A Sociological Study of Awareness and Selective Adoption of Agricultural Technology among Smallholder Farmers in Khanapur Taluk

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ABSTRACT

Agricultural technology is widely promoted to improve farm productivity and rural livelihoods. However, awareness does not necessarily lead to adoption, particularly among smallholder farmers. This paper examines the awareness and selective adoption of agricultural technology among smallholder farmers in Khanapur Taluk, Belagavi district, Karnataka State, India. It applies Rogers' diffusion of innovations, Bourdieu's forms of capital and the Farmer First perspective to explain how information, inequality, social networks and farmers' practical knowledge shape technological choices. The study draws on official statistics, published research, institutional reports and documented local cases relating to paddy cultivation, sweet potato production, community seed conservation, agricultural extension and collective organisations. The findings show that farmers adopt technology selectively rather than uniformly. They readily accept practices that are affordable, familiar and compatible with existing farming systems, but remain cautious about methods that require greater investment, specialised knowledge, labour coordination or control over water. Community seed conservation further shows that farmers are not merely recipients of externally introduced technology; they are also producers and custodians of agricultural knowledge. The study concludes that awareness and adoption are socially embedded processes shaped by landholding, economic and cultural capital, labour availability, gender relations, institutional access, trust and ecological suitability.

Keywords: Agricultural technology, awareness, selective adoption, smallholder farmers, agrarian inequality, indigenous knowledge

Introduction

Agricultural technology has become an important part of India's strategy to improve agricultural productivity, strengthen rural livelihoods, and modernise the delivery of farm services. Public and private institutions increasingly promote improved seed varieties, mechanised equipment, soil testing, mobile advisories, digital markets, drones, and precision-farming practices. The Digital Agriculture Mission, approved in September 2024 with an outlay of ₹2,817 crore, seeks to develop digital agricultural infrastructure through initiatives such as AgriStack, Farmer IDs and digitally enabled decision-support systems [6-7]. However, the growing availability of technology does not necessarily ensure equal access, understanding or use among farmers. This issue is especially significant because small and fragmented operational holdings dominate Indian agriculture. Marginal and small holdings measuring less than two hectares constitute 86.08 per cent of all operational holdings in the country but account for less than half of the total operated area [5]. Smallholder farmers often face constraints related to limited land, inadequate finance, labour shortages, uncertain markets, weak institutional support and unequal access to technical knowledge. Consequently, their adoption of agricultural technology cannot be explained only in terms of individual interest or willingness.

From a sociological perspective, awareness and adoption are related but distinct processes. Awareness refers to a farmer's knowledge of a technology, whereas adoption involves the decision and capacity to put that knowledge into practice. Farmers may be aware of an innovation but unable or unwilling to use it because of cost, complexity, risk, labour requirements or incompatibility with local farming conditions. Access to information is also socially mediated through extension workers, input dealers, neighbours, progressive farmers, cooperatives, producer organisations and digital platforms. These relationships influence what farmers know, whom they trust and which technologies they consider suitable. Selective adoption is therefore central to this study.

Farmers do not necessarily accept or reject agricultural technology as a complete package. They may adopt improved seeds and selected fertiliser recommendations while continuing to use traditional cultivation or harvesting methods. They may also modify an introduced practice, postpone its use, or retain local varieties better suited to local soils, rainfall, household labour, and market demand. Such decisions should not automatically be understood as ignorance, resistance or unwillingness to modernise. They may reflect practical, informed responses to ecological uncertainty, economic limitations, and the risks smallholder households face. Khanapur Taluk in Belagavi district (India) provides a relevant setting for examining these processes. The taluk lies in Karnataka's hilly agro-climatic zone and is characterised by extensive forest cover, high rainfall, paddy cultivation, and a substantial proportion of small and marginal holdings. These conditions influence the suitability, affordability and accessibility of agricultural technologies. At the same time, local practices of seed conservation, farmer-to-farmer learning, extension

demonstrations and collective organisation indicate that technological change is not produced only by government agencies, scientists or commercial institutions [27–33]. Farmers and their social networks also conserve, adapt and circulate agricultural knowledge.

Existing studies have examined farmers' awareness of digital tools, their adoption of recommended agricultural practices and the economic, social and technical barriers to technology use [13–22]. These studies identify cost, credit, education, training, connectivity, farm size and institutional access as important influences [13–22]. However, adoption is often treated mainly as an individual decision or measured through the use of particular inputs, applications and machines. Less attention is given to the combined influence of agrarian inequality, social relationships, gender, institutional mediation, ecological conditions and indigenous knowledge. Sociological analysis of how these factors shape the shift from awareness to actual use among smallholder farmers in the distinctive agrarian setting of Khanapur Taluk is also limited.

Against this background, the present paper examines awareness and selective adoption of agricultural technology among smallholder farmers in Khanapur Taluk. It asks which technologies are adopted, adapted or avoided; how landholding, labour, education, finance, gender and social networks shape these choices; and how local ecology and farmers' knowledge influence the perceived suitability of innovations. Rogers' diffusion of innovations helps explain the movement from awareness to adoption; Bourdieu's forms of capital explain unequal capacities to acquire and use technology; and the Farmer First perspective recognises farmers as knowledgeable actors who assess, adapt, and generate agricultural practices. The paper thus approaches agricultural technology adoption not merely as a technical or economic decision but as a socially embedded process shaped by inequality, trust, institutional access and practical judgement.

Review of The Literature

Agricultural technology adoption is a complex social process, not a simple response to the availability of innovation. Existing studies show that awareness, access and use are shaped by farm size, education, credit, digital skills, social networks, institutional support and the suitability of technology to local conditions [9–22]. The following review examines these dimensions at the national, state and district levels and identifies the need for a sociological analysis of selective adoption among smallholder farmers in Khanapur Taluk:

Nature of New Farm Technology

Recent literature describes precision farming as using sensors, drones, the Internet of Things (IoT), and data analysis to apply inputs more accurately. It also identifies high costs, weak connectivity and limited technical knowledge as barriers [9]. Research on smart farming similarly finds that adoption depends on affordability, infrastructure and skills [10]. Other studies emphasise unequal access to credit and knowledge [11], while research on organic farming identifies labour, certification and market constraints [12]. Taken together, this literature shows that technology is not socially neutral: its benefits depend on the resources and institutions through which farmers encounter it.

