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REVIEW ARTICLE

Agricultural information sources and the knowledge level among paddy farmers in Odisha

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Abstract

Odisha's economy is largely based on paddy cultivation, which employs 83.3 % of the workforce and contributed 21.27 % to the state's GDP (2020-21). Despite its significance, many small and marginal farmers struggle with limited access to timely and reliable agricultural information, affecting their productivity and sustainability. This study explores the sources from which paddy farmers in Odisha obtain their farming knowledge and evaluates how effective these sources are in improving their practices. Using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) methodology, we analyzed 372 studies and selected 63 for detailed review. Results show that 56.66 % of farmers turn to Kisan call centers, while 47.50 % use ICT tools for guidance. Television (39.16 %) and mobile phones (43.34 %) remain widely used, but barriers like digital literacy gaps and limited access to modern technology still hinder effective knowledge-sharing. To bridge these gaps, a balanced approach is needed, one that combines digital innovations with traditional extension services. Strengthening participatory models like farmer field schools and agricultural knowledge and information systems (AKIS) can improve knowledge transfer, encourage the adoption of better farming practices and support long-term sustainability. By integrating technology with conventional methods, policymakers and extension workers can create a more inclusive, accessible and effective agricultural information system, enabling farmers to enhance their livelihoods and make well-informed decisions.

Keywords: agriculture; information; knowledge level; paddy

Introduction

In India, agriculture continues to be the key pillar of the economy and a critical sector supporting rural livelihoods and national food security (1). Paddy production is of immense significance in Odisha, which significantly contributes to India's total rice output. Paddy cultivation is essential to the state's economy and food security since a significant section of the population makes their living from it (2). Approximately 54.6 % of the nation's workforce and 83.3 % of Odisha still work in agriculture and related fields, which contributes 17.8 % of the nation's and 21.27 % of the state's gross value added (GVA) during 2020-21 (3). In Odisha, 35 % of the gross cropped area is irrigated, leaving a significant portion of paddy cultivation dependent on monsoon rains. Projects like the Hirakund dam in western Odisha have helped improve irrigation coverage, but many regions still struggle with water scarcity during the *Rabi* season. The promotion of water-saving practices is critical for improving water-use efficiency in the state (4).

Most farmers in Odisha are small and marginal and their limited access to timely and relevant information makes it difficult for them to improve agricultural production and development (5). The use of information channels by paddy producers is either directly or indirectly linked to higher levels of production, financial stability and farmer empowerment (6). India has one of the world's most complex public systems for assessing, generating and disseminating agricultural information (7). Even though there are many sources and channels available for sharing agricultural information, it's important to understand which one's farmers prefer and rely on based on their unique social and economic circumstances (8). Additionally, farmers are the end users of information including diverse farm technologies and their adoption of newer technologies is influenced by the communication channels through which such information is delivered (9).

The main aim of agricultural education, research and outreach efforts is to support farmers by ensuring they have access to reliable, practical knowledge they can apply on their farms (10). More focus needs to be placed on sharing scientific and technological knowledge from agricultural research institutions with farmers to ensure they can benefit from the latest advancements. As agriculture rapidly transitions from a

traditional, artisanal, labour-intensive industry to a sophisticated, information-intensive sector of the global economy in the twenty-first century, access to information and the use of contemporary communication technologies have become essential for farmers worldwide, particularly in developing nations (11). Factors associated with agriculture, including land, labour, capital and managerial skills, can be enhanced by pertinent and trustworthy knowledge. Therefore, it is extremely important that information be provided to its real consumers through extension, research, education and other organisations (12).

In the southern and eastern regions of the nation, particularly in regions with annual rainfall of more than 150 cm, paddy constitutes the primary food (2). For billions of people paddy is the source of life. In Asia, rice and its derivatives provide 60 to 70 % of the calories consumed by over 2000 million people (13). The United Nations General Assembly (UNGA) declared 2004 to be the international year of rice, highlighting its importance with the theme "Rice is Life" (14).

