensing and data analytics in farm management which are increasingly site-specific and increasingly autonomous (Klerkx et al., 2019). Unlike previous precision agriculture solutions, AI-powered tools can learn on the farm; machine-learning models can be trained with local data, to tailor to a farm's soil, climate and crop history (Khanna et al., 2024). The impact of AI on

agricultural labor can be seen in various ways: for instance, measurement and prediction instruments take some jobs from manual labor and hand over data analysis and model validation to people; automated machines replace manual jobs that require routine tasks, but add new tasks in maintenance and calibration; and recommendation systems leave it to farmers to spot check model-based recommendations against actual conditions.

Another mechanism points to the wide-spread adoption of generative AI. LLM based advisory chatbots such as Farmer. Digital Green deployed in 4 countries, with at initial evaluation more than 15,000 farmers reached, through retrieval augmented dialogue (Singh et al., 2024) is transforming agricultural extension towards a hybrid of human and AI advisory system. Yet, for LLM output to be applicable locally, it needs to be validated and curated in multiple languages, in which case, it seems like deployment of generative-AI would not replace but rather redistribute the human-intermediation work.

Most importantly, the technological context is not the same everywhere: While an increasing share of farms of over 200 hectares have access to adequate coverage of the third or fourth generation of mobile networks, a minority of very small farms (those smaller than one hectare) do not have access to such networks, especially where yield gaps and food insecurity are highest (Mehrabi et al., 2021). This divide relates to a boundary condition of the model presented below: different career orientations can emerge under the same context, depending on the nature of digital infrastructure in a region.

1.3 Agri-FinTech, Financial Inclusion and Algorithmic Risk

Agri-FinTech uses financial technology (mobile payments, digital lending, alternative credit scoring algorithms, parametrics insurance) for agricultural value chains. Due to the limited access to cash and collateral or credit history needed by smallholders, AI powered analytics enable providers to develop new, data-based loan-eligibility criteria based on mobile-usage patterns or satellite-derived yield estimates (Köster et al., 2025). Research in Indonesia proved that the Agri-FinTech platforms have enhanced the resilience of value-chains for smallholders during the COVID-19 crisis (Mahbubi et al., 2024), and a review carried out in Sub-Saharan Africa revealed that digital financial products can support smallholders in coping with production and marketing constraints when combined with investments in digital literacy skills (Mapanje et al., 2023).

The barriers to adoption are not only product availability but also trust: farmers' willingness to adopt Agri-FinTech can be traced to their relationship with trusted intermediaries, structural assurances on data

handling and perceived relative benefit (Köster et al., 2025), reflective of the focus in the financial-inclusion literature on trusted intermediation for under-served populations (Mapanje et al., 2023). Because trust-building between AI-driven platforms and farming communities needs to happen in a human way, this is directly relevant to Section 3: emergent roles (community-based digital-finance facilitators).

But the trust part of the inclusion question is only half the story: Do algorithms treat farmers fairly? Digital-footprint proxies (such as transaction histories, smartphone ownership, social-network data) are not neutral; audits of fintech lending in adjacent sectors identify the miscalibration of underwriting that can systematically misestimate risk for certain groups, even in the absence of explicit considerations of protected characteristics (Coots et al., 2025). As the models are dependent on these historical data, algorithmic underwriting risks algorithmic re-entitlement which is the first-order design consideration further developed in Section 4.4, given that these records are often scarce and thin among women, tenant farmers and smallholders.

2. Method

A conceptual research approach was taken in this paper, which combines literature review of digital agriculture, Agri-FinTech, and a career sustainability approach through narrative secondary sources review, industry resources, and case-based evidence. As is common in conceptual-paper style reviews, there was a documented although not fully systematic search-and-synthesis protocol used to guide the review, as described below, and the review generates a Person Context Time model with a clear evidence base that can be reconstructed.

Literature was identified using structured searches in Scopus, Web of Science, and Google Scholar, plus targeted searches in institutional repositories (FAO, ILO, CGIAR, IFPRI, GSMA and Center for Financial Inclusion) for practitioner and policy reports. Search strings intertwined context dimension terms with the two literatures to explore: (“digital agriculture” OR “precision farming”) AND (“artificial intelligence” OR “machine learning”); (“Agri-FinTech” OR “digital lending” OR “alternative credit scoring”) AND (“financial inclusion” OR “trust” OR “algorithmic bias”); (“sustainable careers” OR “career sustainability” OR “employability”) AND (“technology” OR “digitalization”) AND (“gig economy” OR “platform work” OR “precarity”) AND (“agriculture” OR “rural”). The window for the search covered the period of January 2000 to March 2026 and included the majority of sources that were published in 2015–2026.

Records were filtered twice. Studies were excluded from title/abstract screening if they did not have at least two of digital agriculture, Agri-FinTech/financial inclusion or career or labour-market outcomes. Full-text screening focused on peer-reviewed journal articles in agricultural economics, information systems, vocational behaviour, sociology of work and management, with institutional reports included only if they contained empirical details that could not be found elsewhere. Preprints were only kept when they described original empirical deployments that were relevant for the labour-market and governance claims raised.

This serves the aim of triangulation; if possible, every key piece of evidence regarding trust, adoption, or exclusion for Agri-FinTech is backed up by a minimum of two independent sources (such as the trust-antecedent claims are triangulated between Köster et al. (2025) and Mapanje et al. (2023); the algorithmic-bias claims are based on evidence from a fintech-lending-audit). The six propositions of the model and the model itself were developed abductively through the search of recurring patterns in the literature which included the role of the trust intermediary with respect to the adoption of Agri-FinTech, the focus on hybrid technical-financial-agronomic skills found in research on digital-transformation-skills and the documentation of algorithmic bias and gig-like precarity in adjacent platform-mediated sectors.

There are three types of scope. First, the model was developed for smallholder- and mid-scale-dominated agricultural systems found in LMICs (as the operational scope term is also used throughout, synonymous with the Global South), where the tension between the potential of digital agriculture and its uneven diffusion is most pronounced, and applicability to large-scale, highly capitalized commercial agriculture in high-income economies is highlighted for comparative research in the future. Second, the concept of “career pathway” is applied broadly and includes waged employment, self-employment and agripreneurship, and hybrid pathways of production combined with data or finance-based careers (FAO, 2021; S4YE, 2021). Third, hybrid jobs are not inherently precarious: it is an empirical question whether a specific job is a precarious, “gig” job or a sustainable career.

3. Result

3.1 A person-context-time model

To apply the sustainable careers theory in this context, it is necessary to describe each of the three aspects of the theory in the context of the AI-powered Agri-FinTech. The context dimension is further broken down into four structural conditions of this domain,

namely (C1) Digital Infrastructure, (C2) Data and AI (C3) Finance and (C4) Governance. For the person dimension, it is set as a hybrid competency set using employability, as described by Fugate et al., 2004. The time dimension is set by the imperative to constant re-skilling due to the constant changes in technology, financial products, and conditions in the agriculture sector. Tables 1, 2 and 3 summarize the model, translate the model into a typology of hybrid occupational roles, operationalize the propositions developed below respectively.

The model shown in Figure 1 represents the model described in Table 1. The context dimension is depicted as a multi-actor structure C1 (Digital infrastructure), C2

(Data and AI), C3 (Finance), and C4 (Governance) with C1 gating C2 and C3, in line with its being an infrastructural precondition (Section 1.2), and C4 as a dashed, cross-cutting moderator, reflecting Proposition 4's suggestion that governance strength conditions the degree of conversion of context maturity into sustainable, equitable careers. The person dimension- hybrid competencies through employability (Fugate et al., 2004) is fueled by the context, and the time dimension of continuous re-skilling is both positioned in front of and behind the person dimension, with the time dimension suggested by a dashed feedback arrow and the continuous re-skilling nature suggested by the recurrent nature of the arrow.

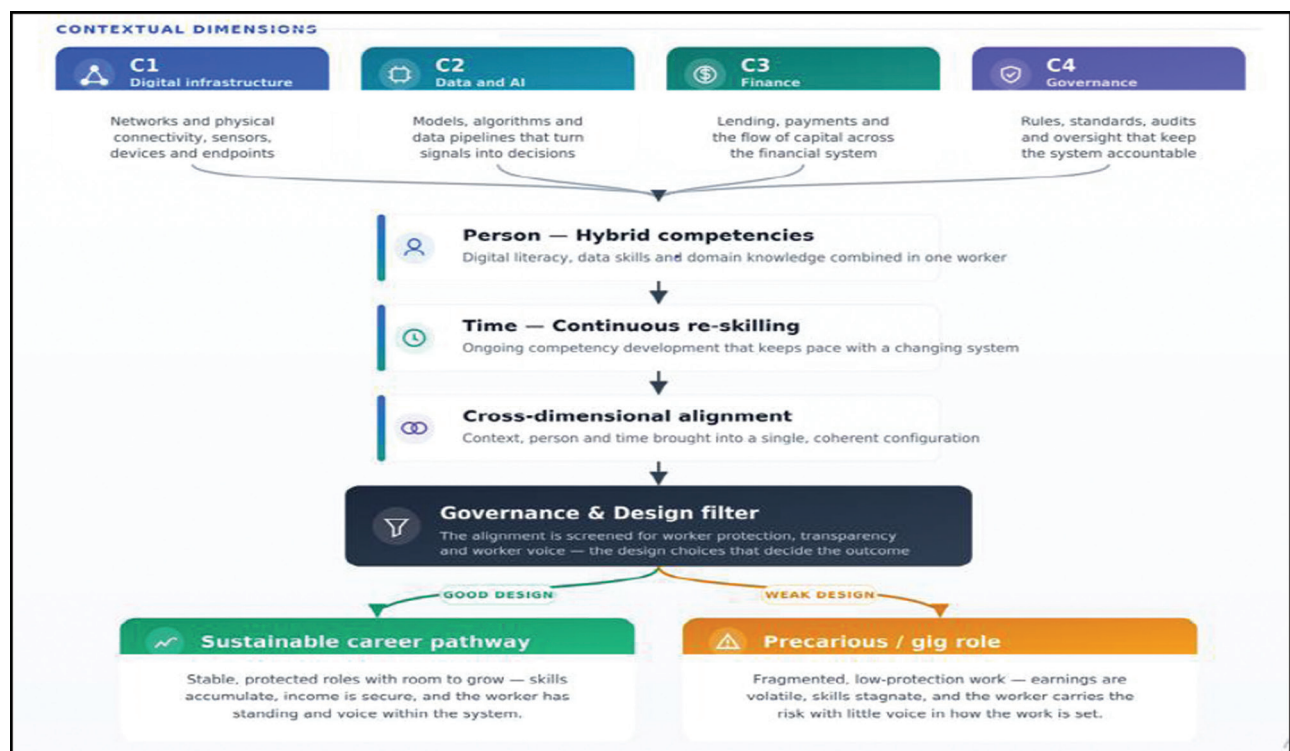


Figure 1. Person-context-Time model of AI-Driven, Agri-Fintech Career sustainability

Table 1. Person-context-Time model of AI-Driven, Agri-Fintech Career sustainability

Dimension	Component	Description	Key Mechanism
Context	C1- Digital infrastructure	Mobile/broadband connectivity, sensor networks, satellite/drone imagery, edge/cloud computing	Gating condition for C2–C3; without it, no hybrid roles can emerge locally
Context	C2-Data and AI	Algorithms, models, and data pipelines converting raw data into recommendations	Durable human-validation and local-translation roles
Context	C3-Finance	Digital lending, payments, parametric insurance, alternative credit-scoring	Trust-building intermediary roles between platforms and farmers
Context	C4-Governance	Data governance, algorithmic-bias auditing, consumer-protection regulation	Enables or constrains engagement with C2–C3; shapes equity of outcomes
Person	Hybrid competencies through employability	Digital literacy, data interpretation, entrepreneurial orientation, domain knowledge	Employability as mediating mechanism (Fugate et al., 2004)
Time	Continuous-skilling	Cumulative competency development amid shifting technology, products, and markets	Paces career sustainability across the working lifespan

The three dimensions intersect at the alignment node represented in Proposition 6, which then splits into a sustainable career pathway and a precarious, gig-ified position that is subjectively sustainable but lacks objective sustainability because of lack of employment protections or algorithmic transparency or worker voice. This visually represents the paper's central qualification an aligned, well-specified context is required but not sufficient, as in principle the same context can be structured to meet each structural requirement without the production of precarity.

3.2 The Context Dimension- Four Structural Conditions

C1-Digital Infrastructure- This condition involves mobile and broadband connectivity, sensor networks, satellite and drone imagery systems, and edge/cloud computing capacity. Because of its high level of heterogeneity (Mehrabi et al., 2021), it is also a gating condition, it is not possible for C2 (Data & AI) or C3 (Finance) to serve local functions without good connectivity, and without C2 or C3, none of the hybrid roles on which they rely can be realized.

Proposition 1 (P1): The number and diversity of AI-enabled Agri-FinTech career paths available to people in a local agricultural community is positively moderated by the density and quality of the local digital infrastructure, such that low-density, low-quality local digital infrastructure leads to limited career pathways, even with sophisticated AI or FinTech offerings.

C2 - Data and AI- This condition includes algorithms, models and data pipelines that transform raw agri- and financial data into recommendations. Local validation is also a typical requirement of the AI models used here, as farmers validate recommendations with field experience (Section 1.2), which creates a long term need for intermediary jobs like model validation technicians, local data annotators, agronomic "translators", etc., not to be completely eliminated by automation due to the role played by intermediary jobs.

Proposition 2(P2): The more local AI-driven recommendation systems such as the generative-AI advisory chatbots depend on context translation from the local to the global and/or require human validation, the more enduring the intermediary jobs involved will be against further automation, though their durability will diminish as foundation-model accuracy for a given crop-region pair increases.

C3- Finance- This condition includes digital lending platforms, payment systems, insurance products and credit-scoring algorithms, as described in Section 1.3. It creates career paths as in trust-based adoption studies (Köster et al., 2025) not only in the FinTech companies

themselves but more specifically in intermediary roles that foster farmer trust: community-based agri-fintech agents, digital-finance extension officers and cooperative-level finance facilitators.

Proposition 3(P3): Career pathways that are built around Agri-FinTech are more likely to be sustainable than are those that are built around Agri-FinTech as stand-alone digital applications, provided that the intermediary role is also defined and transparently governed to build trust, and is backed by employment-like protections, such as a base retainer, defined hours, or cooperative membership; where employment-like protections are absent, piece-rate or commission-only arrangements predict durability but do not necessarily predict subjective sustainability, as per De Vos et al. (2020), Section 3.5.

C4- Governance- This condition trumps the previous three-data governance rules, algorithmic-bias-auditing requirements and consumer protection rules. It is an enabling or constraining condition for the whole context, not a stage in itself, because, if it prevents farmers from engaging with C2 and C3 at all, or makes engagement with C2 and C3 unfair, it prevents the C2 and C3 from ever being engaged. Regardless of the level of development of C1-C3, weak governance can impede adoption or result in discriminatory outcomes.

Proposition 4 (P4): Strength and transparency of data-governance, algorithmic-bias-auditing and consumer-protection arrangements (C4) positively moderate the relationship between context maturity (C1-C3) and (a) the number of individuals that convert context participation into sustainable careers and (b) the equity of that conversion across gender and landholding status; governance effects are expected to be asymmetric, with strengthening weak governance producing larger equity gains than with strengthening already-strong governance.

3.3 Person Dimension- Hybrid competencies through employability

Sustainable engagement with this context demands a mix of digital competences, data interpretation, entrepreneurial orientation and domain-specific knowledge on agriculture, both agronomic and financial, which aligns with the research on digital-transformation-skills (Bouwman et al., 2022) but tailored to the agriculture sector. These competencies are developed by a variety of institutions including training programs, apprenticeship frameworks, and programs that support agripreneurship, and their absence will have a negative impact on career sustainability. Evidence on youth agripreneurship suggests that digital solutions are most effective when they combine aspects of finance, inputs, market access, and capacity development (S4YE, 2021).

The person dimension converts competency development to career sustainability through the capacity to continuously identify and pursue new career opportunities, which is called employability (Fugate et al., 2004). This paper, in contrast, does not consider employability as an unconnected construct side by side with institutional training investment, but rather as a mediating variable.

Proposition 5 (P5): Where (a) individual competencies in hybrids are developed, (b) institutional training and apprenticeship infrastructure are created, and (c) opportunities for continuous re-skilling exist, individual employability - which is a moderate positive function of the three dimensions - is a critical determinant of career sustainability (Fugate et al., 2004), and is a negative function when the three dimensions are not aligned on any dimension. This proposition is based on a minimum maturity level of C1-C3, and where there is no infrastructure or financial access (per P1), person-dimension investment is predicted to increase employability, but to not create the corresponding career-pathway opportunities, because there is no context in which employability is exercised.

3.4 The Time Dimension is Continuous Re-skilling

In this context, the time dimension is not defined by a moment of technology adoption but rather by the gradual evolution of hybrid competences over a working life. Later versions of sustainable careers theory also stress a lifelong career development process and the cross-over of various life domains (Van der Heijden et al., 2020): the re-skilling speed needed for continued employability is then a variable, which can be influenced by C1-C4.

3.5 An Integrative Proposition and a Boundary Condition on Precarity

Combined, P1-P5 suggest that sustainable career pathways do not result from single interventions such as rural broadband expansion or the launch of an Agri-FinTech application, but need to be developed simultaneously, across the three dimensions of career pathways theory (context, person and time).

Proposition 6 (P6): A career pathway that is structurally mature is not a prerequisite for sustainability; sustainability is achieved as a result of what is happening at the intersection, along the context (C1–C4), person and time continuum, where hybrid career pathway roles are structured with appropriate financial stability and worker voice, avoiding gig-ification, and where AI intelligence is matched with and reinforced by competency development.

As stated above, and as can be seen in the hybrid roles listed in Table 2, a number of the listed roles are very similar to gig or piece-rate employment as outlined in other sources. Accessibility of gig work through a platform also represents true flexibility as well as algorithmic control, income volatility, and the lack of typical employment rights and protections that would contribute to an understanding of sustainability in the De Vos et al. (2020) definition (Rani & Furrer, 2021; Wood et al., 2019). The community agents, who are paid by the referral of a successful loan, or the data-validation technicians who are brought in as short-term contractors, work in a structurally similar role: they are durable, and the need for their services is ongoing (P2 and P3, respectively), but not sustainable. The sustainability of a hybrid role or precarious gig depends on external to the tech governance and organizational design do

Table 2. Typology of Emergent Hybrid Career Roles

Role	Conditions	Core competencies	Evidence
Community Based Agri-FinTech Agent	C3, C4	Trust-building, basic financial literacy, local relationships	Köster et al. (2025); Mapanje et al. (2023)
Digital Credit-Scoring / Risk Officer	C2, C3, C4	Data science, algorithmic-bias auditing	Coots et al. (2025)
Model-Validation Technician / Agronomic Translator	C2	Local agronomic knowledge and data interpretation	Khanna et al. (2024)
GenAI Content Curator / Local Validator C2 Multilingual curation / quality assurance of AI advisory content Singh et al. (2024)	GenAI Content Curator / Local Validator C2 Multilingual curation / quality assurance of AI advisory content Singh et al. (2024)	GenAI Content Curator / Local Validator C2 Multilingual curation / quality assurance of AI advisory content Singh et al. (2024)	GenAI Content Curator / Local Validator C2 Multilingual curation / quality assurance of AI advisory content Singh et al. (2024)
Drone-Data Technician	C1, C2	Equipment operation, aerial-imagery interpretation	Klerkx et al. (2019)
Extension skills in combination with digital-finance literacy Extension Education Officer / Cooperative Facilitator	C3, C4	Extension skills combined with digital-finance literacy	Mapanje et al. (2023)

companies consider agents as employees or contractors; do platforms make their algorithms transparent and appeal mechanisms; do platforms have cooperative or union structures to aggregate worker voice? Therefore, P3 and P6 are specified conditionally: there must be a well-defined context that can then be linked to a gigified organizational model which meets all the structural conditions but not the subjective-sustainability condition at the heart of the theory.

