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-Editor

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CONTENTS

Changing Role of Agricultural Extension in India: From Technology Transfer to Digital, Market-Linked and Networked Advisory Systems

Sanjay Kumar Agrawal, IAS

ABSTRACT

Agricultural extension in India is passing through a significant transition. For decades, extension was largely understood as a public mechanism for transferring technologies, improved practices, and research-based recommendations from laboratories and universities to farmers. That role remains foundational, but the environment in which farmers now take decisions has become far more complex. Agriculture is increasingly shaped by climate variability, market volatility, changing pest dynamics, rising input costs, diversification into high-value crops, quality and traceability requirements, and rapid growth of digital communication channels. At the same time, farmers no longer depend only on formal extension institutions for information. They now receive advice from mobile applications, social media platforms, agri-startups, FPOs, local influencers, input networks, and peer communities. Recent policy developments reflect this shift. Bharat-VISTAAR, launched in Phase I on 17 February 2026, has been positioned by the Government of India as an AI-based multilingual farmer advisory platform accessible through multiple channels, including phone, chatbot, web portal, and app, and integrating information on schemes, weather, market prices, crop advisory, and grievance support. Public extension systems are therefore being called upon to move beyond one-way dissemination of technology and become systems of decision support, risk communication, knowledge validation, and market readiness. This article argues that the future of agricultural extension lies in combining the credibility of field-based public institutions with the scale of digital systems, the immediacy of social media, and the participatory energy of peer-led agricultural communication. It also highlights the continuing importance of ATMA, BTM, and ATM structures, the urgent need for capacity building of extension workers, and the emerging challenge of fake, unverified, commercially motivated, and misleading digital media content in agriculture.

Keywords: Agricultural Extension, Digital Advisory, Bharat-VISTAAR, ATMA, Social Media, Agri-Influencers

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1. Introduction

Agricultural extension has historically been one of the most important institutional pillars of India's agricultural development process. Its central purpose has been to connect scientific research, policy support, and field-level practice. Through demonstrations, field visits, training programmes, farmer meetings, and advisory services, extension has helped translate technical recommendations into practical decisions in farmers' fields. Public institutions such as state agriculture departments, Krishi Vigyan Kendras, agricultural universities, and district and block-level extension structures have collectively contributed to technology diffusion, productivity improvement, and strengthening of farmer awareness. ICAR's Agricultural Extension Division continues to define its work in terms of technology application, frontline extension education, knowledge management, and capacity development of both farmers and extension personnel (ICAR, 2026).

However, the agricultural extension has to redefine its role significantly as the world in which it operates has undergone profound changes. The older agricultural policy environment was dominated by the challenge of low productivity and the need to expand adoption of scientific methods. Today, farmers operate in a far more uncertain and dynamic setting. Decisions on crop choice, sowing time, irrigation, pest control, harvest, and sale are influenced not only by technical recommendations but also by rainfall variability, extreme weather, labour availability, price fluctuations, quality standards, storage infrastructure, digital access, and the design of government schemes. As a result, extension has to serve not only as an instrument of technology dissemination but also as a support system for risk management, bank access, market linkage, farmers empowerment, income enhancement, and strategic decision-making (ICAR, 2026).

The communication landscape has changed as dramatically as the production landscape. Farmers today often receive agricultural information through WhatsApp groups, YouTube channels, Facebook pages, Telegram communities, voice messages, mobile apps, local entrepreneurs, FPO leaders, and progressive farmers who have emerged as digital communicators. Social media is no longer peripheral to agricultural learning; in many regions it has become a major parallel pathway of information exchange. MANAGE publications have recognized the growing relevance of social media for agricultural communication, networking, collaboration, and dissemination. This means that extension is no longer the sole source of information. It is one actor in a much broader knowledge ecosystem (MANAGE, 2017).

In this changing context, the role of extension is being redefined. It is moving

from a narrow "transfer of technology" approach toward a broader model of "facilitation of decisions." It is moving from a largely production-oriented logic toward a farm-to-market and value-chain orientation. It is also moving from periodic physical contact to a blended ecosystem of human interface, digital platforms, social media communication, and networked peer learning. This transition is not merely technological. It is conceptual, institutional, and strategic (PIB, 2026).

2. Objectives

This article seeks to examine the changing role of agricultural extension in India in the light of current agricultural, institutional, and communication realities. It aims to explain why extension continues to remain vital, even as its methods, scope, and competencies are changing. It also seeks to highlight the continuing relevance of decentralized extension structures such as ATMA and the role of block-level functionaries like BTMs and ATMs. In addition, it analyses the implications of digital advisory systems, Bharat-VISTAAR, social media-based communication, the rise of agri-influencers, and the spread of fake or misleading agricultural content. Finally, it argues that capacity building of extension workers has become central to the success of future agricultural transformation (PIB, 2026b).

3. Methodology

This is a conceptual and analytical paper based on review of policy material, institutional publications, official releases, and knowledge resources related to agricultural extension, digital advisory systems, social media, and extension capacity building. Official government releases on Bharat-VISTAAR, ICAR material on extension achievements and mandates, and MANAGE publications on ATMA, social media, and extension education form the principal factual base of the discussion. The article is interpretive in nature and is intended to contribute to policy and institutional thinking on agricultural extension rather than to present field-survey findings (PIB, 2026b).

4. Importance of Extension Services in Agriculture

Agricultural extension remains indispensable because it is the bridge that converts knowledge into action. Research institutions may develop improved seeds, nutrient recommendations, pest-management protocols, water-saving methods, climate-resilient practices, post-harvest technologies, and digital tools, but these do not automatically improve farm outcomes unless they are understood, adapted, trusted, and applied by farmers. That last-mile process is the work of extension. Extension thus performs an enabling function that is simultaneously technical, educational, and institutional. It interprets scientific

knowledge for local conditions, demonstrates practical application, builds confidence among farmers, and connects farming households with the wider agricultural support system. ICAR's extension system explicitly includes technology assessment, frontline demonstrations, knowledge dissemination, and capacity building in its mandate, underlining that extension is not an auxiliary function but a core development function (ICAR, 2026).

The importance of extension has, if anything, increased in the current era. Farming has become more information intensive. Farmers need not only crop advice, but also weather-based alerts, market intelligence, information on procurement and schemes, guidance on risk reduction, support in crop diversification, and help in improving quality and value addition. Smallholders, in particular, need advisory support that is timely, understandable, and trustworthy. In an environment where wrong decisions can quickly translate into financial loss, extension serves as a form of public risk management. It reduces uncertainty by helping farmers choose more appropriate practices and by linking them to institutional support (PIB, 2026b).

Extension also matters because agriculture is not only about production. It is about income, resilience, and sustainability. Farmers increasingly require support in integrated farming, efficient use of water, better post-harvest management, market timing, collective action through FPOs, and adoption of environmentally sound practices. Without a strong extension system, many of these transitions remain confined to pilot projects or isolated success stories. Extension gives scale to innovation. It translates policy ambition into field-level adoption (ICAR, 2026b).

5. ATMA, BTM and ATM: Institutional Relevance in a Changing Era

The Agricultural Technology Management Agency, or ATMA, was conceived as a district-level mechanism to decentralize agricultural extension, integrate research and extension, and make local planning more responsive to farmer needs. MANAGE's ATMA material describes it as a new organizational arrangement intended to decentralize day-to-day management of the public agricultural technology system to the district level. This was a major institutional shift because it recognized that agricultural conditions differ across districts and blocks and that extension must be locally planned rather than uniformly transmitted from above (MANAGE, 1999).

ATMA's significance lies in its architecture of decentralization and convergence. It was designed to bring together extension and research actors, support farmer participation, and enable preparation of more location-specific strategic and annual extension plans. In principle, this model addressed one of the

long-standing weaknesses of extension administration: the tendency toward fragmented, department-wise functioning and insufficient field responsiveness. Even in a changing digital era, this institutional logic remains highly relevant. The need for local planning, convergence among agriculture and allied sectors, and farmer-responsive implementation has not declined. On the contrary, it has become more important as farming systems diversify (MANAGE, 1999).

At the block level, the roles of the Block Technology Manager and Assistant Technology Managers are central. MANAGE study material identifies BTMs and ATMs as important block-level extension functionaries who support farmer groups, Farm Schools, Farmer Friends, and field-level extension activity. They form the practical interface between district-level planning and village-level outreach. In operational terms, they mobilize farmers, coordinate demonstrations, facilitate trainings, support group processes, collect feedback, and help localize extension interventions. They are, in effect, the human face of decentralized extension (MANAGE, 2021).

In the current context, the value of these functionaries becomes even greater. Digital platforms can improve scale, but they cannot entirely replace contextual understanding. Farmers often need interpretation, reassurance, verification, and local adaptation of advice. BTMs and ATMs can play a crucial bridging role by translating digital advisories into local action and by feeding local realities back into the wider system. If revitalized and properly trained, they can become the backbone of blended extension, where digital services and field-level support reinforce one another rather than operate separately. MANAGE's continuing focus on BTMs and ATMs in its capacity-building programmes through partner organisations indicates that these roles remain institutionally important (MANAGE, 2021).

6. From Technology Transfer to Decision Support

The traditional description of extension as "transfer of technology" captured an important historical phase of Indian agriculture. At that stage, the central problem was often a gap between available scientific knowledge and actual farmer practice. Demonstrations, training, and structured advisories were therefore appropriate instruments. However, the idea of technology transfer assumes that there is a relatively stable package of recommendations that can be passed from expert to user. Contemporary agriculture is less stable than that. Decisions must be adjusted continuously according to rainfall patterns, heat conditions, market opportunities, pest emergence, logistics, and household economics (ICAR, 2026b).

This is why extension must increasingly be understood as a system of decision

support. The farmer of today does not only ask, "What is the recommended seed or dose?" The farmer also asks, "Should I sow now or wait? Should I shift to another crop? Should I sell immediately or store? Is this pest alert genuine? Which scheme am I eligible for? Is this video advice reliable?" These are practical decision questions under uncertainty. Extension, therefore, must support judgment as much as adoption (PIB, 2026b).

This broader role requires extension personnel to move beyond routine transmission of messages. They must understand local context, recognize farmer heterogeneity, and connect recommendations with market, climate, and institutional realities. It also requires that extension systems become more responsive and interactive, using feedback loops rather than only one-way communication. The changing role of extension, then, is not that it is becoming less important. It is that its importance now lies in a more complex function (ICAR, 2026b).

7. Climate Variability, Diversification and Market Orientation

One of the strongest drivers of change in agricultural extension is climate variability. Uncertain rainfall, heat stress, shifting pest incidence, water scarcity, and localized weather shocks have made agriculture far more risk-prone. Farmers need advisory support that is location-specific, timely, and adaptive. Generic seasonal recommendations are often insufficient in such a context. Extension must therefore engage more deeply with contingency planning, climate-smart practices, efficient resource use, and rapid communication (PIB, 2026).

Another major driver is diversification. Agriculture is no longer dominated only by a narrow set of staple crops. Horticulture, pulses, oilseeds, natural farming systems, integrated farming, and value-added enterprises are expanding in importance. This means extension needs to become more segmented and specialized. A one-size-fits-all approach is poorly suited to a sector in which farmers may require advice on post-harvest grading, protected cultivation, beekeeping, seed production, drip irrigation, branding, or collective marketing (ICAR, 2026b).

Market orientation has similarly changed the scope of extension. Farmers need not only production guidance but also assistance in price realization, aggregation, storage, processing, and market linkage. Social-media-enabled selling, digital price information, FPO channels, and quality-sensitive supply chains are making market literacy a necessary part of extension. In this sense, extension is moving from a "lab-to-land" model toward a "farm-to-market" or even "farm-to-value-chain" model. This is particularly important where income enhancement, not merely yield increase, is the policy objective (PIB, 2026c).

8. Bharat-VISTAAR and the Architecture of Next-Generation Extension

A major marker of this transition is Bharat-VISTAAR. Official government releases describe Bharat-VISTAAR as an AI-based, multilingual, integrated system intended to provide farmers with access to information related to crop advisory, government schemes, weather, market prices, and grievance support. It was launched in Phase I on 17 February 2026 and made available through multiple access channels, including a dedicated phone line, voice-based AI chatbot, web portal, and mobile application. The rollout note states that Phase I integrates ten major central schemes and is intended to expand to more languages over time (PIB, 2026b).

The significance of Bharat-VISTAAR lies not only in its technological features but also in what it says about the future of extension. First, it points toward integrated service delivery. Instead of farmers navigating multiple disconnected sources for scheme eligibility, market prices, crop advice, and complaint resolution, the platform seeks to bring these into a common interface. Second, it expands accessibility by including voice-based channels, which can matter greatly in a context where smartphone penetration, literacy, and language comfort vary widely. Third, it indicates that extension is becoming more conversational and potentially more personalized (PIB, 2026b).

Bharat-VISTAAR should not be understood as a substitute for extension personnel. Rather, it can be seen as an enabling layer that expands the reach, continuity, and responsiveness of public advisory. Its success will depend substantially on whether digital advice is linked with field verification, local institutions, and follow-up support. In other words, the best future is not "digital instead of human extension," but "digital plus human extension" (PIB 2026c).

9. Social Media, Agri-Influencers and the New Communication Ecology

Social media has become one of the most powerful new spaces for agricultural communication. MANAGE publications and related literature have discussed the role of social media in communication, collaboration, online engagement, agricultural awareness, and youth involvement. Today, many farmers learn through short videos, peer demonstrations, influencer commentary, local-language posts, and informal digital communities. The attraction is obvious: social media is immediate, visual, repeatable, and often easier to understand than conventional technical literature (MANAGE, 2017).

This has changed the communication ecology of extension. Earlier, public institutions held a near-monopoly over formal agricultural advice. Now, progressive farmers, agri-startups, content creators, FPO leaders, development organisations, input companies, agribusiness firms and machinery suppliers

often shape perceptions and behaviour. These agri-influencers can perform a positive role by translating technical messages into relatable language, showing actual field practice, and creating peer confidence around adoption. They can make extension more participatory and conversational (Suchiradipta and Raj, 2018).

At the same time, this environment requires public institutions to rethink their communication strategies. It is no longer enough to issue circulars, organize meetings, or publish manuals. Credible extension must now also be visible, timely, and understandable in the media ecosystems where farmers actually spend their attention. MANAGE's work on mobile journalism for extension professionals is relevant in this regard because it reflects the growing need for extension institutions to communicate better in digital formats (MANAGE, 2024).

10. Challenge of Fake, Unverified, Motivated and Misleading Digital Media Posts

The rise of digital communication has created immense opportunities, but it has also generated a serious threat: the spread of fake, unverified, motivated, and misleading agricultural information. Multiple recent sources discussing social media in agricultural contexts identify misinformation, digital literacy gaps, and unreliable content as important constraints. Research and practice discussions note that misinformation can spread rapidly on social media, creating confusion, mistrust, and poor decision-making in farming communities (Kaviya & Natarajan, 2025).

In agriculture, the harm can be immediate and material. False claims may be made about pesticides, miracle inputs, pest-control remedies, crop cures, procurement arrangements, prices, subsidy eligibility, or government actions. Some content is commercially motivated, some is carelessly shared, and some may be deliberately misleading. Farmers are especially vulnerable when such information is presented in vernacular language, delivered through emotionally persuasive videos, or repeatedly circulated within trusted peer groups. In such settings, misinformation can travel faster than scientific correction (Shelke and Murai Atul, 2024).

This challenge changes the role of extension in a fundamental way. Extension agencies can no longer remain only transmitters of information. They must increasingly become validators of information quality. They need to identify falsehoods, issue clarifications quickly, produce simple myth-busting content, and establish themselves as trusted public fact-checkers in agriculture. The credibility of extension in the future will depend not only on whether it can

provide advice, but also on whether it can defend farmers against bad advice (MANAGE, 2024).

In practical terms, this means extension systems must maintain an active digital presence. Silence in digital spaces creates room for misinformation. Timely, short, local-language, farmer-friendly content can serve as a preventive as well as corrective tool. Extension workers also need to teach farmers a basic culture of verification: check the source, confirm with local officials or KVK experts, and avoid acting on sensational or commercially charged claims without validation (MANAGE, 2024).

11. Need for Capacity Building of Extension Workers

If the role of extension is changing so deeply, then the role of the extension worker is changing equally deeply. Capacity building is therefore not a side issue. It is central. ICAR reports that the knowledge and skills of about 1.16 lakh extension personnel were upgraded through 3,948 training programmes, which itself reflects recognition of the scale of the challenge. Capacity development is explicitly part of the extension mandate (ICAR, 2026b).

The modern extension worker must know far more than conventional agronomy. He or she must understand climate-smart agriculture, integrated farming, market-linked extension, digital service platforms, AI-enabled advisory, FPO dynamics, natural farming, post-harvest handling, and behaviour change communication. In addition, because of the rise of social media and misinformation, extension workers need skills in digital communication, content curation, source verification, and quick response messaging. MANAGE and related publications on social media and mobile journalism suggest precisely this broadening of communication expectations from extension professionals (MANAGE, 2024).

This capacity-building requirement is particularly important for ATMA, BTM, ATM, KVK, and state department personnel, because they are the last-mile interface with farmers. If they are not regularly updated, they can neither command farmer trust nor interpret new systems effectively. A digital platform, however sophisticated, is weakened if the field functionary cannot explain or support it. Conversely, a well-trained field worker can greatly amplify the value of a digital system (ICAR, 2026b).

Capacity building must therefore be continuous, modular, and future-oriented. It should not be limited to occasional technical refreshers. It should include field realities, communication methods, market understanding, platform use, and misinformation response. Training also needs to become more practice-based, with real cases, digital demonstrations, and local problem-solving.

The extension worker of the future is not merely an instructor. He or she is a knowledge navigator, digital mediator, trust-builder, and local problem-solver (ICAR, 2026b).

12. Policy Implications

Several policy implications follow from this analysis. First, India needs a blended model of extension in which digital platforms expand scale and continuity, while human institutions provide trust, interpretation, and contextual adaptation. Second, decentralized extension systems such as ATMA should be revitalized and integrated more closely with digital public platforms so that local planning and national digital resources work together. Third, block-level functionaries like BTMs and ATMs need stronger professional support because they are central to field translation of advisory systems (MANAGE, 1999).

Fourth, public extension agencies should treat misinformation management as a core function, not a peripheral concern. This means building rapid-response mechanisms, myth-busting communication, and verified multilingual digital outreach. Fifth, extension capacity building must expand from technical training to include digital literacy, market intelligence, communication design, and information verification. Sixth, public institutions should engage with credible agri-influencers and farmer leaders rather than ignore them, while retaining scientific standards and accountability (MANAGE, 2024).

13. Extension as Behaviour Change and Social Mobilisation

A modern understanding of extension also requires recognition that farmers do not adopt innovations merely because information is available. Adoption depends on trust, affordability, perceived risk, peer examples, local norms, and visible results. Extension is therefore not only a process of information transfer but also a process of behaviour change and social mobilisation. Whether the subject is balanced fertilization, water-saving irrigation, natural farming, residue management, mechanization, crop diversification, or participation in FPOs, farmers often need repeated engagement before practice changes occur.