Awareness and Adoption in India

Evidence from several states shows a recurring gap between awareness and use. In Banaskantha, Gujarat, 94 per cent of respondents knew about agricultural applications, but only 52.13 per cent of those aware used them [13]. In Hisar and Kaithal, Haryana, 57.61 per cent were aware of information and communication technology tools, while awareness of GPS, drones and precision tools ranged from 34 to 42 per cent [14]. In Deoria, Uttar Pradesh, 38 per cent knew of the Kisan Suvidha application, and 12 per cent had heard of smart-farming tools [15]. High device costs, lack of practical knowledge and inadequate training were major barriers among potato growers in Banaskantha [16]. Information alone, therefore, does not remove economic and institutional constraints.

Studies from Belagavi and Karnataka

Research in Karnataka also links adoption to social and economic position. A study of 612 marginal and small farmers across five districts found that education, farm size, credit, farming experience, mobile-phone ownership and cooperative membership influenced adoption [17]. Among 100 farmers in Dharwad district, 70 per cent were classified as medium or high adopters, while 30 per cent were low adopters [18]. A Belagavi district survey of 500 farmers found that television and newspapers were widely used. In contrast, mobile phones and the internet were rarely used for agricultural information at the time of the study [19,20]. Fragmented holdings further restrict mechanisation and economies of scale [1]. These studies point to an uneven technological field shaped by education, finance, media access and organisational membership.

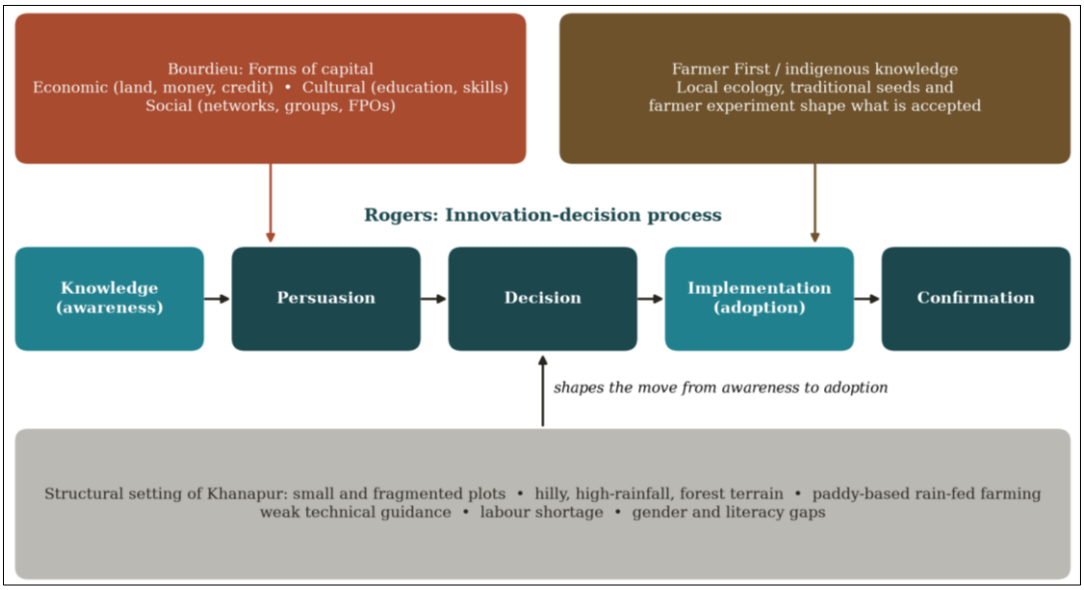
Sociological Perspectives and Research Gap

Adoption studies often treat farmers as isolated decision-makers. Yet age, gender, farm size, labour, social influence, and the wider institutional context shape technology use [21]. Recent analyses of digital agriculture in rural India likewise describe uneven infrastructure, smartphone ownership, and access across social groups [22]. Few studies bring these dimensions together for a hilly taluk such as Khanapur or recognise farmer-led seed conservation as a technological practice. This paper addresses that gap by interpreting the available evidence through diffusion, capital and farmer-centred perspectives.

Theoretical Framework

Agricultural technology adoption is not merely an individual decision based on awareness or perceived usefulness. Farmers' access to resources, their position within the agrarian structure, the social networks through which information circulates, and the compatibility of innovations with local knowledge and farming conditions influence it. No single theoretical approach fully explains these interrelated dimensions.

Therefore, the study combines three complementary sociological perspectives—Rogers' diffusion of innovations; Bourdieu's forms of capital; and the Farmer First perspective — to examine the processes, inequalities, and practical reasoning involved in selective adoption [23–25]. These perspectives collectively guide the analysis, as presented in Figure 1:



Source: Developed by the authors from Rogers [23], Bourdieu [24] and Chambers *et al.* [25].

Fig 1: Sociological Framework for Analysing Awareness and Selective Adoption

Rogers' Diffusion of Innovations

Rogers describes adoption as a process involving knowledge, persuasion, decision, implementation and confirmation [23]. Awareness corresponds mainly to the knowledge stage, whereas adoption requires implementation. Movement between these stages depends on relative advantage, compatibility, complexity, trialability and observability. Mass media may introduce an innovation, but interpersonal networks often shape trust and persuasion. This perspective helps explain why well-known technologies may remain underused when they are difficult to test, observe, or integrate into existing practice.

Bourdieu's Forms of Capital

Bourdieu locates action within an unequal distribution of economic, cultural and social capital [24]. In agriculture, economic capital includes land, money, and equipment; cultural capital includes education, technical confidence, and digital skills; and social capital includes trusted networks, cooperatives, and links with extension agencies. Farmers with stronger combinations of these resources are better placed to convert awareness into use. Adoption is therefore not simply a personal preference; it reflects a farmer's position within the agrarian social structure.

'Farmer First' and Indigenous Knowledge

The 'Farmer First' (FF) perspective challenges a one-way transfer-of-technology model in which experts design innovations and farmers are expected to accept them [25]. Resource-poor farmers in complex, risk-prone environments also experiment, compare, and adapt practices. From this viewpoint, non-adoption need not mean ignorance or resistance. It may express practical knowledge about rainfall, soils, labour, markets and household risk. This approach is particularly relevant to Khanapur's hilly, high-rainfall and forest-fringe setting.

Together, the three perspectives connect process, inequality and agency. Rogers explains how information moves towards use; Bourdieu explains why farmers have unequal capacities to act; and Farmer First recognises farmers as knowledgeable actors who assess suitability and risk. Together, these frameworks treat adoption as a socially embedded and negotiated process.

Aim and Research Questions

The paper aims to undertake a sociological study of awareness and selective adoption of agricultural technology among smallholder farmers in Khanapur Taluk. It asks: (1) which technologies are adopted, adapted or rejected; (2) how do land, labour, education, gender, finance and social networks shape these choices; and (3) how do local ecology and indigenous knowledge influence the perceived suitability of innovation?