While this typology is not a statement of fact, it is illustrative in a conceptual paper as it is meant to be; however, several typologies are cross referenced with documented, real-world deployments, not just speculative. Systematic occupational-classification research such as an exercise in emerging titles, or a job-posting analysis, as described in Section 4.5, is identified as a priority for confirming and refining this typology.

4. Discussion

4.1 Theoretical Contributions

This paper takes the sustainable careers theory's person–context–time framework (De Vos et al., 2020) beyond its predominantly organizational, urban, knowledge-economy context and applies it to a technologically mediated agricultural context, but does not distance itself from the theory's subject, subjective, meaning-making aspect by exclusively foregrounding the structural dimension. Prior scholarship on sustainable careers is based on the idea that career moves occur in various social places and life contexts (Van der Heijden et al., 2020), but has not yet identified the technological

and financial infrastructures linking these places in rural contexts, nor explored the potential for technologically mediated “opportunities” to be organized as precarious gig work. As the context dimension is disaggregated into four structural contexts and the mechanism between context and person-dimension outcomes is specified as employability, this paper demonstrates that context here is a layered structure brought about by multiple actors (technology developers, financial institutions, training providers, regulators), whose alignment has to be actively managed in order for career sustainability to become feasible at all. While similar accounts of prior technology-adoption and digital-innovation-ecosystems exist (e.g., Fielke et al., 2019; Wolfert et al., 2023), the present paper's contribution is that one, established theory of careers is enough to account for how that landscape gets translated into durable careers or not, without a second, competing theory.

4.2 Practical Implications

The model suggests that training institutions need to offer students courses addressing the hybrid competencies outlined in Section 3.3 digital literacy, data interpretation, entrepreneurial orientation, and domain knowledge along with continuous re-skilling mechanisms (Section 3.4) rather than single courses on digital literacy. Overall, the model suggests that investment in trust-building intermediary positions is as important as investment in digital products in the direct-to-farmer model, but may be even more important for the successful adoption and sustainable local careers of Agri-FinTech and AI-agriculture

Table 3. Operationalization of Proposition P1-P6

Proposition	Unit of Analysis	Measures	Conditions
P1.	Agricultural community / district	Mobile-broadband coverage classification; number of unique hybrid job titles	Non-linear: No hybrid positions below a minimum number; saturation above a maximum number
P2	Individual AI/advisory deployment	Proportion of AI recommendations routed through human review; retention/tenure of validation workers (3–5 yrs)	Weakens as foundation-model accuracy for a crop-region combination improves
P3	Individual in a C3 intermediary role	Role tenure; income-stability (coefficient of variation in monthly earnings); validated career-sustainability/employability self-report scales	Holds only where the role carries employment-like protections, not piece-rate/commission-only terms
P4	Regulatory jurisdiction	Composite governance-strength index (data protection, bias-audit requirements, consumer-protection capacity); gender/landholding gap in role conversion	Asymmetric (concave): greater gains to strengthen weak governance than strong governance
P5	Individual worker, training institution	Pre and post digital financial literacy assessments, density of apprenticeships, frequency of re-skilling touchpoints, employability scale (mediator)	(assumes a minimum floor of C1 – C3 maturity)
P6	Ecosystem/context as a whole	Composite alignment index across C1–C4, person, and time; worker-voice/income-stability index	Conditional on hybrid roles not being ‘gig-ified’, structuring

firms (Köster et al., 2025). However, section 3.5 notes that designing firms to run such jobs comes with a real choice between an employment-like mode which supports subjective sustainability and a piece-rate mode which could facilitate adoption to the same degree and create the same job-quality issues described in the gig-economy literature (Rani & Furrer, 2021) this is not an incidental outcome of scale, but rather a design choice. The model also makes clear that investments in infrastructure (C1) without the accompanying investment in training, as part of the person dimension (C4) (including the need for an algorithmic-bias-audit) are not enough: the model suggests that partial development, if technically possible, is not sustainable, as evidenced by the simultaneous need to invest in finance, inputs, market access, and capacity development in the context of agripreneurship investment; similar outcomes are expected for the investment in rural broadband and FinTech pilots.

4.3 Social Implications- Gender, Inclusion and youth employment

The model is especially relevant for financial inclusion, youth employment, and gender equity - rural women's access to the underlying factors that shape the model is limited long before they enter into a hybrid career position. Women in rural LMIC settings face measurable inequalities compared to men in their access to a smartphone or mobile Internet, even when mobile phones are nearly ubiquitous; a survey of smallholders in Uganda revealed that while nearly all households had a mobile phone, smartphone access was limited to about a third of respondents and inequalities stemmed from low digital literacy, time poverty, and access to a male family member's phone (Mulungu, 2025). This gap is an early filter on women's participation as C2 and C3 services are increasingly based on accessing the smartphone.

This adds to a longstanding challenge: women's weaker land rights and asset ownership in turn is also directly reflected, or used as a proxy, in alternative credit scoring models (Section 1.3). The Center for Financial Inclusion (2024) have both found that programs that focus on land tenure alone have led to less than desired outcomes of improving the day-to-day lives of tenants. This is particularly true with respect to C3 and C4, the extension of Agri-FinTech to women-credit-scoring algorithms must be audited for gender correlated bias and person-dimensional training must include explicit focus on digital-literacy and language barriers.

Concurrently, the relative lack of emphasis on land and capital ownership to the extent that they are foregrounded in the role, means that the same structure that can increase inequality in access to land and capital can offer a viable route for youth and women, as

community-based digital-finance agents or data-validation technicians, if these roles (and related training and governance processes) are not gigified, and the processes are deliberately inclusive (Section 3.5), a concern to which women in flexible, informal arrangements are singled out. Social outcomes are instead not technologically determined but are dependent on the design and governance of structural conditions in the model.

4.4 Risks and Critiques: Algorithmic Bias, Gigification, and Exclusion

The use of algorithmic bias to credit scoring is not an implementation problem, but a structural risk embedded in C3 in its current practice. Alternative data credit models can encode and amplify gender, geographic, or land-tenure-based exclusion because the distribution of these proxies for the digital footprint is uneven (Coots et al., 2025). The structural responses of the model are as follows: P4 introduces the capacity for bias-advetting into governance conditions; Table 3 envisions a measure of equity rather than just quantity of context-driven career and credit outcomes.

The gigification risk discussed in Section 3.5 suggests that the mix of hybrid roles identified here as this paper's main contribution to the labour market might just be a shift of job quality issues that are already documented among platform workers in the Global South to agriculture (Rani & Furrer, 2021; Wood et al., 2019). A reader thinking of any proliferation of hybrid roles as being a success in career sustainability is misusing the model; the claim is conditional (P3, P6) rather than unconditional. Similarly, the gender and youth entry points defined in 4.3 are not automatic, but can only happen within a certain governance context. Without conscious and intentional gender-inclusive design, current inequalities in rural access to infrastructure, land and digital literacy are likely to be passed on and even exacerbated by the market. Because of these risks, the social value of this model will not be a part of its conclusions, but rather an empirical and governance-contingent question, exercised through the measures of equity described in Table 3.

4.5 Limitations and Future Research Agenda

Like all conceptual papers, it is necessary to test this model and its propositions empirically. The literature base is triangulated, when possible, but is still deficient of the 60-100 sources that is typical of Q1 conceptual papers in this space, the next step will be a dedicated PRISMA-style systematic scoping review which will build on the search protocol outlined in Section 2.

The structure of the model gives rise to several more priorities. Proposition 1 would be tested in the first step

by comparative case studies across contexts where digital infrastructure maturity (C1) is different, which would investigate whether diversity of career-pathways changes according to the local maturity of digital infrastructure (Mehrabani et al., 2021). Second, longitudinal studies that track workers as they move into hybrid positions would enable direct measurement of the extent to which hybrid work arrangements are sustainable in the sense of De Vos et al. (2020): whether they lead to enduring, meaningful patterns or are transitional and precarious (Table 3), along with a measurement of indicators of worker voice and income stability. Third, future research should test P4 by empirically comparing governance conditions (C3), in particular regulatory environments that vary in data-protection and bias-audit regimes, with algorithmic audit studies similar to those in fintech lending, modelled after those conducted by Coots et al., 2025, but focused on agricultural credit-scoring products. Fourth, further comparative studies need to be conducted to determine if the model's predictions are confirmed, adjusted or differently weighted in the highly capitalized large-scale commercial farms of high-income countries. Fifth, the gender and youth aspects should be the subject of further empirical investigation, which builds on the evidence gathered so far on digital solutions for young agripreneurs (S4YE, 2021), training for rural digital-entrepreneurship (Bouwman et al., 2022), and gender gaps in mobile access (Mulungu, 2025). Sixth, this paper relies on an existing body of literature when building the occupational typology, so the typology should be viewed as illustrative; systematic occupational-classification research (job-posting analysis) would improve the typology.

5. Conclusion

This paper aimed to fill a gap in the literature that connects digital agriculture, financial technology and career theory, namely the digital agriculture and financial technology is transforming the way agriculture is organised and financed, but there is limited theory to guide sustainable career pathways for people working in this sector. This paper established a person–context-time model based on the theory of sustainable careers (De Vos et al., 2020; Van der Heijden & De Vos, 2015), which specifies that the technological and financial environment for AI-driven agriculture (AI context) forms a multi-actor context of digital infrastructure, data and AI intelligence, financial intermediation, and governance and trust, in interaction with individual hybrid competencies and continuous re-skilling, to determine the sustainability of a career.

The model's core theoretical proposition, stated in six propositions, is that the emergence of sustainable career pathways with this domain is an emergent phenomenon,

the result of aligning across person, context, and time dimensions of a single established theory, not the result of any single technological, financial, or educational intervention, and that this alignment is achieved through governance choices that either lead to genuine sustainability or a well-aligned but gigified pathway alternative (Section 3.5). In this re-framing of career sustainability in the digital agriculture, it becomes clear that complementary capabilities will need to be developed at the infrastructure provider, algorithmic-bias auditor, AI developer, FinTech, training provider and regulator levels for careers to remain sustainable and equitable over time in the rural context, if they are to be sustainable at scale. The model provides a testable application of theory of sustainable careers to a new arena for scholars, as well as a set of falsifiable propositions for practitioners and policy makers, who can use it as a diagnostic tool to understand the structural condition that currently prevents the conversion of digital agriculture investments into durable rural livelihoods and as a risk checklist (algorithmic bias, gigification, gendered exclusion - Section 4.4) to assess whether the conversion is taking place equitably. The governance-aware design of this model seeks to create sustainable and inclusive careers, not only efficient infrastructure and precarious work, and this will be critical for AI-driven Agri-FinTech as it spreads to the Global South and beyond.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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Smart Agricultural Innovations for Resource-Efficient and Sustainable Farming

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 25-Sep-26

ACCEPTED: 05-Oct-26

PUBLISHED: 15-Oct-26

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Citation: N. Narasimha Raju, D. Abhishek, K. Jaswanth, P. Bhanu Prasad and B. Hima Chandra (2026). Smart Agricultural Innovations for Resource-Efficient and Sustainable Farming. Horizon J. Hum. Soc. Sci. Res. 8 (S), 153–162. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1404.p153>



ABSTRACT

Purpose: Resource constraints in water, energy, and land, combined with rising food demand, are pushing agricultural systems worldwide toward technology-enabled, resource-efficient practices. While much existing literature examines these smart agricultural innovations from an engineering standpoint, their adoption, scaling, and impact are ultimately shaped by economic, entrepreneurial, and social forces. This review synthesises literature on smart agricultural innovations through a social-science lens, focusing on adoption behaviour, agripreneurship, financial inclusion, gender and rural equity, and policy design. Design/Methodology/Approach: A narrative literature review was conducted, drawing on peer-reviewed journal articles, systematic reviews, and reports from international development agencies published between 2019 and 2026, identified through targeted searches of academic databases and institutional repositories using keywords related to smart farming, precision agriculture, agripreneurship, digital agriculture, and rural financial inclusion. Findings: Four cross-cutting themes emerged: (1) technology adoption is governed less by technical performance than by cost, trust, and contextual fit; (2) agripreneurship and youth-led rural enterprise depend on bundled access to finance, training, and market linkages rather than technology alone; (3) gender and the rural digital divide remain structural barriers to equitable adoption; and (4) government-led digital public infrastructure is emerging as a decisive enabler of inclusive scaling. Practical/Social Implications: The findings suggest that policy and investment should prioritise ecosystem-level enablers, financing, digital literacy, and inclusive design, over standalone technology deployment. Originality: The review contributes an integrated, socially grounded framework for understanding smart agricultural innovation as a rural development and entrepreneurship issue rather than a purely technical one.

Keywords: Agripreneurship; Digital Agriculture; Financial Inclusion; Precision Agriculture; Resource Efficiency; Sustainable Farming

1. Introduction

Agriculture sits at the intersection of two mounting pressures: the need to produce substantially more food for a growing global population, and the need to do so while consuming markedly less water, land, and energy. Farmland expansion has slowed even as the number of

farms feeding the world has grown more concentrated among fewer, larger operations in some regions, while remaining fragmented among hundreds of millions of smallholders elsewhere (Lowder et al., 2021). This structural diversity means that no single technological fix can deliver resource efficiency uniformly across

global agriculture. Instead, the past decade has seen the emergence of a broad family of smart agricultural innovations, precision sensing, satellite and drone-based monitoring, artificial intelligence (AI)-enabled decision support, automated irrigation, and digital farm management platforms, that promise to reconcile productivity with sustainability by matching resource use precisely to crop and field-level need.

Much of the existing scholarship on these innovations approaches them from an engineering or agronomic perspective, evaluating sensor accuracy, irrigation efficiency, or yield gains under controlled conditions. This technical literature is valuable, but it is not sufficient to explain why smart agricultural technologies that perform well in trials frequently fail to scale in practice. A recurring finding across recent reviews is that adoption, or its absence, is driven overwhelmingly by economic, institutional, and social factors: the cost of technology relative to smallholder income, the availability and terms of credit, the trust farmers place in unfamiliar recommendations, the digital literacy and connectivity available in rural areas, and the presence or absence of policy support (Bashiru et al., 2024; Finizola e Silva et al., 2024; John et al., 2023). In other words, smart agriculture is as much a social and economic phenomenon as it is a technical one, and understanding it requires a lens grounded in the humanities and social sciences rather than in engineering alone.

This concern is particularly salient given that the large majority of the world's farms are smallholdings of two hectares or less, operated by households for whom agriculture is inseparable from livelihood, entrepreneurship, and intergenerational opportunity (Lowder et al., 2021). For these households, the decision to adopt a sensor, a mobile advisory service, or a drone-spraying subscription is not merely a technology choice; it is an entrepreneurial and financial decision made under conditions of limited capital, uncertain returns, and, in many regions, unequal access to land, credit, and information along gender lines (FAO, 2023). Understanding smart agricultural innovation therefore requires attention to agripreneurship, the emergence of technology-enabled rural enterprise, to financial inclusion, and to the structural barriers, including the gendered digital divide, that shape who can participate in this transition and who is left behind.

This review addresses that gap by synthesising literature on smart agricultural innovations through an explicitly social-science lens. Rather than cataloguing the technical specifications of individual tools, it asks: what economic, entrepreneurial, and institutional conditions determine whether resource-efficient farming technologies are adopted, sustained, and scaled

equitably? In pursuing this question, the review draws together four bodies of literature that are often treated separately: technology adoption studies in agricultural economics, agripreneurship and rural enterprise research, financial inclusion and rural credit scholarship, and gender and digital-divide literature, before considering how government-led digital public infrastructure is beginning to reshape the landscape in which all of these dynamics play out, using India's ongoing digital agriculture reforms as an illustrative case. The remainder of the paper proceeds as follows: the next section situates the review within existing conceptual and theoretical work; this is followed by the review methodology; the results section presents a thematic synthesis of the literature; the discussion interprets these themes in relation to one another; and the paper closes with conclusions, implications, and limitations.

2. Literature Review and Conceptual Framework

2.1 *Technology Adoption in Smallholder and Commercial Agriculture*

A substantial body of research has examined why farmers adopt, or fail to adopt, precision and smart farming technologies. Reviewing systematic literature on precision agriculture adoption among small-scale farmers, John et al. (2023) identified cost, farm size, access to technical support, and supporting policy as the dominant factors governing uptake, concluding that technologies delivering clearly demonstrable and near-term economic benefit are far more likely to be adopted than those whose payoff is diffuse or delayed. This finding is echoed in qualitative work among small-scale commercial family farms in China, where Kendall et al. (2022) found that adoption decisions were shaped less by the technical sophistication of a tool than by farmers' trust in the information it produced and its compatibility with existing routines and social networks.

At the sub-Saharan African level, Bashiru et al. (2024) conducted a systematic review following PRISMA procedures across 48 eligible studies and found that most smart farming technologies being actively promoted to smallholders remain conventional climate-smart agricultural practices, such as land and water management and improved varieties, rather than the more advanced fourth-industrial-revolution innovations, including automation, the Internet of Things, and artificial intelligence, that dominate discussions of smart agriculture in higher-income contexts. Farmers' own responses to promoted technologies were found to be shaped heavily by socioeconomic circumstance and by the extent to which new tools could be layered onto existing indigenous knowledge rather than replacing

it outright. In a related systematic review focused specifically on climate-smart agriculture, Finizola e Silva et al. (2024) categorised the drivers and barriers to adoption across personal, farm-related, financial, environmental, and informational dimensions, concluding that access to credit in particular has a consistently positive and significant association with adoption across multiple African contexts, since credit access expands farmers' capacity to absorb the transaction, equipment, and input costs associated with new practices.

A parallel line of research has examined digital agriculture ecosystems more broadly, that is, not individual devices but the surrounding platforms, connectivity, and business models required to make digital tools usable by smallholders. Gumbi et al. (2023), in a systematic review of digital agriculture for smallholder farmers, found that the dominant barriers reported in the literature concern digital infrastructure, affordability, and digital literacy or skills, and that research specifically addressing business-model innovation, that is, how digital agriculture services can be priced and delivered sustainably to low-income users, remains comparatively underdeveloped. This is a significant gap, since it suggests that even where digital tools exist, the absence of viable, farmer-appropriate delivery models constitutes an independent barrier distinct from the cost of the technology itself.

2.2 Agripreneurship and Rural Enterprise

A second relevant literature concerns agripreneurship, broadly defined as entrepreneurial activity that applies innovation, including but not limited to digital technology, to agricultural production, processing, or service delivery. This literature intersects with, but is analytically distinct from, the technology-adoption literature discussed above, because it treats the farmer or rural youth not simply as a technology user but as a potential enterprise founder or operator. Within this framing, technology adoption becomes one input among several, alongside access to finance, market linkages, and business skills, that determines whether a rural enterprise succeeds. Reviews of youth-led agribusiness in developing-country contexts consistently emphasise that technical training alone is insufficient without complementary access to financial services, expanded market opportunities, and supportive policy frameworks that address cross-cutting constraints such as gender inequality and social exclusion, a conclusion reflected in continental strategies such as the African Union's youth agribusiness policy architecture spanning 2017 to 2026.

This body of work suggests that smart agricultural technologies are best understood, from an entrepreneurship perspective, as enabling infrastructure for rural enterprise rather than as an end in themselves.