In areas where rice (paddy) is a staple crop, information transfer plays a critical role in enhancing paddy cultivation methods. Higher yields, more sustainable agricultural practices and more resistance to environmental changes are the outcomes of effective knowledge transfer, which guarantees that farmers have access to the newest technologies, equipment and practices (15).

Modern paddy cultivation methods have been extensively promoted by the state government and agricultural organization. This study aims to investigate how paddy farmers acquire agricultural knowledge and to pinpoint methods for improving knowledge absorption and information distribution. This is crucial for improving agricultural methods, raising output and encouraging sustainability among Odisha's paddy farmers.

In this study, a systematic review approach known as the preferred reporting items for systematic reviews and meta-analyses (PRISMA), which includes information from credible sources. PRISMA involves four steps: (1) identification, (2) screening, (3) inclusion and (4) eligibility was done by analysing the scholarly articles on agricultural information dissemination and their sources and farmer knowledge in paddy cultivation (16). PRISMA is often used to carry out systematic reviews and meta-analyses, especially in the fields of environmental science and healthcare (17).

Systematic review process

Identification

To extract suitable articles for the qualitative method, the systematic review procedure was divided into three stages: (1) identification, (2) screening and (3) eligibility. The analysis flow diagram presents a structured and rigorous review process undertaken to explore agricultural information sources and the knowledge level among paddy farmers in Odisha. The study commenced with comprehensive searches in two major academic databases-Scopus (n = 178) and Web of Science (n = 194) resulting in 372 records after removing duplicates (Fig. 1). During the screening stage, 94 records were excluded based on predetermined criteria such as being book chapters, conference proceedings, data papers, non-English publications, those published before 2010 or unrelated to the core subject areas (agricultural sciences, environmental sciences, computer science and social sciences). The remaining 278 full-text articles were evaluated for eligibility, of which 215 were excluded for lacking direct relevance to the research focus. Ultimately, 63 studies met the inclusion criteria and were subjected to detailed quantitative analysis and meta-synthesis. This methodical approach ensures that only the most relevant and high-quality studies were considered, providing a strong foundation for understanding how various information sources influence the knowledge and decision-making capacity of paddy farmers in Odisha. First, using dictionaries and previous research, relevant and similar keywords were found throughout the identification process.

In order to determine the search strings for the Web of Sciences and Scopus databases, a well-structured and focused keyword strategy employed for literature retrieval, specifically for the study on agricultural information sources and the knowledge level among paddy farmers in Odisha (Fig. 2). In Scopus, the search was conducted using the core terms "information," "knowledge" and "paddy" with the publication window set between 2010 and 2025 and restricted to relevant subject areas including agriculture (AGRI), environmental science (ENVI), computer science (COMP) and social sciences (SOCI). A comprehensive set of exact keywords was used to ensure thematic relevance, such as "paddy field," "rice," "cultivation," "remote sensing," "climate change," "water management," "farmers' knowledge," "agricultural robots," "fertilizer application" and others. These keywords reflect the intersection of traditional farming practices, emerging technologies and knowledge dissemination mechanisms. The WoS database followed a similar approach, using the same core search terms and subject areas, with results limited to publications between 2010 and 2024 in the English language. This targeted and systematic keyword framework ensured the inclusion of high-quality, domain-specific literature that directly aligns with the study's objective of assessing how agricultural information is accessed and utilized by paddy farmers in Odisha.

Screening

Screening was the next step in the systematic review procedure. Using inclusion and exclusion criteria, duplicate and irrelevant articles were eliminated in this stage. While the 372 articles were reviewed using the inclusion and exclusion criteria, two things were eliminated in this stage (Table 1). Subject area, timeframe and regions, language and type of literature were among the inclusion and exclusion criteria. In order to remove items like books, book chapters, conference reviews and data papers, the study first determined what kind of research articles to concentrate on in the journal. Furthermore, the research made the decision to exclusively use English. Furthermore, the research did not include any information released before 2010 or beyond 2024. Furthermore, the researcher exclusively examined papers from the biology, agriculture, environmental, computer science and social sciences. Therefore, 94 items in total were excluded according to the inclusion and exclusion guidelines.