Methodology

This paper forms part of the first author's doctoral research titled *Role of Technology-Based Agriculture in the Socio-economic Development of Farmers: A Sociological Study*. The analysis focuses on reported patterns of awareness, access, adoption, adaptation and non-adoption. It uses a descriptive, analytical secondary-data design to examine awareness and selective adoption of agricultural technology among smallholder farmers in Khanapur Taluk. Khanapur Taluk is located in the south-western part of Belagavi district within Karnataka's hilly agro-climatic zone. It comprises 218 villages and three towns, and 86.79 per cent of its population was rural according to the 2011 Census. Its high rainfall, extensive forest cover, dependence on paddy cultivation and predominance of small and marginal holdings make it an appropriate setting for examining the relationship between agricultural technology, agrarian structure and local ecology.

The study draws on the Census of India 2011; the 2024 rainfall report of the *Karnataka State Natural Disaster Monitoring Centre* (KSNDMC); the *Potential Linked Credit Plan 2026–27* for Belagavi district prepared by the *National Bank for Agriculture and Rural Development* (NABARD); taluk-level landholding data; the Agriculture Census 2015–16; the 77th Round Situation Assessment Survey conducted in 2019; and relevant Government of India reports [1,4–8,26,27]. Journal articles, theses and institutional publications provided supporting evidence. Selected newspaper reports were used only to document local initiatives for which peer-reviewed evidence was unavailable [28–32].

Five cases were purposively selected to represent different dimensions of technological awareness and adoption: recommended practices among paddy growers, varietal choice

among sweet potato growers, community seed conservation, agricultural extension and demonstration, and collective access through farmer organisations and common facilities (Table 1) [2,3,27–33]. The following cases were chosen for their relevance to the research objective rather than for statistical representation:

Table 1: Cases selected for the sociological analysis

Case Study	Place and Period	Participants	Focus
Paddy growers and recommended practices [2]	Bidi, Bekwad, Nandgad and Ghosenatti villages; 2014-15	60 paddy growers	Adoption of 14 recommended paddy practices; constraints
Sweet potato growers [3]	Five villages each in Khanapur and Belagavi taluks; kharif 2017	112 growers across both taluks (equal proportions of small and large farmers)	Varietal use and information sources; combined two-taluk evidence
Community seed conservation, Gundenatti [28,29]	Gundenatti village; documentary accounts, c. 2000–2025	Group of 10 farmers, later 40	Farmer-led conservation of native paddy varieties
Demonstration and extension programmes [30–32]	Shedegali horticulture farm (2023); KVK training (2024); Kakkeri (2026)	Participants reported by the individual programme sources	Field tours, method demonstrations and training
Collective platforms [27,33]	Cashew cluster (2023); Dharanisiri FPC, Beedi	Farmers and processors identified in institutional records	Common facilities and producer companies

Source: Compiled by the authors.

The evidence was analysed using descriptive statistics reported in the sources and comparative thematic interpretation. The principal themes were landholding, economic resources, education, labour, gender, information networks, institutional support, ecological suitability and indigenous knowledge. Rogers' diffusion of innovations was applied to examine the movement from awareness to adoption; Bourdieu's forms of capital were used to analyse unequal capacity to access and use technology; and the Farmer First perspective guided the interpretation of adaptation, local knowledge and farmer-led innovation.

Given differences in reference period, geographical coverage, sample size, and research design, the numerical findings identify broad trends rather than enabling direct statistical comparison. Accordingly, the study offers a sociological interpretation of recurring patterns in awareness and selective adoption without claiming statistical representation of all smallholder farmers in Khanapur Taluk.

Results

Socio-Agrarian Context

Table 2: Socio-agrarian profile of Khanapur Taluk and Belagavi district

Indicator	Khanapur taluk	Belagavi district
Geographical area	172,956 ha (1,729.56 sq km)	13,433 sq km
Forest area	91,309 ha (over half)	About 14% of area
Net sown area	50,287 ha	8.90 lakh ha
Normal annual rainfall	1,950.2 mm	826.2 mm
Actual rainfall, 2024	3,018.9 mm (+55%)	1,165.0 mm (+41%)
Main crop	Paddy, 28,275 ha	Cereals and millets 4.56 lakh ha; sugarcane 2.77 lakh ha
Operational holdings	38,153	6.20 lakh
Small and marginal holdings	72.33%	75.14%
Population (2011)	258,089; 86.79% rural	Rural population 34.74 lakh
Literacy (2011)	75.65% (men 84.69%; women 66.39%)	73.48%
Main cultivators (2011)	37,486 (women 25.6%)	7.12 lakh cultivators

Source: Census of India 2011 [26]; Mallikarjuna [2]; KSNDMC [8]; Madegowda and Rajesha [1]; and NABARD PLP 2026–27 [27]. Figures derive from different reporting years and units and should be read descriptively.

Khanapur Taluk presents a predominantly smallholder agrarian setting shaped by its forested landscape, high rainfall and dependence on paddy cultivation. The taluk covers 172,956 hectares, of which 91,309 hectares are under forest, and 50,287 hectares constitute the net sown area [2]. Its normal annual rainfall is 1,950.2 millimetres; however, it received 3,018.9 millimetres in 2024, 55 per cent above normal [8]. Above-normal rainfall was also recorded in 2015, 2016 and 2017, indicating recurring climatic variability [34]. Paddy occupies 28,275 hectares and accounts for 48.19 per cent of the total area under paddy cultivation in Belagavi district [2]. Of the 38,153 operational holdings in the taluk, 72.33 per cent are classified as marginal or small [1]. According to the 2011 Census, the overall literacy rate was 75.65 per cent. Female literacy stood at 66.39 per cent, compared with 84.69 per cent among men, while women constituted approximately one-quarter of the main cultivators [26]. These conditions indicate that agricultural technology adoption in Khanapur occurs within a distinctive social and ecological context characterised by small landholdings, climatic variability and gender disparities in literacy and participation in cultivation.