A drone survey service, a sensor-based advisory subscription, or a digital marketplace platform each represents both a productivity tool for existing farmers and a potential micro-enterprise opportunity for rural youth who can be trained to operate, maintain, or resell access to these technologies within their communities. This dual framing, technology as productivity tool and technology as entrepreneurial opportunity, has important implications for how policy and investment should be designed, a point returned to in the discussion.

2.3 Financial Inclusion, Credit Access, and Rural Investment

Access to finance is repeatedly identified across the reviewed literature as a precondition for, rather than a consequence of, smart agricultural technology adoption. Evidence reviewed by the Food and Agriculture Organization's Investment Centre indicates that access to credit, and particularly microloans, enables farmers to invest in new technology and inputs, access new markets, and increase productivity, but that adoption of financial products in turn depends on liquidity, awareness, and social dynamics within farming communities (FAO Investment Centre, 2025). This creates a structural challenge: the farmers who stand to benefit most from resource-efficient technologies, those operating on the thinnest margins, are often the least able to access the credit needed to adopt them, a pattern that risks reproducing existing inequality between well-capitalised and resource-constrained farms even as smart agriculture technologies proliferate.

Financial exclusion in agriculture has historically been reinforced by conventional lending models that require collateral such as titled land, a requirement that disproportionately excludes women, tenant farmers, and youth who frequently lack such assets even where they perform the majority of agricultural labour (FAO, 2023). In response, alternative and technology-enabled financing models, including mobile-based credit scoring drawing on farm transaction and cash-flow data rather than land title, have begun to emerge as a mechanism for extending credit to previously excluded groups, though evidence on their long-run effectiveness remains mixed and context-dependent. The broader implication for this review is that resource-efficient farming technologies cannot be evaluated in isolation from the financial ecosystem that determines who can afford to adopt them.

2.4 Gender, the Rural Digital Divide, and Structural Exclusion

Gender inequality constitutes one of the most persistent and well-documented barriers to equitable

participation in agricultural innovation. Women perform a substantial share of agricultural labour worldwide, yet in many regions hold weaker land use and ownership rights than men, and continue to face unequal access to inputs, extension services, and finance (FAO, 2023). This structural disadvantage is compounded by a digital gender gap: women in low- and middle-income countries remain measurably less likely than men to own a smartphone or access mobile internet, which limits their ability to benefit from mobile-based advisory services, digital marketplaces, and mobile financial products that increasingly underpin smart agricultural ecosystems. Recent World Economic Forum analysis argues that closing this gap requires deliberately gender-intentional design of digital public infrastructure, including anonymised, gender-disaggregated data collection and interface design, such as multilingual translation platforms, that explicitly account for the access barriers women farmers face (World Economic Forum, 2025). Field initiatives such as the partnership between Maharashtra's state women's economic development corporation and international development actors to expand women farmers' access to digital agriculture illustrate both the scale of the opportunity, given that women constitute a majority of India's agricultural workforce, and the deliberate institutional effort required to realise it (World Economic Forum, 2023).

Taken together, this literature indicates that the digital and financial exclusion of women and youth in agriculture is not a side issue to be addressed after core technology deployment, but a structural feature of the adoption landscape that determines, from the outset, who is positioned to benefit from smart agricultural innovation and who is not.

2.5 Conceptual Framework

Drawing on the literature reviewed above, this paper adopts an ecosystem-based conceptual framework in which smart agricultural innovation is understood not as a discrete technology but as the interaction of four layers: a technology layer (sensing, AI, automation, and digital platforms); an economic layer (cost structures, credit access, and financing models); a social layer (gender, land tenure, digital literacy, and rural entrepreneurship); and an institutional layer (government policy, digital public infrastructure, and extension systems). Within this framework, resource-efficiency outcomes, reductions in water, fertiliser, energy, or labour use, are treated as emerging from the interaction of all four layers rather than from the technology layer alone. A technology that performs well on the technical layer but is unaffordable on the economic layer, incompatible with existing gender norms on the social layer, or unsupported by extension

services on the institutional layer is unlikely to achieve meaningful resource-efficiency outcomes at scale. This framework guides the thematic synthesis presented in the results section.

3. Methodology

This study adopts a narrative literature review design, appropriate for synthesising a conceptually diverse and rapidly evolving body of literature spanning agricultural economics, entrepreneurship, development studies, and information systems research, where a narrow systematic-review protocol restricted to a single discipline or outcome measure would exclude much of the relevant social-science literature. The review followed a structured, though not formally registered, search and selection process to maintain transparency and reduce selection bias.

3.1 Search Strategy and Sources

Literature was identified through targeted searches of academic search engines and publisher databases (including Google Scholar, MDPI, Springer, ScienceDirect, SAGE Journals, and Frontiers), supplemented by reports and policy documents from international development organisations, including the Food and Agriculture Organization of the United Nations, the World Bank, and the World Economic Forum, and by official government publications relevant to India's digital agriculture policy. Search terms combined core concepts using Boolean operators, including combinations of "smart farming," "precision agriculture," "climate-smart agriculture," "digital agriculture," "agriprenurship," "rural entrepreneurship," "agricultural credit," "financial inclusion," "gender digital divide," and "technology adoption," each paired with terms denoting smallholder or developing-country contexts. The search was restricted to English-language sources published between 2019 and 2026 to ensure relevance to the current state of digital and precision agriculture technology, while allowing inclusion of a small number of earlier foundational sources on farm structure and financial inclusion where directly relevant.

3.2 Screening and Selection Criteria

Sources were included if they (a) addressed smart, precision, climate-smart, or digital agricultural technologies; (b) engaged substantively with economic, entrepreneurial, financial, gender-related, or policy dimensions of adoption or impact, rather than purely technical or agronomic performance; and (c) were published in a peer-reviewed journal, or issued by a recognised international development, government, or research institution. Sources were excluded if they were

purely engineering-focused technical evaluations with no discussion of adoption, economic, or social dimensions, or if they could not be verified against a traceable original publication. Priority was given to systematic reviews and meta-analyses where available, as these aggregate findings across larger underlying evidence bases than individual primary studies.

3.3 Analytical Approach

Selected sources were read in full and coded thematically using the four-layer conceptual framework outlined in Section 1.5 as an initial coding structure, which was then refined inductively as recurring sub-themes, adoption drivers and barriers, agripreneurship and enterprise models, financial inclusion mechanisms, and gender and digital-divide dynamics, emerged across sources. This thematic synthesis approach is well suited to review questions concerned with explaining a phenomenon (why adoption succeeds or fails) rather than quantifying its magnitude, and is consistent with established narrative and thematic review practice in the social sciences. The results are organised around these themes in the following section.

4. Results

The thematic synthesis of the reviewed literature yielded four principal findings, presented below, each corresponding to one layer of the conceptual framework introduced in Section 1.5.

4.1 Adoption Is Governed by Economic Fit, Not Technical Performance

Across every adoption-focused study reviewed, technical performance emerged as a necessary but insufficient condition for adoption. John et al. (2023) found that farm size, cost, access to technical support, and policy support were the dominant determinants of precision agriculture adoption among small-scale farmers, a pattern corroborated by Kendall et al. (2022), who found that Chinese family farmers weighed a technology's compatibility with existing routines and social trust networks as heavily as its technical claims. Bashiru et al. (2024) similarly found that, despite the availability of advanced fourth-industrial-revolution technologies, sub-Saharan African smallholders overwhelmingly continue to adopt conventional, lower-cost climate-smart practices, indicating a persistent gap between the technologies being promoted by researchers and private firms and those farmers can realistically absorb given their economic circumstances. Gumbi et al. (2023) extended this finding to digital agriculture platforms specifically, concluding that affordability and the absence of viable business

models tailored to smallholder economics, rather than a lack of underlying digital solutions, constitute the primary constraint on digital agriculture uptake.

4.2 Agripreneurship Depends on Bundled, Not Standalone, Support

The reviewed agripreneurship literature converges on the finding that youth-led and technology-enabled rural enterprise succeeds only where technical exposure is bundled with financing, market access, and mentorship, rather than delivered as a standalone technology intervention. Continental and national youth agribusiness strategies reviewed in this literature explicitly combine access to financial services with expanded market opportunities, climate-smart technology promotion, and attention to gender and social exclusion as interdependent pillars, rather than treating technology adoption as a sufficient intervention on its own. This suggests that smart agricultural technologies function most effectively as entrepreneurial infrastructure when embedded within a wider enterprise-support ecosystem, a finding directly relevant to policy design, discussed further below.

4.3 Financial Exclusion Constrains Adoption Among Those Who Would Benefit Most

Findings across the financial inclusion literature indicate a structural mismatch between need and access: farmers operating on the thinnest margins, who stand to gain the most from resource-efficient technology, are frequently the least able to access the credit required to adopt it. The FAO Investment Centre (2025) review found that credit access, particularly through microloans, enables investment in technology, inputs, and market access, but that uptake of financial products depends on liquidity and social dynamics that are themselves shaped by existing inequality. Collateral-based lending models, which require assets such as titled land that women and tenant farmers frequently lack, compound this exclusion (FAO, 2023). The literature reviewed suggests that alternative, technology-enabled credit-scoring approaches represent a promising but still-maturing response to this constraint, rather than a fully resolved solution.

4.4 Gender and Digital Exclusion Remain Structural, Not Incidental, Barriers

The gender and digital-divide literature reviewed indicates that women's lower access to land rights, extension services, and mobile technology is not an isolated or incidental barrier but a structural feature of the agricultural innovation landscape that shapes adoption outcomes across every other theme identified

in this review (FAO, 2023). Because women constitute a majority of the agricultural workforce in a number of major farming economies, their exclusion from digital and financial innovation represents not a marginal equity concern but a first-order constraint on the aggregate resource-efficiency gains that smart agriculture can realistically deliver at national scale. The World Economic Forum (2025) argues that closing this gap requires deliberately gender-intentional design of digital public infrastructure from the outset, rather than retrofitting inclusion into systems designed without it, a conclusion supported by field-level initiatives explicitly targeting women farmers' access to digital agriculture platforms in states such as Maharashtra, India (World Economic Forum, 2023).

4.5 Digital Public Infrastructure Is Emerging as a Decisive Institutional Enabler

A final and increasingly significant theme concerns the role of government-led digital public infrastructure in shaping the conditions under which the preceding three dynamics play out. India's Digital Agriculture Mission, approved with a central government outlay in the range of several thousand crore rupees, illustrates this institutional layer in practice. Its core components include AgriStack, a shared digital identity and land-record system for farmers modelled on the country's existing digital identity infrastructure, a nationwide Digital Crop Survey combining satellite imagery and artificial intelligence for crop area estimation, and a Krishi decision-support system providing AI-based advisory services in multiple regional languages (Press Information Bureau, Government of India, 2024). By linking farmer identity, land records, and crop data into a single interoperable system, this infrastructure is designed to streamline farmers' access to credit, insurance, and subsidy schemes that have historically been constrained by fragmented documentation and verification processes, directly addressing the financial-exclusion barrier identified in Theme 3.3. At the same time, commentary on the initiative cautions that reliance on formal land-ownership records risks excluding tenant farmers and sharecroppers who lack registered tenancy documentation, illustrating that digital public infrastructure, if not deliberately designed for inclusion, can reproduce rather than resolve existing structural exclusion. This tension between infrastructure as an enabler of inclusion and infrastructure as a potential new gatekeeper recurs across the broader digital agriculture literature and is addressed further in the discussion.

5. Discussion

The results presented above point to a consistent underlying pattern: the technical capability of smart

agricultural innovations has, in most of the contexts reviewed, outpaced the economic, entrepreneurial, and institutional infrastructure required to translate that capability into equitable, scaled resource-efficiency outcomes. This pattern echoes the broader argument that transformative change in agri-food systems is achieved not through isolated technological breakthroughs but through the deliberate bundling of innovations, financing, and institutional support into coherent packages suited to local conditions (Barrett et al., 2022). The findings of this review extend that argument specifically to the social dimensions of smart agriculture: bundling, in the cases reviewed, must include not only complementary technologies but also credit products, entrepreneurship training, and gender-intentional design if resource-efficiency gains are to reach the smallholders, women, and rural youth who make up the majority of the world's farming population.

This has a direct implication for how the relationship between agripreneurship and technology adoption should be understood. Rather than treating rural youth and women primarily as technology adopters whose behaviour is to be encouraged or nudged, the agripreneurship literature reviewed here suggests they are more productively understood as potential technology intermediaries and enterprise operators, individuals who can be supported to build small businesses around drone spraying services, sensor installation and maintenance, or digital advisory subscriptions within their own communities. This reframing shifts the appropriate unit of policy intervention from the individual farm household to the local rural enterprise ecosystem, a shift broadly consistent with the finding that youth agribusiness strategies succeed only when technology promotion is combined with financial and market-access support rather than delivered in isolation.

The financial inclusion findings similarly suggest that policy and investment aimed at expanding smart agriculture adoption should prioritise de-risking credit for smallholders, women, and youth ahead of, or at minimum alongside, direct technology subsidies. Where credit remains collateral-based and inaccessible to those without titled land, even a fully subsidised technology may fail to reach its intended users because complementary inputs, maintenance, or working capital remain unaffordable. The cautious optimism found in the literature regarding alternative, transaction-based credit scoring reflects a genuine but still-unproven pathway around this constraint, one that merits continued monitoring rather than uncritical promotion.

The case of India's Digital Agriculture Mission illustrates both the promise and the risk inherent in the institutional layer of the conceptual framework. On one

hand, a unified, interoperable digital identity and land-record system has clear potential to resolve long-standing frictions in credit, insurance, and subsidy delivery that have historically disadvantaged smallholders, a direct institutional response to the financial-exclusion theme identified above. On the other hand, the same infrastructure, if built around formal land title as its foundational credential, risks systematically excluding the tenant farmers, sharecroppers, and, disproportionately, women who lack such documentation, precisely the groups identified throughout this review as facing the most acute barriers to begin with. This suggests that digital public infrastructure for agriculture is not inherently inclusive or exclusionary; its distributional effects depend entirely on design choices made at the outset, reinforcing the World Economic Forum's (2025) argument that gender- and equity-intentional design must be built into digital agricultural infrastructure from its foundation rather than added retrospectively.

Taken as a whole, these findings support a reframing of "smart agriculture" away from a primarily technological category and toward a primarily institutional and entrepreneurial one. The central research and policy question this review surfaces is not which sensor, algorithm, or platform performs best under trial conditions, but which combination of financing, training, and infrastructure design allows a given technology to reach, and be sustainably used by, the farmers, entrepreneurs, and communities for whom it is intended.

6. Conclusion

This review set out to examine smart agricultural innovations for resource-efficient and sustainable farming through a social-science lens, focused on adoption behaviour, agripreneurship, financial inclusion, and gender and institutional equity, rather than through a purely technical or agronomic framing. The synthesis of literature across these domains indicates that the primary constraints on the scaled, equitable adoption of resource-efficient farming technologies are economic and institutional rather than technical: cost relative to smallholder income, access to credit, digital and gender-based exclusion, and the design of surrounding policy and infrastructure. Agripreneurship emerged as a particularly important but underutilised framing, one that repositions rural youth and women not merely as technology users to be persuaded but as potential enterprise operators around whom local, technology-enabled rural economies can be built. The case of India's Digital Agriculture Mission demonstrates that government-led digital public infrastructure is becoming a decisive variable in this landscape, capable of either resolving or reinforcing

existing patterns of exclusion depending on how deliberately inclusion is designed into its foundations. Overall, the review supports the conclusion that achieving resource-efficient, sustainable farming at scale requires treating smart agricultural technology as one component of a broader socio-economic ecosystem, rather than as a self-sufficient solution.

6.1 Implications of the Study

The findings of this review carry several implications for policymakers, development practitioners, financial institutions, and researchers concerned with agricultural innovation. For policymakers, the results suggest that public investment in smart agriculture should be evaluated not solely on the technical merits of the technologies being promoted but on the extent to which complementary financing, extension, and infrastructure are in place to enable their use by the smallholders, women, and youth who make up the majority of the farming population. A subsidy or distribution programme for sensors, drones, or digital advisory platforms is unlikely to achieve its intended resource-efficiency outcomes if it is not accompanied by parallel investment in affordable credit and digital literacy training, since the review indicates that these factors, rather than the technology itself, most frequently determine whether adoption occurs and is sustained. This implies a need for closer coordination between ministries or departments responsible for agriculture, rural finance, and digital infrastructure, which in many contexts continue to operate as separate policy silos despite the interdependence documented throughout this review.

For development practitioners and non-governmental organisations working in rural entrepreneurship, the review's agripreneurship findings suggest that technology-focused interventions are likely to have greater and more durable impact when designed explicitly as enterprise-support programmes, combining technical training with access to start-up finance, mentorship, and market linkages, rather than as one-off technology distribution or awareness campaigns. This is particularly relevant for programmes targeting rural youth, for whom the entrepreneurial framing offers a pathway to income generation that a purely productivity-oriented framing does not. For financial institutions, the review highlights a significant and only partially served market opportunity in designing credit products that do not depend on collateral inaccessible to women, tenant farmers, and youth, an area in which technology-enabled, transaction-based credit scoring shows promise but requires further institutional investment and regulatory support to mature into a reliable alternative to conventional lending. Finally,

for researchers, the review points to the continued need for interdisciplinary work that bridges agricultural engineering, economics, and gender studies, since the evidence reviewed here suggests that the technical and social dimensions of smart agriculture are empirically inseparable in determining real-world outcomes, even though they are frequently studied in isolation from one another within disciplinary silos. Institutions engaged in applied data-science and social-impact training are well positioned to contribute to this interdisciplinary research agenda, including through the kind of student-led review work presented here.

6.2 Limitations and Recommendations for Future Research

This review is subject to several limitations that should be considered when interpreting its findings. First, as a narrative rather than a formally registered systematic review, the source selection process, while structured and transparent, was not exhaustive and may not capture the full universe of relevant literature, particularly non-English-language sources and unpublished grey literature from national agricultural research systems, which may under-represent country-specific dynamics not covered in the international peer-reviewed literature consulted here. Second, the review synthesises evidence drawn primarily from sub-Saharan Africa, South and Southeast Asia, and India, reflecting the concentration of the underlying adoption and financial-inclusion literature in these regions; findings may not generalise fully to smallholder contexts in Latin America or to commercial farming contexts in high-income economies, which follow substantially different adoption pathways not explored in depth here. Third, because India's Digital Agriculture Mission is a recently launched and still-evolving initiative, the discussion of its institutional implications is necessarily based on programme design documents and early implementation reports rather than on long-term outcome evaluation, and its distributional effects, particularly for tenant farmers and women, should be treated as a hypothesis for future empirical testing rather than an established finding.

Future research would benefit from primary empirical studies that directly test the bundling hypothesis advanced in this review, for example, through comparative evaluation of technology-only interventions against technology-plus-financing-plus-training interventions among otherwise similar smallholder or youth agripreneur populations, to establish more rigorously whether bundled delivery produces materially better adoption and livelihood outcomes than standalone technology distribution. Longitudinal research tracking the gender-disaggregated outcomes of digital public infrastructure

programmes such as India's Digital Agriculture Mission, once sufficient implementation data become available, would also make a valuable contribution, allowing researchers to test empirically whether such infrastructure narrows or widens existing rural gender and tenancy-based inequalities as it scales. Finally, given the concentration of existing evidence in a relatively small number of countries, future comparative research across a wider range of agricultural and institutional contexts would strengthen the generalisability of the ecosystem-based conceptual framework proposed in this review.

Acknowledgements

The authors gratefully acknowledge the guidance and support of the faculty co-authors during the preparation of this manuscript.