This makes communication strategy central to extension effectiveness. Demonstrations remain important because they reduce uncertainty. Farmer-to-farmer learning remains important because social proof matters. Timely advisory remains important because risk perception changes quickly in agriculture. Extension personnel must therefore be skilled in persuasion, listening, follow-up, and adaptation of messages to local realities. Behaviour change is especially relevant in areas where public policy seeks to encourage sustainable agriculture, efficient resource use, climate resilience, and group-based action.

14. Extension orientation of production departments

Production department has a crucial role to play in agriculture extension by taking care of various needs of the farmers ranging from enhanced production to linking the same with market. The responsibilities of the production department are no longer confined just to transfer of technology with focus on enhanced production. In the present environment, it is imperative to cover risk associated with the production, bank integration facilitating technology adoption, aggregation for achieving the scale, satisfaction of farmers and linking the surplus with market. Production department has to facilitate the process of farmers getting aggregated in groups through appropriate model for achieving the scale and improve access to common infrastructure and markets. Production planning is influenced by market demand and expected price and therefore, the production department needs to arrange timely availability of correct market information. There is also need for having a strong feedback mechanism ensuring two-way flow of information. The information on field level challenges faced by the farmers and their satisfaction with the existing technology suggested by the department will help in making extension more responsive and adaptive. As agriculture is undergoing changes and becoming comprehensive, there is need to follow holistic approach to help farmers enhance the income from agriculture. This expect the production department to focus beyond technology transfer to planning, processing, storage, transportation, risk mitigation and bank integration and marketing so as to make agriculture profitable for farmers.

15. Role of Women, Youth and Community Resource Persons

The changing role of extension must also be viewed through the lens of inclusion. Women play a major role in agricultural operations, livestock management, post-harvest work, seed care, and household-level decision-making, yet extension systems have often been insufficiently responsive to their needs and constraints. Similarly, rural youth are increasingly important as technology adopters, agri-entrepreneurs, custom hiring operators, digital communicators, and local service providers. Community resource persons, progressive farmers, and local para-extension workers can also become valuable carriers of agricultural knowledge.

Future-ready extension systems should therefore deliberately widen their social base. Women farmers need advisory that is accessible in terms of timing, language, and relevance. Youth can serve as digital bridges who help farmers access advisories, apps, market information, and platform-based services. Community resource persons can strengthen continuity where formal staffing is limited. In this sense, extension must evolve from a narrow departmental function into a broader ecosystem of public, community, and digital actors working together.

16. Toward a Future-Ready Extension Architecture

The changing role of agricultural extension in India ultimately points toward a new architecture rather than a single reform. This architecture would combine strong public credibility, decentralized field presence, AI-enabled digital access, verified social media communication, and sustained capacity building. It would preserve the strengths of face-to-face extension while adding speed, scale, and continuity through digital channels. It would also create better linkages among research institutions, extension departments, KVKs, FPOs, market systems, and grievance-redress mechanisms.

Such a system must remain farmer-centric. Technology is only useful when it improves decision quality at the farm level. Digital platforms are only meaningful when they are understandable and trusted. Social media outreach is only valuable when it is credible. Capacity building is only effective when it equips field workers to solve real problems. The long-term success of extension, therefore, will depend on whether India can design institutions that are both technologically advanced and locally grounded.

In the coming years, the most successful extension systems are likely to be those that combine four qualities: credibility, responsiveness, inclusiveness, and adaptability. Credibility will come from science-based public institutions. Responsiveness will come from data, local feedback, and real-time communication. Inclusiveness will come from better engagement with women, youth, community institutions, and diverse farming systems. Adaptability will come from continuous learning and capacity building within the extension machinery itself. These qualities together can redefine agricultural extension as a strategic public service for resilient and remunerative agriculture.

17. Conclusion

Agricultural extension in India is not becoming obsolete; it is being redefined. Its classical role of transferring technology remains important, but that alone is no longer enough for an agricultural system facing climate shocks, market volatility, diversified livelihoods, and digital information overload. The extension system must now help farmers not only adopt technologies, but also interpret information, manage uncertainty, access schemes, improve market readiness, and avoid misinformation (PIB, 2026b).

The continuing relevance of extension services is evident in the enduring importance of decentralized structures like ATMA and the frontline roles of BTMs and ATMs. At the same time, the emergence of Bharat-VISTAAR, social media-based learning, and peer communication networks shows that the modalities of extension are evolving rapidly. The future lies in synthesis:

public credibility with digital scale, field presence with AI-enabled access, and institutional authority with participatory communication (MANAGE, 1999).

One of the most important emerging lessons is that extension in the digital age must not only disseminate knowledge; it must also protect the quality of knowledge. Fake, unverified, and motivated digital media posts can harm farmers directly, and extension institutions must be prepared to counter them. This makes capacity building of extension workers even more urgent. A future-ready extension worker must be technically sound, digitally fluent, communicatively effective, and institutionally trusted. That is the real meaning of the changing role of agricultural extension in India today (Kaviya & Natarajan, 2025).

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Promotion of nutritional, economic and livelihood security through small-scale Giriraja backyard poultry farming

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ABSTRACT

The paper analyzed small-scale Giriraja variety backyard poultry farming by 120 farmers in Mysore and Mandya districts of India's Karnataka state by considering economic, nutritional and livelihood securities. Data collected from 120 farmers on livelihood security with respect to income generation and increased dietary intake through backyard poultry farming. The majority of respondents were selling Giriraja backyard birds at 10-15 weeks age with an average body weight of 2.035 kg. Mean selling price of live birds and eggs was Rs. 58.4/kg and Rs. 3.29/egg, respectively. The respondents on average produced and sold 662 and 652 birds and 2108 and 2006 eggs, respectively. The average income earned was Rs.1385/month with a wide income range of Rs.220 to 6500/month. The average cost-benefit ratio of Giriraja poultry farming was 5.45. They were using the income for daily household expenses, increasing flock size, and children's education. Regarding nutritional benefits, each respondent's family was consuming 16.08 kg of chicken and 117 eggs per year. Considering the average family size of 4 members, each household's consumption amounts to 4.02 kg of chicken and 29 eggs per year. Overall, backyard poultry farming helped the respondents as a tool in income generation and nutritional security, besides empowering them economically.

Keywords: Giriraja, backyard poultry, livelihood security, nutritional security

Introduction

Backyard poultry production is a simple and low-cost way to provide nutritious food, especially eggs and chicken meat. These foods are good sources of protein that people can afford. Rural women mostly manage this farming system. It helps improve food security, reduce poverty, and empower communities (Dinesh, 2025). The Indian government and the Indian Council of Agriculture Research (ICAR) have prioritized boosting meat and egg production through backyard

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poultry to enhance food security and rural livelihoods, and supported various programmes. This has resulted in the release of some important backyard poultry varieties viz., Vanaraja and Gramapriya (Ayyagari, 2001), Debendra and CARI-Gold (Kataria and Johari, 2001), Krishna-J (Khan, 2001) and Giriraja (Ramappa, 2001). The Giriraja, a hybrid colored chicken variety developed for backyard rearing by the College of Veterinary Science in Bangalore, demonstrates high egg production and improved growth compared to local breeds. It is well-suited for both mixed and backyard farming systems.

Specific Objectives of the Study

- To investigate how Giriraja backyard poultry farming enhances dietary intake by providing a sustainable source of nutritious eggs and meat, as well as how it contributes to income generation for families involved.
- To provide a comprehensive understanding of the benefits associated with Giriraja backyard poultry farming and its potential role in improving overall well-being and economic stability within communities.

Methodology

Following an exploratory research design and survey method, this study aims to explore how Giriraja backyard poultry farming contributes to enhancing livelihood security through improved dietary intake and increased income generation. In Mysore ($11^{o}45^{1}$ N and $75^{o}57^{1}$E) and Mandya ($12^{o}52^{1}$ N and $76^{o}9^{1}$ E) districts of India's Karnataka state, a total of 120 farmers were selected randomly from six villages in each district, with ten farmers from each village. The key survey questions were on personal and socio-economic characteristics, uses and functions, marketing body weight and price, number of birds produced and sold, cost-benefit ratio, distributional benefits of income, and nutritional security in the form of egg and chicken consumption per year by the family. The 120 respondents were personally interviewed using a standardized structured interview schedule. The researchers also employed general observation on aspects related to the study to cross-check the information collected. The data obtained from the interviews were coded, entered into the computer spreadsheet, and analyzed using descriptive analysis procedures (SPSS, 2006). Frequency tables and percentages were generated as the summaries of the data for analysis.

Results and Discussion

Table 1 provides key information about the respondents. Most (67.5%) were middle-aged, with an average age of 44.6 years. About 16.7% were young (under

35), and 15.8% were older (over 55). Just over half (51.7%) were male, while 48.3% were female, involved in backyard poultry farming. Most had a high school education (31.7%), followed by primary (29.2%) and middle-level education (15.8%). Only 10.8% were illiterate. About 80% lived in nuclear families, with 53.3% having four members, 22.5% five, and 21.7% three, averaging 3.99 members. About 63.3% respondents were from Other Backward Classes (OBC), 60% lived in kachha (temporary) houses, 23.4% in pucca (permanent) houses, and 10.8% in mixed houses. Regarding land, 36.7% owned up to 0.5 acres, 32.5% one acre, 14.1% 1.5 acres, and 15% more than 1.5 acres. Only 1.7% were landless poultry farmers. Most (48.4%) worked in agriculture, followed by animal husbandry (48.8%) and poultry (10.8%). For 50% of the respondents, animal husbandry was a secondary occupation, and for 44.1%, poultry was also part of their income. Most had one to four years of experience in Giriraja poultry farming (56.7%). About 30% had five to eight years, and 8.3% had over eight years, with an average of 4.46 years.

Table: 1 Personal and socio - economic profile of the respondents (N=120)

S.no	Variable	Frequency	Percentage	Mean	SD	Range
1	***Age (years)***					
	Young (Mean-SD) Less than 35 years	20	16.7	44.6	9.85	21-72
	Middle aged (Mean±SD) 36 to 54 years	81	67.5			
	Old (Mean-SD) More than 55 years)	19	15.8			
2	***Sex***					
	Male	62	51.7			
	Female	58	48.3			
3	***Education***					
	Illiterate	13	10.8			
	Can read	6	5.0			
	Can read and write	1	0.8			
	Primary education	35	29.2			
	Middle level education	19	15.0			

	High school	38	31.7			
	Above High school	8	6.7			
4	***Family Type***					
	Nuclear	96	80.0			
	Joint	24	20.0			
5	***Family size (No.)***					
	2.00	2	1.7	3.99	-	2-6
	3.00	26	21.7			
	4.00	64	53.3			
	5.00	27	22.5			
	6.00	1	0.8			
6	***Caste***					
	General	6	5.0			
	Scheduled caste	37	30.8			
	Scheduled Tribe	1	0.8			
	Other backward caste	76	63.4			
7	***Type of house***					
	Hut	7	5.8			
	Kaccha	72	60.0			
	Pucca	28	23.3			
	Mixed	13	10.8			
8	***Land possession***					
	Landless	2	1.7	2.04	1.08	
	Up to 0.5 Acre	44	36.7			
	Up to 1 Acre	39	32.5			
	Up to 1.5 Acre	17	14.1			
	More than 1.5 Acre	18	15.0			
9	***Main occupation***					
	Agriculture	58	48.4			
	Animal Husbandry	49	40.8			
	Poultry	13	10.8			

10	***Subsidiary occupation***					
	Animal Husbandry	60	50.0			
	Poultry	53	44.1			
	Business	2	1.7			
	None	5	4.2			
11	***Experience of the respondents (years)***					
	Freshly started	6	5.0	4.46	2.88	0-15
	1-4	68	56.7			
	5-8	36	30.0			
	More than 8	10	8.3			

About 90.8, 58.3, and 62.5 percent of respondents gave first rank to backyard poultry as a source of income, a source of food, and for social functions, respectively (Table 2). Indicating backyard poultry as a source of income with first rank clearly reveals the commercial value of backyard poultry for the respondents. The study highlighted the significant role of backyard poultry eggs and meat as sources of food, as evidenced by consumption patterns. Use of backyard poultry for social functions also signifies the cultural factor behind their farming.

Table 2. Uses and functions of backyard poultry and ranking (N=120)

Rank	Source of income		Source of food		Social function	
	F	%	F	%	F	%
Rank I	109	90.8	70	58.3	75	62.5
Rank II	11	9.2	45	37.5	45	37.5
Rank III	0	0	5	4.2	0	0
Total	120	100	120	100	120	100

The majority (43.3%) of farmers were selling the birds at the age of 10-15 weeks, and nearly half (50.8%) of respondents sold their birds with a body weight range of one to two kg (Table 3). The majority (48.3%) of respondents sold the eggs @ Rs. 3.50/egg, and the majority (78.3%) of respondents sold birds at the price range of Rs. 50-70 per kg live weight. The meat and eggs of Giriraja backyard poultry are highly valued with prices being 50–100% higher than industrially produced eggs and birds.

Table 3. Marketing age, body weight, and price of backyard poultry (N=120)

Marketing age (weeks)	Frequency	Percentage
Not selling chicken	4	3.4
3-3.5	13	10.8
7-9.5	41	34.2
10-15	52	43.3
40-72	10	8.3
Marketing body weight of birds (Kg)		
< 1	16	13.3
1-2	61	50.8
2-3	32	26.7
3-5	11	9.2
Marketing price of egg (Rs/egg)		
3.00	12	10.0
3.50	58	48.3
4.00	28	23.3
4.50	14	11.7
5.00	8	6.7
Marketing price of live birds (Rs/Kg)		
< 50	13	10.8
50-70	94	78.3
70-80	9	7.5

Note: Mean marketing body weight: 2.035 kg; Mean egg price: Rs. 3.29; Mean live bird price: Rs. 58.4 / kg.

The majority of respondents (65.8%) sold between 1-100 birds annually, with an average production and sale of around 662 and 652 birds, respectively (Table 4). Additionally, about 32.5% sold between 1000-2000 eggs per year, with average egg production and sales of 2108 and 2006 eggs, respectively (Table 5).

Table 4. Average number of birds sold and produced per year (N=120)

Distribution	Average Birds sold		Average birds produced	
	Frequency	Percentage	Frequency	Percentage
1-100	79	65.8	66	55
101-200	23	19.2	25	20.8
201-400	2	1.6	7	5.8
Above 1000	12	10	12	10
Mean	652		662	

Table 5. Eggs sold and produced per year (N=120)

Distribution	Eggs sold		Total eggs produced	
	Frequency	Percentage	Frequency	Percentage
Nil	9	7.5	9	7.50
1-1000	27	22.5	21	17.50
1000-2000	39	32.5	40	33.33
2001-3000	21	17.5	18	15.00
3001-4000	15	12.5	19	15.83
4001 and above	9	7.5	13	10.84
Mean	2006		2108	
Range	0 to 8000		0 to 8250	

The majority of respondents (33.4%) were earning Rs. 1001 to 1500 per month through backyard poultry alone (Table 6). The average income was Rs. 1385 with a widespread range of Rs. 220 to 6500. The cost-benefit ratios for the majority of respondents (70.8%) varied between 3.35 and 7.55, with an average ratio of 5.45 (as shown in Table 7). This average is notably higher than that of most agricultural and livestock farming activities, highlighting the potential for profitability in this sector. The strong cost-benefit ratios can likely be attributed to effective low-input scavenging or semi-scavenging backyard production systems, along with favorable market prices for backyard poultry products. These findings suggest that there is a significant opportunity for growth and development in backyard poultry farming.

Table 6. Income earned per month through Giriraja poultry (N=120)

Categorization (In Rupees)	Frequency	Percentage	Mean	Range
Up to 500	15	12.5	1385	220-6500
Between 501 to 1000	34	28.3		
Between 1001 to 1500	40	33.4		
Between 1501 to 2000	12	10.0		
Between 2001 to 2500	12	10.0		
Above 2500	07	5.8		

Table 7. Cost: benefit ratio in Giriraja poultry farming (N=120)

Categorization	Frequency	Percentage	Mean	SD	Range
Low CB ratio (Mean-SD : < 3.35)	18	15	5.45	2.10	1.55-12.30
Medium CB ratio (Mean±SD: 3.35 to 7.55)	85	70.8			
High CB ratio (Mean+SD: > 7.55)	17	14.2			

Approximately 71.67% of respondents used about 51.74% of their income from Giriraja backyard poultry for household expenses, while 54.17% and 41.67% allocated income—29.38% and 27.8%, respectively—for increasing flock size and for children's education (Table 8). The distributional benefits of income are clear-cut examples of the capacity of backyard poultry to substitute a substantial amount of income in the livelihood security of farmers.

Table 8. Distributional benefits of income earned through Giriraja poultry farming

Purpose	Frequency (Percentage)	Average income utilization (Percentage)
Household activities	86 (71.67)	51.74
Increase flock size	65 (54.17)	29.38

Children education	50 (41.67)	27.8
Medicine	13 (10.83)	15.00
Recreation	9 (7.5)	10.00
Livestock purchasing	9 (7.5)	39.40
Agriculture	8 (6.67)	28.15
Gold purchasing	5 (4.17)	37.00

The majority (41.6) of the respondents' families were consuming 1-5 birds/year, followed by 29.5 percent consuming 6-10 birds/year, with a mean consumption of 7.9 birds/year. With an average body weight of 2.035 kg, each respondent's family was consuming 16.08 kg chicken/year (Table 9). The majority (40%) of respondents' families were consuming 1-100 eggs per year, followed by 39.2 percent consuming 101 to 200 eggs per year, with a mean consumption of 117 eggs /year (Table 10).

Table 9. Number of birds consumed per family per year (N=120)

Number of Giriraja birds Consumed	Frequency	Percentage	Mean (Range)
Nil	15	12.5	7.9* (0-50)
1-5	50	41.6	
6-10	35	29.2	
11-15	5	4.2	
16-20	8	6.7	
21 and above	7	5.8	

Table 10. Eggs consumed per family per year (N=120)

Distribution	Frequency	Percentage	Mean (Range)
Nil	11	9.1	117 (0-275)
1-100	48	40	
101-200	47	39.2	
201-300	14	11.7	

It is clear from the findings that each respondent's family is consuming 16.08 kg of chicken and 117 eggs per year. With a mean family size of four members, each family member is consuming 4.02 kg of chicken and 29 eggs per year. The Indian Council of Medical Research (ICMR) has set beneficial guidelines recommending a per capita consumption of 180 eggs and 11 kg of meat (Mehta

et al., 2003; Marmat et al., 2024). However, in 2023-2024, the actual availability in India reached only 103 eggs and 7.39 kg of meat per person annually (BAHS, 2024; PIB, 2024). This indicates an opportunity for improvement in nutritional intake across the population. Notably, the study found that engaging in Giriraja backyard poultry farming can significantly enhance nutrition by providing an additional 4.02 kg of chicken and 29 eggs per household. Encouraging such practices could play a pivotal role in meeting dietary recommendations and improving overall health.

In India's northeastern region, which holds over 69 million poultry, backyard farming predominates, supporting rural livelihoods, nutritional security, and women's empowerment (Doley et al., 2025). Backyard poultry farming presents a feasible, economical method for supplying nutritious food, particularly eggs and chicken meat, which serve as affordable and accessible protein sources (Singh et al., 2017; Sonkar et al., 2020; Sree et al., 2025).