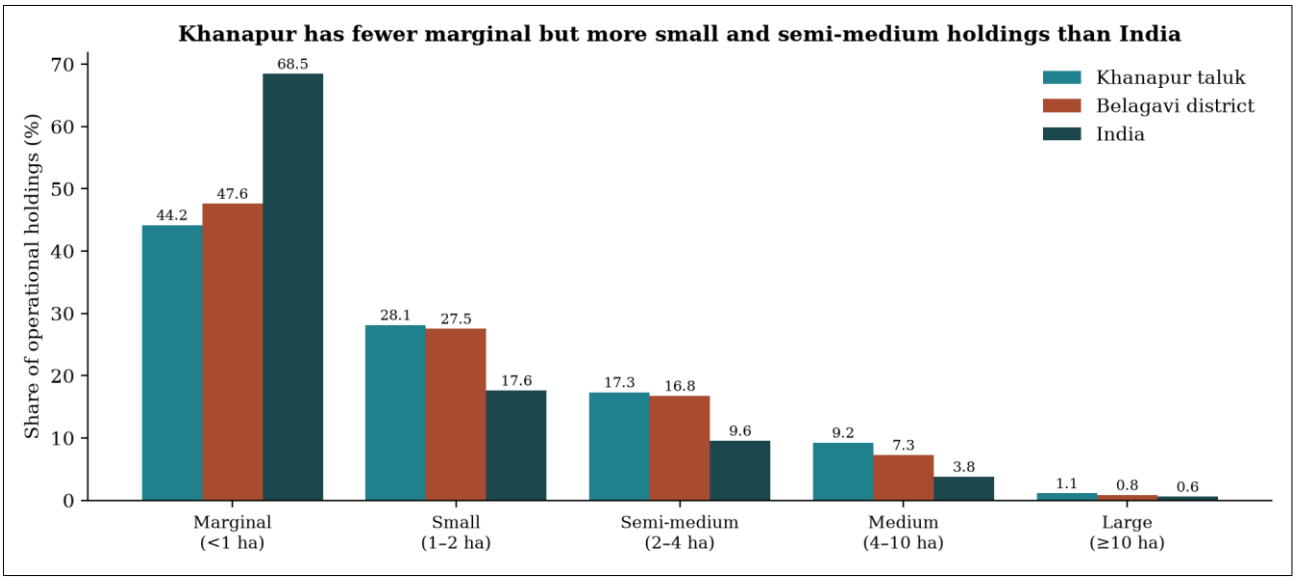
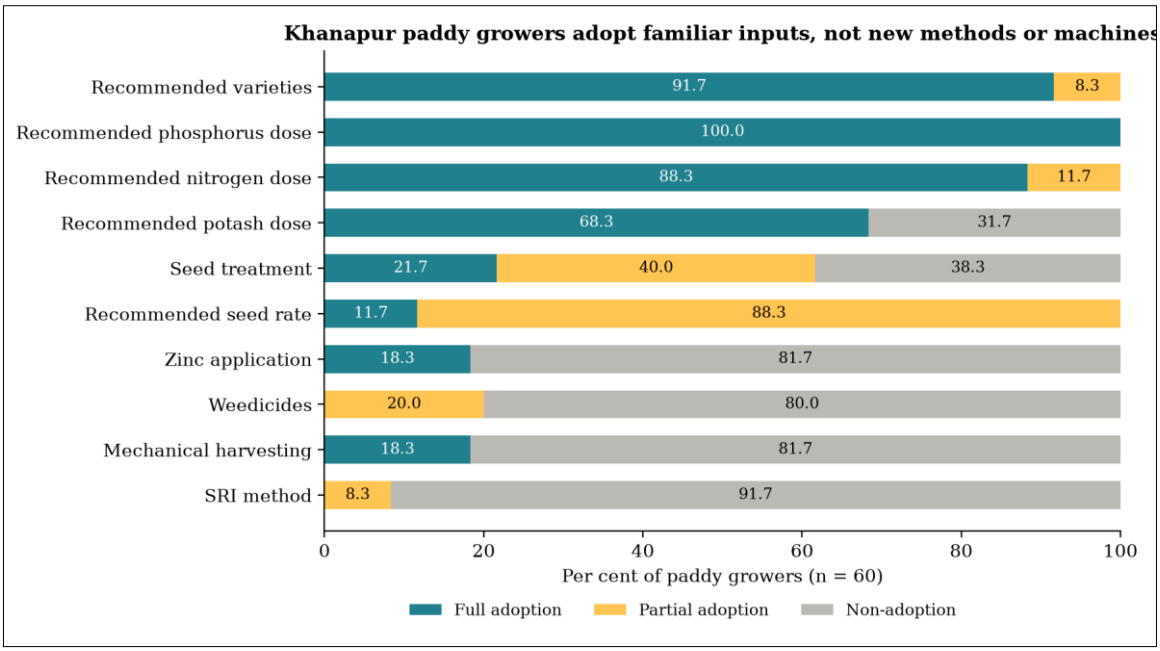


Fig 2: Share of operational holdings below and above 2 hectares: Khanapur, Belagavi and India

Figure 2 compares the distribution of operational holdings below and above two hectares in Khanapur Taluk, Belagavi district and India. Holdings below two hectares constitute 72.33 per cent of all operational holdings in Khanapur, compared with 75.14 per cent in Belagavi district and 86.08 per cent nationally. Correspondingly, holdings above two hectares account for 27.67 per cent in Khanapur, 24.86 per cent in Belagavi district and 13.92 per cent in India. Although Khanapur has a relatively lower proportion of holdings below two hectares than Belagavi district and India, nearly three-fourths of its operational holdings remain marginal or small. This pattern indicates that smallholder farming is central to Khanapur's agrarian structure. Limited and fragmented holdings may reduce farmers' capacity to invest in costly machinery, experiment with unfamiliar practices, or bear the risks associated with technological change. Consequently, farmers may favour affordable, divisible inputs such as seeds and fertilisers while selectively adopting machinery and resource-intensive methods. The figure therefore shows that farm size is not merely an economic variable but a structural condition influencing farmers' access to and adoption of agricultural technology.

Paddy Growers: Patterned Adoption



Source: Constructed from Mallikarjuna [2].

Fig 3: Adoption of recommended paddy practices among sampled farmers in Khanapur Taluk

A 2014–15 study of 60 paddy growers in four Khanapur villages recorded the adoption of 14 recommended practices [2]. Adoption was high for inputs that could be incorporated into familiar routines: 91.7 per cent fully adopted recommended varieties; 100 per cent adopted the phosphorus recommendation; and 88.33 per cent fully adopted the recommended nitrogen dose. Adoption was lower for practices requiring new knowledge, additional management or a change in method. Only 21.67 per cent fully adopted seed treatment and 18.33 per cent used zinc. No respondent fully adopted weedicides, although 20

per cent used them partially. Traditional cultivation was reported by 91.67 per cent, while 8.33 per cent used SRI. Mechanical harvesting was used by 18.33 per cent, whereas 81.67 per cent harvested manually (Figure 3). The pattern is not a simple division between 'modern' and 'traditional'; it reflects selective incorporation based on cost, complexity, and compatibility. The same respondents ranked non-availability of labour first among production constraints, followed by erratic rainfall and lack of technical guidance [2]. Pests and diseases, delayed access to good seed, and inadequate credit followed (Figure 4). The ranking shows that adoption is constrained simultaneously by labour relations, ecological uncertainty and institutional support. Lack of guidance should therefore be understood as an extension-access problem rather than simply a lack of awareness.