Funding

The authors declare that they received no financial support for the research, authorship, and/or publication of this article.

Declaration of Conflicting Interests

The authors declare that they have no competing interests.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the author(s) used an AI-assisted tool (Claude, Anthropic) to assist with literature search, thematic organisation, and language drafting. All AI-assisted content was reviewed, verified against original sources, and edited by the author(s), who take full responsibility for the accuracy and originality of the final manuscript.

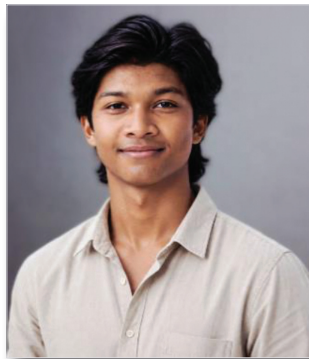
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Climate Risk Insurance for Farmers in India: Effectiveness, Gaps and Emerging Technology

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 25-Sep-26

ACCEPTED: 05-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Mallepally Greeshma and Idemakanti Chandrakanth Reddy (2026). Climate Risk Insurance for Farmers in India: Effectiveness, Gaps and Emerging Technology. Horizon J. Hum. Soc. Sci. Res. 8 (S), 163–169. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1405.p163>



ABSTRACT

Agricultural productivity and incomes are greatly affected by the variability of climate conditions and the occurrence of extreme weather, which are also especially damaging for small and marginal farmers. Climate risk insurance helps to transfer parts of the risk and improve financial resilience of farmers. This paper explores the effectiveness of agricultural climate risk insurance and its key gaps, paying special attention to India. The research is based on the existing secondary literature, government reports, and available evidence, with PMFBY scheme in India used as an example of agricultural climate risk insurance in the country and IBLI project in East Africa as a comparison tool. Basis risk, delayed claims, lack of awareness of farmers, data problems, affordability, and institutional coordination are among the main barriers. New technologies such as remote sensing, YES-TECH, WINDS, and claims through smartphone are possible options for improving insurance. Technology alone is not enough for proper functioning of agricultural climate risk insurance; suitable products, settlements, good data, and farmers' involvement are also necessary.

Keywords: Climate risk insurance; PMFBY; crop insurance; basis risk; index insurance; smallholder farmers; remote sensing; agricultural risk management

1. Introduction

Agriculture is highly vulnerable to climate and weather-related risks such as droughts, floods, cyclones, heat stress, and unpredictable rains. Such events may result in reduced yield, lower farm incomes, and low household resilience, especially for smallholder and marginal farmers due to their low ability to cope with repetitive losses. The IPCC recognizes climate-related extremes as a key risk to agricultural production and food security and uses insurance as a financing mechanism for climate-related risks (IPCC, 2022).

Increasing frequency and intensity of disasters have led to large losses of agricultural production. FAO

data shows that disasters accounted for losses of more than USD 108 billion in crop and livestock production in developing countries between 2008 and 2018, where the share of losses due to drought was significant (FAO, 2021). This highlights the need for mechanisms that can provide timely financial support to farmers after climate-related losses.

Climate Risk Insurance (CRI) is one such mechanism that transfers part of the financial consequences of climate-related shocks from farmers to insurers. It may be based on actual farm losses (indemnity insurance) or on a predefined index such as rainfall, temperature or vegetation conditions (index insurance). Index-based

products can reduce some costs associated with individual loss assessment, but they may also create basis risk, where the insurance payout does not correspond closely to the farmer's actual loss (IPCC, 2022).

The effectiveness of agricultural insurance depends not only on the availability of insurance but also on affordability, farmer awareness, trust, data quality and timely claim settlement. Evidence from India shows that farmers' demand for weather insurance can be affected by price, liquidity constraints and trust, while other research suggests that weather-index insurance may not always provide sufficient protection against farm-level yield variation (Cole et al., 2013; Michler et al., 2022).

In India, the Pradhan Mantri Fasal Bima Yojana (PMFBY), introduced in 2016, is the country's major crop insurance programme. It aims to provide financial support to farmers suffering crop losses from insured risks while supporting income stability and agricultural investment. Under the scheme, farmer premium contributions are capped at 2% for Kharif foodgrain and oilseed crops, 1.5% for Rabi crops and 5% for annual commercial and horticultural crops. Recent reforms have also emphasized technology-based crop yield estimation, weather data and digital claim processing (Gol, 2020).

Therefore, this paper examines the effectiveness and major gaps of climate risk insurance in India, with the Pradhan Mantri Fasal Bima Yojana (PMFBY) as the principal case study. It also examines the role of emerging technologies in improving insurance delivery and draws lessons from the Index-Based Livestock Insurance (IBLI) programme in East Africa. The analysis focuses on insurance effectiveness, farmer participation, basis risk, claim settlement, affordability, data availability and technology-enabled delivery.

2. Methodology

This study adopted a narrative review and comparative case-study approach. Secondary information

was collected from peer-reviewed journal articles, reports of international organisations and Government of India publications relating to agricultural insurance, climate risk, PMFBY, RWBCIS and index-based insurance. Recent literature was prioritized for the Indian context, while seminal and widely cited studies were retained to establish the conceptual and empirical foundations of agricultural insurance.. The analysis focused on five dimensions: insurance design, farmer participation, claim settlement, basis risk and technology-enabled delivery. PMFBY was selected as the principal Indian case study because of its national scale, while IBLI was selected as an international comparator because of its established use of satellite-based index insurance. The findings were synthesised qualitatively rather than through a formal meta-analysis.

3. Evidence from Past Studies

The reviewed studies indicate from the above table, that the effectiveness of agricultural insurance depends on both product design and farmer-level factors. Evidence from India highlights the importance of price, liquidity and trust in farmer participation, while research on weather-index insurance points to the problem of basis risk. Insurances in East Africa show that index insurance can help reduce exposure to climate risks but it does not cover all uninsured risks. The implications of these findings are that insuring alone will not be enough but proper index design and proper implementation will be essential for proper risk protection.

3.1. Research Gap

Previous studies have proven that agricultural insurance helps reduce the impact of climate-induced losses on farmers. However, issues like basis risk, farmers' participation, costs, data availability, and prompt claims handling continue to limit its efficacy. In India, the increasing use of remote sensing, weather information

Table 1. Summary of Selected Studies on Agricultural and Climate Risk Insurance

Study	Context	Key finding	Relevance to this paper
Cole et al. (2013)	India - rainfall insurance	Demand was affected by price, liquidity constraints and trust	Explains challenges in farmer participation
Michler et al. (2022)	India – weather-index insurance	Weather explained only part of crop-yield variation	Highlights basis-risk concerns
Jensen et al. (2016)	East Africa – IBLI	Index insurance can support resilience, but uptake remains challenging	Provides international comparison
Carter et al. (2017)	Index insurance	Insurance can help households manage climate-related shocks	Establishes the resilience role of insurance
Nayak et al. (2020)	India – crop insurance	Identified implementation and participation challenges	Provides Indian crop-insurance context

Source: Compiled from the studies cited in the table.

and digital technologies under PMFBY creates an opportunity to improve insurance delivery. However, the effectiveness of these technological interventions and their ability to address existing institutional and farmer-level constraints require further consideration. Therefore, this paper examines PMFBY from the perspectives of effectiveness, implementation gaps and technology, while drawing lessons from IBLI in East Africa.

4. Climate Risk Insurance: Concept and Types

4.1 Concept of Climate Risk Insurance

Climate Risk Insurance (CRI) is a risk-transfer mechanism through which farmers or other agricultural stakeholders pay a premium to receive financial compensation when specified climate-related risks cause insured losses. It can help farmers protect income, maintain consumption and continue investment following adverse climatic events.

Climate risk insurance can broadly be classified into indemnity-based insurance and index-based insurance.

4.2 Indemnity-Based and Index-Based Insurance

It is evident from Table 2 that indemnity-based insurance provides a closer link between the actual farm loss and the insurance payout but requires field-level

assessment, which can increase administrative costs and settlement time. Index-based insurance can reduce the need for loss determination on an individual basis, and hence make the process faster and cheaper. But the payout is dependent on how well the selected index performs. This means that choosing one of these methods will have to weigh precision against efficiency.

4.3 Basis Risk

The basis risk is one of the greatest challenges of index-based agriculture insurance. It is characterized by the fact that there is no close correlation between the payment made and the loss suffered. It can arise because the geographical area used for calculating an index may experience different weather or yield conditions from an individual farmer's field, resulting in either inadequate compensation or a payout that does not correspond to the farmer's actual loss.

5. PMFBY in India: Design, Performance and Gaps

5.1 Evolution of Crop Insurance in India

India has progressively developed crop insurance programmes to protect farmers from production risks. Important milestones include the experimental crop insurance initiatives introduced in the early 1970s,

Table 2. Comparison of Indemnity-Based and Index-Based Agricultural Insurance

Parameter	Indemnity-based insurance	Index-based insurance
Trigger	Actual assessed loss	Predefined index
Assessment	Farm/field-level assessment	Weather, yield or vegetation data
Administrative cost	Relatively high	Relatively lower
Basis risk	Generally lower	Important concern
Payout	Based on assessed loss	Based on index threshold
Major advantage	Closely linked to actual loss	Faster and potentially less costly
Major limitation	Costly and time-consuming assessment	Payout may not match actual farm loss

Source: Compiled by the author based on literature on indemnity- and index-based insurance.

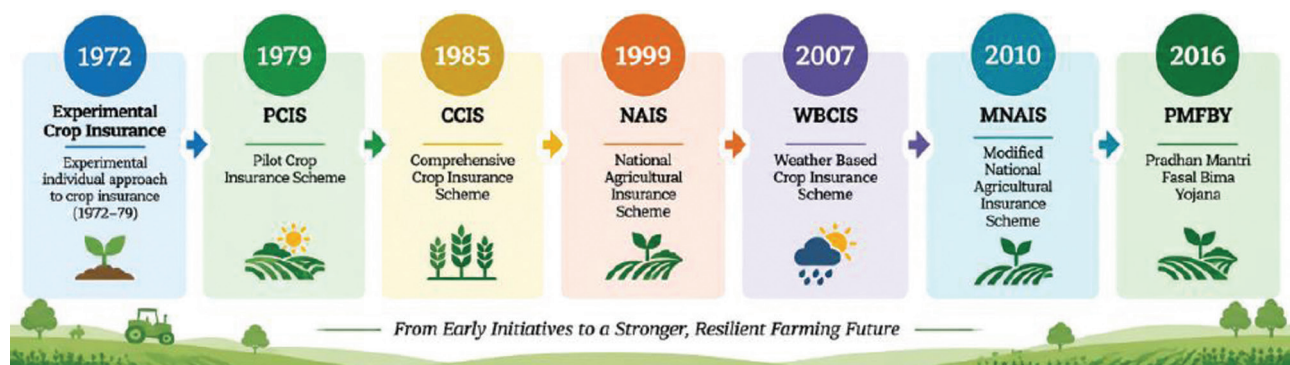


Figure 1. Evolution of Crop Insurance in India

Source: Compiled from Government of India/PMFBY historical documents.

the Pilot Crop Insurance Scheme (PCIS) in 1979, the Comprehensive Crop Insurance Scheme (CCIS) in 1985, the National Agricultural Insurance Scheme (NAIS) in 1999, the Weather Based Crop Insurance Scheme (WBCIS), the Modified NAIS (MNAIS) in 2010 and PMFBY in 2016.

5.2 PMFBY: Design and Objectives

The Pradhan Mantri Fasal Bima Yojana (PMFBY) was introduced in 2016 with the objective of providing financial support to farmers suffering crop losses due to specified risks. The scheme also aims to stabilize farm income, encourage modern agricultural practices and maintain agricultural credit flow.

The farmer's premium contribution is capped at 2% of the sum insured for Kharif food grain and oilseed crops, 1.5% for Rabi crops and 5% for annual commercial and horticultural crops (GoI, 2020).

PMFBY has subsequently incorporated greater use of technology, including remote sensing, improved crop-yield estimation, weather data and digital claim processing.

5.3 Performance and Scale of PMFBY

PMFBY has achieved substantial national scale since its introduction. According to Government of India data as of August 2026, from Kharif 2016 to Rabi 2025–26, more than 92.46 crore farmer applications were insured and more than 26.33 crore applications received claims amounting to over ₹2.06 lakh crore.

Table 3. Selected PMFBY Performance Indicators

Indicator	PMFBY
Period	Kharif 2016–Rabi 2025–26
Farmer applications insured	>92.46 crore
Applications receiving claims	>26.33 crore
Claims paid	>₹2.06 lakh crore

Source: Government of India (2026)

The figures from the above table demonstrate the very large scale of PMFBY in terms of insurance coverage and financial compensation. More than 92 crore farmer applications have been insured since the scheme's introduction, while more than 26 crore applications have received claims. The difference between these figures should not be interpreted as a failure of the scheme, because an insurance claim arises only when an insured loss occurs. The data instead demonstrate both the extensive reach of PMFBY and the substantial financial support provided to farmers experiencing insured losses.

6. Major Gaps in PMFBY

From Table 4, there are several areas where weaknesses in the design and execution of PMFBY are revealed. These include basis risk as well as data issues which influence loss estimation accuracy, and delays in filing claims, lack of awareness, and trust which can decrease the value and involvement of farmers. Together, such weaknesses seem to imply that any improvements to the outcomes of insurance require technological, as well as practical and institutional advancements.

6.1 Basis Risk

The concept of basis risk is very important for index insurance and area-based insurance. The number of losses that a farmer suffers in his/her particular field can be different from those experienced on the average for the insurance unit, resulting in inadequate compensation or even compensation despite little losses.

6.2 Claim Settlement

Timely compensation is essential because farmers need immediate money after suffering a loss in order to buy seed, fertilizer, and other materials for the next planting season. Delayed payments reduce the efficiency of insurance as an effective risk management tool. (Nayak et al., 2020).

Table 4. Major Gaps and Implementation Challenges in PMFBY

Major gap	Problem	Implication
Basis risk	Area-level/index assessment may differ from individual farm loss	Farmer may receive inadequate compensation
Claim delays	Settlement may take considerable time	Reduces usefulness of insurance
Limited awareness	Farmers may not fully understand coverage and triggers	Affects participation and expectations
Data limitations	Yield and weather data may have spatial/temporal limitations	Can affect assessment accuracy
Affordability	Premiums and indirect participation costs can remain concerns	May restrict voluntary participation
Trust	Delays or unexpected payouts can reduce confidence	Weakens future participation
Institutional coordination	Multiple agencies are involved in implementation	Can create administrative difficulties

Source: Compiled by the author from the available literature and references given in the text.

6.3 Farmer Awareness and Trust

The effectiveness of insurance depends upon farmers' knowledge regarding risks insured, premiums, loss assessment, and claims criteria. Similarly, previous research conducted in India has stressed that trust and liquidity are important determinants for taking insurance.

7. Technology-Enabled Climate Risk Insurance

Technology is increasingly being incorporated into agricultural insurance to improve measurement, transparency and speed.

7.1 Remote Sensing

Satellite-based remote sensing can provide information related to the size of the area covered by crops, health of the vegetation, and growth of crops in extensive geographical locations.

7.2 YES-TECH

YES-TECH (Yield Estimation System Based on Technology) uses technology-based approaches for improving yield estimation of crops under the PMFBY scheme. It seeks to decrease the dependency on conventional crop cutting approach and increase accuracy in yield estimation process.

7.3 WINDS

The Weather Information Network and Data System (WINDS) aims to improve weather data access and extend

the geographic scope of meteorological information. Improved weather data would help to carry out a proper risk assessment and develop insurance products.

7.4 Digital Claim Settlement

Digital systems such as DigiClaim can support electronic processing and settlement of insurance claims, potentially reduce administrative delays and improve transparency.

Most of the technologies discussed in Table 5 focus on overcoming two main limitations associated with agricultural insurance, namely the quality of information used to assess the risk and the effectiveness of the claims processing. On the one hand, YES-TECH and remote sensing help with yield and crop assessment. On the other hand, WINDS improves weather information and DigiClaim enables online claims processing. Still, these technologies should be considered only as supporting means rather than all-encompassing solutions since affordability, farmer education, trust, and product design remain important factors.

8. IBLI in East Africa: Lessons for India

The IBLI project stands as a relevant example of index-based insurance at the international level. Designed for use by pastoralist communities in East Africa, IBLI uses satellite information about vegetation to gauge drought-induced livestock losses. Unlike the PMFBY project, which is primarily concerned with crop production, IBLI focuses

Table 5. Major Technologies Relevant to PMFBY

Technology/system	Main function	Potential benefit
YES-TECH	Technology-based yield estimation	Improved yield assessment
WINDS	Weather data infrastructure	Better risk assessment
Remote sensing	Crop monitoring	Wider and faster assessment
CCE-Agri App	Digital crop-cutting information	Improved data recording
DigiClaim	Digital claim processing	Faster and more transparent settlement

Source: Compiled by the author from the available literature and references given in the text.

Table 6. PMFBY and IBLI: Comparison

Feature	PMFBY	IBLI
Main sector	Crops	Livestock
Main risk	Crop production risks	Drought/forage scarcity
Geographic focus	India	East Africa
Index/data approach	Yield, weather and technological assessment	Satellite-derived vegetation index
Major strength	Very large scale	Innovative satellite-based insurance
Major challenge	Basis risk, delays and participation	Basis risk and uptake
Key lesson	Technology can support large-scale delivery	Index design and farmer engagement are critical

Source: Compiled by the author from the available literature and references given in the text.

on livestock. IBLI illustrates the usefulness of using satellite indices to offer insurance services when assessing farm losses through traditional methods is difficult. However, IBLI also points out some of the challenges faced by index insurance schemes such as basis risk.

Based on the IBLI experience, it is important that the design of index should take into consideration the risk faced by the farmers. In addition, education and communications of farmers have an important role in improving their knowledge. Jensen et al. (2016) also found that IBLI decreased the exposure of farmers to covariate risks; however, there was still a high degree of basis risk.

9. Limitations of the Study

This study is based primarily on secondary information from peer-reviewed literature, government publications and institutional reports. It does not include primary data collected directly from farmers, insurers or implementing agencies. The study also does not undertake econometric analysis or a formal systematic review of the literature. Therefore, the findings should be interpreted as a qualitative assessment of the available evidence on climate risk insurance, PMFBY and IBLI rather than as a direct measurement of causal impacts or farmer-level outcomes.