Experiences in several developing and under developed countries also suggest that increased backyard chicken farming would contribute positively on livelihood security in terms of household food security, improved nutritional intake and in income generation (Bhurtel, 1996; Kumtakar, 1999; Rangnekar and Rangnekar, 1996; Panda and Nanda, 2000; Dessie and Ogle, 2001; Mandal et al., 2002, Rajini and Narahari, 2002; and Conroy et al. 2004 and 2005).

Conclusion

This study investigated the impact of small-scale Giriraja backyard poultry farming on improving nutrition, fostering economic stability, and enhancing livelihoods in rural communities. The research highlights the numerous nutritional benefits associated with cultivating this particular breed of poultry at home, as well as the economic advantages that arise from egg and meat production, which can significantly contribute to the financial well-being of rural households.

In light of the emphasis placed by the Government of India and the Indian Council of Agricultural Research on backyard poultry as a vital strategy for ensuring livelihood security in rural areas, the study provides compelling evidence of the positive outcomes experienced by farmers who engage in backyard poultry farming. Understanding the motivations behind farmers' decisions to rear backyard poultry is critical; these factors can greatly influence the planning, execution, and sequencing of intervention strategies aimed at enhancing the sector.

In particular, in regions such as Mandya and Mysore, where approximately 90 percent of produced eggs and birds are sold in local markets, farmers may

be more inclined to adopt a commercial approach to family poultry farming. This inclination underscores the importance of providing targeted institutional support to assist these farmers in scaling their operations effectively.

The data collected revealed that the average income derived solely from backyard poultry farming amounts to Rs. 1,385, which underscores its significant role in alleviating poverty within these communities. Furthermore, the average cost-benefit ratio of 5.45 is notably higher in comparison to many other agricultural and livestock farming practices, indicating a favorable economic return on investment.

The economic contributions of backyard poultry farming are further illustrated through its impact on various household expenditures, including those related to food, healthcare, and children's education. These benefits collectively indicate the positive economic repercussions experienced by the respondents involved in this study.

From a nutritional standpoint, the benefits of Giriraja backyard poultry farming are multifaceted and significant. The study reported that respondents consumed an average of 4.02 kg of chicken and 29.32 eggs directly sourced from their backyard operations. This represents a substantial contribution to their overall nutritional intake, enhancing food security within the household.

Based on these findings, the study strongly recommends the large-scale distribution of Giriraja poultry within social frameworks to extend these benefits to a wider array of rural communities, thereby promoting improved nutrition and economic upliftment across the region.

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Impact of Agro Advisory Services of District Agro Meteorological Units (DAMU) of Krishi Vigyan Kendra's in Southern Karnataka

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ABSTRACT

Weather variability and climate change increasingly threaten agricultural production in rain-fed regions of India. To address weather-related risks, the Indian Meteorological Department (IMD), in collaboration with the University of Agricultural Sciences, Bangalore, established District Agro-Meteorological Units (DAMUs) at Krishi Vigyan Kendras (KVKs) for dissemination of location-specific weather forecasts and agro-advisories. The present study evaluated the impact of DAMU agro-advisory services in Southern Karnataka. The study was conducted in Tumkur, Ramanagara, Mandya and Chamarajanagara districts, where DAMUs have been functioning since 2019–20. An ex-post facto and exploratory research design was employed, and 120 farmers (30 from each district) receiving DAMU advisories were selected through purposive sampling. Data were collected using a structured interview schedule and analyzed using descriptive statistics. Results indicated that the four DAMUs together reached 95,441 farmers through digital platforms such as WhatsApp, Facebook and the Meghdoot application. Most respondents were middle-aged, small and marginal farmers with moderate to higher educational levels. Awareness about climate change was high (86.67 %), and KVK–DAMU units were the principal source of agrometeorological information for 96.67 per cent of the respondents. Adoption of DAMU advisories was very high (98.33 %), and a similar proportion perceived the advisories as useful. The advisories significantly influenced major farm operations, particularly harvesting, spraying and irrigation scheduling. Economic benefits due to advisory adoption ranged from Rs. 5,000 to above Rs. 20,000 per season. The study highlights the effectiveness of DAMU-based agro-advisory services in improving farm-level decision-making, reducing weather-related risks and enhancing farm income in Southern Karnataka.

Keywords: Agro-advisory services, DAMU, agrometeorology, climate change, farmer adoption, Karnataka

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Introduction

Agriculture in India is highly sensitive to weather and climate variability, as a substantial proportion of cropped area is rain-fed and dependent on the southwest monsoon. Variations in rainfall distribution, rising temperatures and increasing frequency of extreme weather events such as droughts, heat waves and unseasonal rainfall have intensified production risks and livelihood insecurity among farming communities. Climate change has further aggravated these challenges by increasing the unpredictability of weather patterns, making farm planning and timely decision-making more complex, particularly for small and marginal farmers.

Weather-induced risks affect all stages of crop production, including sowing, irrigation scheduling, nutrient management, pest and disease incidence, and harvesting operations. In the absence of timely and location-specific weather information, farmers often suffer avoidable yield losses and increased production costs. Therefore, the provision of reliable weather forecasts coupled with crop- and location-specific agro-advisories has emerged as a critical strategy for enhancing climate resilience and improving farm productivity.

Early warning systems (EWS) have become crucial in managing the increasing uncertainties of weather patterns caused by climate change. These systems help to provide timely and accurate information, allowing farmers and other stakeholders to make informed decisions that can mitigate the impact of extreme weather events. Indian Meteorological Department (IMD), Government of India in collaboration with the University of Agricultural Sciences, Bangalore established four District Agro-Meteorological Units (DAMUs) at Krishi Vigyan Kendras of Tumkur, Ramanagara, Chamarajanagara, and Chikkaballapura districts during the year 2019-20. A forecast of twice a week (Tuesday and Friday) for the next succeeding five days on weather parameters such as taluka-wise rainfall, temperature, relative humidity etc., is disseminated through the newspaper, Radio, TV, SMS, WhatsApp, and Facebook. Hence, measuring and documenting the impact of these agro-advisory services is crucial in understanding the extent of benefits the farmers received in improving their agricultural outcomes.

Objectives of the Research

1. To consolidate the data on District wise DAMUs operations in terms of number of advisories, area covered, number of farmers and EWs covered, etc.,
2. To measure the extent of the impact of weather forecasting parameters and agro-advisories on farmers and EWs

3. To enlist the constraints faced by farmers and EWs in utilizing the weather parameters and agro-advisories

Review of literature

Agrometeorological advisory services (AAS) in India have undergone significant development from generalized weather bulletins to structured, location-specific advisory systems such as District Agro-Meteorological Units (DAMUs) (Rathore et al., 2014). Studies have emphasized that weather-based agro-advisories play a crucial role in improving farmers' decision-making under climate variability by guiding timely operations such as sowing, irrigation, plant protection and harvesting (Singh et al., 2018). Empirical evidence from Karnataka indicates that farmers receiving agrometeorological advisories achieved higher crop yields and economic returns compared to non-beneficiaries (Nannewar et al., 2020). Similarly, Kanimolzhi et al. (2023) reported a high level of adoption of DAMU advisories among farmers in Tamil Nadu, particularly for scheduling critical farm operations. Farmer perception studies conducted in Andhra Pradesh and Telangana revealed that timely weather advisories helped reduce production losses and input costs while enhancing farm profitability (Ushasri et al., 2022). Studies from West Bengal and Maharashtra further confirmed that regular use of agrometeorological advisories contributed to increased net returns and improved livelihood security, highlighting the effectiveness of AAS in promoting climate-resilient agriculture (Thakur et al., 2020).

Methodology

The present study was carried out in four districts of Southern Karnataka, namely Tumkur, Ramanagara, Mandya and Chamarajanagara, where District Agro-Meteorological Units (DAMUs) were established at Krishi Vigyan Kendra's (KVKs) during 2019–20 under the University of Agricultural Sciences, Bangalore. These districts represent diverse agro-climatic situations and are predominantly dependent on monsoon rainfall, making them suitable for assessing the impact of agro-meteorological advisory services.

An ex-post facto and exploratory research design was adopted, as the DAMU agro-advisories had already been disseminated to farmers prior to the conduct of the study. The investigation also incorporated case documentation and video documentation to supplement quantitative findings and capture experiential evidence of advisory use.

Sl. No.	District	KVK-DAMU	Sample	Villages and sampling
1	Tumkur	KVK, Konehalli, Tiptur	30	Purposive sampling
2	Ramanagara	KVK, Magadi	30	
3	Chamarajanagara	KVK, Haradanahalli	30	
4	Mandya	KVK, Mandya	30	
Total sample			120	

The respondents for the study comprised farmers who were regular recipients of DAMU agro-advisories. A purposive sampling technique was employed for the selection of respondents. From each district, 30 farmers were selected, resulting in a total sample size of 120 respondents. In addition, extension personnel associated with DAMU operations were consulted to provide supporting qualitative information.

Primary data were collected through personal interviews using a pre-tested structured interview schedule developed in accordance with the objectives of the study. The schedule included items related to socio-economic characteristics of respondents, awareness of climate change, sources of agricultural information, extent of adoption and use of DAMU advisories, perceived usefulness, influence of advisories on farming operations, economic benefits derived and constraints faced in utilizing the advisories.

The data collected were coded, tabulated and analysed using descriptive statistical techniques such as frequency and percentage. The results were presented in tabular form to facilitate comparison across districts and to assess the overall impact of DAMU agro-advisory services.

Results and Discussion

KVK wise DAMU details

The data presented in table 1 depicts the KVK wise details of DAMU working under UAS, Bangalore. It is clear from the table 1 that, 35,000 farmers are reached through WhatsApp, Facebook and Meghdoot app by DAMU of KVK, Tumkur followed by DAMU of KVK Mandya covering 26,560 farmers through 79 WhatsApp groups, Facebook and Meghdoot app. DAMU of KVK Chamarajanagara and KVK Ramanagar are covering 19,821 and 14,060 farmers respectively through various social medias. In total the 4 DAMU units are covering a total of 95,441 farmers across 4 districts.

Table 1: KVK wise DAMU details

Sl. No	KVK'S	Social medias utilized for dissemination of advisories	No of farmers reached	Total no of farmers reached
1	Ramanagar	Whatsapp	5,063	14,060
		Face book	4,947	
		Megadhoot app	4,050	
2	Tumkur	Whatsapp	35,000	35,000
		Face book		
		Megadhoot app		
3	Mandya	Whatsapp	79 groups	26,560
		Face book	24,510	
		Megadhoot app	2,050	
4	Chamarajanagar	Whatsapp	19,821	19,821
		Face book		
		Megadhoot app		
			Total	**95,441**

Socio-Economic characteristics of respondents

Table 2: Age category of farmers

(N=120)

Sl. No	Age category (years)	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	Young (up to 35)	10	33.33	13	43.33	11	36.67	15	50.00	49	40.83
2	Middle (36-50)	18	60.00	13	43.33	16	53.33	12	40.00	59	49.17

3	Old (>50)	2	6.67	4	13.33	3	10.00	3	10.00	12	10.00
	Total	**30**	**100.00**	**30**	**100.00**	**30**	**100.00**	**30**	**100.00**	**120**	**100.00**

It is clear from the results presented in table 2 that, in Ramanagar district majority (60.00 %) of the respondents belonged to middle aged category followed by young (33.33 %) and old age (6.67 %) categories respectively. In Tumkur district equal (43.33 %) percent of the respondents belonged to young and middle-aged categories followed by old age category (13.33 %). In Mandya district, slightly more than half (53.33 %) of the respondents belonged to middle aged category followed by young (36.67 %) and old (10.00 %) age categories respectively. In Chamarajanagar half (50.00 %) of the respondents belonged to young age category followed by middle (40.00 %) and old (10.00 %) age categories respectively. In total nearly half (49.17 %) of the respondents belonged to middle aged category followed by young (40.83 %) and old (10.00 %) age categories respectively.

Table 3: Educational status of farmers

Sl. No	Educational categories	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Illiterate	1	3.33	2	6.67	0	0.00	1	3.33	4	3.33
2	Literate	3	10.00	0	0.00	1	3.33	0	0.00	4	3.33
3	Primary school	2	6.67	0	0.00	0	0.00	2	6.67	4	3.33
4	Middle school	3	10.00	0	0.00	0	0.00	1	3.33	4	3.33
5	High school	8	26.67	9	30.00	11	36.67	1	3.33	29	24.17
6	PUC/Diploma/ ITI	7	23.33	10	33.33	9	30.00	9	30.00	35	29.17
7	Degree	6	20.00	8	26.67	3	10.00	16	53.33	33	27.50
8	Post graduate	0	0.00	1	3.33	6	20.00	0	0.00	7	5.83

With respect to educational status of the respondents, the data in table 3 reveals that, in Ramanagar district slightly more than 25.00 percent of the respondents were educated up to high school followed by PUC/Diploma/ITI (23.33 %), Degree (20.00 %) and Middle school (10.00 %) respectively. In Tumkur district

one third (33.33 %) of the respondents were educated up to PUC/Diploma/ ITI followed by high school (30.00 %) and degree (26.67 %). In Mandya district, 36.67 percent of the respondents were educated up to high school followed by PUC/Diploma/ITI (30.00 %) and post-graduation (20.00 %). In Chamarajanagar district slightly more than half (53.33 %) of the respondents were educated up to degree followed by PUC/Diploma/ITI (30.00 %) and primary school (6.67 %). In total almost equal per cent of the respondents were educated up to PUC/ Diploma/ITI (29.17 %) and degree (27.50 %) followed by high school (24.17 %) and post-graduation (5.83 %).

Table 4: Land holding status of farmers

Sl. No	Type of farmer	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Landless	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2	Marginal (<2.5 acre)	15	50.00	12	40.00	12	40.00	11	36.67	50	41.67
3	Small (2.5-5.00 acre)	12	40.00	12	40.00	16	53.33	16	53.33	56	46.67
4	Medium (5.00 - 10.00 acre)	3	10.00	6	20.00	2	6.67	2	6.67	13	10.83
5	Large (>10.00 acre)	0	0.00	0	0.00	0	0.00	1	3.33	1	0.83

The details pertaining to land holdings of the respondents is presented in table 4. The results revealed that, in Ramanagar district half of the respondents belonged to marginal land holders category followed by small (40.00 %) and medium (10.00 %) land holders category. In Tumkur district equal (40.00 %) per cent of the respondents belonged to marginal and small land holders category followed by medium land holders category (20.00 %). In Mandya district slightly more than half (53.33 %) of them belonged to small land holders category followed by marginal (40.00 %) and medium (6.67 %) land holders category. In Chamarajanagar district slightly more than half (53.33 %) of them belonged to small land holders category followed by marginal (36.67 %) and medium (6.67 %)

land holders category. Overall majority (46.67 %) of the respondents belonged to small land holders category followed by marginal (41.67 %) and medium (10.83 %) land holders category respectively.

Awareness of farmers on climate change

Table 5: Awareness of farmers on climate change

Sl. No	Awareness	Ramanagar (n=30)		Tumkur (n=30)		Mandya (n=30)		Chamaraja nagar (n=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Aware	18	60.00	28	93.33	28	93.33	30	100.00	104	86.67
2	Not aware	12	40.00	2	6.67	2	6.67	0	0.00	16	13.33

The data presented in table 5 regarding awareness of farmers on climate change revealed that, cent per cent of Chamarajanagar farmers, 93.33 per cent of Tumkur and Mandya farmers and 60 per cent of Ramanagar district farmers are aware of the climate change. Overall majority (86.67 %) of the farmers are aware of the climate change in the districts.

Sources of information on agriculture related aspects

Table 6: Sources of information on agriculture related aspects

Sl. No	Source of information	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Own Experience	0	0.00	4	13.33	0	0.00	29	96.67	33	27.50
2	Agricul-ture/Hor-ticulture/ sericulture Officer	3	10.00	7	23.33	3	10.00	19	63.33	32	26.67
3	TV News	0	0.00	1	3.33	1	3.33	0	0.00	2	1.67
4	Newspaper	1	3.33	2	6.67	14	46.67	2	6.67	19	15.83
5	Radio	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

6	KVK & DAMU unit	29	96.67	27	90.00	30	100.00	30	100.00	116	96.67
8	All of the above	0	0.00	2	6.67	0	0.00	0	0.00	2	1.67

The data in table 6 depicts the sources contacted by the respondents for obtaining information about agriculture related aspects. It is clear from the table that, in Ramanagar great majority (96.67 %) of the respondents contacted KVK & DAMU unit for obtaining information followed by Agriculture/Horticulture/sericulture Officer (10.00 %). In Tumkur district great majority (90.00 %) of the respondents contacted KVK & DAMU unit for obtaining information followed by Agriculture/Horticulture/sericulture Officer (23.33 %) and own experience (13.33 %). In Mandya district cent per cent of them contacted KVK & DAMU unit for obtaining information followed by Newspaper (46.67 %) and Agriculture/Horticulture/sericulture Officer (10.00 %). In Chamarajanagar district cent per cent of them contacted KVK & DAMU unit for obtaining information followed by Own Experience (96.67 %) and Agriculture/Horticulture/sericulture Officer (63.33 %). In total a great majority (96.67 %) of the respondents contacted KVK & DAMU unit for obtaining information on agriculture related aspects followed by own experience (27.50 %), Agriculture/Horticulture/sericulture Officer (26.67 %) and Newspaper (15.83 %).

Adoption of advisories given by DAMU units

Table 7: Adoption of advisories given by DAMU units

Sl. No	Extent of Adoption	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Adopted	30	100.00	29	96.67	29	96.67	30	100.00	118	98.33
2	Not adopted	0	0.00	1	3.33	1	3.33	0	0.00	2	1.67

It is evident from the results presented in table 7 that, cent percent of the respondents adopted the advisories given by the DAMU unit in Ramanagar and Chamarajanagar districts. Equal per cent (96.67 %) of the respondents in Tumkur and Mandya districts adopted the advisories provided by the DAMU units. Overall, great majority (98.33 %) of them adopted the messages/advisories provided by the DAMU units.

Perceived usefulness of advisories

Table 8: Perceived usefulness of advisories

Sl. No	Useful-ness	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamara-ja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	useful	29	96.67	30	100.00	29	96.67	30	100.00	118	98.83
2	Not useful	1	3.33	0	0.00	1	3.33	0	0.00	2	1.67

The data presented in table 8 revealed the usefulness of messages/advisories as perceived by the respondents. It is evident that, cent per cent of the respondents in both Tumkur and Chamarajanagar districts perceived that the messages/advisories provided by the DAMU units are useful. A great majority (96.67 %) of respondents in Ramanagar and Mandya districts perceive that the messages/advisories provided by the DAMU units are useful. Overall great majority (98.33 %) of respondents found the messages/advisories provided by the DAMU units are useful.