Varietal Choice Among Sweet Potato Growers

A survey of 112 sweet potato growers from ten villages—five each in Khanapur and Belagavi taluks—found that 95 per cent cultivated local varieties, while only 5 per cent used improved varieties [3]. Farmers preferred local varieties because of their adaptability, satisfactory yield and better market price. Extension personnel, input dealers and financial agents were among their sources of agricultural information, inputs and credit. The continued cultivation of local varieties should therefore not be interpreted simply as a lack of awareness or resistance to innovation. Instead, it illustrates selective adoption based on farmers' assessment of ecological suitability, expected returns and market risk. However, the findings were reported jointly for Khanapur and Belagavi taluks, and the sample included both small and large farmers. The percentages should therefore not be treated as Khanapur-specific or as exclusively representative of smallholder farmers.

Farmer-Led Seed Conservation and Local Knowledge

Documentary accounts from Gundenatti village describe a farmer-led initiative to recover, conserve and circulate native paddy varieties. The initiative began with a group of ten farmers, most of whom cultivated less than five acres. Through seed collection, training, exposure visits and interaction with the GREEN Foundation and Mugad Paddy Research Station, the group reportedly expanded to forty farmers [28]. Within seven years, the village conserved sixty native paddy varieties. Shankar Langati, a small farmer from the same village, subsequently developed a collection of more than 260 traditional paddy varieties and shared his knowledge with farmers and agricultural students [29].

This case is sociologically significant because it presents farmers as producers, conservators and transmitters of agricultural knowledge rather than merely as recipients of externally developed technology. Cooperation among farmers, voluntary organisations and agricultural research institutions illustrates how social networks and collective participation can generate social capital and facilitate the circulation of knowledge. The case also supports the Farmer First perspective, which recognises farmers' capacity to experiment with, adapt and select agricultural practices suited to their ecological and social conditions. Nevertheless, because the evidence comes mainly from documentary and journalistic accounts rather than a systematic field survey, it should be treated as an illustrative case of farmer-led innovation and not as representative evidence of technology adoption throughout Khanapur Taluk.

Institutional Support and Collective Access

Khanapur's institutional environment includes demonstration centres, agricultural training programmes, and collective platforms intended to improve farmers' access to knowledge and agricultural resources. The government horticulture farm at Shedegali functions as a model nursery and training centre, where farmers are introduced to practices such as top-working grafting, vermicomposting, beekeeping and the cultivation of fruit and medicinal crops [30]. In March 2024, ICAR–KLE Krishi Vigyan Kendra, Mattikopp, conducted a five-day natural farming programme for Krishi Sakhis from Belagavi and Khanapur taluks. The programme included demonstrations of natural farming preparations and a visit to a progressive farmer's field [31]. In a training programme organised at Kakkeri under the Agricultural Technology Management Agency scheme, participants received information on reducing chemical fertiliser use, adopting organic farming practices, and obtaining subsidies for food-processing units [32].

These programmes support agricultural awareness because field demonstrations and exposure visits allow farmers to observe unfamiliar practices under practical conditions. Krishi Sakhis' participation also indicates the use of local women intermediaries to communicate agricultural knowledge. From Rogers' diffusion perspective, demonstrations and field visits may increase the observability and trialability of innovations and help farmers move from initial awareness to informed evaluation. However, the available sources do not provide systematic information about the number and social background of participants, subsequent adoption, continuity of use or long-term outcomes. These programmes should therefore be presented as components of the local extension environment rather than as evidence of successful technology adoption [30–32].

Collective platforms form another part of this institutional environment. A cashew cluster with a common service centre and processing machinery was established in Khanapur Taluk. At the same time, the Dharanisiri Farmer Producer Company at Beedi is listed under the Rashtriya Krishi Vikas Yojana (RKVY) [27,33]. Such institutions may help farmers share facilities, obtain information, reduce individual investment costs and improve their collective bargaining capacity. From Bourdieu's perspective, collective membership and institutional networks may enable farmers to convert social capital into better access to economic and informational resources. Nevertheless, the available documents do not provide adequate evidence concerning active membership, participation by marginal and small farmers, use of common facilities or effects on technology adoption. These platforms should therefore be treated as elements of Khanapur's institutional setting and not as confirmed evidence of equitable access or successful adoption.

Taken together, extension activities and collective platforms demonstrate that agricultural awareness and adoption are institutionally mediated processes. Demonstrations can improve the visibility of agricultural practices, while collective organisations may reduce some of the costs and risks associated with technology adoption. Their actual influence, however, depends on accessibility, social inclusion, regular participation and sustained institutional support. Further field-based research is required to determine whether these initiatives have enabled marginal and small farmers, particularly women and socially disadvantaged cultivators, to adopt and continue using appropriate agricultural technologies.

Synthesis of Findings and Discussion

Table 3: Synthesis of evidence from the Khanapur cases

Aspect	Main finding for Khanapur	Evidence
Farm structure	72.33% small and marginal holdings; hilly, forest, high-rainfall setting	[1,2,8]
Awareness	Access through dealers and extension is documented; lack of technical guidance ranked third among paddy constraints.	[2,3]
Adoption of inputs	High in the paddy sample: varieties 91.66%, phosphorus recommendation 100%, nitrogen 88.33%	[2]
Adoption of new methods and machines	Low in the paddy sample: SRI 8.33%, no full weedicide adoption, mechanical harvesting 18.33%	[2]
Varietal choice in sweet potato	Across the combined Khanapur–Belagavi sample, 95% used local varieties and 5% used improved varieties.	[3]
Farmer-led innovation	Documentary accounts describe collective conservation and one farmer conserving more than 260 varieties.	[28,29]
Extension and institutions	Demonstration and training events, one listed FPO and a cashew cluster; coverage and outcomes are not measured.	[27,30–33]

Source: Compiled by the authors. Percentages refer to the samples and years specified in the sources.