10. Policy Suggestions and Conclusion

The effectiveness of climate risk insurance in India can be improved by reducing basis risk through localized indices, better crop-yield estimation, remote sensing and improved weather-data infrastructure. Claims resolution should be speedy and transparent by virtue of digitalization and technological assessment of losses, and there should be an increase in the level of awareness of farmers so that they may comprehend coverage, triggers, and claims process. The insurance should be customized for local crops and climate risk rather than adopting standardized solutions in heterogeneous areas. The experience of IBLI suggests that satellite indices have proved useful when assessing losses using standard ways is difficult, but this is possible only under proper design of indexes, understanding of farmers, and managing basis risk. PMFBY has shown that the delivery of crop insurance at a massive scale is possible, but its effectiveness is contingent on effective loss assessment, speedy claims resolution, and proper design of insurance products for farmers' needs. Technologies like YES-TECH, WINDS, and remote sensing can facilitate all these, but there is a need for reliable data, proper product design, farmer involvement, and institutional coordination. Thus, climate risk insurance should play the role of one

aspect of the integrated agricultural risk management approach along with other measures like resilient farming, credit, extension, irrigation, and agriculture infrastructure.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors have not used generative AI or AI-assisted technologies. The authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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CASE STUDY

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From Forest Resources to Markets: A Case Study of Rural Livelihoods, Collective Action and Sustainable Value Chains in Odisha, India

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Citation: Manorama Choudhury and Rabi Narayan Subudhi (2026). From Forest Resources to Markets: A Case Study of Rural Livelihoods, Collective Action and Sustainable Value Chains in Odisha, India. Horizon J. Hum. Soc. Sci. Res. 8 (S), 170–183. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1406.p170>

**ABSTRACT**

This paper examines the first-year experience of BhaMa Foundation and MSE Bazaar in developing market-linked livelihood opportunities for rural and tribal micro-enterprises in India. The case emerged from a 2024 visit to Gochha in Nayagarh district, Odisha, where women producing sal-leaf plates requested a machine to reduce physical labour. The eventual delivery of the machine exposed a wider problem: a production asset can address one constraint without resolving market access, information, quality or bargaining power. The paper therefore examines an emerging model that combines skills, quality practices, aggregation, market information and buyer access, with particular attention to the Sal Seed and Mango Kernel value chains. Operational figures are drawn from the organisation's internal records, reported as audited by a local chartered accountant, while the qualitative account is based on field observations and interviews. The case does not constitute an impact evaluation. Its contribution is to identify mechanisms through which production capability and market connectivity may jointly support rural livelihoods.

Keywords: Agribusiness; Market access; Rural livelihoods; Social entrepreneurship; Sustainable value chains; Tribal enterprises

1. INTRODUCTION

Travel beyond India's cities into rural and remote communities' offers an important perspective on the country's development journey. Economic transformation is not experienced uniformly, and the availability of local resources or productive skills does not necessarily translate into secure and sustainable livelihoods. In many rural settings, households combine agriculture, forest-based collection, small enterprise activity and informal trade. The economic value generated by these activities may nevertheless be constrained by fragmented supply,

limited market information, inconsistent quality, weak aggregation and dependence on intermediaries.

The experience described in this paper began with a visit to Gochha in Nayagarh district, Odisha, in 2024. There, women were making *khali patra*, or leaf plates, from sal leaves collected from the forest. The work provided an important source of household income, but it was physically demanding. The immediate request was for a machine that could reduce labour. A commitment was made to help arrange one, and a subsequent offer of corporate social responsibility support appeared to make

the intervention possible. Yet the machine took nearly four months to reach the women because of procedural requirements. The delay changed the question. A machine could address a production constraint, but it could not by itself address the wider conditions that determine whether a rural enterprise can earn sustainably.

This distinction is important for agribusiness and rural development. Productivity is only one part of a livelihood system. A producer may increase output and still remain vulnerable if there is no reliable buyer, if product quality is inconsistent, if individual volumes are too small to negotiate effectively, or if prevailing prices and demand are not known. The case of BhaMa Foundation and MSE Bazaar developed from an attempt to address these interconnected constraints rather than treating them as separate problems.

The purpose of this paper is to examine how the first-year experience of BhaMa Foundation and MSE Bazaar sought to connect rural and tribal micro-enterprises with markets through skills, quality practices, aggregation, market information and buyer access, focusing particularly on the Sal Seed and Mango Kernel value chains. It asks three questions: What constraints to market participation were identified through field experience? How did the emerging model attempt to address them? What can the first-year evidence reasonably establish about livelihood and market outcomes?

The paper is not presented as an impact evaluation. The available material is primarily qualitative and practice

based, supplemented by operational records reported by the organisation. The records are stated to have been audited by a local chartered accountant, whose details can be made available for verification. The analysis therefore distinguishes reported operational indicators from independently demonstrated outcomes. This distinction is important in rural development, where reach, participation, transactions and livelihood impact are often conflated.

The central argument is straightforward. Rural livelihood development cannot be reduced to improving production capacity. Where local resources and traditional skills already exist, a meaningful intervention may be to build the institutional and commercial bridge that connects producers with information, aggregation, quality systems and markets. The BhaMa-MSE Bazaar experience provides a grounded case through which this proposition can be examined and relates directly to the special issue's emphasis on economics, entrepreneurship and innovation.

2. BACKGROUND AND LITERATURE CONTEXT

The case sits within several established strands of social-science research. Rural households commonly construct livelihoods from multiple activities rather than from a single source of income. Seasonal and non-farm activities can be particularly important when agricultural income is limited, helping households manage consumption and production across the

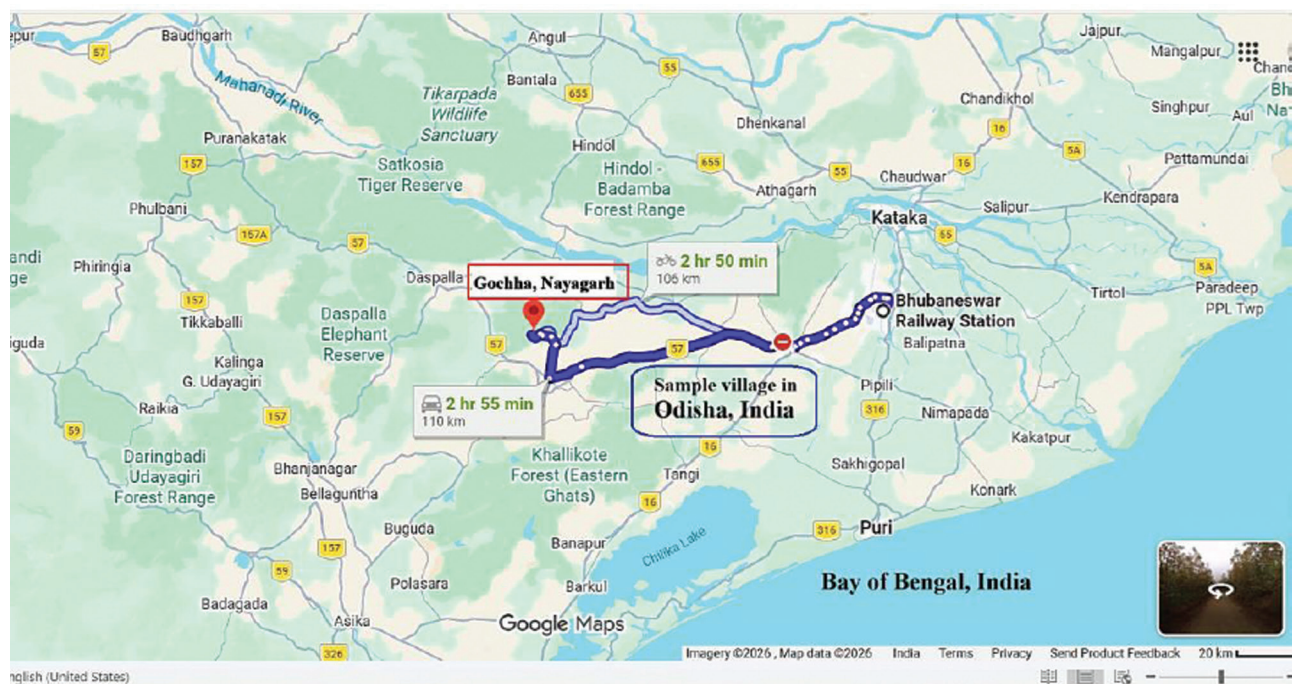


Figure 1. Location of Gochha, Nayagarh district, Odisha, India.

Source: Author's field documentation, 2025.



Figure 2. Rural women and community members at a village setting in Odisha associated with the field context of the initiative.

Source: Photograph by the author, 2025.

year (Barrett et al., 2001). This perspective is relevant because Sal Seed and Mango Kernel are described in the case as seasonal resources that may supplement agricultural income. The case therefore concerns not only commodity sales but also the timing and reliability of livelihood opportunities.

A second strand concerns the commercialisation of non-timber forest products. Belcher and Schreckenberg (2007) caution against assuming that commercialisation automatically produces better livelihoods. The distribution of benefits depends on production organisation, transaction costs, market structures, value addition and bargaining relationships. A forest product may have a recognised market and still generate limited returns for collectors when producers face poor information or weak negotiating positions. This literature supports the paper's focus on the institutional conditions surrounding market participation.

A third strand concerns collective action and market-chain coordination. When individual producers supply small and irregular quantities, they may struggle to meet buyer requirements or to absorb the costs of searching for markets. Collective organisation can help overcome some of these barriers, although collective action does not automatically guarantee equitable governance or benefit sharing. Devaux et al. (2009) show why coordination among small producers can matter for

market-chain innovation. In the BhaMa case, SHGs, FPOs, APOs and local aggregators are described as mechanisms for bringing dispersed production into more commercially meaningful volumes.

The case also has a clear social-entrepreneurship dimension. Social entrepreneurship research commonly examines entrepreneurial activity that seeks social value while employing organisational and market mechanisms to address social problems (Mair & Martí, 2006). BhaMa's stated purpose is to strengthen rural and small enterprises while building commercially sustainable market linkages. The aspiration to reduce dependence on philanthropy gives the model an entrepreneurial orientation. At the same time, the case does not assume that commercial participation is automatically socially beneficial. The more defensible proposition is that commercially viable relationships may complement social support when they are accompanied by capability building, transparency and producer agency.

The business-model perspective adds another useful dimension. Teece (2010) describes business models in terms of how organisations create and capture value. In the present case, value is not located only in a processed commodity or finished product. It can also arise through aggregation, quality assurance, information, buyer coordination and the reduction of transaction frictions. The emerging model can therefore be interpreted as an

attempt to redesign the relationship between dispersed rural supply and market demand.

Relevant work already published in Horizon JHSSR provides useful points of comparison. Sarkar (2024), in a JHSSR case study of Madur Mat production in Sabang, West Bengal, places women's craft production and livelihood empowerment within a local enterprise setting. The comparison is useful because both cases examine community-based production as a route to economic participation, while the present case places greater emphasis on forest-linked resources and market coordination.

The JHSSR archive also includes research on sustainable consumption in Odisha. Giri et al. (2024) examine consumer attitudes toward paper-bag usage in Odisha, illustrating the journal's engagement with sustainability-related economic behaviour in the same state as the present case. The relevance here is contextual rather than empirical: sustainability initiatives involve both production and market behaviour.

A further JHSSR reference is Biswas and Biswas (2024), whose case study considers heritage tourism and sustainable development in West Bengal. Its relevance is conceptual rather than empirical, reinforcing the value of examining locally embedded economic resources through a community-development and sustainability lens.

Taken together, the literature suggests a four-part analytical framework for this case: productive capability, collective organisation, market connectivity and livelihood value. Productive capability concerns skills, processing and quality. Collective organisation concerns aggregation and participation in SHGs, FPOs, APOs and other local groups. Market connectivity concerns information, price discovery and buyer access. Livelihood value concerns whether these mechanisms translate into improved and more resilient economic opportunities. The framework guides the interpretation without implying that the case has already demonstrated causal effects.

3. METHODOLOGY

This paper uses a qualitative, retrospective case-study approach. The case is bounded by the first year of the BhaMa Foundation and MSE Bazaar initiative, with particular attention to its early work on the Sal Seed and Mango Kernel value chains in rural and tribal communities. The unit of analysis is the emerging market-linkage model rather than an individual household. An embedded illustrative case, concerning Manjulata Naik and women in Boudh who collectively marketed approximately 15 metric tonnes of Sal Seed, is used to make the broader mechanism more concrete.

The evidence base consists of the author's field observations, visits to rural and tribal communities,

interactions with participants and stakeholders, qualitative interviews, descriptions of the intervention process, and operational figures reported in the manuscript. The quantitative information is based on the organisation's internal records, which the author reports were audited by a local chartered accountant; the auditor's details are available for verification. The material includes the Gochha experience, the development of BhaMa Foundation and MSE Bazaar, observations from field travel, and reported experiences from the Sal Seed and Mango Kernel value chains. An official TDCCOL guideline is also used to contextualise Sal Seed procurement and the government-declared MSP.

The analysis is thematic rather than statistical. Recurring issues were organised around collection, quality, aggregation, market information, buyer access and bargaining power. The analysis then considers how the emerging model responded to each constraint and what level of evidence is available for the resulting change. Quantitative indicators are treated as reported operational measures, while qualitative observations are used to examine mechanisms and experiences.

Several limitations remain. First, much of the evidence is closely connected to the organisation implementing the intervention, creating a risk of positive reporting bias. Second, there is no comparison group or baseline household survey against which outcomes can be attributed to the intervention. Third, several terms are programme-specific rather than standard statistical categories. In this paper, "micro-enterprise" denotes the organisation's operational category for a rural income-generating unit participating in its activities; "connected" denotes a linkage established with the initiative; "engaged" denotes participation in a group, meeting or value-chain activity; "onboarded" denotes inclusion in the enterprise network; "aggregator group" denotes a group coordinating collection or aggregation; and "business turnover" denotes the gross transaction or sales value recorded by the initiative, not profit or household income. These definitions should be read as operational labels and checked against the organisation's records.

These limitations determine the level of inference that is appropriate. The paper can make observations about the intervention's design, the problems it sought to address, the organisational responses described by the author and the operational indicators reported for the first year. It cannot establish a causal effect on household welfare or environmental conditions. Future research should combine field interviews, transaction records and longitudinal household or enterprise data to test whether reported changes persist.

All six field photographs used in the article were taken by the author, and permission for their publication

has been granted. The captions identify the available field context and avoid treating photographs as proof of economic outcomes. They are used as documentary context within the case-study narrative.

4. FINDINGS AND DISCUSSION

4.1 From a production problem to a livelihood problem

The Gochha experience provided the starting point for the model. Women producing leaf plates wanted a machine that would reduce physical labour. The four-month delay in delivering the machine revealed a broader issue: production assistance does not necessarily address the economic system in which production occurs. A machine can increase productive capacity, but its economic value depends on access to inputs, appropriate quality, sufficient demand, working capital, buyer relationships and the ability to obtain a viable return.

The story is important precisely because the initial intervention was reasonable. There was a real physical burden, and a machine was a practical response. The lesson was not that technology is unimportant. The lesson was that technology is one component of a livelihood system. This distinction is relevant to contemporary rural innovation, where mechanisation and digital tools can receive more attention than the institutional conditions required for those tools to generate durable economic value.

The subsequent question was therefore not simply how to support one village but whether a repeatable structure could help many rural enterprises diagnose gaps, strengthen capabilities and reach markets. The concern about scale became a central design question. BhaMa Foundation emerged to work on the producer side, while MSE Bazaar developed as a market-facing mechanism. The model therefore divided the problem into complementary but connected functions rather than assuming that either production support or market access alone was sufficient.

4.2 From helping one village to building a sustainable model

The experience prompted a broader examination of how similar support could be extended to the many micro and small enterprises that often need limited but well-directed handholding to improve their commercial position. Around the same time, Mr. Prashant Kumar Sahu expressed an interest in joining such an initiative. Mr. Bhaskar Panigrahi, Chairman and CEO of ConnectM, was invited to become involved, but his initial response was cautious because a new initiative would require both

time and a sustainable structure. His central question was whether the idea could scale.

That question changed the direction of the discussion. The challenge was no longer merely how to help individual enterprises, but how to build a model capable of helping large numbers of enterprises become more commercially capable. An institution was needed that could work at the grassroots level, diagnose gaps, strengthen capabilities and help enterprises become more resilient. Mr. Sahu suggested the name BhaMa, combining Bhaskar and Manorama, and the initiative subsequently took shape as BhaMa Foundation.

As the model developed, it became clear that strengthening producers was only one half of the equation. Scaling would require partners, investment and a market mechanism. Mr. Mahesh Navani, COO of eClinicalWorks, agreed to become an equal partner with the condition that the work should improve rural livelihoods and contribute to a circular economy. BhaMa's purpose therefore became centred on empowering micro and small enterprises by diagnosing gaps, improving processes, enhancing skills and creating sustainable market linkages.

4.3 Finding the missing bridge

Field experience increasingly suggested that the missing element was often a bridge between what communities could produce and where that production could be marketed. Producers may possess natural resources, traditional skills and willingness to work, while buyers may have demand, but fragmented transactions can prevent the two sides from connecting efficiently. The author describes an observation by HG Gauranga Das Prabhu ji about the contrast between urban consumers and rural producers. In the context of the present case,



Figure 3. Women engaged in processing and packaging activities within a rural enterprise setting.

Source: Photograph by the author, 2025.

that observation became a way of thinking about the weak connection between village production and urban or larger-market demand.

MSE Bazaar emerged from this reasoning. BhaMa Foundation strengthens the producer side through skills, processes, quality and aggregation, while MSE Bazaar builds the market side by connecting enterprises with demand and buyers. *Vanajata Udyan* Fresh in Bhubaneswar was established as an early retail bridge, bringing forest products from tribal and small enterprises closer to consumers. The significance of these components is organisational: the intervention is not limited to training producers but attempts to coordinate several stages of a transaction.

The emerging sequence can be expressed analytically as producer capability, quality improvement, aggregation, market information, buyer linkage, value creation and greater self-reliance. The sequence should not be interpreted as automatic. Quality improvement without a buyer does not guarantee income. Buyer access without sufficient volume may not create a sustainable relationship. Aggregation without transparent pricing can reproduce unequal bargaining relationships. The case is therefore best understood as a coordination problem rather than as a simple supply problem.

4.4 From forest resources to “Waste to Wealth”

Effective scaling required focus rather than attempting to work with too many products simultaneously. From more than 250 items originally identified by Mr. Sahu, only a few were selected for initial intervention. The first major value-chain experience came through Sal Seed, followed by Mango Kernel. This narrowing of focus is itself a form of organisational learning. A market-linkage initiative that attempts to handle every local product may spread its attention too thinly to develop reliable quality systems, buyer relationships and aggregation structures.

The case uses Sal Seed and sal-leaf products as part of its forest-based livelihood context. Rather than relying on an unsupported estimate of Odisha’s forest coverage, the paper focuses on the market and institutional dimensions of these resources. For Sal Seed procurement, the Tribal Development Co-operative Corporation of Odisha Ltd. (TDCCOL, 2024) specifies an MSP of ₹20 per kg for Fair Average Quality (FAQ) Sal Seed for the MFP crop year 2024 and sets out procedures for collection, quality, records and payment. This provides an official benchmark against which the case’s later market observations can be understood.

The “Waste to Wealth” idea is therefore understood carefully. In this case it does not necessarily mean converting physical waste into a new manufactured

product. Rather, it refers to recognising economic value in resources, skills and materials that may already exist but remain under-commercialised. The distinction matters for sustainability. Creating value from a resource is not the same as increasing extraction. Long-term viability requires attention to harvesting practices, regeneration, quality, processing, local value addition and the distribution of returns.

4.5 Building on Odisha’s existing ecosystem

The case describes an existing rural livelihood ecosystem involving initiatives such as Mission Shakti Odisha, the Department of Agriculture & Farmers’ Empowerment and ORMAS. BhaMa’s stated role is not to replicate these efforts but to complement them and complete the loop from community production and aggregation to enterprise development and market access. The institutional proposition is significant because rural enterprise development rarely depends on one organisation alone.

The case describes an existing rural livelihood ecosystem involving Mission Shakti Odisha, the Department of Agriculture & Farmers’ Empowerment, ORMAS and other actors. Based on qualitative interviews and organisational records, BhaMa’s stated role is to complement such initiatives by linking community production and aggregation with enterprise development and market access. The paper treats these institutions as part of the case context rather than evaluating their programmes. The longer-term ambition of increasing annual family income from approximately ₹85,000 to ₹1.40 lakh is a target described by the initiative, not a demonstrated outcome.



Figure 4. Women members of a Self-Help Group participating in a rural enterprise setting in Odisha.

Source: Photograph by the author, 2025.