Economic benefit derived due to adoption of advisories provided by the DAMU units

Table 9: Economic benefit derived due to adoption of advisories provided by the DAMU units

Sl. No	Economic benefit	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	5000 - 10,000	25	83.33	15	50.00	19	63.33	0	0.00	59	49.17
2	10,001 - 15,000	4	13.33	6	20.00	8	26.67	0	0.00	18	15.00
3	15,001 - 20,000	1	3.33	6	20.00	2	6.67	0	0.00	9	7.50
4	Above 20,000	0	0.00	3	10.00	1	3.33	30	100.00	34	28.33

It can be seen from the table 9 that, in Ramanagar district majority (83.33 %) of the respondents got an economic benefit of 5000-10000 followed by 10001-15000 (13.33 %) and 15001-20000 (3.33 %) due to adoption of advisories sent

by DAMU units. In Tumkur district half of the respondents got an economic benefit of 5000-10000 followed 10001-15000 (20.00 %) and 15001-20000 (20.00 %). In Mandya district majority (63.33 %) of the respondents got an economic benefit of 5000-10000 followed by 10001-15000 (26.67 %) and 15001-20000 (6.67 %). In Chamarajanagar district cent percent of the respondents derived an economic benefit of more than 20000 due to adoption of advisories. Overall slightly less than half (49.17 %) of them derived an economic benefit of 5000-10000 followed by above 20000 (28.33 %) and 10001-15000 (15.00 %).

Usefulness of training programmes organized by DAMU units

Table 10: Usefulness of training programmes organized by DAMU units

Sl. No	Usefulness	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Useful	30	100.00	30	100.00	30	100.00	30	100.00	120	100.00
2	Not Useful	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

The data in table 10 revealed that, cent per cent of the respondents in all the four districts viz., Ramanagar, Tumkur, Mandya and Chamarajanagar perceived that the awareness training programmes conducted by DAMU units are useful.

Extent of use of advisories sent by DAMU units

Table 11: Extent of use of advisories sent by DAMU units

Sl. No	Extent of use	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Daily	0	0.00	2	6.67	0	0.00	0	0.00	2	1.67
2	Weekly twice	27	90.00	22	73.33	0	0.00	28	93.33	77	64.17
3	Weekly once	2	6.67	2	6.67	8	26.67	2	6.67	14	11.67
4	Fort-night	1	3.33	4	13.33	22	73.33	0	0.00	27	22.50

The data regarding extent of use of advisories sent by DAMU units is presented in table 11 and it reveals that, high majority (90.00 %) of the respondents in Ramanagar district use the advisories sent by the DAMU units weekly twice followed by weekly once (6.67 %) and once in fortnight (3.33 %). In Tumkur district majority (73.33 %) of them use the advisories sent by the DAMU units weekly twice followed by fortnight (13.33 %), daily and weekly once (6.67 %) respectively. In Mandya district nearly three fourth (73.33 %) of them use the advisories once in fortnight followed by weekly once (26.67 %) and in Chamarajanagar district high majority (93.33 %) of them use the advisories weekly twice. Overall majority (64.17 %) of the respondents use the advisories sent by DAMU units weekly twice followed by fortnight (22.50 %) and weekly once (11.67 %).

Effect of advisories on farming operations as expressed by the respondents

Table 12: Effect of advisories on farming operations as expressed by the respondents

Sl. No	Effect	Ramanagar (n_1=30)		Tumkur (n_2=30)		Mandya (n_3=30)		Chamaraja nagar (n_4=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Sowing operations	1	3.33	17	56.67	6	20.00	9	30.00	33	27.50
2	Irrigation schedule	3	10.00	9	30.00	23	76.67	13	43.33	48	40.00
3	Fertilizers application	6	20.00	6	20.00	11	36.67	7	23.33	30	25.00
4	Spraying operations	26	86.67	9	30.00	19	63.33	21	70.00	75	62.50
5	Harvesting operations	28	93.33	13	43.33	21	70.00	27	90.00	89	74.17

The data presented in table 12 depicts the effect of advisories sent by DAMU units on agricultural operations carried out by the respondents. It is evident from the table that, in Ramanagar district majority (86.67 %) of the respondents expressed the fact that the messages sent by DAMU units has influenced their harvesting operations followed by spraying operations (86.67 %), fertilizer application (20.00 %) and scheduling of irrigation (10.00 %). In Tumkur district slightly more than half (56.67 %) of the respondents expressed the fact that the messages sent by DAMU units has influenced

their sowing operations followed by harvesting operations (43.33 %), irrigation schedule and spraying operations (30.00 %) and fertilizers application (20.00 %) respectively. Irrigation scheduling was the major operation influenced by the messages sent by DAMU unit of Mandya district as expressed by majority (76.67 %) of the respondents followed by harvesting operations (70.00 %), spraying operations (63.333 %) and fertilizers application (63.33 %). In Chamarajanagar district, high majority (90.00 %) of the respondents expressed harvesting operations were greatly influenced by the messages sent by DAMU units followed by spraying operations (70.00 %), irrigation schedule (43.33 %) and sowing operations (30.00 %). Overall nearly three fourth (74.17 %) of the respondents expressed harvesting operations were significantly influenced by the DAMU messages followed by spraying operations (62.50 %), scheduling of irrigation (40.00 %) and sowing operations (27.50 %).

Suggestions for effective functioning of DAMU units as expressed by the respondents

Table 13: Suggestions for effective functioning of DAMU units as expressed by the respondents

Sl. No	suggestions	Ramanagar (n=30)		Tumkur (n=30)		Mandya (n=30)		Chamaraja nagar (n=30)		Total (n=120)	
		No	%	No	%	No	%	No	%	No	%
1	Predictions should be more precise	11	36.67	9	30.00	23	76.67	5	16.67	48	40.00
2	Predictions should be given for village level / panchayath level	23	76.67	21	70.00	19	63.33	7	23.33	70	58.33
3	Modernize Meghdoot / DAMINI app	13	43.33	13	43.33	3	10.00	21	70.00	50	41.67
4	Provide predictions 4-3 times per week	7	23.33	11	36.67	4	13.33	17	56.67	39	32.50

It is clear from the results presented in table 13 that, in Ramanagar district majority (76.67 %) of the respondents expressed the suggestion for predictions should be given for village level / panchayath level followed by Modernize Meghdoot / DAMINI app (43.33 %), Predictions should be more precise (36.67 %) and Provide predictions 3-4 times per week (23.33 %). In Tumkur district Predictions should be given for village level / panchayath level was the major suggestion offered by the majority (70.00 %) of the respondents followed by Modernize Meghdoot / DAMINI app (43.33 %), Provide predictions 3-4 times per week (36.67 %) and Predictions should be more precise (30.00 %). Predictions should be more precise was the important suggestion expressed by the majority (76.67 %) of the respondents in Mandya district followed by Predictions should be given for village level / panchayath level (63.33 %) and Provide predictions 3-4 times per week (13.33 %). In Chamarajanagar district Modernization of Meghdoot / DAMINI app was the suggestion given by majority (70.00 %) of the respondents followed by Provide predictions 3-4 times per week (56.67 %) and Predictions should be given for village level / panchayath level (23.33 %). Overall Predictions should be given for village level / panchayath level was the important suggestion given by more than fifty (58.33 %) per cent of the respondents followed by Modernization of Meghdoot / DAMINI app (41.67 %), Predictions should be more precise (40.00 %) and Provide predictions 3-4 times per week (32.50 %).

Conclusion

The present study clearly demonstrates that agro-meteorological advisory services delivered through District Agro-Meteorological Units (DAMU) of Krishi Vigyan Kendras (KVKs) have significantly enhanced farm-level decision-making in Southern Karnataka. The high level of adoption and perceived usefulness reflects strong farmer confidence in weather-based advisories disseminated by KVKs. The advisories effectively supported farmers in making timely decisions regarding critical agricultural operations such as harvesting, irrigation scheduling, sowing, and plant protection measures, thereby minimizing weather-induced risks and crop losses. Farmers reported tangible economic benefits, including cost savings in irrigation and plant protection, reduction in crop damage, and improved productivity. These outcomes confirm the positive contribution of DAMU services towards enhancing farm income, resource-use efficiency, and overall farm resilience. The findings of this study are in line with earlier agrometeorological research (Rathore et al., 2014; Nannewar et al., 2020), which also reported improved decision-making ability and economic gains among farmers receiving weather-based agro-advisories. Although the DAMU project formally continued up to 2025, the Krishi Vigyan

Kendras are sustaining the initiative by regularly recording weather parameters, analyzing data, and disseminating twice-weekly agro-advisories to farmers and extension personnel of various developmental departments. However, there remains scope for further strengthening the system through: Improving forecast accuracy, enhancing village-level customization of advisories, expanding digital dissemination channels and strengthening feedback mechanisms from farmers. Hence, strengthening these aspects will further enhance the effectiveness, credibility, and impact of DAMU-based agro-advisory services in Southern Karnataka.

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Economic Performance of Farmer owned Agro -Tourism Enterprises in Karnataka, India

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ABSTRACT

Indian agriculture is increasingly challenged by declining profitability due to rising input costs, climate variability and market fluctuations, necessitating diversification of farm-based income sources. Agro-tourism has emerged as an enterprise integrating agriculture with tourism to enhance livelihood security and economic sustainability of rural households. The present study analysed the impact of agro-tourism on the economic performance of farmer owners of Agro-Tourism Centers (ATCs) in Karnataka state. An ex-post facto research design was adopted in four districts Bangalore, Chikkamagaluru, Tumkur and Kodagu selected based on the concentration of agro-tourism centers. Primary data were collected from 40 ATC farmer owners through personal interviews using a pre-tested structured interview schedule. Economic performance was assessed using indicators such as annual gross sales, product-related sales, farm economic condition and perceived changes in profit after adoption of agro-tourism. Data were analysed using descriptive statistics and Spearman's rank correlation. The results showed that 82.50 per cent of respondents recorded annual gross sales above ₹2,50,000 and 75 per cent fell under medium to high economic performance category. A majority reported increased profits after adopting agro-tourism due to direct marketing of farm produce, value-added services and experiential activities. Correlation analysis indicated that economic motivation, decision-making ability, customer preference orientation, information-seeking behaviour, innovativeness, hospitality and risk orientation had significant positive association with economic performance. The study concludes that agro-tourism is a viable farm diversification strategy capable of stabilizing farm income and generating local employment opportunities, and that improved institutional support, training and market linkages can further enhance its adoption and contribution to rural development.

Keywords: Agro-tourism, Economic performance, Farm diversification, Rural entrepreneurship, Farm income, Karnataka.

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Introduction:

India, traditionally known as a land of villages, continues to rely on agriculture, which contributes about 15-18% of the national Gross Value Added and supports nearly 45-50% of the workforce (Government of India, 2024). However, increasing input costs, climate variability and market uncertainties have reduced farm profitability, necessitating diversification of income sources (FAO, 2022). At the same time, tourism has emerged as one of the fastest-growing sectors of the Indian economy, with a rising demand for rural and experiential travel (Ministry of Tourism, 2023). In this context, agro-tourism is gaining importance as a complementary farm enterprise that integrates agricultural activities with recreational experiences, providing additional income opportunities to farmers while offering authentic rural exposure to visitors (Barbieri & Tew, 2010; Phillip et al., 2010). Thus, agro-tourism is increasingly recognized as a sustainable strategy for enhancing farm income and promoting rural development.

Concept of Agro Tourism:

Agro-tourism is a junction where agriculture meets tourism. In India it refers to tourism activities that take place on agricultural farms or rural areas. It offers visitors an opportunity to experience and engage in various agricultural activities, such as farming, milking cows, planting seeds, harvesting crops, and learning traditional farming techniques.

The authentic definition of agro-tourism is provided by the World Tourism Organization (1998) in its Global Report on Agro-tourism, it defines agro-tourism as: "involves accommodation being offered in the farmhouse or in a separate guesthouse, providing meals and organizing guests' activities in the observation and participation in the farming operations".

Gannon (1994)., defined Agro tourism as "A range of activities, services and amenities provided by farmers and rural people to attract tourists to their area in order to generate extra income for their business."

Background of the study :

Today agriculture sector in India is facing acute problems like of infrastructure, warehousing, climate change, excessive rains, drought, no irrigation facilities, availability of inputs, finance and effective marketing etc., Agriculture in India is most uncertain depending on monsoon with less avenues from irrigation. Hence it is needed to supplement the income of rural folk and the Indian farmers should find an alternate means of income. Since agriculture is the main occupation of the people in India there is a need to think of allied income generation strategies with agriculture, one of which is agro tourism Chadda and Bhakare (2012).

Karnataka being a popular tourism hub and is one of the prominent agricultural producing states in India and it is one of the top ten domestic tourism destinations in India, Ranking IV among the states Hamsa et al., 2015) and there is a large scope and great potential to develop agro-tourism. Many ATCs already established in different parts of Karnataka. These Agro tourism approach has lot of potential to transform and develop a rural economy into a modern economy by utilizing the local resources to its fullest potential. However, it is unfortunate that the development of agro tourism in Karnataka lags behind neighboring states like Maharashtra, which is tragic considering the immense potential it holds. This situation highlights the need for extensive research and focused efforts to know the challenges and interventions required to promote agro tourism in Karnataka, considering its potential to enhance livelihood security and boost economic performance.

As there are no much studies conducted on ATCs, keeping in view the importance of ATCs as a means of supplementary source of income to farmers and Agro-tourism presents a promising alternative by diversifying income sources and creating employment opportunities within the local community. a study on ATCs is of paramount importance. Hence the present study was planned with the objective of analyzing the impact of Agro Tourism on Economic peformance of Farmers.

Hence, the present research study entitled **"Economic Performance of Farmer owned Agro -Tourism Enterprises in Karnataka, India"** was conducted.

With this background, the present study is designed with the following objectives:

1. To Assess the economic performance of farmer owners of Agro-Tourism Centers.
2. To know the relationship of profile characteristics with economic performance of farmer owners of Agro-Tourism Centers.

Methodology

The current study was conducted in four selected districts viz., Bangalore, Chikkamagaluru, Tumkur, and Kodagu districts of Karnataka state, as these districts having more number of ATCs. Ex-post facto research design was followed. The primary data was collected from 40 Agro Tourism Centers (ATCs) of four selected districts, comprises of 10 ATCs from each district.

Primary data were collected from 40 farmer owners of ATCs, with ten centers selected from each district. The agro-tourism centers were identified through information obtained from the tourism department and further selected using

the snowball technique, and respondents were selected through simple random sampling.

Economic performance was used as the dependent variable and measured using modified economic performance indicators based on the procedure suggested by Barbieri and Tew (2010). Twenty independent variables related to personal, socio-economic, psychological and situational characteristics of the respondents were taken according to need of the study.

Data were collected through personal interviews using a pre-tested structured interview schedule, which was also administered through Google Forms for convenience. The collected data were analysed using appropriate statistical tools. Both parametric and non-parametric statistical tools were used for analysis. Statistical tools included were mean, frequency, percentage, standard deviation, range, Spearman's rank correlation.

Results And Discussions

1. Economic performance of farmer owners of agro-tourism

The Heading 1 provides an overview of the economic performance of owner farmers of agro-tourism centers, the results explain on various aspects such as 1.1 gross sales, 1.2 product-related sales, 1.3 farm economic situation, and 1.4 perceived changes in farm profits after offering agro- tourism activities in consecutive tables. The key findings in each category are discussed below.

Economic performance of farmer owners of agro-tourism centers.

Table 1.1 : ATC Gross Sales (Annual)

(n=40)

Sl.No.	Particulars	Frequency	Percent
	ATC Gross Sales (Annual)		
1	Less than 50,000 Rs	00	0.00
2	Rs 50,000-1,00,000	01	2.50
3	Rs 1,00,000 -2,49,999	06	15.00
4	Rs 2,50,000 or more	33	82.50

From the results of table 1.1 it was evident that the majority (82.50%) of the respondents reported gross sales of Rs 2,50,000 or more annually. About 15 per cent respondents reported gross sales between Rs.1,00,000 to 2,49,999 Only one respondent (2.50%) had gross sales between Rs 50,000 and Rs 1,00,000. None of the respondents reported gross sales below Rs 50,000. These findings are in line with results of Karijgi (2019).

Table 1.2 : Products-Related Sales Percentage:

(n=40)

Sl. No.	Particulars	Frequency	Percent
	Products-Related Sales Percentage		
1	Less than 25%	02	5.00
2	25% to 50%	03	7.50
3	51% to 75%	14	35.00
4	76% to 99%	19	47.50
5	100%	02	5.00

Nearly half of the respondents (47.50%) stated that 76 per cent to 99 per cent of their sales were related to products. Only two respondents (5.00%) reported that 100 per cent or more of their sales were related to products. None of the respondents reported having no product- related sales as depicted in table 1.2.

Table 1.3 : Stated Farm Economic Situation:

(n=40)

Sl. No.	Particulars	Frequency	Percent
	Stated Farm Economic Situation		
1	Very profitable	08	20.00
2	Generating some profit	15	37.50
3	Breaking even	16	40.00
4	Operating at a loss	01	2.50
5	Very loss	00	0.00

A significant proportion of respondents (40.00%) stated that they were breaking even in terms of farm economic situation as mentioned in table 1.3. More than one third of respondents (37.50%) reported generating some profit. One fifth of the respondents (20.00%) stated that farm economic situation is very profitable. Only one respondent (2.50%) reported operating at a loss. These results are supported by the results of Pitrova et al. 2020.

Table 1.4 : Perceived Changes in Farm Profits after Offering Agro-tourism Activities:

(n=40)

Sl. No.	Particulars	Frequency	Percent
	Perceived Changes in Farm Profits after Offering Agro-tourism Activities		
	A) Nature of Change in Profits after Agro-tourism Development		
1	Significantly increased	11	27.50
2	Slightly increased	18	45.00
3	Did not change	08	20.00
4	Slightly decreased	03	7.50
5	Significantly decreased	00	0.00
	B) Percent of Profit Change after Agro-tourism Development		
6	1% to 25%	00	0.00
7	26% to 50%	05	12.50
8	51% to 75%	17	42.50
9	76% to 99 %	18	45.00
10	100% or more	00	0.00

1.4.A. Nature of Change in Profits after Agro-tourism Development:

From the table 1.4.A. More than two-fifth of the respondents (45.00%) reported a slight increase in profits after offering agro-tourism activities. 27.50 per cent of respondents reported a significant increase in profits. A small percentage of respondents (7.50%) reported a slight decrease in profits. No respondents reported a significant decrease in profits.

1.4. B. Percent of Profit Change after Agro-tourism Development: Table 1.4.B. revealed that nearly half of the respondents (45.00%) reported a profit change ranging from 76 per cent to 99 per cent. 42.50 per cent of respondents reported a profit change ranging from 51 per cent to 75 per cent. A smaller proportion of respondents (12.50%) reported a profit change ranging from 26 percent to 50 per cent.

The above results from the tables indicated that agro-tourism had a positive impact on the economic performance of the farmers who own and operate these centers. The majority of respondents reported a significant increase in profits after introducing agro-tourism activities. This finding suggests that

agro-tourism can be a lucrative venture for farmers. The reasons behind these positive outcomes could be attributed to various factors. Agro-tourism offers farmers an opportunity to diversify their income streams, tapping into the growing demand for unique and authentic agricultural experiences. By offering activities such as farm tours, farm stays, and farm-to-table dining experiences, farmers can attract tourists and generate additional revenue. . Moreover, agro-tourism helps to create a direct connection between consumers and producers, allowing farmers to market their products and generate sales on-site. This direct marketing approach eliminates intermediaries and maximizes profits for the farmers. These results are supported by the results of Akis et al. 1996.