Eligibility

Examining the materials' title, abstract and substance was crucial to determining the inclusion criteria and the review's goal. In the third level eligibility level, 278 publications were used and evaluated and finally 63 documents remained which were used for analysis in this study.

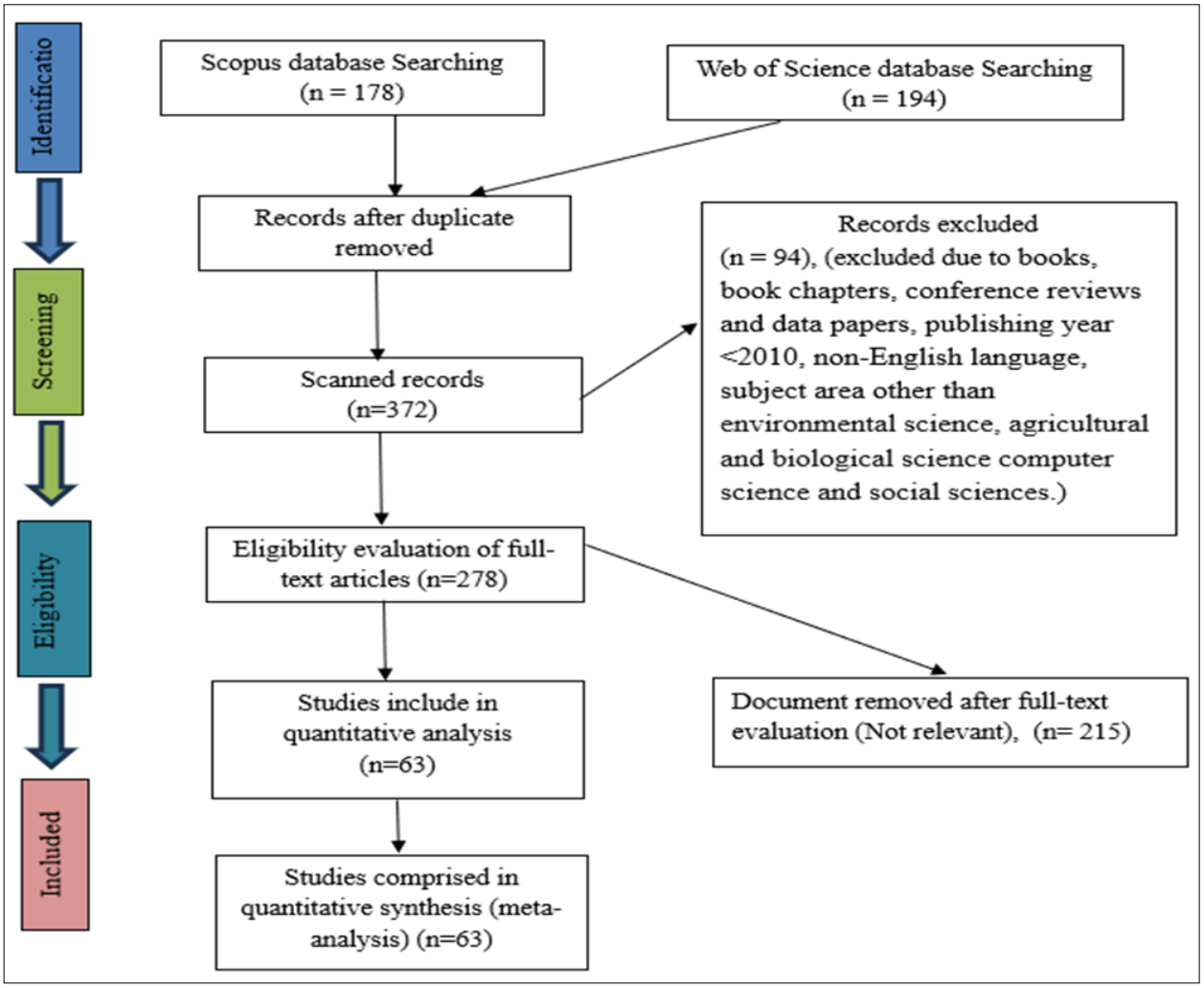


Fig. 1. Systematic review process flow diagram.