The evidence suggests a patterned form of selective adoption. Farmers readily incorporate some inputs, retain locally adapted materials in other contexts and avoid practices that demand capital, specialised knowledge, coordinated labour or control over water. Table 4 places these local patterns beside selected Indian evidence; it is an indicative comparison, not a direct statistical benchmark, because the sources use different samples, places and periods.

Table 4: Indicative comparison of Khanapur-related evidence with selected Indian evidence

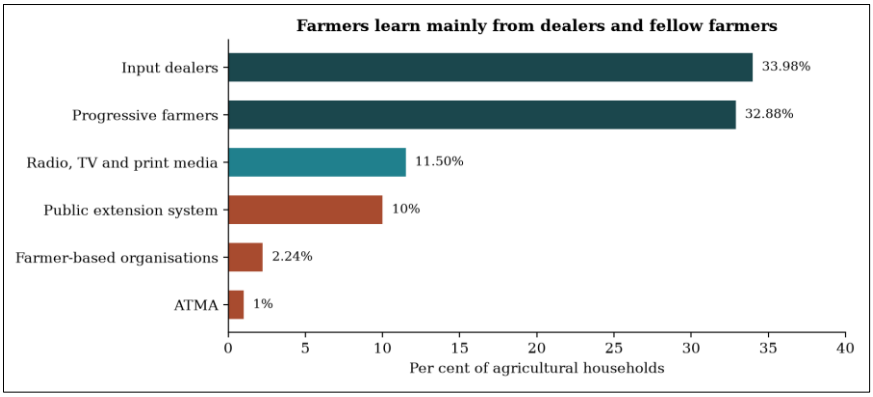
Dimension	Khanapur taluk	Selected Indian evidence
Small and marginal holdings	72.33% of holdings	86.08% of holdings [5]
Access to technical advice	Lack of technical guidance ranked third among nine constraints in one paddy sample	48.7% and 42.2% of households received advice in the two survey visits [4]
Main channels of information	Sweet potato sources included dealers, extension agents and finance-linked agents; district survey: TV 94.8%, mobile 3%, internet 1.2%	Input dealers 33.98%, progressive farmers 32.88%, public extension about 10% [35]
Awareness of digital tools	District survey recorded low use of mobile phones and the internet for farm information.	Apps known to 94% in Banaskantha; smart tools to 12% in Deoria [13,15]
Adoption of improved inputs	Paddy sample: 91.66% recommended varieties; combined sweet potato sample: 5% improved varieties	70% medium–high adopters in Dharwad [18]
Adoption of new methods and machines	SRI 8.33%; mechanical harvest 18.33%	Drones used by 3–22% of sampled farmers; <2% of net sown area [36]
Farmer-led innovation	Community conservation of native paddy varieties	Policy focus on digital technology [6]
Collective institutions	One listed FPO and a cashew cluster; user reach not reported	Promoted nationally; 35 registered FPOs in Belagavi district [27]
Gender	Women 25.6% of main cultivators; female literacy 66.39%	Women hold 13.96% of operational holdings [5]

Source: Compiled from [1–3,19,2[6]] and the sources cited in the table. Comparisons are descriptive because definitions, samples, geographical coverage and reference periods differ.

Land, Capital and Unequal Capacity

Although Khanapur has a smaller proportion of marginal holdings than India as a whole, 72.33 per cent of its operational holdings remain below 2 hectares. Fragmented plots raise per-acre machinery costs and reduce economies of scale. Smallholder farmers may therefore adopt divisible inputs, such as seed or fertiliser, more readily than expensive and indivisible machinery. In Bourdieu's terms, limited economic capital narrows the range of feasible choices [24]. Yet economic capital does not act alone: access to credit, technical competence and organisational membership affect whether a farmer can evaluate, obtain and sustain an innovation.

Information, Trust and Mediation

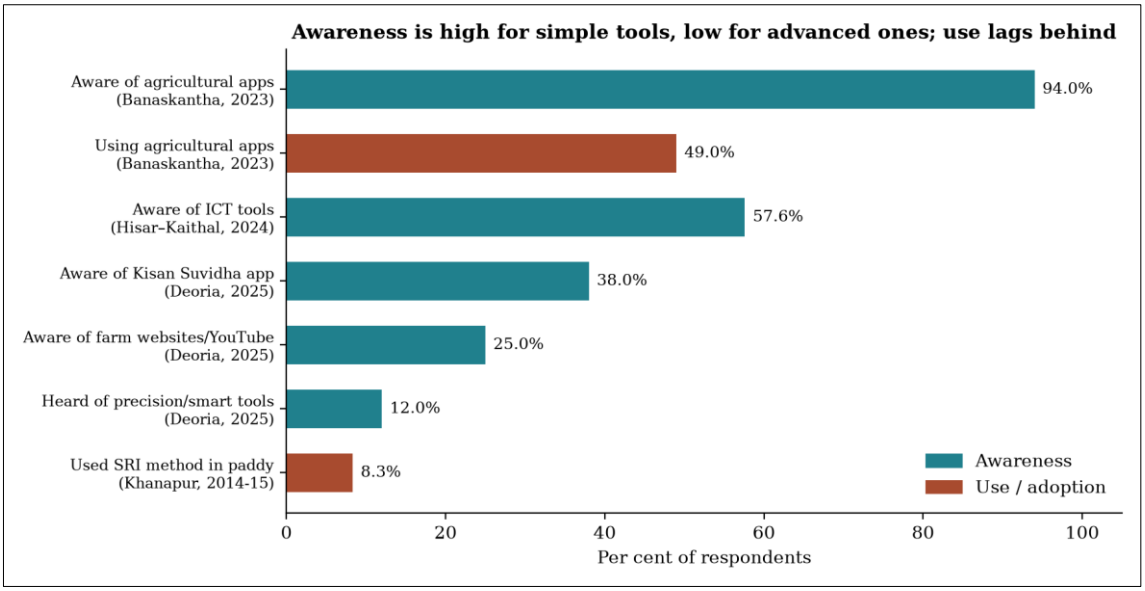


Source: Sahu *et al*. [35], using NSS 77th Round data [4]

Fig 4: Sources of agricultural information among farm households in the Indo-Gangetic Plains.

Evidence from the Indo-Gangetic Plains in Figure 4 shows that input dealers and progressive farmers are major sources of agricultural information, while public extension agencies account for a smaller share [35]. The sweet potato study similarly identifies extension agents, input dealers and finance-linked agents as sources of information and materials [3]. Paddy growers' ranking of inadequate technical guidance also points to an institutional gap [2]. In the Belagavi district survey, discussion and demonstration were valued channels, whereas digital media were little used for agricultural information at the time of data collection [19]. These findings support Rogers' emphasis on interpersonal influence [23], but they also reveal a relation of dependence: the adviser may simultaneously be a seller, lender or market intermediary. Information is therefore embedded in relations of trust, commerce and power.