4.6 Building the Sal Seed and Mango Kernel value chains

Sal Seed and Mango Kernel are presented as seasonal resources that can provide income during agricultural lean months. Instead of approaching them simply as commodities to be collected and sold, BhaMa Foundation and MSE Bazaar began examining collection, quality, aggregation, market information, buyer access and bargaining power as connected parts of the value chain. The approach is consistent with the literature on non-timber forest products and collective market action (Belcher & Schreckenberg, 2007; Devaux et al., 2009).

Table 1. Reported value-chain constraints and intervention logic. The final column describes the intended or reported operational result and should not be read as independent impact measurement.

The table shows why the intervention is broader than a market-place function. Collection is addressed through mobilisation; quality through awareness and training; aggregation through village and cluster structures; market information through buyer and price information; buyer access through direct connections; and bargaining through collective volumes. Each response addresses a different friction in the chain. The model's strength, therefore, lies in the combination rather than in any single intervention.

4.7 Collective action, aggregation and bargaining power

The value-chain experience shifts attention from the individual producer to the institutional conditions of market participation. Collective action can reduce transaction costs and make small volumes commercially relevant. It can also improve information flows and create a basis for negotiating with buyers. At the same

time, collective structures require governance. The case would be strengthened by documentation of who decides prices, how payments are made, how quality disputes are handled and how benefits are distributed within groups. Without such information, the existence of aggregation alone cannot establish that producer bargaining power has improved.

The case of Manjulata Naik and the women of Boudh provides a useful illustration. The group reportedly marketed approximately 15 metric tonnes of Sal Seed collectively. The significance is not merely the quantity but the possibility that aggregation allowed dispersed collectors to act as a recognisable market participant. This interpretation is consistent with the broader literature on collective action and market-chain innovation (Devaux et al., 2009) and also resonates with JHSSR's publication of community-enterprise case research, such as Sarkar's (2024) study of women's craft production.

4.8 Price discovery and the Sal Seed example

The Sal Seed experience offers the clearest numerical example in the manuscript. During a two-month collection period in 2026, the organisation's internal records report procurement prices ranging from ₹13/kg at an earlier point to as high as ₹32/kg later in the period. These records are reported as having been audited by a local chartered accountant. As an external benchmark, TDCCOL's 2024 guideline specified an MSP of ₹20/kg for FAQ Sal Seed and required systematic procurement records (TDCCOL, 2024). The 2026 figures should therefore be understood as reported transaction observations, not as evidence that the intervention caused a price increase.

The available evidence supports a more cautious interpretation. Price comparisons should be read with attention to date, geography, quantity, quality or grade,

Table 1. Sal Seed and Mango Kernel Value-Chain Constraints and BhaMa-MSE Bazaar Responses

Value-chain area	Key challenge	BhaMa-MSE Bazaar intervention	Reported/expected result
Collection	Scattered individual collection	Cluster-based mobilisation through SHGs, FPOs, APOs and local aggregators	Greater collective participation
Quality	Inconsistent drying, grading and storage	Awareness and training on quality practices	Better market readiness
Aggregation	Small quantities and fragmented supply	Village and cluster-level aggregation	Larger tradable volumes
Market information	Limited knowledge of prevailing prices	Sharing buyer demand and market information	Better price discovery
Buyer access	Dependence on local intermediaries	Direct connection with credible trade partners	Wider market participation
Bargaining power	Individual collectors have little negotiating strength	Collective volumes and improved market conditions	Potentially stronger negotiating position

Source: Author's synthesis based on field observations, qualitative interviews, and BhaMa Foundation/MSE Bazaar internal records.

Note: The table synthesises the principal value-chain constraints and responses described in the case. "Reported/expected result" refers to reported operational observations or intended effects; it does not represent an independently measured impact evaluation.



Figure 5. Collection of forest resources as the first stage of a rural value chain.

Source: Photograph by the author, 2025.

and whether the quoted amount was farm-gate or delivered price. Transport, cleaning, drying and other transaction costs may also affect comparability. The present paper therefore uses the ₹13/kg and ₹32/kg observations to illustrate the importance of price information and market conditions, while avoiding a causal claim about BhaMa's effect on prices.

The analytical lesson nevertheless remains important. Market information can have economic value even before any physical transformation occurs. Knowing prevailing demand and having credible alternatives can alter a producer's negotiating position. Aggregation can strengthen that position by increasing the commercial relevance of the producer group. Buyer access can reduce dependence on a single local intermediary. These mechanisms offer a social-science explanation for why market linkage can complement productivity interventions.

The same caution applies to the example of a woman receiving ₹3,200 for two sacks of Sal Seed. The transaction illustrates the human meaning that the author attaches to a payment for collected produce, but it should not be used as evidence of a general income effect unless the quantity, grade, price, costs and comparable prior transaction are documented.

4.9 Reported scale: reach is not the same as impact

The first year is reported to have produced substantial operational reach. The organisation's internal records report more than 7,000 villages across 16 districts, 368+ aggregator groups, 283+ community-level meetings, and

more than 1.10 lakh micro-enterprises connected with or onboarded to the initiative. They also report business turnover exceeding ₹14 crore through the Sal Seed and Mango Kernel value chains. Because these are internal operational measures, their significance depends on the definitions and counting procedures described above.

The distinction among outputs, short-term outcomes and longer-term impacts is essential. Outputs include meetings conducted, groups engaged and enterprises onboarded. Short-term outcomes may include improved information, better quality practices, aggregation and increased participation in organised markets. Longer-term impacts would include sustained household income growth, reduced vulnerability, stronger women's economic agency, enterprise survival, improved bargaining relationships and demonstrable environmental sustainability. The current case provides evidence primarily at the level of activities and reported operational outcomes, not independently verified long-term impact.

Accordingly, the figure of 7,000+ villages is treated as reported village-level reach. The 368+ aggregator groups are reported groups involved in collection or aggregation under the organisation's operational definition. The 1.10 lakh+ micro-enterprises are reported participating units under the organisation's definition and should not be assumed to correspond to a legal enterprise classification. These distinctions make the figures useful as measures of programme scale while limiting claims about impact.

The reported ₹14 crore+ turnover is treated as a business indicator derived from the organisation's records. In the absence of a more detailed accounting schedule in the paper, turnover should not be interpreted as profit, producer income or household welfare. The author can provide the underlying records and audit-verification details if required by the journal.

The manuscript also reports a field estimate that the initiative touched the livelihoods of more than one million people. Because this is an indirect estimate based on enterprises and associated producers or family members, it remains explicitly an estimate. It is not presented as evidence that more than one million people experienced measurable improvements in income or welfare.

4.10 Seasonal income and livelihood resilience

The manuscript makes an important point when it argues that rural development cannot be measured only by annual income. Seasonal cash flow can matter because households face periods in which agricultural earnings are low or absent. Income from forest products can support household expenditure, healthcare, debt repayment and agricultural inputs. In this sense, the timing of income can be as important as the total amount. This is consistent with the broader livelihood-diversification literature,

which emphasises the role of multiple income sources in managing seasonal and economic risk (Barrett et al., 2001).

At the same time, increased commercialisation does not automatically produce resilience. Dependence on one commodity can create new vulnerability if prices fall, resources decline or buyers withdraw. The decision to explore multiple value chains is therefore potentially significant. Sal Seed and Mango Kernel provide different seasonal opportunities, while Moringa is being evaluated as a possible future value chain. Diversification across products and collection periods may reduce dependence on a single seasonal market, but this remains a proposition for future evaluation rather than a demonstrated outcome.

4.11 Social entrepreneurship, agency and self-reliance

The stated ambition to reduce dependence on philanthropy gives the case a clear social-entrepreneurship dimension. The initiative began with a problem that could have been addressed through a conventional charitable donation. Instead, the experience encouraged the promoters to ask how rural enterprises could become more commercially capable. This is consistent with a social-enterprise orientation in which social objectives are pursued through entrepreneurial and market mechanisms (Mair & Martí, 2006).

The distinction between charity and enterprise should nevertheless be handled carefully. Rural communities should not be described as successful merely because they participate in markets, nor should philanthropy be treated as inherently ineffective. CSR support, grants and public programmes can provide essential enabling infrastructure. The more defensible proposition emerging from the case is that one-time assistance is unlikely to be sufficient where the underlying constraint is a weak market system. Durable livelihood improvement requires a combination of capability, institutions, finance, information and market access.

The author's statement that people treated as partners begin to behave like entrepreneurs captures this idea in accessible language. In scholarly terms, it can be reframed as a proposition about agency. When producers have information, collective mechanisms and credible market alternatives, they may have greater capacity to make economic decisions rather than simply receive assistance. Whether this confidence translates into durable changes in bargaining power, investment and control over income is an empirical question. Future research should examine women's decision-making, control over income and participation in producer organisations directly.

4.12 Sustainability and the risk of equating market growth with development

The manuscript uses the language of sustainable value chains and circular economy. These concepts need to be understood as more than market growth. A sustainable value chain should consider economic viability, the distribution of benefits and environmental conditions. Forest-based value chains additionally require attention to harvesting, regeneration and resource monitoring. The commercial success of a forest product can become environmentally problematic if increased demand encourages unsustainable extraction.

The case contains promising elements: better use of existing resources, seasonal income generation, reduced dependence on distress sales, potential value addition closer to communities and a stated intention to build commercially sustainable systems. These are components of a sustainability strategy, not proof of sustainability. The "Waste to Wealth" framing is strongest when it means increasing the value captured from existing skills and resources without assuming that more extraction is always better.

A future monitoring system could therefore include resource-level indicators alongside commercial ones. These might include harvesting practices, regeneration conditions, post-harvest losses, quality grades, rejection rates, processing yields and the share of value retained by producer groups. Such measures would allow the model to test whether economic value creation is compatible with the ecological base on which forest-linked livelihoods depend.

4.13 The institutional ecosystem and innovation

The case does not present BhaMa Foundation as operating alone. It describes interaction among rural entrepreneurs, SHGs, FPOs, APOs, aggregators, buyers, financial institutions such as Axis Bank, strategic partners such as Manorama Industries Ltd., Raipur, and the field team. Public livelihood initiatives are also part of the surrounding ecosystem. Based on the case's qualitative interviews and organisational records, these relationships are understood as a network through which mobilisation, demand, finance and market coordination can be connected.

The innovation dimension of the case is therefore organisational as much as technological. The Gochha experience began with a request for a machine, but the most consequential learning concerned the relationships around production. Clustering, aggregation, information sharing and coordinated buyer access are forms of process innovation. This broad understanding of innovation fits the special issue's emphasis on

entrepreneurship and innovation because it recognises that rural transformation can occur through changes in institutions and market relationships as well as through new machinery.

The manuscript also proposes future use of data and AI-enabled tools to capture field learning, track value chains and streamline processes. This should be presented as an emerging plan rather than an achieved innovation. A useful system could record collection volumes, quality grades, transaction dates, buyer requirements, prices, payments and logistics at cluster level. Such data could improve visibility and support more transparent price discovery. It could also allow the organisation to identify bottlenecks and compare performance across value chains.

4.14 Human dignity as an economic outcome

One of the strongest features of the original narrative is its insistence that livelihood development concerns dignity as well as money. A small payment can have a different meaning when it reflects a fairer return for labour and greater choice in selling. Economic participation can involve information, voice, recognition and the capacity to make decisions. The language of partnership rather than pity is therefore worth retaining, provided that it does not substitute for evidence.

4.15 What the first year has taught the model

The first-year lessons can be consolidated into four propositions. First, a production asset is not equivalent to a livelihood model. Second, productivity without market access is incomplete. Third, market access without quality and aggregation can be fragile. Fourth, scale without environmental, social and economic sustainability is not necessarily development. This model is represented in figure-6.

These propositions are more analytically useful than a slogan-based presentation because they connect directly with the literature and with the evidence available in the case. The first concerns the difference between productive capacity and livelihood systems. The second and third concern value-chain coordination and transaction conditions. The fourth concerns the multidimensional meaning of sustainable development. The broader proposition is that rural entrepreneurship may be strengthened when producers are positioned as economic actors within functioning value chains rather than treated only as recipients of assistance. The case is still too early to establish that this transformation has been achieved at scale, but it provides a plausible model and a set of mechanisms that can be tested.

4.16 Implications for the CUTM-JHSSR special-issue agenda

The case speaks directly to the special issue's three linked concerns: economics, entrepreneurship and innovation. Its economic dimension lies in the attempt to improve the terms on which dispersed rural production enters markets. The entrepreneurship dimension lies in creating a structure that treats local producers as participants in value creation rather than as passive recipients of assistance. The innovation dimension is organisational as much as technological. The model experiments with clustering, aggregation, information sharing and coordinated buyer access before relying on more advanced digital tools.

The case also has implications for how rural innovation is evaluated. An intervention should not be judged only by the number of machines distributed, villages visited or enterprises contacted. More informative indicators would include repeated transactions, price transparency, payment timeliness, quality improvements, producer

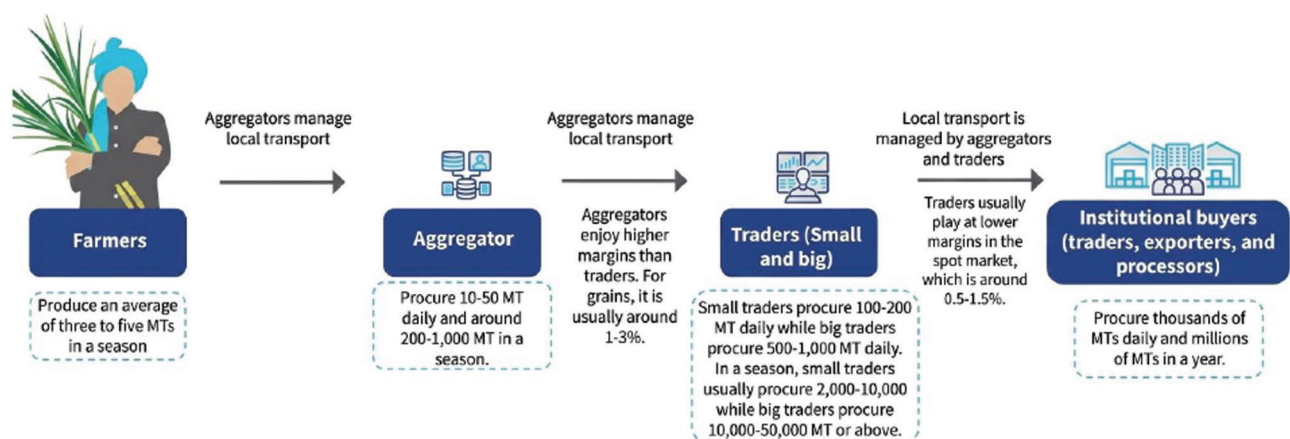


Figure 6. Farmer to market: a value-chain conceptual model.

Source: Conceptual model by the authors

retention, value distribution and resource sustainability. This moves evaluation from activity counting toward understanding whether the institutional conditions for durable enterprise have been created.

From an economic-development perspective, the case raises a further question about where value is captured. If rural communities supply raw materials while processing, branding and final marketing occur elsewhere, improvements in producer prices may remain limited. The manuscript's future emphasis on processing and value addition closer to producing communities is therefore important. Research should track value distribution across stages of the chain rather than measuring only total turnover.

5. CONCLUSIONS AND FUTURE DIRECTIONS

The BhaMa Foundation and MSE Bazaar experience began with a practical problem in Gochha: women making sal-leaf plates needed a machine to reduce physical labour. The difficulty of delivering that machine revealed a larger problem. Rural livelihoods cannot be strengthened sustainably through isolated production interventions when the surrounding market system remains fragmented.

The emerging model responded by combining producer-side and market-side functions. BhaMa Foundation focuses on skills, processes, quality and aggregation, while MSE Bazaar seeks to connect rural enterprises with demand and buyers. The early focus on Sal Seed and Mango Kernel allowed the initiative to examine collection, quality, aggregation, market information, buyer access and bargaining power as connected parts of the same value chain. *Vanajata Udyan* Fresh added an early retail bridge, while partnerships with groups, buyers, financial institutions and field actors broadened the institutional network.

The reported first-year figures indicate substantial operational reach: more than 7,000 villages, 368+ aggregator groups, more than 1.10 lakh micro-enterprises and reported turnover exceeding ₹14 crore. The Sal Seed records also report prices ranging from ₹13/kg to ₹32/kg during a two-month collection period in 2026. These figures are presented as internal operational observations, reported as audited by a local chartered accountant, rather than as independently demonstrated impact. The price observations are additionally interpreted in light of TDCCOL's 2024 MSP guideline and are not treated as a causal programme effect.

The central scholarly contribution of the case is therefore not a claim that the model has already transformed rural livelihoods. It is the identification of a potentially important mechanism through which such transformation may occur. The case suggests that

production capability, collective organisation, market information, quality practices and buyer access may be mutually reinforcing. It also shows why technology alone may be insufficient when the institutional and commercial environment remains weak.

Future research should move from descriptive case evidence toward systematic evaluation. Priority areas include longitudinal measurement of household income, producer prices and enterprise survival; analysis of women's control over income and economic decision-making; assessment of the distribution of value along the chain; measurement of quality improvements and post-harvest losses; and evaluation of the environmental sustainability of forest-resource collection. Comparative studies across districts and value chains could examine whether the model works differently under different institutional and market conditions.

The proposed use of data and AI-enabled tools may also provide an opportunity to turn field learning into an institutional knowledge system. Such tools should be designed around transparent data governance, practical usability and producer benefit. Digital innovation will be valuable only if it improves decisions and relationships within the value chain. Similarly, expansion into Moringa and other products should follow evidence about market demand, resource sustainability, quality requirements and producer returns rather than scale for its own sake.

The longer-term ambition described by the promoters is to move rural micro and small enterprises from the margins toward greater recognition as contributors to local economic development. The aspiration to increase family income, strengthen rural enterprise participation and potentially reduce distress-driven migration is consistent with the broader goal of building resilient rural economies, but these outcomes require sustained evidence. The next stage should therefore focus not only on adding villages and products, but on demonstrating whether the model produces durable economic, social and environmental value.

The journey from one village to a broader model remains unfinished. Its most important lesson may be that sustainable rural entrepreneurship is not created by production capacity alone. It emerges when resources, people, collective institutions, information and markets are connected in ways that allow producers to participate with greater agency and resilience. The case began with a machine, but its deeper question is about the system surrounding the machine. That is where the future research value of the BhaMa experience lies.

The promoters continue to draw strength from the teachings of the Bhagavad Gita, particularly the emphasis on purposeful and honest action. In this paper, that reflection remains peripheral to the empirical argument.

The substantive lesson is more practical: a village visit can identify a problem, but sustainable development requires the patience to understand the system behind that problem. One year is only the beginning of that process.

Acknowledgements

The authors sincerely thank the reviewers and editors from CUTM and Horizon JHSSR for their valuable feedback and comments in improving this manuscript. Authors record their gratitude to Prof. Dr. Nayan Deep S. Kanwal for his inputs and constructive suggestions for improving this article significantly.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors did not use Generative AI and AI-assisted technologies for research ideas, theoretical framework, analysis, interpretation, arguments, or conclusions presented in the manuscript. All intellectual content, conceptual development, methodological decisions, and scholarly interpretations remain the sole responsibility of the authors.

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Appendix A.

Additional Field Photograph



Figure A1. Close-up of a forest-derived plant material documented during field collection.

Source: Photograph by the author, 2025.