Database	Keywords
Scopus	TITLE-ABS-KEY (information AND knowledge AND paddy) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (SUBJAREA , "AGRI") OR LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "COMP") OR LIMIT-TO (SUBJAREA , "SOCI") LIMIT-TO (EXACTKEYWORD , "Rice") OR LIMIT-TO (EXACTKEYWORD , "Paddy Field") OR LIMIT-TO (EXACTKEYWORD , "Agriculture") OR LIMIT-TO (EXACTKEYWORD , "Cultivation") OR LIMIT-TO (EXACTKEYWORD , "Remote Sensing") OR LIMIT-TO (EXACTKEYWORD , "Crops") OR LIMIT-TO (EXACTKEYWORD , "Climate Change") OR LIMIT-TO (EXACTKEYWORD , "Food Supply") OR LIMIT-TO (EXACTKEYWORD , "Soils") OR LIMIT-TO (EXACTKEYWORD , "Satellite Imagery") OR LIMIT-TO (EXACTKEYWORD , "Water Management") OR LIMIT-TO (EXACTKEYWORD , "Food Security") OR LIMIT-TO (EXACTKEYWORD , "Crop Production") OR LIMIT-TO (EXACTKEYWORD , "Paddy Farming") OR LIMIT-TO (EXACTKEYWORD , "Paddy Rice") OR LIMIT-TO (EXACTKEYWORD , "Oryza") OR LIMIT-TO (EXACTKEYWORD , "Farmers Knowledge") OR LIMIT-TO (EXACTKEYWORD , "Agricultural Robots") OR LIMIT-TO (EXACTKEYWORD , "Classification (of Information)") OR LIMIT-TO (EXACTKEYWORD , "Knowledge") OR LIMIT-TO (EXACTKEYWORD , "Agricultural Management") OR LIMIT-TO (EXACTKEYWORD , "Paddy-rice") OR LIMIT-TO (EXACTKEYWORD , "Fertilizer Application") OR LIMIT-TO (EXACTKEYWORD , "Fertilizers") AND (LIMIT-TO (LANGUAGE , "English"))
Web of Science (WoS)	TITLE-ABS-KEY (information AND knowledge AND paddy) AND PUBYEAR > 2009 AND PUBYEAR < 2025 AND (SUBJAREA , "AGRI") OR (SUBJAREA , "ENVI") OR (SUBJAREA , "COMP") OR LIMIT-TO (SUBJAREA , "SOCI") AND (LIMIT-TO (LANGUAGE , "English"))

(Source: Web of Science and Scopus)

Fig. 2. Web of Science and Scopus database.

Table 1. Inclusion and exclusion criteria for selected paper Web of Science and Scopus data base

Criterion	Eligibility	Exclusion
Literature type	Research articles and reviews	Books, book chapters, conference reviews and data papers
Language	English	Non-English
Time period	2010 - 2025	<2010
Subject areas	Environmental science, agricultural and biological science, computer science and social sciences	Other than environmental science, agricultural and biological science, computer science and social sciences

Inclusion

Therefore, 63 documents remained and were used for analysis in this study.