Non-Adoption as Practical Judgement



Source: Constructed from [2,13–15]. Figures come from different studies and are not directly comparable.

Fig 5: Awareness and use of selected agricultural technologies in Indian studies

Cost and inadequate training explain part of the awareness–use gap [16,17], but Khanapur also illustrates ecological and cultural compatibility. In the paddy study, labour shortage and erratic rainfall were the two highest-ranked constraints [2]. SRI requires changes in water, nursery and labour management, which may reduce its perceived suitability under particular local conditions. Sweet potato growers retained local varieties because they valued their adaptability, yield and price [3]. Through the Farmer First lens, these decisions need not signify backwardness. They may reflect practical judgement by households that bear the consequences of crop failure, debt and market uncertainty [25].

Farmer-Led Innovation and Social Capital

The Gundenatti case broadens the meaning of agricultural technology. Farmer groups, seed melas, non-governmental organisations and research stations created a network through which native varieties were collected, tested and circulated [28,29]. In Bourdieu's terms, social capital enabled access to knowledge and recognition even where individual economic capital was limited [24]. The case also challenges a linear model in which innovation moves only from laboratory to farm. Farmers can be producers and custodians of technological knowledge, especially in seed selection and adaptation.

Institutions, Gender and Power

Collective platforms, custom-hiring arrangements and demonstrations can reduce individual costs and make innovations observable. However, the existence of an FPO, training event or digital platform does not establish equal participation. Women constituted about one-quarter of Khanapur's main cultivators in 2011, yet female literacy was substantially lower than male literacy [26]. Nationally, women operated 13.96 per cent of holdings in 2015–16 [5]. Krishi Sakhis offer one route to reach women [31], but land titles, time burdens, mobility, device ownership, and voice within organisations also shape access. A sociological analysis must therefore examine who is recognised as the 'farmer' and whose knowledge enters institutional decisions.

Sociological Interpretation

The evidence does not support a simple narrative in which informed farmers adopt and uninformed farmers resist. Instead, adoption varies with the volume and composition of capital, the credibility of information networks, local labour arrangements, ecological suitability, and household exposure to risk. Awareness may be widespread for some inputs, yet implementation remains limited when a practice is costly, complex or incompatible. Conversely, the continued use of local seed may represent informed adaptation rather than technological exclusion. Technological change in Khanapur is thus negotiated within an agrarian field marked by inequality, interdependence and practical knowledge.

This study synthesises heterogeneous secondary sources rather than reporting a new representative survey. The cases differ in year, sample, geographical coverage, and research design, and one sweet potato dataset combines Khanapur and Belagavi taluks. Some local initiatives are documented mainly through institutional or newspaper accounts. The findings therefore identify sociological patterns and plausible mechanisms; they do not estimate current prevalence, establish causality or represent all smallholder farmers in Khanapur Taluk. Future research should use a stratified household survey, gender-disaggregated data, interviews and participant observation to test these interpretations.

Recommendations

- Strengthen repeated village-level demonstrations through the Krishi Vigyan Kendra, the Shedegali farm and experienced local farmers. Demonstrations should include follow-up visits so that awareness can develop into confident use.
- Expand accountable FPOs, machinery banks and custom-hiring centres. Monitor membership, pricing, and access by landholding category and gender, so collective resources do not concentrate among better-off farmers.
- Test technologies under Khanapur's hill, rainfall and labour conditions before large-scale promotion. Participatory trials should combine scientific advice with farmers' knowledge of seed, soils and risk.
- Provide short voice and video advisories in Kannada and Marathi, while retaining face-to-face support for farmers with limited digital access. Expand the Krishi Sakhi network and recognise women cultivators directly in training and registration.
- Train and regulate input dealers as local information intermediaries. Advice should be separated, as far as possible, from sales incentives and linked to public extension and referral mechanisms.

Conclusion

This sociological study shows that awareness does not automatically lead to the adoption of agricultural technology among smallholder farmers in Khanapur Taluk. Sampled paddy growers adopted recommended varieties and selected fertiliser recommendations more widely than SRI, weedicides or mechanical harvesting, while the combined Khanapur–Belagavi sweet potato sample largely retained local varieties [2, 3]. These choices cannot be explained by awareness alone. Rogers highlights compatibility and interpersonal communication; Bourdieu reveals unequal access to economic, cultural and social capital; and Farmer First recognises farmers' capacity to judge, adapt and generate knowledge. Effective policy must therefore go beyond simply delivering technology. It should reduce material barriers, strengthen trusted and inclusive institutions, test ecological suitability and treat women and men farmers as active producers of knowledge.