Table 1.5 : Overall economic performance of farmer owners of agro-tourism

Table 1.5 represents the overall economic performance of owners practicing agro- tourism, based on a sample size of 40 farmers. The economic performance is categorized into three groups viz., low, medium, and high. The frequencies and percentages of each category are provided in the table 1.5.

The results revealed that, the medium economic performance category, constituted majority (40.00%) of the sample. High economic performance category accounted for 35.00 per cent of and remaining 25.00 per cent of the owners had a low economic performance.

Table 1.5 : Overall economic performance of farmer owners of agro-tourism centers

(n=40)

Category	Criteria	Frequency	Per cent
Low	<17.73	10	25.00
Medium	17.73-20.66	16	40.00
High	>20.66	14	35.00

Mean: 19.20 S D: 2.92

The results of the study indicated that a significant portion of the owners of agro-tourism (75.00%) falls within the medium to high economic performance range. This finding suggests that the majority of farmers who have diversified their activities into agro-tourism are experiencing satisfactory economic outcomes. Several factors could contribute to these results, the level of investment and infrastructure development in the agro-tourism centers, market demand, owners' management skills, marketing strategies, and the quality of services etc. might leading to higher economic returns. These results of the study were supported by results of Barbeiri and Tew (2010) which says agro tourism is having a positive impact on farm profits.

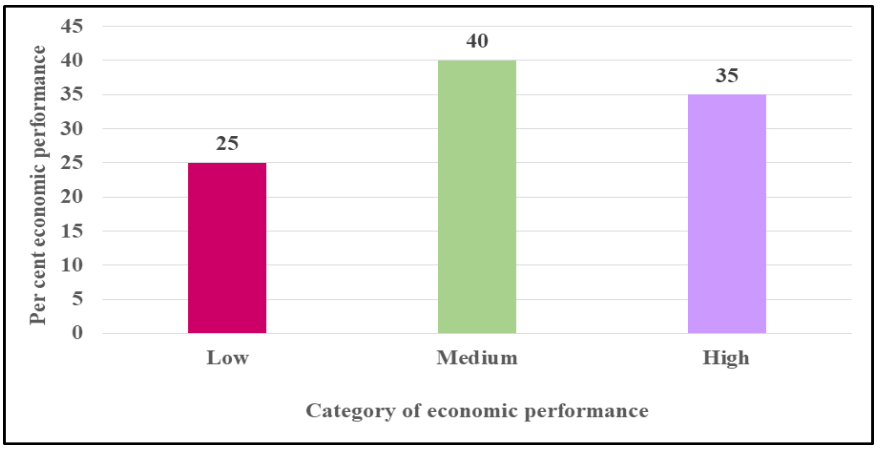

Figure 1: Overall economic performance of farmer owners of agro-tourism centers

2. Relationship of profile characteristics with economic performance farmer owners of agro-tourism centers

The Table 2 represents the correlation of various independent variables with the Economic Performance of farmer owners of agro-tourism centers. The correlation coefficient was reported to assess the strength and significance of the associations. From the table 2 it is identified that the variables such as annual income, economic motivation, information seeking behavior, innovativeness, risk orientation, decision making ability, customer preference and hospitality were highly significant at 1 per cent level. Further results indicated that education, family size, land holding, cosmopoliteness, mass media exposure, achievement motivation, management orientation and self-confidence were significant at 5 per cent level with Economic Performance. On the other hand, the variables age, farming experience, social participation and extension agency contact did not exhibit significant association with Economic Performance.

Table 2: Rank correlation between profile characteristics and economic performance of farmer owners of agro-tourism centers

(n=40)

Sl. No.	Independent Variables	Correlation co-efficient(r)
1.	Age	-0.086 ^{NS}
2.	Education	0.389*
3.	Farming experience	0.032 ^{NS}
4.	Family size	0.313*

5.	Land Holding	0.320*
6.	Annual income	0.450**
7.	Social Participation	0.036 NS
8.	Cosmopoliteness	0.397*
9.	Mass media exposure	0.317*
10.	Extension agency contact	0.230 NS
11.	Economic Motivation	0.639**
12.	Information seeking behavior	0.587**
13.	Innovativeness	0.467**
14.	Risk orientation	0.498**
15.	Achievement motivation	0.375*
16.	Decision making ability	0.631**
17.	Management orientation	0.406*
18.	Self confidence	0.412*
19.	Customer preference	0.618**
20.	Hospitality	0.483**

**=Significant at 1 %, *=Significant at 5 %, NS=Non-significant

1. Education and Economic Performance

The correlation coefficient (r = 0.389*) suggests positive association between education and economic performance, which is statistically significant at the 0.05 level. This significant correlation between education and economic performance indicates that farmers with higher levels of education tend to have better economic performance. This may be because educated farmers possess enhanced knowledge and skills in managing their agro-tourism centers, making them more efficient and effective.

2.2. Family size and Economic Performance

The correlation coefficient (r = 0.313*) shows a moderate positive relationship between family size and economic performance, which is statistically significant

at the 0.05 level. This implies that farmers with larger family sizes tend to have better economic performance. This may be because a larger family can contribute to increased labor availability and support, allowing for better management of agro-tourism activities and increased economic stability.

2.3. Land Holding and Economic Performance

The correlation coefficient (r = 0.320*) suggests a moderate positive relationship between land holding and economic performance, which is statistically significant at the 0.05 level. The significant association suggests that farmers with larger land holdings tend to have better economic performance. Having more land allows farmers to diversify their agro-tourism activities and generate higher revenues.

2.4. Annual Income and Economic Performance

The correlation coefficient (r = 0.450**) explains highly significant association between annual income and economic performance. This implies that farmers with higher annual incomes tend to have better economic performance in their agro-tourism ventures. Higher income levels provide financial stability, allowing for investments in agro-tourism infrastructure, marketing, and diversification, that ultimately improving the quality of their agro-tourism services, leading to increased profitability.

2.5. Cosmopoliteness and Economic Performance

The correlation coefficient (r=0.397*) suggests a moderate positive relationship between cosmopoliteness and economic performance, which is statistically significant at the 0.05 level. Farmers with a cosmopolitan outlook, open to diverse ideas and practices, are more likely to have better economic performance in their agro-tourism ventures.

2.6. Mass Media Exposure and Economic Performance

Mass media exposure showed significant association with economic performance (r= 0.317) indicates that farmers with higher exposure to mass media tend to have better economic performance. This exposure can provide them with valuable information on market trends, customer preferences, and innovative practices, that they can incorporate into their agro- tourism activities which might increase their profit.

2.7. Economic Motivation and Economic Performance

The correlation coefficient (r = 0.639**) indicates a strong positive relationship between economic motivation and economic performance. Their motivation likely leads to planned decision-making, strategic planning, and effective resource utilization, which contribute to their overall success.

2.8. Information seeking behavior and Economic Performance

The correlation coefficient (r = 0.587**) shows a significant positive association between information seeking behavior and economic performance. The highly significant positive correlation between information seeking behavior and economic performance suggests that farmers who actively seek information about agro-tourism trends, market dynamics, and customer preferences tend to have better economic performance. Their proactive approach to acquiring knowledge allows them to make informed decisions and adapt their offerings to meet customer demands. Similar observations were reported by Deshmukh and Patil (2021), who emphasized that information and communication technologies enhance enterprise efficiency and market linkage in agricultural ventures.

2.9. Innovativeness and Economic Performance

The correlation coefficient (r = 0.467**) displays a significant positive association between innovativeness and economic performance. The significant positive correlation between innovativeness and economic performance indicates that farmers who embrace new ideas, technologies, and practices tend to have better economic performance. Their willingness to experiment and adapt to changing circumstances gives them a competitive edge, attracts more customers, and enhances overall profitability.

2.10. Risk Orientation and Economic Performance

The correlation coefficient (r = 0.498**) indicates a significant positive association between risk orientation and economic performance. The significant positive correlation between risk orientation and economic performance suggests that farmers with a higher willingness to take calculated risks tend to have better economic performance. Taking risks can lead to new opportunities, diversification of services, and higher returns, although it also carries a certain level of uncertainty.

2.11. Achievement Motivation and Economic Performance

The correlation coefficient (r = 0.375*) suggests a moderate positive relationship between achievement motivation and economic performance, that is statistically significant at the 0.05 level. The significant positive correlation between achievement motivation and economic performance indicates that farmers with a strong drive for excellence tend to have better economic performance. Their motivation to succeed drives them to continuously improve their agro-tourism centers, attract more customers, and achieve higher levels of success.

2.12. Decision Making Ability and Economic Performance

The correlation coefficient (r=0.631**) demonstrates a significant positive

relationship between decision-making ability and economic performance. The highly significant positive correlation between decision-making ability and economic performance suggests that farmers with strong decision-making abilities tend to have better economic performance. Their ability to analyze information, evaluate options, and make sound decisions contributes to effective resource allocation, risk management, and overall business performance.

2.13. Management Orientation and Economic Performance

The correlation coefficient (r = 0.406*) indicates a significant positive correlation between management orientation and economic performance. The significant positive correlation between management orientation and economic performance indicates that farmers with management skills in planning, organizing, and controlling their agro-tourism operations tend to have better economic performance. Effective management practices enable them to optimize resource utilization, streamline processes, and deliver quality services to customers.

2.14. Self-Confidence and Economic Performance

The correlation coefficient (r = 0.412*) indicates a significant positive correlation between self-confidence and economic performance. The significant positive correlation between self-confidence and economic performance indicates that farmers with higher self- confidence tend to have better economic performance. Their self-assurance enables them to overcome challenges, take calculated risks, and make confident decisions, leading to improved business outcomes.

2.15. Customer Preference and Economic Performance

The correlation coefficient (r = 0.618**) indicates high association between customer preference and economic performance. The highly significant positive correlation between customer preference and economic performance suggests that farmers who understand and cater to customer preferences tend to have better economic performance. By aligning their offerings with customer expectations, they can attract more customers, generate repeat business, and establish a strong reputation in the market.

2.16. Hospitality and Economic Performance

The correlation coefficient (r =0.483**) highlights the significant association between hospitality and economic performance. The significant positive correlation between hospitality and economic performance indicates that farmers who prioritize hospitality and provide exceptional customer experiences tend to have better economic performance. Positive word- of-mouth, customer satisfaction, and repeat visits can contribute to increased revenues and business growth.

Conclusion

A large share of India's rural population continues to depend primarily on agriculture for income, yet farming alone often fails to ensure stable earnings. In this situation, agro-tourism has emerged as a promising approach that combines agriculture with service-based activities, creating additional employment opportunities and strengthening rural economies.

The study revealed that agro-tourism significantly improves the economic performance of farmer owners in Karnataka by providing an additional and relatively stable source of income. Most agro-tourism farmers recorded higher annual gross sales, improved profitability and medium to high levels of overall economic performance after adopting agro-tourism activities. Direct marketing of farm produce and experiential services such as farm stay and local cuisine contributed substantially to income enhancement. The results also showed that entrepreneurial and behavioural traits such as economic motivation, decision-making ability, innovativeness, hospitality and customer orientation were strongly associated with better economic outcomes, indicating that agro-tourism functions more as a rural enterprise than a traditional farming activity. Therefore, agro-tourism can be considered a viable farm diversification strategy that enhances income stability and supports sustainable rural development.

To strengthen its impact, supportive institutional measures such as simplified registration procedures, skill-oriented training programmes, improved market linkages and basic infrastructure development are necessary. Extension agencies and tourism departments may collaborate to provide enterprise guidance and promote agro-tourism centres through organised tourism circuits.

Overall, promotion of agro-tourism can help transform farms into economically resilient enterprises while generating employment opportunities in rural areas.

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Prospect of profitability and socio-technological status of banana production in Rajshahi region in Bangladesh

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ABSTRACT

This study seeks to evaluate the socio-technological conditions of banana growers and to document the technologies adopted in banana production in Puthia and Charghat Upazila in Rajshahi. For primary data collection, a survey was conducted among 53 banana producers. To fulfill the study's aims, descriptive analysis and multiple regression analysis were applied as analytical tools. The study reveals that both education and total input cost affect on total income; Total input has a strong positive correlation with total input cost (r=0.719), while the correlation with education is weak (r=0.178). A significant majority of farmers cultivate the Anupom variety (18.86%) and face issues with the banana fruit and scarring beetle (60.38%), alongside major problems like high fertilizer prices (86.79%). Most farmers primarily use irrigation (75.47%) for soil management, yet a large percentage are unaware of digital ICT tools (79.25%) and few use improved technology. Governmental support is virtually non-existent, with only 1.87% of respondents receiving assistance. Consequently, the most desired support from the government is a reduction in prices (75.47%), followed by the availability of seedlings, weather-resistant varieties, and financial aid. The study's outcomes lead to the following recommended policies and actions are useful for improving banana production and achieving the SDG's goal, including making HYV suckers more accessible, improving extension services and transportation, promoting Good Agricultural Practices (GAP), and integrated pest management and Strengthening extension support and promoting ICT-based training could enhance productivity and sustainability.

Keywords: socio-technological, profitability, production, recommendations.

Introduction

Banana (Musa paradisiaca, family Musaceae) is recognized as one of the world's

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oldest cultivated fruit, and remain staple across many cultures due to its medicinal, economic value, nutrition (Kumar et al., 2012) . Despite the difficulty in pinpointing its exact origin, this tropical native is now an extensively cultivated crop in tropical and subtropical zones worldwide. (MF Alam et al 2014).

It evolved from one of the first cultivated fruits into the most heavily exported fresh fruit in the world (ITC News, 2018; Reay, 2019; WorldAtlas, 2020). Banana is grown not only for eating fresh but also for cooking, and its leaves are widely used in countries such as India and Bangladesh (Khanum et al., 2000). In Bangladesh, banana cultivation is a significant year round agricultural activity and preferred as a second most important fruit crop after mango. Bangladesh is ranked among the world's top 20 banana producers, with an annual output of 833,309 tonnes (AtlasBig.com, 2021). While banana produced all over the country, certain districts such as Narsingdi , Gazipur , Tangail , Rangpur, Khulna, Noakhali , Faridpur are The main areas of banana cultivation in Bangladesh (Bhuiyan et al 2021). Its cultivation plays a vital role in providing nutrition, extra income, and employment in Bangladesh (Kamal et al., 2014).

Rajshahi a region known for its favorable agro-climatic zone. Commercial farming of banana has been gaining ground in the region including its vast Barind tract with farmers reaping a sound profit from the cropping (dailyasianage,2018). In recent years, Rajshahi has undergone noticeable transformation in banana farming. At present Puthia, Durgapur and Charghat upazilas ,(DAE) with a total contribution of approximately 35,000 metric tonnes from around 2,000 hectares of land. Despite of this growth, productivity remain low with average yield is much lower compared to significantly higher outputs in other countries. Furthermore, government-sponsored initiatives to promote banana farming and commercialization in Bangladesh are currently limited .As a result, banana production faces a wide range of challenges that hinder productivity and threaten the sector's sustainability. These include rising production costs, pests and diseases, yield uncertainties, and labor issues such as scarcity and high wages. Farmers also struggle with lack of quality suckers, inadequate power, high input costs,water shortages in summer, limited credit access, price manipulation by commission agents, and insufficient cold storage. (Jalaluddin et al., 2022,Sakthiganesh et al., 2022 & Jomanga et al., 2022).These factors not only affect the livelihoods of smallholder farmers but also leads to erosion of banana genetic diversity and gradual decline of regional supremacy in producing bananas . Therefore to unlock its full potential ,it is crucial to understand the socio-economic and technological conditions under which farmers operates. However, there is limited empirical evidence on how existing socio-technological conditions and production constraints affect the profitability of banana cultivation in the Rajshahi region.The objective of this study is to

assess farmer knowledge, challenges faced by farmers, and the profitability conditions of banana cultivation, and provide recommendations for sustainable banana production.

Some available studies have been conducted on banana for providing policy guide line (Kamal et al 2014) , guideline the sustainable solution to farmers(Sarma et al 2021), improving profitability and productivity(Phulara et al 2020;Bhatta et al 2020) ,postharvest handling(Woldu et al 2015) ,identify factors affecting profitability and value chain (Mahalaksmi et al 2016;Fonsah et al 2018;Muthee et al 2019;Lucas et al 2021), adaptability of new technology(Jhariya et al 2019;Pradhan et al 2017),analyze profitability (Munia et al 2019) but there are no previous studies have been carried out in our study area. This study contributes to the literature by providing location-specific evidence on socio-technological status and farm-level profitability of banana cultivation in Rajshahi, Bangladesh. However The findings will provide valuable insights for researcher, policy maker and other stake holders interested in advancing banana production. This study also highlights aspects relevant to Sustainable Development Goal 12 by supporting responsible consumption and production through improved food security, environmental sustainability, and livelihoods of marginal farmers. This study aims to bridge the knowledge gap by examining the socio-technological status and identify the profitability challenges of banana cultivation, faced by banana growers in one of major banana production area in Bangladesh3. Materials and Methodology

3.1 Study area: The present study was conducted in Puthia and Charghat upazila between June and July 2025 ; Specially Raghurampur , Jhalmalia , Banneshwar, Nandangahi.

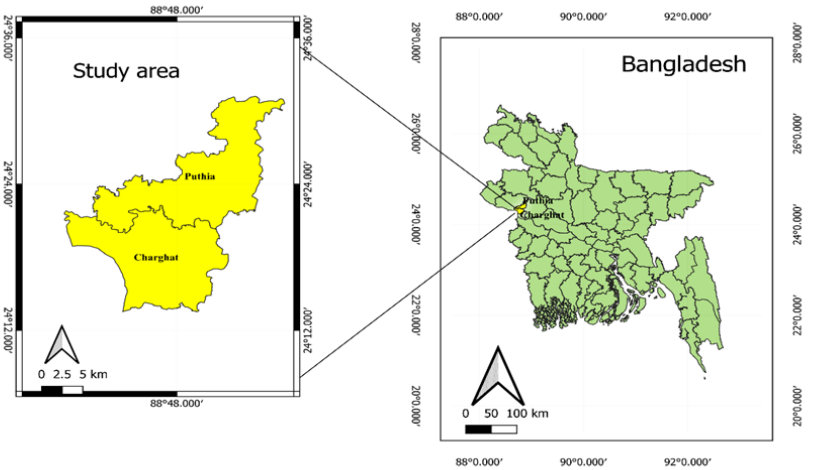


Figure 1: Maps of study area in Rajshahi region ; Puthia, Charghat.

3.2 Data collection:A total of 53 banana farmers were interviewed for primary data collection. The respondents were selected using a purposive sampling technique, focusing on active banana growers in the selected areas. Data were collected directly from the field through face-to-face interviews at farmers' houses and local haats (markets). The sample size of 53 farmers was considered adequate to represent the active banana growers in the selected study areas within the time and resource constraints of the study. For secondary data collection, information was gathered from various reliable sources, including peer-reviewed research publications, academic journals, magazines, newspapers, research articles, internet sources, and relevant government websites.

Study materials: Major challenges faced by farmer, total input cost, total income, cultivated area, main source of income. pest and diseases, government help, preferred support.

3.4 Analysis: By using SPSS descriptive analysis done among age, experience and cultivated area , Correlation and regression is done between education, total input and total income.