Theoretical framework and concepts

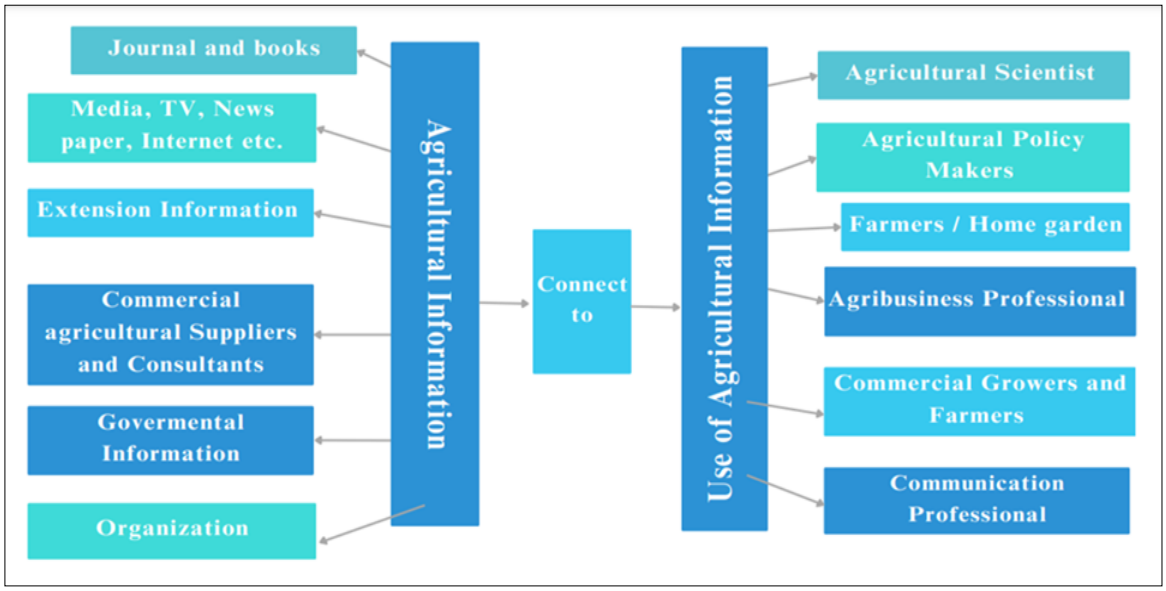
Concept map for agricultural information is presented in Fig. 3 (10). An agricultural information system is a platform that collects, processes, shares and manages agricultural data, ensuring that these processes work together smoothly to support the knowledge and decision-making of farmers (18).

The significant potential services to paddy farmers through the application of ICT include a variety of applications for enhancing productivity, sustainability and efficiency in decision-making. These include ICT-based weather forecasting, which offers real-time and location-based climate information. ICT-based agricultural market information systems, which furnish real -time prices and demand-related data. ICT facilities for enhancing soil quality by means of precision agriculture and monitoring soil health and solutions for effective water resource management in order to ensure optimal irrigation strategies as well as conserving water resources (19).

Among them, television (39.16 %) and cell phones (43.34 %) are the most common ways that paddy farmers in Odisha's Nuapada district receive agricultural knowledge. These devices offer vital agricultural information. It was observed that ICT tools offer retrievable information to 47.50 % of the growers and the Kisan call centre provides agriculture information to 56.66 % (20). The online phone-based expert assistance service, Kisan call centers (KCC), was introduced by the Department of Agriculture & Cooperation (DoAC & FW), Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India. This service has been accessible to farmers across the nation since January 2004. The agricultural community may get extension services by calling the toll-free number "1800-180-1551," which is open every day from 6 am to 10 pm (21).

In agriculture, communication methods are essential for improving farmers' production, involvement and knowledge (22, 23). Communication models in agriculture are frameworks used to understand how information, knowledge and technologies are transferred from one entity to another within the agricultural sector. In agricultural communication, no single model can effectively meet all the needs of farmers (24). Instead, a combination of models is often the most effective way to ensure that farmers can access and implement useful knowledge. For example, mass media can provide general advice on a wide scale, while participatory and agricultural knowledge and information system (AKIS) models ensure localized, farmer-centred communication.

AKIS is a conceptual framework that describes the network of actors, institutions and processes involved in the creation, exchange and application of agricultural knowledge and information. It includes researchers, extension services, educators, input suppliers, farmer organizations, policy-makers and farmers themselves. The model emphasizes strong linkages and continuous interaction among these stakeholders to ensure that innovations are demand-driven, context-specific and effectively translated into practice. By fostering collaboration and knowledge flow, AKIS aims to enhance agricultural productivity, sustainability and the overall resilience of farming communities (25). Among them, dialogic communication is more important in participative communication than linear communication (26). The focus is on collaborative and participatory processes in research, issue identification, decision-making, change implementation and assessment.



Source: (NP.2012)

Fig. 3. Concept map for agricultural information.