Biographical Statement of Author(s)

Manorama Choudhury

is a U.S.-based writer, social entrepreneur, philanthropist, and cultural advocate originally from Berhampur, Odisha, India. A multilingual author writing in Odia, Hindi, and English, her scholarly and creative interests encompass Indian literature, culture, aesthetics, spirituality, and the intersection of cultural heritage with contemporary society. She holds a Bachelor's degree in Psychology and Political Science, an MBA from Berhampur University and Bentley University, and a diploma in Interior Decoration from Kolkata, India.

Manorama is the author of *Ashtanayika: Tatwa O Kabita* in Odia and co-author of *Ashtanayika: The Romantic Heroines from the Natyashastra to Modernity* in English. These research-based works examine *Shringar Rasa* and its continuing influence on Indian literature, art, and cultural expression. Her poems, essays, and articles



have appeared in print and digital publications, and her poetry has been presented at literary and cultural forums in India and North America.

Beyond her literary work, Manorama has contributed to initiatives in women's empowerment, education, health, indigenous arts, handloom promotion, and community development. She is Chairwoman of Avanti Holdings Company and co-founder/advisor of the *BhaMa* Foundation and MSE Bazaar, and has been associated with several nonprofit and philanthropic initiatives. Her contributions to art, literature, and cultural diplomacy have received recognition, including the Outstanding Woman of the Year for Art and Literature award (2023) and the Business Excellence Award for Outstanding Woman in Cultural Diplomacy (2025).

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He has held academic and leadership positions at Berhampur University, VIT University, and KIIT University, where he served as Professor of Management and Chairperson of the MBA Programme. He has contributed to university academic and administrative bodies, including Boards of Studies, recruitment committees, and Academic Councils. He is a former President of the Operational Research Society of India (ORSI),

Bhubaneswar Chapter, and served for more than a decade as Chief Editor of Parikalpana: KIIT Journal of Management (now published by Emerald group of journals).

Professor Subudhi has authored 19 books and published more than 100 research papers in national and international journals and conference proceedings. His scholarly work has been published by internationally recognised publishers, including Springer, Taylor & Francis and Emerald Publishing. He has presented research at more than 60 academic conferences, including international forums, and has served as a resource person for numerous faculty development programmes and research workshops. He has supervised 16 doctoral scholars and completed five major funded research projects supported by national and international agencies. His academic contributions also include work in research methodology and social science research, including participation in an International Sociological Association conference at the University of Leicester, UK.

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CASE STUDY

Peer-reviewed | Open Access

Transformation of Tribal area into production of Nutritious Millets in Koraput through Odisha Millet Mission: A Case Study Analysis

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ARTICLE INFO

Article history

RECEIVED: 15-Aug-26

REVISED: 25-Sep-26

ACCEPTED: 05-Oct-26

PUBLISHED: 15-Oct-26

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Citation: Debajani Palai and Rabi Narayan Subudhi (2026). Transformation of Tribal area into production of Nutritious Millets in Koraput through Odisha Millet Mission: A Case Study Analysis. Horizon J. Hum. Soc. Sci. Res. 8 (S), 184–192. <https://doi.org/10.37534/bp.jhssr.2026.v8.nS.id1407.p184>



ABSTRACT

India is traditionally an agrarian based economy. Odisha, a state of India, is now a point of discussion in the entire world for its famous Millets Mission. Initially, the Odisha Millet Mission (OMM) was launched by the Department of Agriculture and Farmers Empowerment, Government of Odisha, in seven districts in 2016-17. Over the years, from 30 blocks, it has scaled up to 142 blocks in nineteen districts. Nearly 75,000 hectares are cultivated by 1.5 lakh farmers for producing millets. The mission helps to reduce critical challenges like malnutrition, shortage of food, food insecurity etc. and revitalise sustainable farming and consumption of millets from Tribal areas, which foster economic opportunities and social upliftment. The Government emphasises on the production of millets, and at the same time it integrates it into public nutrition schemes like Integrated Child Development Services (ICDS), Public Distribution Systems (PDS), Mid-Day Meal (MDM) Scheme and other welfare schemes. In Koraput Odisha Millet Mission has expanded with 12 blocks and 25000 farmers are engaged in the cultivation of 10,000 hectares of land under the guidance of District Collector. Now Koraput is a role model for sustainable development under Odisha Millets Mission. The mission has brought together multiple stakeholders like Farmer Producer Organisations, Self-Help Groups, Agricultural Technology Management Agency, etc.

The main **Objective** of the Case Study is to highlight the OMM in Koraput District. The study throws light on the basic integrated technologies like line Sowing, Line Transplantation, non-chemical crop management, etc. used in millet cultivation, which are helpful to make the environment clean and green. The social inclusion of men and women, protection of the environment, and focus on nutrition and productivity have created a field to achieve Sustainable Development Goals such as, SDG1-No Poverty, SDG 2- Zero Hunger, SDG 5- Gender Equality, SDG 8- Economic Growth, SDG9- Industry, Innovation & Infrastructure and many others.

The **Methodology** of the study is qualitative, and data is collected from secondary sources from the internet, journals, newspapers, etc.

This case study **concludes** that the great success of OMM is a live example of millet, enjoyed by all, which was traditionally treated as the 3rd choice food (after rice and wheat), now transformed into a nutritious food.

Keywords: Nutritious millet, Odisha Millet Mission, SDGs, Agriculture, Tribal development



1. INTRODUCTION

Millet, as part of traditional agricultural food systems, have been cultivated by several rural farmers. Millet crops are unique in that they grow easily in resource-constrained regions and rain-fed areas. Tribal areas are an ideal platform for producing millets with limited inputs and water. The Odisha Millet Mission in Koraput is closely associated with the farming of traditional food grains, which provides food security and employment to many households (Sahoo, 2021). But the cultivation of millet declined over several decades, and alternative crops occupied a higher place in farming, reducing millet-specific area. The Odisha Millet Mission (OMM) has taken different initiatives to highlight the crop (Chapke, et al., 2025). In today's era, millet is a healthy food for commercial sale rather than only household consumption. Earlier, the farmers of Koraput had a high preference for other crops and left finger millet for household use only. The production, procurement and marketing of millets were heavy challenges for traditional farmers (Sahoo and Samantaray, 2021). With the introduction of OMM in 2017 by the Government of Odisha, the ignored crop has got its identity in international basis. The main objective of this scheme is to increase production of millets along with their marketing and commercial consumption with the help of broader value-chain intervention. It also includes improvement in sowing seeds, processing, and marketing of output with developed agronomic practices which help to increase both household consumption and export (NCDS, 2022). Similarly, the Mission enhances Tribal farming in seven Blocks (Dasmantapur, Nandapur, Boipariguda, Kundra, Boriguma, Semiliguda and Lamtaput) of Koraput in the first phase. As a result, OMM incorporates climate resilience, gender equality, nutritious products and better livelihoods (WFP India & Odisha Millet Mission, 2022). According to the Mid-term Evaluation report of NCDS, 204 Gram Panchayats, 1,197 villages, and 19,007 farmers benefited from OMM by the end of Kharif 2019-20. In seven blocks, 7,318.91 hectares of fields are significantly cultivated in Koraput (NCDS, 2022). The economic and social condition of farmers and women has improved as a large number of women have participated extensively in cultivation, harvest and post-harvest activities of millet (Sahoo and Samantaray, 2021). The basic challenge of OMM was to generate economic returns without reducing the nutritional value of millet cultivation. The women have closely associated with farming, creating aware of the other local women to be engaged in livelihood practices and value-added functions (Rana and Sahoo, 2023). Their participation transforms community-level enterprises into commercial-level enterprises. OMM strengthens the cooperation and active

participation of women and provides better opportunities in the mission of the millet value chain (WFP India & OMM, 2022).

2. LITERATURE REVIEW

Sahoo & Samantaray (2021) have studied the relevance of farming of millet in rain-fed communities. Diversified farming and adaptability to climate provide food security and livelihood. The authors have collected primary data from 150 millet cultivators and observed that millet plays a vital role in household consumption, as it provides economic potential. The authors have discussed on the constraints, such as procurement and marketing faced by rural farmers, which influenced the choice of crops. They evaluated that commercial indicators are not enough to measure the success of the millet mission, but other indicators like cultural practices, household consumption, stability of livelihood, and food security in tribal areas are very important.

The Naba Krushna Choudhury Centre of Development Studies (NCDS, 2022) Odisha Millet Mission (OMM) is an integrated intervention that represents a comprehensive approach to the development of millets. The programme has emphasised not only farm-level production but also processing, marketing, maintaining the value chain and consumption of millets. The NCDS helps in the assessment of district-level production and conducting baseline surveys. The basic roles of NCDS can be explained in the following manner (NCDS, 2022).

Role of NCDS in the Millet Mission

NCDS designed the mission of OMM in the early stage of development in 2017, which brought together both the Government of Odisha and Civil Society Organizations. It is known as *Shree Anna Abhiyan*. The Phase-I evaluation was done by NCDS researchers by considering the baseline 2016-17, and they evaluated the cultivation of millets, cultivated lands, number of farmers engaged, total productivity, engagement of women, livelihood and enhancement in socio-economic values. NCDS used Scientific Monitoring & Evaluation to assess the outcomes of programmes. As a result, this mission accelerated improvements in the performance of millet production, resilience of the environment, improvements in life and livelihood, and the development of tribal people in Koraput. The mid-term assessment conducted by NCDS offers substantial empirical evidence on the early spread of the Odisha Millet Mission (OMM) across Koraput district. During the Kharif season of 2019–20, OMM activities across the seven selected blocks extended to 204 Gram Panchayats and 1,197 villages and hamlets. The programme involved approximately 19,007 farmers,

with millet cultivation covering 7,318.91 hectares (NCDS, 2022). According to the report of Naba Krushna Choudhury Centre of Development Studies (NCDS, 2022), the OMM was launched in 2016-17 in Koraput, and the first-phase evaluation was conducted in 2017-18 to assess total yield, level of production, practices of agronomic techniques, nutrition, consumption and market accessibility. The programme was evaluated in seven (7) blocks with five hundred fifty-nine (559) households of millet cultivators and analysed the changes in production process, market participation, and involvement of women farmers (NCDS, 2022).

Tripathy et al. (2024) have focused on the assessment of the impact of the Odisha Millet Mission on tribal farmers living in Koraput, Odisha. They have used a purposive random sampling technique and collected data from one hundred twenty (120) respondents from four villages in Koraput. The basic objective was to assess the benefits gained by the mission and the successful implementation of the programme. The authors assessed the perceptions of farmers and beneficiaries based on different OMM practices, such as improved agronomic techniques, availability of quality seeds, food security, and increased consumption at both the household and commercial levels. The research concludes that OMM has played a vital role in enhancing employment and income among farmers in Koraput.

Saha et al. (2021) have emphasised the basic problems of the tribal population who lived in a highly vulnerable situation and faced malnutrition. There was environmental instability and exploitation of middlemen, which created risks for tribal farmers. The initiatives taken by OMM have helped the farmers, and they prefer millets to sell in mandis at the right price. There is collaboration between mandis and Large Area Multi-Purpose Societies (LAMPS), Tribal Development Cooperative Corporation (TDCC), Odisha State Agricultural Marketing Board, etc. The farmers get a mandi card which consists of their land holdings and the regulation of purchased quantity. As a result, the middlemen cannot exploit them. Another common problem of malnutrition in tribal people is curbed with the production and local consumption of millets.

Sahoo et al. (2024) have studied the impact of OMM on tribal lives and their livelihood in Koraput. Their study states that millet is a nutritious product that is consumed by both human beings and animals. Millet can be grown in low-water, environmentally varied, hilly areas with less moisture. The pro-environmental crop is getting popular due to OMM. The mission boosts cultivation through modern techniques, procurement, consumption and value addition. The study also states that OMM helps in creating employment and providing livelihood for

tribal farmers in Koraput. The study suggests that, for a better standard of living, further initiatives like creating awareness among tribal farmers must be taken by the government. It will provide more opportunities to them.

Rana and Sahoo (2023) have discussed the increasing participation of women farmers in millet farming in Koraput. Women play a multifaceted role in livelihood and household activities. The authors have collected data from three hundred (300) farmers engaged in farming and post-harvesting of millet. The authors have analysed that there is the demonstrative effect of women, and a large number of women are involved in diversified activities of cultivation of millet, its supply, marketing and consumption aspects. Rana and Sahoo have concluded that OMM strengthens the power of women and enhances their socio-economic status. Similarly, Chapke et al. (2025) focused on millet cultivation and its cultural significance in Koraput. This study also highlights the efforts of women farmers during the harvest and post-harvest period. The women farmers are more responsive and adaptive to accessible technologies.

Patnaik et al. (2024) have studied farmers who benefited from OMM in Koraput and farmers who do not belong to Koraput. OMM acts as an intervention by creating awareness among farmers about millet production through modern technology, adopting new cultivation strategies, selling quality products at reasonable prices through mandis, enabling easy and quick earnings, and engaging in social activities to create a broad publicity channel for millets. Similarly, by implementing a comprehensive value-chain approach, OMM integrates the production of millet, distribution and consumption. At the same time, it creates gender equity and maintains practices of climate resilience (WFP India & Odisha Millet Mission, 2022).

The United Nations in India has also emphasised that the Mission seeks to strengthen the livelihoods and food security of small-scale farmers, while simultaneously expanding millet consumption through institutional procurement and nutrition-focused interventions (United Nations in India, 2022). Consequently, OMM represents a transition beyond a purely production-centred model towards the creation of a broader and more integrated millet ecosystem.

3. OBJECTIVE AND METHODOLOGY

Main objective of this paper, while discussing the case, is to examine the implementation and evolution of the Odisha Millets Mission (OMM) in Koraput district, with particular emphasis on the production and expansion of millets and participation of farmers, especially women. The other main objective is to focus on challenges faced by OMM in Koraput and assess socio-economic

development of tribal-rural people with the sustainability of millet-based agriculture.

The case study approach follows a qualitative methodology to explore the Odisha Millet Mission in Koraput. Data are collected from secondary sources, including academic research, government publications, and NCDS reports.

4. FINDINGS AND DISCUSSION

4.1 Cultural resources as foundations of digital agribusiness narratives

According to the NCDS report, OMM has expanded in Koraput in its initial implementation stage. Initially, OMM has covered seven blocks, two hundred four Gram Panchayat and one thousand one hundred ninety-seven villages by the Kharif season (2019-20). Millet cultivation has covered approximately 7,318.91 hectares of land by nineteen thousand seven farmers.

Over this period, the programme had reached a cumulative total of 19,007 farmers (NCDS, 2022). The following table explains both indicators and the status of Kharif 2019-20

Indicator	Status by Kharif 2019–20
Blocks covered	7
Gram Panchayats	204
Villages/Hamlets	1,197
Farmers covered	19,007
Area under millet cultivation (ha)	7,318.91

Source: NCDS (2022), based on OMM monitoring records.

It is found that beyond the limited pilot programme, OMM has progressed successfully in Koraput and engaged a large number of farmers by providing their livelihood.

Similarly, the expansion can also be understood by the following table, which exhibits crop seasons, farmers and cultivated areas by farmers.

Crop season	Farmers covered	Area (ha)
Kharif 2017–18	2,662	1,134.45
Rabi 2017–18	111	61.40
Kharif 2018–19	6,542	2,348.74
Rabi 2018–19	145	50.80
Kharif 2019–20	9,547	3,723.52
Cumulative total	19,007	7,318.91

Source: NCDS, 2022.

The findings indicate that the majority of the programme's expansion took place during the Kharif seasons. This pattern can be attributed to Koraput's substantial reliance on agriculture dependent on monsoon

rainfall. The consistent growth in farmer participation across successive Kharif seasons further suggests that the geographical coverage and institutional reach of the Odisha Millets Mission (OMM) were gradually expanding (NCDS, 2022).

4.2 Shree Anna Abhiyan

"Shree Anna Abhiyan" is the local name for OMM in Koraput, which transformed the district into a centre of indigenous millet farming and increased the income of nearly thirty thousand local tribal farmers. The following picture is collected in this purpose which states the role of millets in the upliftment of tribal farmers.

4.3 Koraput's Success Story under Odisha Millets Mission

Nowadays, Koraput is very famous not only for sustainable production of ragi but also for rural infrastructural development. "*Mandia*" (or, millet), the finger millet, is heavily produced in hilly areas in Southern Odisha where rainfall is low. "*Mandies*", the millet procurement centres have been set up by the district administration across blocks like Kundra, Nandapur, etc., for fair pricing. Women empowerment is another achievement of Koraput as they have participated in controlling local processing units and preservation of seeds. Women Self-Help Groups (WSHGs) take initiative in food safety and security, supply chain management, and value-added services at the grassroots level. Ragi is a very nutritious crop, and OMM has emphasised reducing malnutrition by preserving nutrition very successfully in each phase of production, distribution and consumption (<https://milletsodisha.com/>).

4.4 Transformation of Tribal areas into Socio-Economic Development of farmers

The Department of Agriculture and Farmers' Empowerment in Odisha has promoted cultivation of millets through the Odisha Millet Mission in 2017 in Koraput with a vision to enhance the socio-economic condition of Tribal people by providing them both employment and nutritious life. The district of Koraput was very well known for resource constraints and lack of livelihood facilities. The crucial steps taken by the government to promote cultivation of millet have provided tremendous opportunities to the people of the tribal area. As the life of Ragi grows, the lives of farmers are being uplifted. Patnaik et al. studied the positive impact on the well-being of tribal communities and their socio-economic progress in 2020-21 and did interviews with villagers. They identified that the mission has helped them to enhance their knowledge in production

by adopting advanced technologies and increase their standard of living by increasing annual income. Without any gender discrimination, both males and females are engaged in farming of millet, its supply, and maintenance of the value chain, consumption and commercialisation. The socio-economic conditions of Tribal farmers have positively improved (Patnaik et al., 2024).

Under the guidance of IAS Keerthi Vasan, the District Collector, OMM has expanded in twelve blocks along with ten thousand hectares of cultivation with twenty-five thousand farmers, which has become a role model of sustainable development and inclusive farming in Koraput. The programme was started with seven blocks; now it provides collaborative implementation of modern farming approaches, such as the System of Ragi Intensification (SRI), System of Finger Millet Intensification (SFMI), etc., which reduces the use of inputs, enhances the productivity of millets, promotes the transplantation of young seeds and improves the resilience of crops <https://www.mssrf.org/stories-of-change/somarai-hantal>. The following picture depicts the success of Somarai Hantal, who has received the award of “Best SMI Farmer” on 10th November, 2025, at *Mandia Divas* (or, Millet day).

SMI is known as the System of Finger Millet Intensification or the System of Ragi Intensification approach to farming. The award winner has stated that by using such modern approaches, her yield has increased at an increasing rate. After receiving the award from the District Administration, Somarai has become an inspiration for many women not only in Goloriguda but also for all Tribal communities and Rural Farmers. <https://www.mssrf.org/stories-of-change/somarai-hantal>. By empowering Tribal Communities, OMM has connected farmers with institutional buyers by providing fair prices

for millet. The Minimum Support Price (MSP) scheme has been introduced, and value-added enterprises like Millet Shakti Cafes and outlets have been established in Koraput to make urban areas aware of millets and create more livelihood opportunities. The recent Koraput evidence particularly highlights the need to combine indigenous knowledge with ergonomic and gender-sensitive technological interventions (Chapke et al., 2025).