4.Result

4.1 Producers age, experience and cultivated area

As shown in Table 1, producers' ages range from 25 to 70 years, indicating a wide variation in age among the respondents. Based on a survey of 53 farmers, cultivation experience ranged from 1 year to 55 years, showing considerable variation among producers. Similarly, cultivated areas ranged from a minimum of 1 ha to a maximum of 16 ha.

Table 1: Descriptive statistics of producers age, experience and cultivated area

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age (Year)	53	25	70	44.13	11.561
Experience	53	1	55	20.11	12.367
Ciltivated area(ha)	53	1	16	2.64	2.932
Valid N (list wise)	53				

4.2 Producer's education, total input cost effects on total income

Table 2 shows how education and input cost affect farmers' income. Income was highest (200,000 Tk) with higher education and input cost (81,000 Tk).

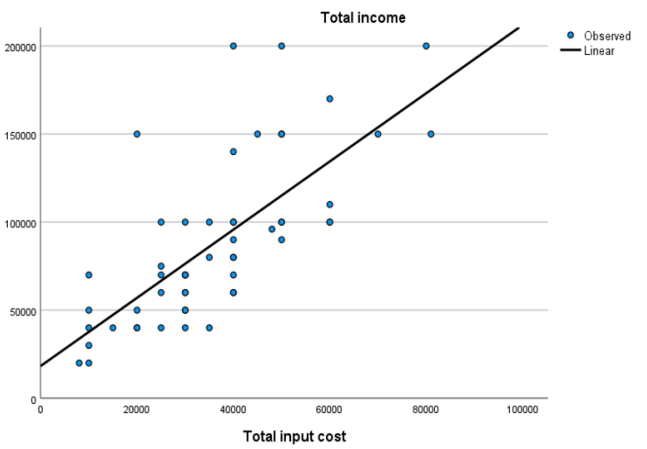
Lower education and inputs led to less income.A strong positive correction existed between input cost and income ($r = 0.719$, $p < 0.05$).Education had a weak link with income ($r = 0.178$), meaning input use influenced the income more than education.

Table 2: Relationship between education and total input cost with total income

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Education	53	0	13	6.26	5.167
Total input cost	53	8000	81000	36169.81	17287.986
Total income	53	20000	200000	88320.75	46556.737
Valid N (list wise)	53				

Correlations (Total input cost and total income)			
		Total input cost	Total income
Total input cost	Pearson Correlation	1	.719**
	Sig. (2-tailed)		.000
	N	53	53
Total income cost	Pearson Correlation	.719**	1
	Sig. (2-tailed)	.000	
	N	53	53

Linear relationship between total input cost and total income



4.3 Relationship between Benefit cost ratio, profitability and total area

Profitability increases against the total cultivable area. Maximum profit shows 160,000 taka with a benefit cost of 7.50. Whereas minimum profitability shows 5000 taka with a benefit-cost ratio of 1.33. Though in both cases it's confirming overall profitability, a higher standard deviation (36185.631 taka) confirms increasing cultivable land plays a significant role in the benefit-cost ratio (minimum 1.33 to maximum 7.50). This observation shows similarity with the findings that banana production increases with increased cultivable land

Table 3: Descriptive analysis of Profitability and Benefit cost ratio

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Profitability	53	5000	160000	52150.94	36185.631
Benefit Cost Ratio (Income/ input)	53	1.33	7.50	2.6374	1.24353
Valid N (listwise)	53				

Table 4 represents clear differences in profitability and economic efficiency across farm sizes. Small farms recorded the highest mean profitability (Tk. 52,586.96) and the highest B:C ratio (2.7033), indicating that they generated the greatest return per unit of investment. Medium farms performed moderately (profitability Tk. 51,000.00; B:C ratio 2.2200), On the other hand large farms reveal comparatively lower profitability (Tk. 45,000.00) and B:C ratio (2.1650).

Table 4: Differences in profitability and economic efficiency across farm sizes

Total Area (Begha)		**Profitability**	**Benefit Cost Ratio(Income/ input)**
Large	Mean	45000.00	2.1650
	Std. Deviation	7071.068	.23335
medium	Mean	51000.00	2.2200
	Std. Deviation	37148.351	.57896
small	Mean	52586.96	2.7033
	Std. Deviation	37238.317	1.31232
Total	Mean	52150.94	2.6374
	Std. Deviation	36185.631	1.24353

4.4 Cultivated banana varieties

Table-5 shows the distribution of banana varieties grown by farmers. Several single and mixed varieties were reported here .The lowest share (1.88%) was found in combinations like Chinchampa + Honuman and Gin + Chapa.The highest percentage was for Anupom (18.86%).Overall, Anupom and Gin were the most preferred varieties.

Table 5: Percentage of cultivated banana varieties

Variation	Item	Percentage
Anupom+ rongila	4	7.55
Rongila+ Sagor	3	5.66
Chinichampa +honuman	1	1.88
Anupom	10	18.86
Gin+ anaji+ anupom	1	1.88
Rongila+ anupom+gin	3	5.66
Rongil + chapa	2	3.77
Gin+ chapa	1	1.88
Gin	9	16.98
Gin+ rongila	3	5.66
Rongila	6	11.32
Gin + anupom	3	5.66
Chapa + anupom	1	1.88
Gin+ manik + chapa	1	1.88
Chapa	5	9.43

4.5 Fertilizers types used by farmers

Table-6 represents the percentage of fertilizer types used by farmers. The combination of fertilizers appears to vary by type. poultry manure and only MP are rarely used (1.88%), whereas TSP and MP are the most preferred (32.08%).

Table 6: Percentage of fertilizer types used by farmer

Types	Item	Percentage
TSP	9	16.98
MP	1	1.88
TSP+MP	17	32.08
TSP+ MP+ Urea	13	24.52
TSP + Urea	2	3.77
MP + Urea	4	7.55
TSP + MP+ Boric acid	2	3.77
TSP+ MP+ Zinc	2	3.77
Poultry	1	1.88
Zinc+ MP	2	3.77

4.6 Main input cost

Figure-2 shows the main input costs arise during banana cultivation. However, these costs may change over time due to fluctuations in market prices and farming practices. Labor cost is the lowest for farmers with a percentage of 1.88%, while fertilizer cost occupies the largest share at 52.83%.

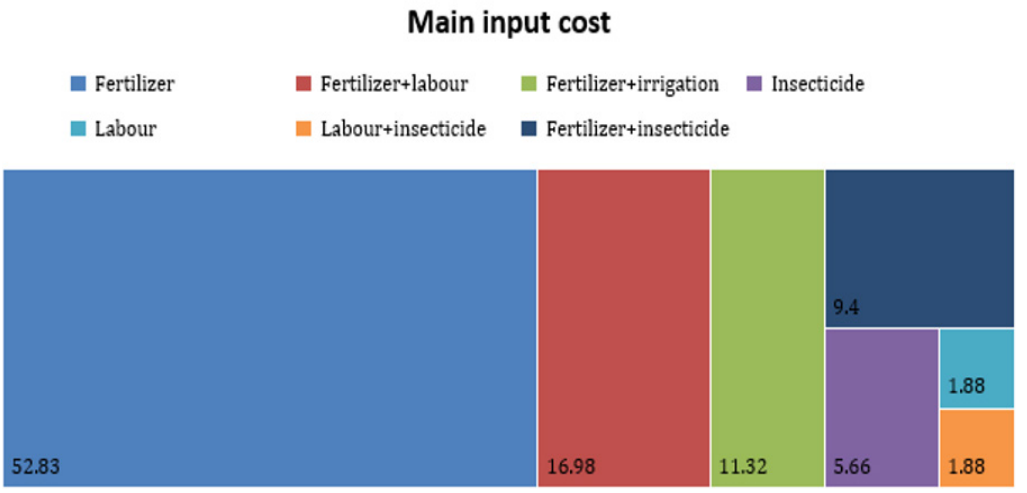


Figure 2: Main input cost arise during Banana cultivation

4.7 ICT tool and improved technology

Figure 3(A) and Figure 3(B) illustrate the percentage of farmers using ICT tools and improved technologies in banana production respectively. In the case of ICT tool usage, it is observed that most farmers are not familiar with using such tools, showing a difference of 58.5% between users and non-users. Similarly, a comparable pattern is evident in the use of improved technologies, where 81.13% of farmers do not adopt them, while only 10.86% make use of such technologies.

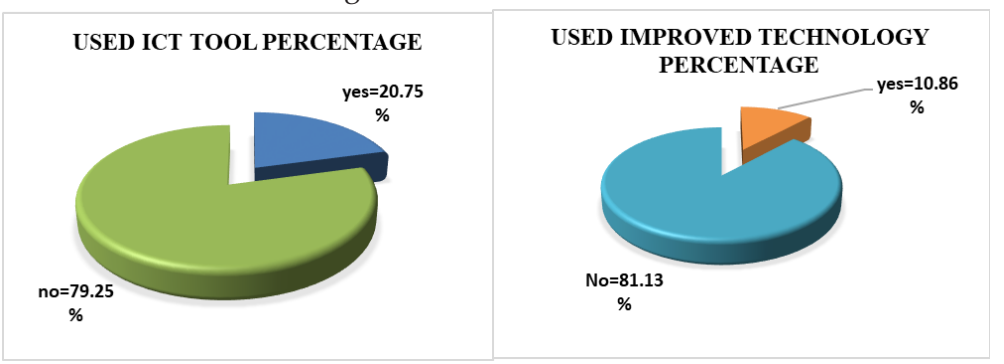


Figure-3: Percentage of ICT tools (3.A) and improved technology (3.B) used by banana cultivars

4.8 Disease and pest attack in banana field:

Table-7 presents the various disease and pest that farmers believe are responsible for reducing banana production.It is observed that the most common pest causing production loss is the banana thrips. In contrast, the least common pests are the cutworm and earthworm. Comparing their prevalence, banana thrips account for 60.38%, which is 58.49% higher than that of cutworm and earthworm.

Table 7: Percentage of disease and pest attack on banana

Variation	Item	Percentage(%)
Virus	9	16.98%
Banana thrips	32	60.38%
Hopper	1	1.89%
Banana weevil	3	5.66%
Cutworm	1	1.89%
Earthworm+ banana thrips	1	1.89%
Banana thrips+ virus	1	1.89%
None	5	9.43%

4.9 Techniques of managing soil health

Figure 4 represents the percentage of techniques adopted by farmers to manage soil conditions. Though the soil management techniques depend on variable factors like environmental conditions, plant growth stages and resource availability. About 3.77% of farmers suggested using organic compost, cow dung or no treatment for better soil health. In comparison, About 75.47% of farmers considered irrigation as a necessary practice for maintaining healthy soil.

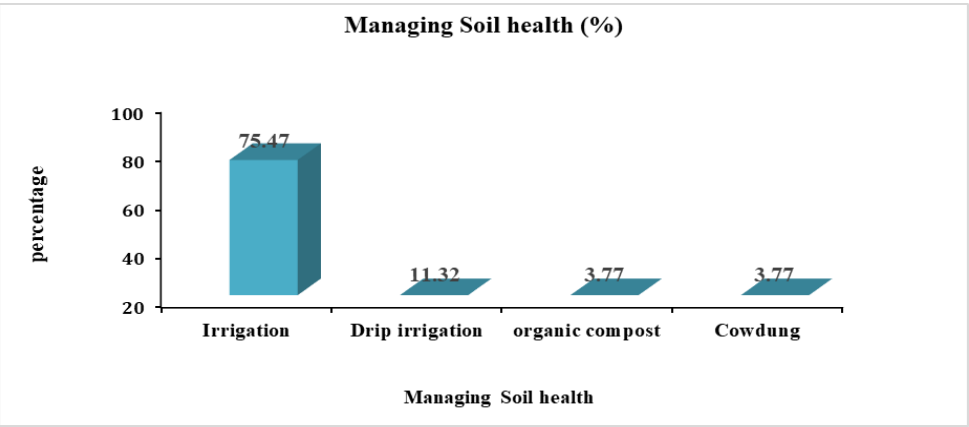


Figure 4: Percentage of techniques adopted by farmer for managing soil condition

4.11 Member of incorporation and government support

Pie chart 5.A illustrates the percentage of banana producers involved in cooperatives. only 7.54% of banana producers are member of different incorporation while the remaining 92.45% are not members of any incorporation. This indicates a very low level of incorporation participation. Pie chart 5.B illustrates the government's assistance to farmers. They reported that only 2% of them receiving support whereas 98% are deprived of any assistance.

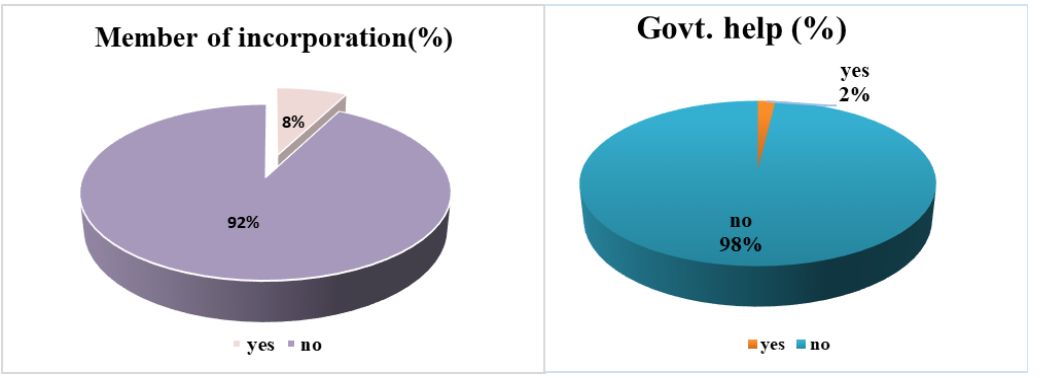


Figure 5: Percentage of farmers who's are attach to incorporation (5.A) and Govt. help they received (5.B).

4.12 Challenges faced by farmers and preferred support by them

Chart 6.A illustrates the primary challenges faced by farmers. Most of them (86.79%) attributed their problems to the high cost of fertilizer. On the other hand, root damage was a significant challenge for only 13.21% of banana production. Pie chart 6.B illustrates the government's assistance to farmers. They reported that only 2% of them receiving support whereas 98% are deprived of any assistance.

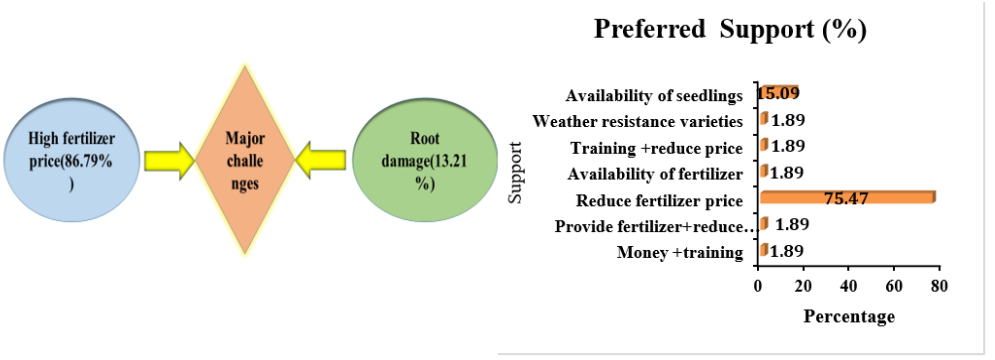


Figure 6: Major challenges faced by farmers (6.A) and support preferred (6.B) by farmer.

5. Discussion

The results of the study here farmers with higher levels of education, particularly up to honours level (13 years), attained higher incomes, with the maximum reported income reaching 200,000 Tk, while the maximum input cost was 81,000 Tk. Descriptive statistics indicated that the mean input cost was 36,169.81 Tk (SD = 17,287.98) and the mean income was 88,320.75 Tk (SD = 46,556.73). The statistics positive association between total input cost and total income ($r = 0.719$, $p < 0.01$), here greater input investment regularly improved income. And the union between education and income was weak ($r = 0.178$, $p = 0.201$), that show education alone did not having a major impact on income. This observation we saw previous evidence from Sylhet, where education had a positive yet relatively weaker effect on banana returns compared to input-related variables (Islam et al., 2017).

Profitability increases against the total cultivable area. Maximum profit shows 160,000 taka with a benefit cost of 7.50. Whereas minimum profitability shows 5000 taka with a benefit-cost ratio of 1.33.Though in both cases it's confirming overall profitability, a higher standard deviation (36185.631 taka) confirms increasing cultivable land plays a significant role in the benefit-cost ratio (minimum 1.33 to maximum 7.50). This observation shows similarity with the findings that banana production increases with increased cultivable land .

The higher profitability executed among small farms supports the inverse relationship (IR) hypothesis, It implies that smaller holdings make more effective and intensive use of available labor. Similar findings were reported in studies on (Madhur Gautam 2018) This paper seeks to determine whether small farms continue to exhibit higher productivity in Bangladesh or if ongoing agricultural changes have modified the pattern. The observed benefit cost (BCR) greater than one implies that the total return transcends total production cost ensuring positive net income for farmers. This finding claim that banana farming remains a financial sustainable agricultural enterprise. Familiar results were represented in documents on (Z.T. Munia 2019 and M. MOHIUDDIN 2020) this evidence reveals that profitability in banana farming depends not only on farm size but also on effective management of critical inputs. Banana farming exhibits structural differenences in return across farmer catagories highlightes the importance of scale execution and less resource use.

Some condition of Choice of variety, the majority of farmers cultivated Anupom (18.86%), Gin (16.98%), Rongila (11.32%), and Chapa (9.43%), and while mixed combinations such as Chinchampa + Honuman, Gin + Chapa, and Gin + Manik + Chapa were adopted (1.88%). Overall, the study shows that farmers have balance between productivity (as in Anupom and Gin) and market-driven

preferences (as in Chapa and Rongila). That means they have deep knowledge about the environmental condition on their local area and also market demands and personal needs. This strategy of maintaining varietal diversity plays a crucial role in ensuring both livelihood security and resilience in smallholder farming systems (Miah et al., 2016).

In this study, most of the farmers (32.02%) mentioned that they usually apply a mix of triple super phosphate (TSP) and muriate of potash (MP). The second most common practice among farmers was applying a combination of TSP, MP, and urea. According to Munia et al. (2019), farmers commonly used five types of fertilizers: urea, MP, TSP, gypsum, and zinc sulphate . For better banana growth, Islam et al. (2020) reported that applying 500 g of urea and 450 g of MP per plant, either alone or combined, can improve yield. According to (Zhang et al 2020) the application of organic fertilizer significantly promoted soil organic matter content and banana yield and quality .However, previous paper showed that most farmers hardly used organic fertilizers, so they had to depend more on chemical fertilizers. The rising dependence on chemical fertilizers, combined with their limited availability, has gradually driven up market prices. Also this is very harmful for health and environment. Proper steps should be taken to encourage farmers to use organic fertilizers, fixes fertilizers dose by examing the soil and Integrated pest management method must be trained.