Enhancing farmers' empowerment and adaptability to the effects of climate change through participatory communication. AKIS concept emerged in the late 1980s and early 1990s, primarily developed and promoted by the World Bank in collaboration with the Food and Agriculture Organization (FAO). AKIS framework is a participatory paradigm that emphasises communication and interaction amongst various agricultural sectors. Knowledge exchange among farmers, researchers, extension officers, agribusinesses and policymakers are highlighted by the AKIS model (27).

National agricultural policies and priorities influence the focus areas of AKIS activities and research and innovation, focusing either on sustainable development, climate adaptation or rural development (28). Also, the diffusion of innovations model developed by Everett Rogers is one of the most widely used frameworks in agricultural communication (29). The diffusion of innovations model aptly explains technology adoption in paddy farming in Odisha. The uptake of innovations-such as climate-resilient practices, urea deep placement, mechanization and hybrid seeds-is influenced by factors including access to extension services, education, institutional support, farmer group participation and secure land tenure. Successful diffusion of these technologies has resulted in higher yields, increased income and improved farm efficiency among adopting farmers. It also identifies key influencers (early adopters, change agents) who accelerate the spread of innovations in rural communities (30).

Sources of agricultural information for paddy farmers

Agricultural information is a broad range of data and communications relevant to farmers' agricultural production operations (31). Natural resource production and conservation, animal husbandry and welfare and agricultural production and protection are all included in this. Furthermore, the information must include the recognition of the inherent ambiguity in decision -making processes (32). Information performs a crucial role in development, especially in the agricultural field, where rice farming is vital as rice is the staple food (33).

The primary information sources utilised by farmers in the state of Haryana are the agriculture sector (39.7 %), radio (23.8 %), agricultural universities (33.5 %) and television (38.4 %). Periodically, information was given by the agriculture development officer, horticulture development officer and other agriculture officials of other agriculture departments at the state agricultural department. Agricultural input merchants maintained constant contact with farmers (34). They also provide farmers with timely information on new seed kinds and chemicals. It has been revealed that input dealers provided 21.9 % of farmers with the latest information, followed by private businesses (17.1 %) and other farmers (16.2 %). A relatively small number of farmers (8.8 %) obtained up-to-date information from the internet. It proves that farmers were isolated from the quickly changing technologies of this era. The respondents' level of literacy may be the cause of this.

Farmers' adoption of various enhanced agricultural techniques is influenced by the reliability of information channels and sources (35). According to paddy producers, credibility is the dependability and knowledge of the sources and distribution channels of paddy information. The agriculture department (84.52), co-operatives (80.56) and agricultural scientists (85.00) were the main reliable personal cosmopolite sources. Agricultural scientists and departments are considered the most reliable personal cosmopolitical sources because of their solid understanding of the agricultural field.

Key sources of information

Government extension services

Farmer producer organizations (FPOs) have emerged as key players in agricultural, supported by favourable legal and policy frameworks and government programmes that aim to give smallholder farmers more authority (36). The FPOs eliminate middlemen by connecting farmers directly to markets (37). This enables farmers to adapt their production by assisting them in better understanding market demands and quality standards and FPOs also spread information about integrated pest management (IPM) and additional eco-friendly approaches to pest management (38).

NGOs and community-based organizations: Non-governmental organizations (NGOs) and community-based organizations (CBOs) serve as vital information sources for paddy growers, particularly in rural and underserved areas. These organizations provide farmers with access to agricultural best practices, climate-resilient farming techniques and market information to enhance productivity and sustainability (39, 40). Through training and workshops, demonstration plots and capacity-building programs, NGOs and CBOs enable paddy growers to adopt innovative farming technologies and address challenges like pest management, water scarcity and soil health (41). Additionally, they often act as intermediaries between farmers and government agencies, facilitating access to subsidies, credit schemes and extension services. By fostering community participation and empowering farmer groups, NGOs and CBOs contribute to the development of resilient and self-reliant agricultural communities.

ICT-based tools (mobile apps, SMS, social media, radio, television)

Informal networks: Informal networks are a reliable and easily available source of information for paddy farmers in Odisha and they are crucial in the dissemination of agricultural knowledge (42). These include the internet, extension agents, local organizations, fellow farmers and community media (43, 44). Farmers rely heavily on these informal exchanges due to their immediacy, contextual relevance and cost-effectiveness, especially in remote areas where formal agricultural extension services may be limited (45, 46).