References

1. Madegowda M, Rajesha B. An analysis of the status and challenges of small and marginal farmers in Belagavi district, Karnataka. EPRA Int J Agric Rural Econ Res. 2025;13(9):19-23.
2. Mallikarjuna MS. An economic analysis of production and marketing of major cereal crops in Belagavi district of Karnataka [MSc (Agri) thesis]. Dharwad: University of Agricultural Sciences; 2016.
3. Prakash P, Jaganathan D, Sivakumar PS, Immanuel S, Kishore P, Kumar P. Does APMC market increase farmers' income? Evidence from value chain analysis of sweet potato in Karnataka. Indian J Agric Econ. 2018;73(3):342-357.
4. National Statistical Office. Situation assessment of agricultural households and land and livestock holdings of households in rural India, 2019. NSS Report No. 587 (77/33.1/1). New Delhi: Ministry of Statistics and Programme Implementation, Government of India; 2021.
5. Department of Agriculture, Cooperation and Farmers Welfare. Agriculture Census 2015-16 (Phase-I): All India report on number and area of operational holdings. New Delhi: Ministry of Agriculture and Farmers Welfare, Government of India; 2019.
6. Press Information Bureau. Digital Agriculture Mission [Internet]. New Delhi: Ministry of Agriculture and Farmers Welfare, Government of India; 2024 Dec. Available from: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2082787
7. Press Information Bureau. Artificial Intelligence (AI) transforming Indian agriculture [Internet]. New Delhi: Ministry of Agriculture and Farmers Welfare, Government of India; 2026. Available from: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2227914
8. Karnataka State Natural Disaster Monitoring Centre. Rainfall, moisture index, agriculture, reservoir levels, minor irrigation, earthquake in Karnataka–2024 [Internet]. Bengaluru: KSNDMC; 2025. Available from: https://data.opencity.in/dataset/karnataka-annual-rainfall-districts-taluks-and-hoblis
9. Sharma RK. Role of precision farming and smart technologies in modern agriculture. J Agric Digit Res. 2025;6(2):6-8.
10. Polwaththa KPGDM, Amarasinghe AAY, Amarasinghe STC. Emerging smart farming technologies for sustainable crop production: a review of AI, IoT, robotics, and precision agriculture. J Agric Digit Res. 2026;7(1):16-23.
11. Reddy PM. Innovative approaches to sustainable agriculture in the 21st century. J Agric Digit Res. 2025;6(2):9-12.
12. Tanaka SJ. Organic farming practices: challenges, opportunities, and prospects. J Agric Digit Res. 2025;6(2):13-16.
13. Patel R, Thakkar MG. Awareness, expectations and usage of agricultural apps by farmers in Banaskantha district of Gujarat. Pharma Innov J. 2023;12(8S):670-674.
14. Shehrawat PS, Aditya, Singh S, Arulmanikandan B. Farmers' awareness level and adoption regarding usage of ICT for crop production. Int J Agric Ext Soc Dev. 2024;7(11S):167-173.
15. Raja MM, Dwivedi P, Pandey VN, Mall R, Mall G. Knowledge level of farmers regarding modern communication media: a study in Deoria district of Uttar Pradesh. Int J Agric Food Sci. 2025;7(7):570-572.
16. Samaddar S, Pandya SP, Lal SP. Bridging the digital divide in agriculture: an investigation into ICT adoption for sustainable farming practices in Banaskantha district of Gujarat, India. Int J Environ Clim Change. 2023;13(9):1376-1384.
17. Basavaraj. Determinants of agricultural technology adoption by marginal and small farmers in Karnataka [doctoral thesis]. Bengaluru: CMR University; 2021. Available from: http://hdl.handle.net/10603/444240
18. Kambali KK, Biradar SA, Pattar J, Tamgale G. Technology adoption and its impact on farm income: a study of farmers in Dharwad district, Karnataka. Int J Bioresour Sci. 2024;11(2):139-144.
19. Naik BB. Use of communication channels for their information needs by farmers of Belagavi district: a study. J Emerg Technol Innov Res. 2021;8(7):e532-e539.
20. Naik BB, Bankapur VM. Usage of communication channels for information dissemination by farmers of Belgavi

district: a study. Int J Res Libr Sci. 2021;7(4):254-264.
21. El Bilali H, Ben Hassen T, Bottalico F, Berjan S, Capone R. Acceptance and adoption of technologies in agriculture. AGROFOR Int J. 2021;6(1):135-150.
22. Kotu SC, Baksi S, Modak TS, Maurya N. Examining the ground for adoption of digital technologies in agricultural production in India [Internet]. Bengaluru: Foundation for Agrarian Studies; 2026. Available from: https://fas.org.in/examining-the-ground-for-adoption-of-digital-technologies-in-agricultural-production-in-india/
23. Rogers EM. Diffusion of innovations. 5th ed. New York: Free Press; 2003.
24. Bourdieu P. The forms of capital. In: Richardson JG, editor. Handbook of theory and research for the sociology of education. New York: Greenwood; 1986. p. 241-258.
25. Chambers R, Pacey A, Thrupp LA, editors. Farmer first: farmer innovation and agricultural research. London: Intermediate Technology Publications; 1989.
26. Office of the Registrar General and Census Commissioner, India. Census of India 2011: Primary Census Abstract, Belgaum District, Karnataka. New Delhi: Ministry of Home Affairs, Government of India; 2013.
27. National Bank for Agriculture and Rural Development. Potential linked credit plan 2026-27: Belagavi District [Internet]. Bengaluru: NABARD Karnataka Regional Office; 2026. Available from: https://www.nabard.org/auth/writereaddata/tender/pub_0601260526382020.pdf
28. Pailoor A. In search of lost diversity [Internet]. Deccan Herald. 2010 Nov 29. Available from: https://www.deccanherald.com/content/116708/in-search-lost-diversity.html
29. Belagavi farmer sparks silent revolution, preserves over 260 traditional paddy varieties [Internet]. The New Indian Express. 2025 Oct 19. Available from: https://www.newindianexpress.com/cities/bengaluru/2025/Oct/19/belagavi-farmer-sparks-silent-revolution-preserves-over-260-traditional-paddy-varieties
30. Desai RB. A garden of exotic fruits, medicinal plants in a model nursery and training centre in Khanapur [Internet]. The Hindu. 2023 Aug 13. Available from: https://www.thehindu.com/news/national/karnataka/a-garden-of-exotic-fruits-medicinal-plants-in-a-model-nursery-and-training-centre-in-khanapur/article67190464.ece
31. ICAR-Agricultural Technology Application Research Institute, Zone XI. Five-day capacity-building programme on natural farming for Krishi Sakhis. KVK Times. 2024;2(17):5.
32. ChiniMandi. Karnataka: scientists urge farmers to reduce chemical fertiliser use and adopt organic farming [Internet]. 2026. Available from: https://www.chinimandi.com/karnataka-scientists-urge-farmers-to-reduce-chemical-fertiliser-use-and-adopt-organic-farming/
33. India Organic Trade Fair. FPOs contact details under RKVY scheme [Internet]. Bengaluru: Department of Agriculture, Government of Karnataka and ICCOA; 2023. Available from: https://itf2023.organics-millets.in/fpo-list-rkvy/
34. Biradar N, Tirlapur L, Kerur A, Bheemappa A. Scientific rationality of indigenous crop management practices of two agro-ecological zones of Karnataka. Int J Chem Stud. 2020;8(6):2897-2903.
35. Sahu S, Bishnoi S, Sharma PR, Satyapriya, Mahra GS, Burman RR, *et al*. Exploring popular information sources and determinants of farmers' access to agricultural extension services in the Indo-Gangetic plains. Front Sustain Food Syst. 2024;8:1339243.
36. Narayanan S, Saha S, Gautam A, Reardon T. Game of drones: on the cusp of a revolution in Indian agriculture [Internet]. The India Forum. 2026. Available from: https://www.theindiaforum.in/economy/game-drones-cusp-revolution-indian-agriculture
37. Press Information Bureau. 7.75 crore Kisan Credit Cards operational as of March 2024 [Internet]. New Delhi: Ministry of Finance, Government of India; 2025 Jan 31. Available from: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2097879