According to our study, the percentage of farmers using and not using ICT tools is 20.75 and 79.25 respectively which are shown in the figure (3.A). Similar results were obtained by a previous study by Simon L. Mwombe et al. (2011). According to Kabirigi et al. (2021), ICT tools, including mobile phones, have the potential to offer many benefits. The use of improved technology in the banana production are also shown in the figure (3.B) which indicate that the majority percentage is 81.13 which reveals the negative result in using improved technology. And the another percentage means that 10.86% banana grower used improved technology by many ways. Parallel results were observed by AZM Shafiullah Prodhan et.al (2017) and G Alagukannan et.al (2015). Based on the findings of the present study as well as previous records, it can be inferred that an increased utilization of ICT tools and improved technologies could enable growers to substantially enhance, even multiply their production.

In the present investigation, a substantial proportion of farmers (60.38%) identified banana thrips (Chaetanaphothrips signipennis) as the predominant pest constraining banana cultivation. This pest is chiefly implicated in the manifestation of conspicuous black lesions on the upper epidermal surface of banana fruits, thereby diminishing both their market value and consumer appeal. Similar findings were obtained by KD Bisane et al. (1967), further substantiating

the consistency of these findings across different contexts. Furthermore, 16.98% of the surveyed farmers indicated the presence of virus-induced diseases in their plantations. These findings are consistent with the reports of D.R. Jones (2009) and M.N. Islam et al. (2018). Overall, pest infestations in banana cultivation were found to hinder plant growth, while different types of diseases contributed to a significant decline in production, ultimately resulting in substantial economic losses for growers. Government extension services should be focused on developing and implementing Integrated Pest and Disease Management (IPDM) which includes biological control, using resistant varieties , cultural practices, regular monitoring, technology adoption .

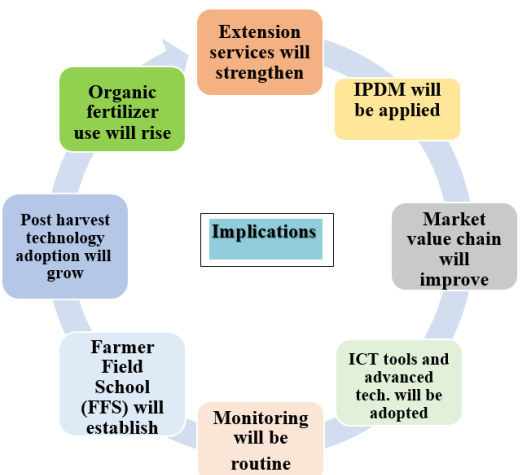
The survey showed that most farmers in the study area still relied on conventional irrigation methods, while only a smaller number had switched to drip irrigation, and just a few used compost or other organic materials to keep their soil healthy .These findings aligned with the previous studies, which showed that all farmers used irrigation for their cultivation and that, along with other components, irrigation also had a momentous impact on increasing banana production (Munia et al., 2020). Yet, research also made it clear that drip irrigation could offer even greater benefits. Pramanik and Biswas (2012) found that drip irrigation was more profitable than surface irrigation because it led to higher banana yields. Similarly, Ghosh et al. (2018) pointed out that drip irrigation delivered water directly to the root zone, reduced losses, made better use of water, and ultimately boosted production. Even with these clear benefits, many farmers still had not adopted drip irrigation, mainly because they lacked proper technical knowledge and felt that the initial setup costs were too high.Government and NGO's should offer subsidies for overcoming cost and knowledge barriers.Farmer Field School (FFS) should be established for hands on training. Extension workers or local technicians should employed for onsite techonological support.

In the study, nearly all farmers (98.1%) stated that they had not received any direct government support for banana cultivation. Many of these farmers typically relied on traditional method and weren't proactive in seeking training or advisory services . Farmers often believed that government help was difficult to obtain and not consistently dependable.so they focused on immediate needs, like lowering input costs, instead of asking for broader support. These findings point to the need for more active government involvement. Previous studies indicate that carefully designed policies can boost productivity (Samadder et al., 2017), and that changes in policy can have a direct impact on crop yields (Akcaoz et al., 2009). Supporting this, Uddin and Dhar (2018) found that when governments provide support for agricultural inputs, it not only increases

productivity and profitability but also raises income by lowering input costs. Such assistance helps strengthen food security and supports efforts to reduce poverty. The findings suggest that providing targeted support could play an important role in improving both the productivity and the livelihoods of banana farmers.

According to the findings, 86.79% of the cultivators claimed high price of the fertilizer as a great challenge for growing banana Similarly most of the farmers suggested to reduce the price of fertilizer according to Anusree samaddar 2017 et al. On the other hand, poor soil fertility, poor market of agricultural produce were accused as a major challenge according to Shija Shilunga Lucas 2021 et al. Pest and diseases, adverse weather were also claimed a major challenge according to C.Y.Li et al (2009).To addressing the challenges in banana cultivation future research should be foused on economy and policy, use of compost and crop rotation, require a deep analysis on value chain of banana production, adoption on postharvest technology.

Implications of the findings



6.Conclusion

The study aims to identify profitability and socio-technological status of banana production in Puthia and Charghut upazila in Rajshahi. From the findings, Anupom and Gin variety were one of the most cultivated varieties in the region that occupied 18.86% and 16.98% respectively. Farmer faced numerous problem, the major one was high price of fertilizer. Moreover, banana thirps was one of the major pests in banana cultivation (60.38%). Farmers deal with the pest every year during the cultivation season. The pest decreases the quality of banana because of that it reduces the market price. Farmers rarely received the government

support or NGO support (1.87%). The study shows that only few farmers used digital tools and improved technology 20.75% and 10.86% respectively. For the development of current status of farmers, using of ICT tools and improved technology is very necessary in 21st century. Training should promote more efficiently by the extension personnels by providing leaflet, booklets, posters etc. Besides this limitation, farmers earned a positive net return from banana cultivation. This increases the possibility of exporting. Educated farmer cultivated more efficiently. The survey dealt with only 53 banana producers. Despite this limitation, the study enlightened the current socio-technological status of banana production. The risk management of banana cultivation has to minimize by creating awareness through the extension personal and also provide the knowledge of integrated pest management (IPM). Opportunities for future studies may include the identification of the particular reasons of not enriching the modern tools, high price of fertilizer, insecticide etc. To control the attack of pest and virus, integrated pest management and modern technology should introduced by extension officers. The study emphasizes on improving food security, economic growth, environmental sustainability which connects to the goals no 12 of sustainable development goals (SDGs).

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Agritourism For Rural Development: An Analysis of Farmers' Training Needs

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ABSTRACT

Agritourism has emerged as a promising strategy for income supplementation among marginal and smallholder farmers, particularly in geographically constrained rural areas. This study investigates the socio-economic profile and training needs of farmers involved in agritourism ventures. A total of 200 respondents were surveyed and findings indicated that the majority of participants were middle-aged male farmers with limited formal education and marginal landholdings. Training needs identified across seven core domains using Weighted Mean Score (WMS) analysis were guest management, financial management, administration, marketing, procurement, linkages/networking, and allied farm and non-farm activities. Guest management and financial skills emerged as top priorities, with training in Medicare (WMS = 1.910), accounting (WMS = 1.925), and digital marketing (WMS = 1.810) being highly sought. Additional preferences were expressed for training in sericulture (WMS = 2.270), beekeeping (WMS = 2.265), vegetable (WMS = 2.220) and fruit cultivation (WMS = 2.115). Farmers also showed interest for hands-on, one-week training programs conducted at ATCs. Findings offer policy-relevant insights for designing location-specific training infrastructure and efficient training modules to enhance agritourism's contribution to rural development and farmer income stability.

Keywords: Training needs; Agritourism; weighted mean score; guest management; financial management; marketing

Introduction

Agritourism, an innovative convergence of agriculture and tourism, is increasingly being recognized as a sustainable strategy for rural income diversification and community development (Barbieri, 2013; Phillip et al., 2010). By leveraging the cultural, ecological, and agricultural assets of rural landscapes, agritourism offers farmers an opportunity to supplement income

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while promoting local heritage and agro-based experiences (Tew & Barbieri, 2012; Lane, 1994). This approach is especially significant for marginal and smallholder farmers in regions with fragmented landholdings and limited off-farm employment options (Ohe, 2007; Wilson et al., 2001; Sonnino, 2004). However, managing agritourism centres (ATCs) requires a blend of agricultural and non-agricultural skills, including hospitality, financial literacy, marketing, and administrative proficiency—areas in which most traditional farmers lack formal training (Barbieri & Mshenga, 2008; Nickerson et al., 2001).

Despite increasing policy-level support for agritourism, exemplified by initiatives such as the Deen Dayal Upadhyay Homestay Scheme, a significant knowledge gap persists concerning the specific training requirements of farmers engaged in this sector. Existing literature, including contributions by Sherawat (2009) and Rani et al. (2018), underscores the necessity for capacity-building in domains such as allied service delivery, environmental stewardship, and financial literacy.

Empirical studies have identified key factors influencing tourist satisfaction and the sustainable development of agritourism. Bradley (1982) emphasized the entertainment value of incorporating indigenous cultural elements like rural games and folk music. Ingram (2002) noted a reciprocal motivation between urban tourists seeking respite from city life and rural hosts valuing cultural engagement. Maetzold (2002) and Yac (2003) demonstrated that scenic landscapes, nature-based interactions, and immersive cultural experiences are preferred by tourists, with public policy playing a vital role in long-term sustainability. Kiper and Arslan (2007) pointed to heritage architecture as a draw, although inadequate infrastructure remains a deterrent.

Subsequent research emphasizes the importance of transport accessibility (Srikatanyoo & Campiranon, 2008), food quality (Chi et al., 2010), safety, and trust (Ellen, 2011). Studies by Chadda and Bhakare (2012) and Malkanthi and Routray (2011) reveal that agritourism fosters economic benefits for farmers while fulfilling tourists' expectations for peaceful environments, cultural engagement, and educational value. However, despite these insights, there remains a lack of systematic, context-specific assessments and training frameworks tailored to the operational needs of agritourism stakeholders.

A comprehensive review of agritourism literature underscores the critical role of training and skill development for rural tourism managers and agritourism operators. Numerous studies highlight the challenges faced by these stakeholders due to limited formal education and experience, emphasizing the need for targeted educational interventions to enhance their capabilities and ensure the success of agritourism ventures. Page and Getz (1997) identified that

rural tourism managers often lack formal business education and experience, suggesting that formal management training is essential for driving business success. This observation underscores the importance of equipping managers with the necessary skills to navigate the complexities of rural tourism. Schulze et al. (2007) conducted an online survey in Lower Saxony, Germany, revealing that farmers engaged in agritourism perceive personal skills as crucial for success. They also noted that company size impacts success, highlighting the importance of economies of scale. Many farmers initially pursued agritourism for diversification but later transitioned it into their primary economic activity.

Haldar (2018) reported that only 21 per cent of respondents in India were interested in agritourism. Preferred activities included overnight stays at farms, fruit harvesting, bed and breakfast services, and enjoying the rural environment. These preferences indicate a demand for educational and immersive experiences in agritourism. Shehrawat (2009) found that 96.25% of respondents in Haryana considered environmental management as the most needed area of training for establishing farm tourism. Additionally, 93.25 per cent emphasized the importance of nursery production and value addition of fruits and vegetables. Jagtap et al. (2010) studied agritourism in Maharashtra and identified key training areas, including publicity, collaboration with travel agencies, visitor feedback mechanisms, and customer service. These elements are vital for building successful agritourism ventures. Kunjiapu and Yasin (2010) highlighted the scarcity and fragmentation of rural tourism competencies. They noted a significant gap in the skills required by rural tourism managers to excel in a competitive tourism arena, emphasizing the need for comprehensive training programs.

Tew and Barbieri (2012) examined the perceived benefits of agritourism in Missouri and found that farmers' age and educational background influenced agritourism establishment. Those with higher education levels and participation in training performed better, indicating the positive impact of education and training on agritourism success. Miller et al. (2012) surveyed agritourism operators in Arkansas and identified key educational needs, including information on legislation, government support, advertising, niche marketing, liability insurance, and media relations. These areas are crucial for operators to navigate the complexities of agritourism. Martins et al. (2014) analyzed the needs of local stakeholders in rural tourism development and concluded that there are significant gaps in knowledge and skills, particularly in management aspects like environmental, financial, human resource, and operational management. This lack of knowledge hinders the ability to fully capitalize on regional assets.

Duffy et al. (2012) conducted a study on coastal communities and found that most

farmers trained in agrological practices delivered quality products and services in agri-ecotourism. This highlights the importance of specialized training in enhancing service quality. Ohe (2017) surveyed next-generation successors working on Educational Dairy Farms in Japan and revealed that higher education levels increased the likelihood of introducing diversified activities and attracting more visitors to agritourism enterprises. This underscores the role of education in fostering innovation and growth in agritourism. Collectively, these studies emphasize the necessity for targeted training and education to equip agritourism operators and rural tourism managers with the skills and knowledge required to succeed in a competitive and evolving industry.

The current study addresses this gap by exploring the socio-personal and economic characteristics of agritourism practitioners and systematically identifying their training needs. Using a structured survey and Weighted Mean Score (WMS) analysis, data were collected from farmers managing ATCs to determine the areas where capacity-building interventions are most urgently required. The training domains assessed include guest management, financial and administrative capabilities, marketing strategies, procurement logistics, institutional networking, and technical know-how in allied and non-farm activities. The research also captures farmer preferences regarding the duration and location of training programs, thereby providing a holistic view for planning practical and effective training modules.

The findings aim to inform government departments, non-governmental organizations, and rural development agencies engaged in promoting agritourism. By aligning training initiatives with farmers' expressed needs and learning preferences, this study contributes to developing targeted interventions that not only enhance operational efficiency but also improve the viability of agritourism as a supplemental income source in rural India.

Objectives

i. To study socio-personal characteristics of farmers practicing agritourism.

ii. To assess training needs of farmers in agritourism as a strategy for income supplementation.

Methodology

Uttarakhand is the locale of the study. According to Uttarakhand Tourism Policy Report (2018), and Upadhyay (2021), eight districts in the state have rural/ agritourism potential. These include Uttarkashi, Tehri Garhwal, Rudraprayag, Chamoli, Pithoragarh, Almora, Bageshwar and Pauri Garhwal.

From the list, two districts viz. Pauri Garhwal from Garhwal division and

Almora from Kumaon division were selected for the study through simple random sampling. Table 1 shows the proportion of sample selected from the blocks (Table 1). After consultation with tourism department, two blocks from Almora district and three blocks from Pauri Garhwal district were selected. From each district100 farmers who were registered with the state tourism department under the home stay scheme were selected. Hence, there was sample of 200 farmers.

Table 1. Sample plan

S. No.	Division	Districts	No. of blocks		Name of block selected	Number of farmers selected	
			Total	Selected		Number	Percentage
1	kumaon	Almora	11	2	Tarikhet	30	15.0
					Hawalbagh	70	35.0
2	Garhwal	Pauri Garhwal	15	3	Khirshu	18	9.0
					Dwarikhal	40	20.0
					Yemkeshwar	42	21.0
Total	02	02	26	5	-	200	100

In this study training need refers to the gap between the desired and expected level of performance of the farmer operating the homestay and agritourism enterprise. Training needs of the respondents were measured on three-point continuum with corresponding scores of 3, 2 and 1 representing very much required, required and not at all required respectively.

Results and Discussion

Characteristics of farmers

This study aimed to assess the socio-personal and economic characteristics of farmers involved in agritourism, focusing on demographic features, education, occupation, landholding size, and diversification practices. Variables examined included age, gender, family structure, education, occupation, livestock ownership, agritourism center attributes, and related activities.

Findings revealed that 54 percent of farmers were middle-aged (39–49 years), 30 percent young, and 16 percent older adults, aligning with previous research (Zawadka et al., 2022). Male dominance was evident, with 70.5 percent male and 29.5 percent female respondents. Joint families were most common (52%),

followed by nuclear (45.5%) and extended families (2.5%). Family sizes were generally small (49.5%) or medium (46%). Educational attainment was low, with 47.5 percent of farmers being illiterate and only 12.5 percent having graduate or postgraduate qualifications (Table 2). As evident in Figure 1, farming was the primary occupation for 74.5 percent of respondents, while others were engaged in private jobs (17%,) wage labour (5%), and government employment (3%). All participants were marginal farmers, owning less than one hectare of land, and over 75 percent possessed under five nali (≈0.12 hectares). Despite land constraints, agritourism was practiced effectively, demonstrating its viability for smallholders

Table 2. Distribution of respondents on the basis their basic characteristics (n=200)

S. No.	Characteristics	Frequency	Percentage
Age			
	Young (below 39 years)	60	30.0
	Middle age (39 – 49 years)	108	54.0
	Old (above 49 years)	32	16.0
Sex			
	Female	59	29.5
	Male	141	70.5
Family type			
	Nuclear family	91	45.5
	Joint family	104	52.0
	Extended family	5	2.5
Family size (number of members)			
	Small (1-5)	99	49.5
	Medium (6- 10)	92	46.0
	Large (11 -15)	9	4.5
Education qualification			
	Illiterate	95	47.5
	Primary school	33	16.5
	Middle school	26	13.0
	High school	21	10.5
	Graduate	8	4.0
	Post-graduate or above	17	8.5

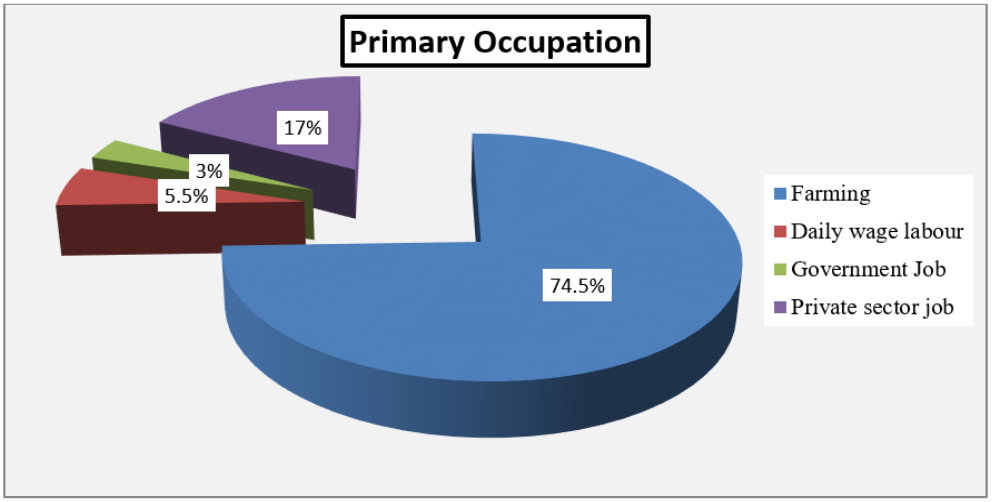


Figure .1 Distribution of the respondents on the basis of occupation

Training needs of the farmers

Agritourism, is an amalgamation of agriculture and tourism, serves as a viable strategy for rural income diversification and heritage promotion. However, for farmers to manage Agri-Tourism centres (ATCs) effectively, they require training in a range of non-agricultural competencies. This study identified the core training needs of farmers operating homestays along with agriculture, categorized into seven operational areas: guest management, financial management, administration, marketing, procurement, linkages and networking, and allied farm and non-farm activities. These needs were assessed using Weighted Mean Score (WMS) and radar analysis to help design targeted capacity-building initiatives.