The government of Odisha has implemented various programs to enhance information sources available to paddy farmers as:

1. **Odisha free smartphone yojana for women farmers**: It is launched on 9thApril, 2018 and provides smartphones to women farmers to get useful agriculture information (47).
2. **Mukhyamantri abhinav krushi yantrapati samman yojana**: May 2018, for rewards innovation of farming tools and implements.
3. **Mukhyamantri krushi udyog yojana:** Launched on 17thMay 2018, provide subsidized loan to farmers.
4. **KALIA Yojana:** Launched on 21stDecember 2018, KALIA stands for -"krushak assistance for livelihood and income augmentation". This government yojana has been launched by the state government of Odisha for the welfare of farmers in the

state (48).

Impact of agricultural information on paddy cultivation practices

Dissemination of relevant information, especially in paddy farming, is crucial in helping farmers adopt modern technologies, improve crop management and effectively address environmental issues such as pests, diseases and climate change (49). Along with other elements, including soil, weather, biochemical products and their use, information access is essential to obtaining the greatest agricultural goods. Farmers who engage in agricultural operations need a variety of knowledge (50). Among its impact, agricultural information enhances productivity, improves water management, promotes sustainable farming practices, enables better pest and disease control, supports adaptation to climate change and reduces input costs (51). Also, information transfer efficiency is influenced by seed selection criteria, with centrality measures enhancing diffusion success, while random selection can yield variable results due to high uncertainty (52).

Productivity and crop yield

One of the primary determinants of agricultural yield and productivity is climate (53). Climate factors, particularly temperature and rainfall, have a direct influence on farming and any changes to them will undoubtedly have a big effect on crop output and yield. Newspapers, internet and television are just a few of the information sources that offer news and updates prior to weather changes (54).

Strategies to improve information sources and knowledge among paddy farmers

Farmers have different choices for information sources. However, most extension organizations have limited resources and time to investigate how diverse information sources influence the spread of new and improved technologies and the farmers should be given an opportunity to get timely farm-related information (55). The enhanced technology and agricultural knowledge distributed through technologies can significantly contribute to agricultural growth in a developing nation like India (56). Enhancing information sources and knowledge among paddy farmers is crucial for boosting productivity, sustainability and resilience in rice cultivation. The following evidence-based strategies are tailored to meet the specific information and knowledge needs of paddy farmers.

Mobile applications and digital solutions powered by ICT

Customized mobile applications: Agricultural mobile applications have been shown to improve accessibility and knowledge exchange among paddy farmers. In India, mobile systems such as Kisan call centre and e-krishi have offered farmers guidance on crop management, insect control and fertiliser application. This digital method facilitates the distribution of localised information, empowering farmers to make educated decisions (57).

Digital and SMS notifications for prompt information: Timely information dissemination, especially through digital and SMS alerts, is crucial for rice farmers to respond to weather fluctuations and pest outbreaks (58).

Empowering extension workers: Providing agricultural extension staff with up-to-date and pertinent knowledge, especially about climate adaptability and novel paddy varieties, can improve their capacity to assist paddy farmers (59, 60).

Outreach to the mass media and farmer education

Agricultural radio programs: Mass media platforms like as radio and television provide effective means to disseminate crucial information to a substantial number of paddy farmers. Radio programs include consistent agricultural segments on subjects such as pest management, appropriate irrigation and post-harvest handling, resulting in a significant enhancement of farmers' understanding and the adoption of best practices (61).

Farmer field schools (FFS): Farmer field schools focus on practical, hands-on learning and have been highly successful in transferring knowledge among paddy farmers. An evaluation shows that FFS participants are more likely to adopt integrated pest management (IPM) techniques, reducing pesticide use and improving yield quality (62).

Collaborations with agricultural research institutions

Collaborations with institutions of agricultural research: Partnerships among governments, academic institutions and the commercial sector can promote the adoption of cutting-edge methods for growing rice. For example, high-yielding rice cultivars have been developed as a consequence of collaborations with the International Rice Research Institute (IRRI) and resilient farming practices, which are then shared with farmers through organized training.