4.5 OMM: A Path Forward to Fulfilling SDGs

The Odisha Millet Mission (OMM), introduced by the Government of Odisha during 2017–18, represents an integrated policy intervention aimed at strengthening the millet sector across the stages of production, processing, marketing and consumption. Rather than treating millet cultivation solely as an agricultural activity, the mission connects it with nutrition, livelihood improvement, environmental sustainability and social inclusion. The success of OMM can also be evaluated in terms of Sustainable Development Goals (SDGs), by using a qualitative mapping approach based on the Food and Agriculture Organization’s Climate-Smart Agriculture framework. According to Bhattar and Laha (2026)

OMM has transformed hilly and dry areas with a lack of rain and low-fertility lands into a big commercial area of production of a nutritious product, Millet. The small farmers, tribal women and other rural people are engaged in farming millet locally and transporting it globally. OMM as an intervention contributes to achieving SDG goals. By cultivating millet in Koraput it employs tribal farmers. As a result, there is improvement in livelihood and reduction of poverty and fulfilment of the goal of SDG1. Similarly, Koraput is now very famous for producing and providing a very nutritious product, Millet. It is helpful



Figure 1. Millet crop cultivator being rewarded at a state level function

Source: <https://www.mssrf.org/stories-of-change/somarai-hantal>

to reduce malnutrition-related problems and preserve food properly, and fulfil the goal of SDG2. The goal of SDG 5 is achieved by OMM as it creates employment opportunities for both males and females without doing any discrimination. It maintains the principle of social inclusion. Similarly, economic development is the 8th goal of SDG, which is achieved by OMM by enhancing both life and livelihoods of tribal people. The climate resilience and environmental security goal is fulfilled by OMM (SDG13) (Bhatter & Laha, 2026)

I. Basic Challenges Faced By OMM

OMM has faced some basic challenges related to inadequate infrastructural development and lack of accessibility of quality seeds. Another issue is small and fragmented landholdings, low fertility of land and low productivity. OMM also faced high cost of production at its initial phase due to a lack of awareness and proper training in mechanical cultivation. The tribal farmers have faced difficulties due to exploitation of intermediaries regarding procurement, marketing and selling of millet. Again, lack of value addition facilities and inadequate processing facilities decline production (Nayak & Das, 2022; Tripathy et al., 2024; ICRISAT, 2021; Sahoo & Samantaray, 2021).

II. Strategies to Curb the Challenges

“Farm-to-Farm” strategy that strengthens the value chain from millet production to procurement can easily address the basic challenges. Timely provision of better-quality seeds by OMM has brought high-quality millet

that is full of nutrition. It helps to provide employment, reduce poverty, maintain the principle of inclusion and ensure environmental safety. By creating awareness among young farmers and taking help from traditional farmers, the mission has improved production and maintained food safety. The Self-Help Groups (SHGs) and Farmer Producer Organisation (FPO) take care of entire village-level processing and value addition. The procurement centres are decentralised, and prompt payment is given to farmers on their sales. It helps to make the millet-based product process systematic to maintain its nutrition and engage more and more women employed in millet farming enterprises. As a result, the socio-economic status of tribal people has gradually enhanced. (NITI Aayog, 2023; World Food Programme India & Odisha Millet Mission, 2022; ICRISAT, 2021; Government of India, 2026, <https://www.soundnlight.in/koraputs-success-story-under-odisha-millet-mission-2/>)

III. Future Scope and Applications

The future perspective and application of OMM is very broad and it is not restricted within the district, Koraput, but is spreading increasingly. The millet is used by local people as a source of food and fodder and for commercial uses. The “Shaktimayee Ward Mission Shakti Mahasangh”, “Subhadra Shakti Bazaars”, and “Women-Led Farmer Producer Organisations” are providing marketing platforms for tribal women farmers. At the same time millet has created its own place in foreign markets. The Agricultural and Processed Food Products Export Development Authority (APEDA) has facilitated Dubai



Figure 2. Prime Minister of India flagging off the first commercial millet consignment.

Source: Times of India- <https://timesofindia.indiatimes.com/city/bhubaneswar/odishas-first-millet-consignment-reaches-abroad/articleshow/97402045.cms>

Consignment for millet. The different products made from millet are appreciated in overseas (<https://timesofindia.indiatimes.com/city/bhubaneswar/odishas-first-millet-consignment-reaches-abroad/articleshow/97402045.cms>)

The above picture is the first commercial millet consignment that has reached the international market by Farmer Producer Organisations (FPO) run by women. By exporting millets and millet-related products like ragi chips. Snacks, flour, instant mixes etc., add value to millet and increase the income of tribal farmers. As a result, their standard of living will be increased, and they will maintain socio-economic security. They are self-dependent and use their community-based processing units for millet procurement (ICRISAT, 2021; NITI Aayog, 2023).

The OMM provides a large number of employment opportunities with the development of entrepreneurial skills and techniques. It preserves the environment and culture and enhances nutrition. It creates market expansion and women's empowerment. The significant and future scope of OMM is broader, as it includes strengthening vulnerable households, small and marginal farmers, serving children and supporting the production of a diversified diet. OMM acts as an intervention by creating institutional consumption and creating demand in the world market (United Nations in India, 2022; World Food Programme India & Odisha Millet Mission, 2022). OMM contributes to strengthening climate resilience by practising conservation of soil, soil moisture, soil management, crop diversification and proper use of natural resources and by producing millets to provide livelihoods for tribal farmers. Day by day, it expands and develops with the help of digital marketing. OMM enhances its scope by utilising online platforms for promotion, selling, and consumption of millet-based foods (ICRISAT, 2021; NITI Aayog, 2023).

5. CONCLUSION

The Department of Agriculture and Farmers' Empowerment of the Government of Odisha initiated the Odisha Millets Mission (OMM) in 2016-17. Its main objective was to cultivate millets in tribal, rain-fed regions of Koraput District. The programme was implemented in areas that were affected by unemployment, drought, malnutrition, food insecurity, ecological instability and limited livelihoods. Primarily, it was implemented in thirty blocks across seven districts, but gradually it has expanded to one hundred forty-two blocks across nineteen districts. Historically, millet was known as the diet of poor people and its position came after rice and wheat. People were not aware of the nutritional value of the food. But now as a nutritious food, millet is very popular not only in

Koraput, Odisha, but it is also exported to different states of India and also in overseas. By promoting millets as both a nutritious food and a viable agricultural commodity, the mission seeks to strengthen the resilience and economic well-being of vulnerable farming communities. Millets are included in welfare programmes in the Mid-Day Meal scheme and Integrated Child Development Services. OMM creates a platform for achieving Sustainable Development Goals (SDGs) of zero hunger and no poverty, reduction of malnutrition, provision of employment, women empowerment, socio and economic development. OMM also supports sustainable rural development and climate resilience.

Acknowledgements

The authors sincerely thank all individuals and institutions who supported this research study, particularly the guidance from editorial team of JHSSR, for revising and improving this paper.

Funding

No funding was received for this research.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Declaration of use of secondary resources in the Writing Process

During the preparation of this manuscript, the authors referred and used materials relating to OMM. But the authors independently developed the conceptual framework and scholarly arguments and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

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He has held academic and leadership positions at Berhampur University, VIT University, and KIIT University, where he served as Professor of Management and Chairperson of the MBA Programme. He has contributed to university academic and administrative bodies, including Boards of Studies, recruitment committees, and Academic Councils. He is a former President of the Operational Research Society of India (ORSI),

Bhubaneswar Chapter, and served for more than a decade as Chief Editor of Parikalpana: KIIT Journal of Management (now published by Emerald group of journals).

Professor Subudhi has authored 19 books and published more than 100 research papers in national and international journals and conference proceedings. His scholarly work has been published by internationally recognised publishers, including Springer, Taylor & Francis and Emerald Publishing. He has presented research at more than 60 academic conferences, including international forums, and has served as a resource person for numerous faculty development programmes and research workshops. He has supervised 16 doctoral scholars and completed five major funded research projects supported by national and international agencies. His academic contributions also include work in research methodology and social science research, including participation in an International Sociological Association conference at the University of Leicester, UK.

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Acknowledgement of
REFEREES FOR THE HORIZON
JOURNAL OF HUMANITIES & SOCIAL SCIENCES RESEARCH
(JHSSR)

July – October 2026

JHSSR-CUTM Special Edition [Vol. 8(S) Oct. 2026]

The Editorial Board of the HORIZON Journal of Humanities and Social Sciences Research wish to gracefully thank the following for acting as referees for manuscripts submitted to JHSSR between July and October 2026.

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REFEREES FOR THE HORIZON
JOURNAL OF HUMANITIES & SOCIAL SCIENCES RESEARCH
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JHSSR-CUTM Special Edition [Vol. 8(S) Oct. 2026]

Note

This JHSSR-CUTM special issue of the JHSSR has been reviewed by experts in Agribusiness & Agricultural Economics; Agricultural Entrepreneurship & Rural Enterprise; Agricultural Innovation & Smart Farming; Agricultural Policy & Institutional Studies; Agri-FinTech, Financial Inclusion & Risk Management; Climate Change, Environmental Sustainability & Resilience; Development Studies & Sustainable Development; Digital Agriculture & Digital Transformation; Fisheries & Blue Economy; Food Systems, Supply Chains & Market Access; Gender & Women's Economic Empowerment; Indigenous Knowledge, Culture & Environmental Humanities; Nutrition, Food Security & Sustainable Food Systems; Rural Development & Sustainable Livelihoods; Rural Sociology, Youth & Migration Studies.

These experts provided candid and critical comments, which helped our editorial team pinpoint the specific comments and improved the papers' quality. The JHSSR editorial board is very grateful for the invaluable contributions from all reviewers listed above (*sorted by alphabetical order by first name*).





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INSTRUCTIONS TO AUTHORS

(Manuscript Preparation & Submission Guide)

Revised: Oct. 2026

Please read the guidelines below and follow the instructions carefully. **Manuscripts that do not adhere to the Journal's guidelines will not be put into the peer-review process until requirements are met.**

MANUSCRIPT PREPARATION



A well-formatted manuscript follows all journal instruction. All elements of the manuscript are printed in English with 1-inch margins at top, bottom, and sides. Right margins are unjustified. Horizon journals accept manuscript submissions which uses any consistent text— Format-free Submission! This saves you time and ensures you can focus on your priority: the research.

However, citations/ references must be formatted by you as per APA format.

Submission Preparation Checklist

As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to these guidelines.

- ✓ The submission represents an original work that has not been published elsewhere nor submitted to another journal in any language for publication;
- ✓ The submission cites current theoretical and empirically-based literature, including relevant articles published in the Horizon Journal of Humanities and Social Sciences Research;
- ✓ The submission is written in language that is engaging, lively, and direct, using active voice whenever possible;
- ✓ The submission includes a maximum of four tables and figures uploaded as separate files, if applicable;
- ✓ The submission adheres to word count and APA 7 stylistic and bibliographic requirements; and
- ✓ The author/s must declare the use of Generative AI and AI-Assisted Tools in Figures, Images, and Artwork.

Checklist for Manuscript Submission

- Cover letter
- Declaration form
- Referral form
- Manuscript structure

(Title, Author details and affiliation, Abstract, Keywords, etc. using the **IMRAD** style). See below explanation.

Manuscript Types

Horizon accepts submission of mainly **four** types of manuscripts for peer-review.

1. REGULAR ARTICLE

Regular articles are full-length original empirical investigations, consisting of introduction, materials and methods, results and discussion, conclusions. Original work must provide references and an explanation on research findings that contain new and significant findings.

Size: Generally, these are expected to be **around 6,000** words (excluding the abstract, references, tables and/or figures), a maximum of 80 references, and an abstract of 100–150 words.

2. REVIEW ARTICLE

These report critical evaluation of materials about current research that has already been published by organizing, integrating, and evaluating previously published materials. It summarizes the status of knowledge and outline future directions of research within the journal scope. Review articles should aim to provide systemic overviews, evaluations and interpretations of research in a given field. Re-analyses as meta-analysis and systemic reviews are encouraged. The manuscript title must start with "Review Article".

Size: These articles do not have an expected page limit or maximum number of references, should include appropriate figures and/or tables, and an abstract of 100–150 words. Ideally, a review article should be **around 3,000 words**.

3. SHORT COMMUNICATIONS

They are timely, peer-reviewed and brief. These are suitable for the publication of significant technical advances and may be used to:

- (a) Report new developments, significant advances and novel aspects of experimental and theoretical methods and techniques which are relevant for scientific investigations within the journal scope;
- (b) Report/discuss on significant matters of policy and perspective related to the science of the journal, including 'personal' commentary;
- (c) Disseminate information and data on topical events of significant scientific and/or social interest within the scope of the journal.

The manuscript title must start with "*Brief Communication*".

Size: These are usually **between 800 to 1,500 words** and have a maximum of three figures and/or tables, from 8 to 20 references, and an abstract length not exceeding 150 words. Information must be in short but complete form and it is not intended to publish preliminary results or to be a reduced version of Regular or Rapid Papers.

4. OTHERS

Invited papers, Book reviews, Brief reports, Opinion, Case studies, Action research, Concept papers, Theological-Historiographical analysis, and Letters to the Editor may be considered subject to the discretion of the journal editors.

PLEASE NOTE: NO EXCEPTIONS WILL BE MADE FOR PAGE LENGTH.

Manuscript Format

Horizon emphasizes on the linguistic accuracy of every manuscript published. Articles must be in English and they must be competently written and argued in clear and concise grammatical English. Contributors are strongly advised to have the manuscript checked by a colleague with ample experience in writing English manuscripts or a competent English language editor.

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- **ABSTRACT:** Should describe your entire study at a glance. No more than 150 words (maximum).
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- **METHODOLOGY:** This should include details of any experiments conducted or data collected.
- **RESULTS AND DISCUSSION:** This section should answer the question you raised in the introduction.
- **CONCLUSION:** Here you should include your findings.
- **RESULTS AND DISCUSSION:** This section should answer the question you raised in the introduction.
- **CONCLUSION:** Here you should include your findings.
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- **ACKNOWLEDGEMENTS:** This usually follows the Discussion and Conclusions sections. Its purpose is to thank all of the people who helped with the research but did not qualify for authorship.
This could be someone from a sponsoring institution, a funding body, other researchers, or even family, friends or colleagues who have helped in the preparation. Individuals and entities that have provided essential support such as research grants and fellowships and other sources of funding should be acknowledged. Contributions that do not involve researching (clerical assistance or personal acknowledgements) should not appear in acknowledgements.
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are complete and consistently styled and formatted as per the journal's in-house style (APA Edn. 6 or 7) failing which your article will **not be accepted for peer-review**. You may refer to the Publication Manual of the American Psychological Association for further details (<http://www.apastyle.org/>). You may generate APA citations here: <https://www.scribbr.com/apa-citation-generator/new/article-journal/> A video is available for your viewing pleasure at <https://vimeo.com/191910171>

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APA citation example (7th edition)

Bakari, R. (2022). The relations among social media addiction, self-esteem, and life satisfaction in university students. *Horizon J. Hum. Soc. Sci. Res.*, 4(1), 176–186. <https://doi.org/10.37534/bp.jhssr.2022.v4.n1.id1148.p25>

- **BIOGRAPHICAL STATEMENT OF AUTHORS:** Authors should submit a biographical statement to be included in the manuscript to be published by JHSSR. The biographical statement should include the author(s) full name, affiliation, email. In addition, it is also appropriate to discuss your personal history, academic program and/or field placement, and interest in the article's subject. The biographical statement may **not exceed 75 words**. The author biography should be **separately** accompanied with a **high-resolution picture (in JPEG file format)** of each author listed in this manuscript as this would be published along with the article (**not pasted in a word file**).
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Most scientific papers are prepared according to a format called **IMRAD**. The term represents the first letters of the words Introduction, **M**aterials and Methods, **R**esults, **A**nd, **D**iscussion. IMRAD is simply a more 'defined' version of the "IBC" [Introduction, Body, Conclusion] format used for all academic writing. IMRAD indicates a pattern or format rather than a complete list of headings or components of research papers; the missing parts of a paper are: **Title, Authors, Keywords, Abstract, Results & Discussion, Conclusions, Competing interests' statement, Acknowledgement, Declaration on the use of Generative AI and AI-Assisted Tools in Figures, Images, and Artwork, References and Biographical Statement of Author(s)**. Additionally, some papers include Appendices or Supplementary data.

The *Introduction* explains the scope and objective of the study in the light of current knowledge on the subject; the *Materials and Methods* describe how the study was conducted; the *Results* section reports what was found in the study; and the *Discussion* section explains meaning and significance of the results and provides suggestions for future directions of research. The manuscript must be prepared according to the Journal's style.

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Manuscripts for submission to Horizon should be organised in the following order:

Page 1: Running head or title (No more than 40-character spaces).

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This page should also contain the **full title** of your paper not exceeding 30 words, with name(s) of all the authors, institutions and corresponding author's name, institution and full address (Street address, telephone number (including extension), hand phone number, and e-mail address) for editorial correspondence. First and corresponding authors must be clearly indicated.

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¹Department of English Studies, Texas University, Dallas, USA., ²Department of the Deputy Vice Chancellor, Texas University, Dallas, USA.

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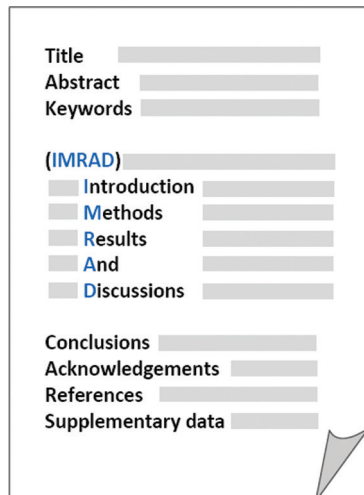
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This page should begin with the **Introduction** of your article and followed by the rest of your paper.

Manuscript Style

The manuscript should be written using the **IMRAD** style of writing. Regular Papers should be prepared with the headings INTRODUCTION, MATERIALS and METHODS, RESULTS AND DISCUSSION, CONCLUSIONS, ACKNOWLEDGEMENTS, REFERENCES, and SUPPLEMENTARY DATA (if available) in this order.



The diagram shows the structure of a manuscript in the IMRAD format. It includes sections for Title, Abstract, Keywords, (IMRAD) Introduction, Methods, Results, And, Discussions, Conclusions, Acknowledgements, References, and Supplementary data. Each section is represented by a horizontal bar of varying length, indicating its relative size in the document.

MAKE YOUR ARTICLES AS CONCISE AS POSSIBLE

Most scientific papers are prepared according to a format called IMRAD. The term represents the first letters of the words Introduction, Materials and Methods, Results, And, Discussion. It indicates a pattern or format rather than a complete list of headings or components of research papers; the missing parts of a paper are: Title, Authors, Keywords, Abstract, Conclusions, and References. Additionally, some papers include Acknowledgments and Appendices.

The Introduction explains the scope and objective of the study in the light of current knowledge on the subject; the Materials and Methods describes how the study was conducted; the Results section reports what was found in the study; and the Discussion section explains meaning and significance of the results and provides suggestions for future directions of research. The manuscript must be prepared according to the Journal's instructions to authors.

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All tables should be prepared in a form consistent with recent issues of Horizon and should be numbered consecutively with Roman numerals. Explanatory material should be given in the table legends and footnotes.

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JHSSR aspires to advance research in the field of social sciences through a collection of quality, relevant, and advanced interdisciplinary articles in the fields associated with the scope of the journal.

Published bi-annually, the journal encourages submission of manuscripts by lecturers, post-doctorates and scholars that use quantitative or qualitative methods. Articles combine disciplinary methods with critical insights to investigate major issues shaping national, state, and institutional contexts. We seek to present the cutting-edge innovations and/or latest insights and strive to maintain the highest standards of excellence for JHSSR.

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E-mail: CEE@horizon-jhssr.com
URL: www.horizon-jhssr.com

eISSN 2682-9096



PUBLISHER

B.P. Services
Masreca19, Persiaran Rimba Permai
Cyber 10, 63200 Cyberjaya, MALAYSIA

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