Interaction with local NGOs and cooperatives: NGOs and farmer cooperatives are instrumental in bridging knowledge gaps. Organizations such as Oxfam have worked with local farmer groups to introduce sustainable rice intensification (SRI) practices, which have led to increased yields and water conservation (63).

Knowledge level

Understanding knowledge levels among paddy growers in Odisha is essential to identify the key drivers of productivity, sustainability and resilience in the field of agriculture. As a cornerstone of Odisha's economy and food security, paddy farming draws on a blend of traditional wisdom and modern practices across critical areas, including crop selection, pest management, water usage and post-harvest handling. This diverse knowledge base enables farmers to adapt and respond to evolving agricultural challenges while supporting long-term productivity. However, many paddy growers in Odisha face knowledge constraints due to gaps in agricultural education and inadequate access to updated information sources (64). Knowledge levels among paddy growers in Odisha were categorized as medium (48.34 %), high (30 %) and low (21.66 %) regarding information and communication technology tools and rice cultivation practices (20).

Adaption of agricultural innovations

Adoption of innovative agricultural technology and techniques by rice farmers is heavily dependent on efficient information transmission systems that close the knowledge gap between practical application and research. Various information channels play a crucial role in this process, including extension services, mass media, peer-to-peer networks and modern ICT tools. Traditional approaches, such as guidance from agricultural extension officers and on-field demonstrations, continue to provide personalized support to farmers. Meanwhile, contemporary channels like mobile apps, SMS alerts and social media network are increasingly leveraged to reach broader audiences efficiently. Participatory learning techniques and farmer field schools further increase the innovations' applicability and

accessibility, assisting farmers in comprehending and implementing these practices in their unique environments (65, 66).

Research gap

Limited comparative evaluation of agricultural information sources

There is a noticeable lack of comprehensive studies that systematically compare the effectiveness, accessibility and reliability of diverse agricultural information sources—such as government extension services, ICT platforms, mass media, progressive farmers and agri-input dealers.

Insufficient research on trust and credibility of information sources

The influence of trust, credibility and perceived relevance on the acceptance and utilization of agricultural information by paddy farmers remains underexplored. Understanding these perceptions is essential to improving the design and delivery of extension services.

Under representation of ICT adoption in remote and tribal areas

Despite the growing use of ICT in agriculture, there is limited empirical evidence on the adoption, accessibility and utility of digital tools (such as mobile apps, WhatsApp groups and agri-portals) among paddy farmers in remote and tribal-dominated regions of Odisha.

Limited longitudinal studies on knowledge retention and application

There is a lack of longitudinal research tracking how agricultural knowledge is retained, updated and practically applied by paddy farmers over multiple seasons. Such insights are crucial for designing continuous learning interventions.

Lack of evidence on policy and scheme awareness through information sources

There is minimal research evaluating the extent to which agricultural information sources disseminate government scheme-related knowledge (e.g., PM-KISAN, DBT, crop insurance) and how this affects farmers' awareness and uptake of benefits.

Conclusion

Improving paddy production in Odisha involves timely and authentic farm information, particularly for small and marginal farmers. Various channels-government extension services, ICT tools, FPOs, NGOs and community organizations-are major sources of knowledge sharing but are influenced by farmer awareness, accessibility and trust. Cyber facilities such as call centres, mobile applications and the social media are filling the gap in knowledge, while programmes such as the Odisha Free Smartphone Yojana and KALIA Yojana are making information and financial assistance even more accessible.

A mixed method of adopting traditional extension approaches with newer ICT and participatory communication models can largely enhance the uptake of better practices. Priorities involve better farmer education, enhancing digital literacy and promoting inter-agency collaboration among research institutions, government departments and local farming communities. By providing paddy farmers with credible and relevant information, productivity, resilience and long-term sustainability in Odisha's agriculture can be improved significantly.

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Authors' contributions

SS collected the information required for the research article. AP has written the manuscript. MDR interpreted the information and prepared the final draft of the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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