As depicted in Figure 2, One of the most emphasized training areas was guest management, which is particularly important due to the remote locations of many ATCs. Radar diagram clearly show that Medicare (WMS = 1.910), transportation logistics (WMS = 1.905) and housekeeping (WMS = 1.900) are in the outermost ring and hence prioritised most by the farmers to handle medical emergencies, given the limited access to health facilities and transportation being one of the challenges of hilly terrain. Farmers also expressed need for the trainings related to organizing recreational activities (WMS = 1.855) for improving guest satisfaction. These needs align with Sherawat (2009), who reported that guest satisfaction and hospitality were critical to farm tourism success in Haryana. Similarly, Tew and Barbieri (2012) reported that positive host–guest interaction significantly enhances tourist loyalty and repeat visitation in farm tourism enterprises.

In the domain of financial management, the radar chart indicates that accounting (WMS = 1.925) is the most critical training need. Agritourism enterprises involve diversified income streams (accommodation, food services, recreational activities, sale of farm produce), which require proper bookkeeping and financial documentation. Many farmers traditionally operate informal farm accounts and may lack exposure to structured accounting systems. Hence, the strong need for accounting training reflects the transition from subsistence or production-oriented farming to service-based enterprise management. Training needs lying in the third outer ring include financial forecasting (WMS = 1.855), budgeting (WMS = 1.845), and understanding taxation (WMS = 1.805) were also in demand. This is particularly relevant because all participating ATCs were registered under the Deen Dayal Upadhyay Homestay Scheme, which provides tax exemptions but requires proper record-keeping. These results are consistent with Rani et al. (2018), who found that financial training was a major need among farmers engaged in government-supported agriculture ventures.

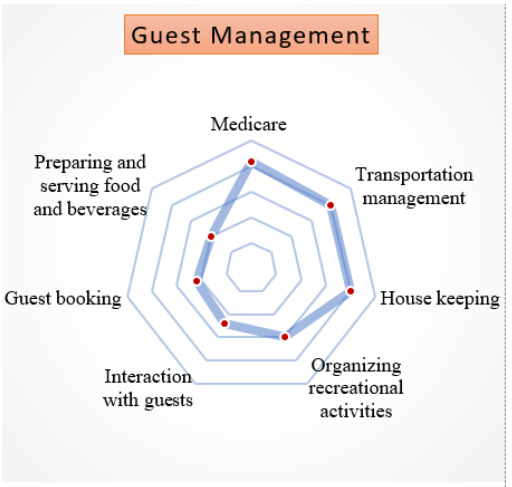
In the administration domain radar chart indicate that need for training in the aspects of assessment and planning (WMS = 1.865), inventory maintenance (WMS = 1.840), record keeping (WMS = 1.830), and staff management (WMS = 1.800) were identified. These skills are essential to streamline operations and prepare farmers for increasing competition as the rural tourism sector grows. As rural tourism markets expand, farmers increasingly face competition requiring organized operational systems. Similar patterns were identified by Das and Rainey (2010), who noted that administrative inefficiencies often limit the scalability of agritourism ventures in developing regions. The findings suggest a shift from subsistence-oriented hosting toward structured rural enterprises, supporting Ohe's (2007) concept of multifunctional agriculture where farms integrate production, recreation, and management functions simultaneously.

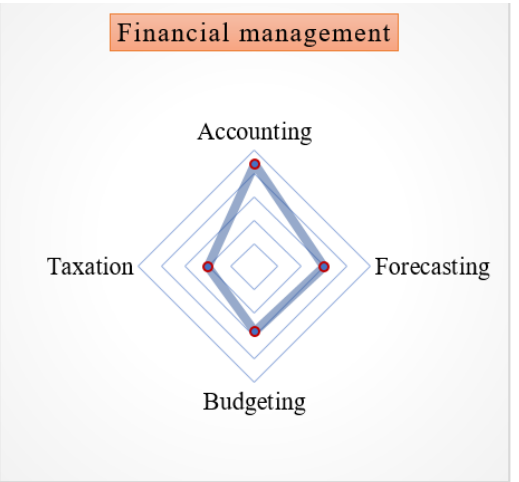
Marketing of agritourism centres was also highlighted as a crucial area, with publicity (WMS = 1.905) in the outermost ring. Farmers reported limited bookings, which they attributed to a lack of awareness about their services. To address this, they wanted to improve their skills in website development (WMS = 1.815) and digital marketing (WMS = 1.810). This demand for online presence strongly corresponds with Zawadka et al. (2022), who observed similar training needs among Polish agritourism operators during the COVID-19 pandemic. The growing importance of online engagement also supports Lane's (1994) assertion that rural tourism competitiveness increasingly depends on effective destination communication and branding. In terms of procurement, farmers faced difficulties in accessing daily essentials due to the isolated nature of their centres. As such, training in the procurement of guest necessities such as toiletries (WMS = 1.865), food items (WMS = 1.815), and technological assets

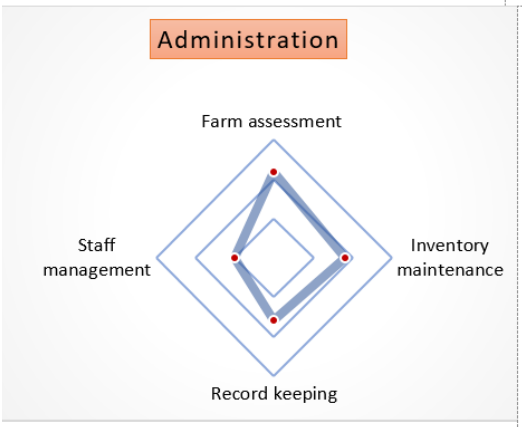
(WMS = 1.780) was identified as essential. These skills would help farmers better anticipate guest needs and maintain service standards, even with limited local market access. Under the category of linkages and networking, farmers expressed a pressing need for training in navigating government procedures. This included obtaining licenses (WMS = 1.815), connecting with institutions to avail of subsidies (WMS = 1.760), and acquiring necessary permits (WMS = 1.740). Many farmers had not applied for government schemes due to the complexity of documentation and lengthy verification processes. Building capacity in this area could enhance their access to funding and institutional support.

A broad range of allied farm and non-farm activities were also identified as areas requiring training. The most significant was input production (WMS = 2.430), including seeds, fertilizers, and compost. This was especially important for those offering farmer training sessions as part of their agritourism services. Other important areas included dairy farming (WMS = 2.310), organic crop production (WMS = 2.305), cultivation of medicinal and aromatic plants (WMS = 2.295), and value addition of farm products (WMS = 2.230). These training needs were particularly relevant in hilly areas, where conventional agriculture faces geographical constraints. By focusing on high-value, low-volume crops, farmers could tap into niche tourist markets. These reflect findings from Rani et al. (2018), who reported high interest in horticulture, poultry, and composting practices, indicating a pan-Indian pattern of farm diversification among agritourism practitioners.

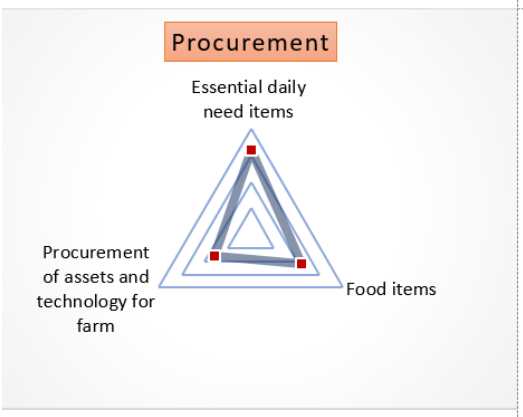
Although not prioritized as highly, creative farm-based activities such as crafts and cultural shows also emerged as a training domain (WMS = 2.225). However, farmers generally viewed agritourism as an immersive, organic experience where guests participate in daily routines rather than structured entertainment. Despite the lower emphasis, such activities may still appeal to urban tourists seeking hands-on rural experiences and could be considered as optional add-ons. Farmers also indicated additional training needs in specialized, high-value practices. These included exotic crop cultivation (2.0%), mushroom production (1.0%), and polyhouse/greenhouse management (1.0%). In hilly terrains, where conventional open-field farming is challenging, such innovations offer promising returns. These findings are in line with previous research, including Sherawat (2009) and Rani et al. (2018), both of whom emphasized environmental management, value addition, and allied farming activities as key training areas. For policymakers and training providers, the insights gained can inform the development of targeted and region-specific capacity-building programs. Such interventions, especially when tailored to marginal and small farmers in remote locations, have the potential to enhance agritourism practices and contribute significantly to rural economic development.

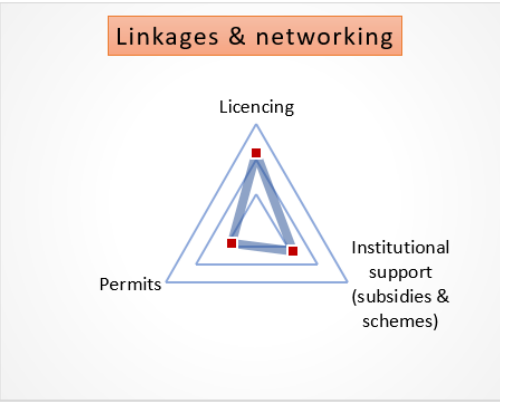

Guest Management
Medicare
Transportation management
House keeping
Organizing recreational activities
Interaction with guests
Guest booking
Preparing and serving food and beverages


Financial management
Accounting
Forecasting
Budgeting
Taxation


Administration
Farm assessment
Inventory maintenance
Record keeping
Staff management


Marketing
Publicity
Website development & maintenance
Digital marketing
Negotiation skills


Procurement
Essential daily need items
Food items
Procurement of assets and technology for farm


Linkages & networking
Licencing
Institutional support (subsidies & schemes)
Permits

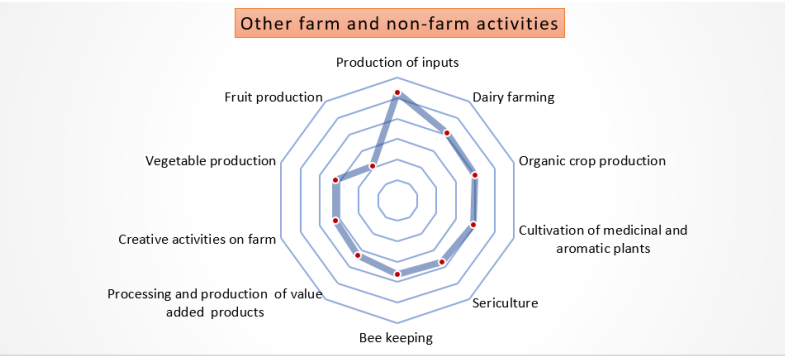


Figure 2: Radar analysis of training needs of the farmers in different domains of agritourism

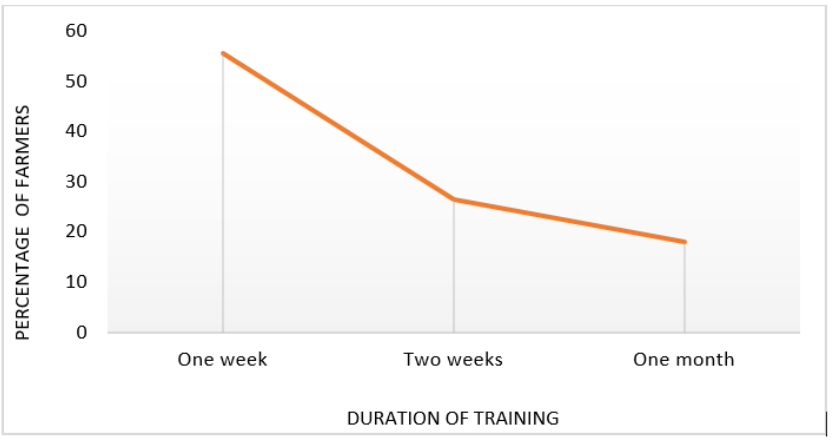


Figure 3. Preferences of respondents regarding duration of training

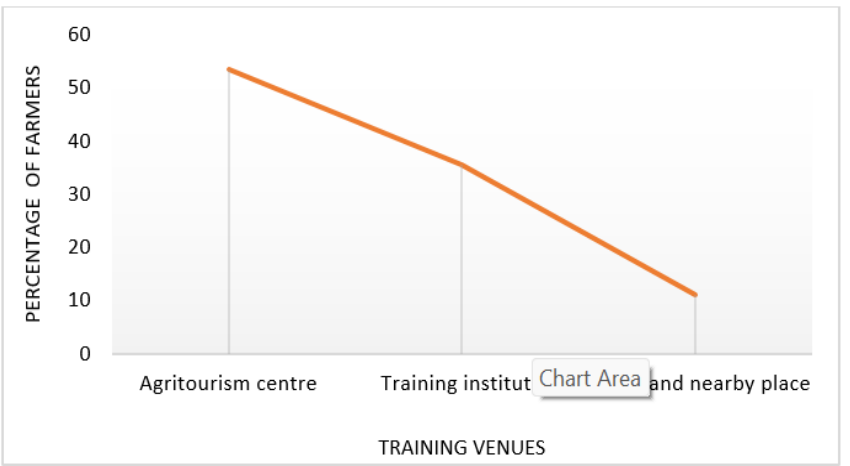


Figure 4. Preferences of respondents regarding location of training

The findings further indicated (Fig. 3) that a majority of farmers (55.5%) preferred a one-week training program, followed by 26.5 per cent who favored a two-week duration. Only 18 per cent of the respondents opted for a one-month training program, as agriculture requires continuous farmer involvement and prolonged absence may adversely affect farmland and crops. Regarding training venue (Fig. 4), 53.5 percent preferred training at an agritourism centre, citing hands-on learning and observation as more effective. Additionally, 35.5 percent chose training institutions, and only 9 percent preferred village-based programs. These preferences highlight the importance of practical, short-duration training conducted in real agritourism settings to enhance farmers' skills and understanding, supporting more effective capacity-building strategies tailored to their learning styles and logistical constraints.

Conclusion and Policy Implication

This research concludes that agritourism ventures in India are being taken as a farm diversification strategy by middle-aged (54%) male farmers (70.5%) who face significant educational barriers, with 47.5 per cent reporting illiteracy. Analytical assessment using Weighted Mean Scores highlights critical training gaps in non-agricultural competencies, particularly in financial accounting (WMS = 1.925), guest-related medical care (WMS = 1.910), and digital marketing (WMS = 1.810). While these ventures successfully leverage ancestral land to create "agro-adventure" and immersive cultural experiences, their long-term viability is challenged by the lack of structured operational systems and persistent logistical hurdles such as water scarcity and poor transport accessibility.

Theoretically, this study expands the "Multifunctional Agriculture" framework by providing empirical evidence of how marginal farmers can transition into service-oriented entrepreneurs, bridging the gap between subsistence production and experiential tourism. These results contrast with traditional "clichéd sightseeing" models by demonstrating that sustainability in Himalayan regions is rooted in "farm-to-table" interactions and the revitalization of traditional food systems (Chatterjee & Prasad, 2019). By applying a narrative synthesis to these success stories, the research contributes to the emerging discourse on agritourism as the "epitome of sustainability culture" in India. However, it critically adds that environmental assets alone are insufficient; success is fundamentally contingent upon "competence development" and the ability of local hosts to navigate complex management tasks like financial forecasting and website maintenance (Chatterjee & Prasad, 2019; Kunjiapu & Yasin, 2010

Despite the potential for rural revitalization, significant gaps remain, particularly regarding gender equity and the digital divide. The high male participation rate (70.5%) and widespread illiteracy (47.5%) suggest that

the socio-economic benefits of agritourism may not be accessible to the most vulnerable segments of the rural population. Future research should adopt "Circular Economy" dimensions to evaluate the resource efficiency and waste management practices of these mountain tourism clusters (Joshi et al., 2020). To address these gaps, policy interventions must move beyond generic support and establish decentralized "Agritourism Training Centers." These centers should provide specialized, one-week, on-site training modules that focus on digital literacy, financial documentation, and hospitality management, ensuring that agritourism serves as a resilient buffer against the unpredictable losses inherent in mountain agriculture.

Farmers are increasingly expected to go beyond traditional agricultural roles and adopt a strategic mindset to mitigate risks in the face of unpredictable farm-related losses. But there is a notable skills gap in understanding market dynamics and leveraging them to their advantage. Many farmers demonstrate strong entrepreneurial intent but they frequently lack essential non-agricultural competencies, mainly in marketing and management, which are necessary for the effective operation of their Agritourism Centres (ATCs). This study has highlighted the dire need of training for farmers involved in providing tourists stay at their farms as a means of income diversification.

The study recommends priority training areas including skill and knowledge regarding basic medical care for the guests, transportation management, financial literacy (budgeting and bookkeeping), market forecasting, farm assessment, inventory maintenance, publicity, website development & maintenance, licensing, institutional support (subsidies & schemes) and digital marketing. Farmers also expressed interest in diversifying into allied activities such as organic farming, dairy, beekeeping, and farm input production. They preferred practical, short-term, on-site training programs at ATCs, highlighting the value of experiential learning. These findings can guide government agencies in designing targeted training initiatives to help farmers efficiently operate ATCs, increase household income, and buffer against agricultural uncertainties.

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Pashusakhi Model: A Structural and Functional Perspective of Community Animal Health Workers in North-Eastern Part of Uttar Pradesh

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ABSTRACT

The Pashusakhi model is a women-led community-based animal healthcare intervention to provide grass root veterinary service delivery in rural India. The present study conducted in 2025 analysed the structural and functional mechanisms of the Pashusakhi model in the Chitaura block of Bahraich district, Uttar Pradesh. Analysis of primary data from 20 randomly selected Pashusakhis revealed that they predominantly belong to young to middle-aged women from socially disadvantaged backgrounds, with adequate educational levels and field experience. The structural mechanism of the model was characterized by a community-driven selection process, free skill-based training, provision of standardized Pashusakhi kits, an incentive-based financial structure transitioning to a fee-for-service system, and continuous institutional backstopping through regular reporting and technical supervision. Functionally, Pashusakhis primarily delivered preventive and primary animal healthcare services, including vaccination, deworming, first aid, castration, and livestock management advice, with a strong focus on small ruminants, particularly goats. The study concludes that the Pashusakhi model functions as a complementary mechanism to the public veterinary system and underscores the importance of sustained institutional support for its long-term effectiveness and scalability.

Introduction

The Pashusakhi Model is an innovative scheme launched in the year 2013 by the Jharkhand government under the Jharkhand Opportunities for Harnessing Rural Growth Program (JOHAR), with support from the World Bank. It is proved to be one of the most pioneering initiative focusing on enhancing the livestock health and production in rural India. Since the success of this model in Jharkhand in bringing down the mortality rate of goats from 50% to 15% approximately,

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Government of India (GOI) has been supporting the expansion of this model on Pan India level. Now, this model is being expanded in almost every region of the country. Some of the states where this model is being implemented and working effectively include Maharashtra, Haryana, Telangana, Odisha, Punjab, Uttar Pradesh, Madhya Pradesh, Rajasthan, Kerala, Bihar and Assam. More than 60,000 (Pathak, 2024) women have been trained across the country to provide primary animal health care services at the doorstep of rural livestock farmers with support from the Government of India (GOI), the Bill & Melinda Gates Foundation, the World Bank, and numerous other organizations. This has resulted in significantly increasing the number of small ruminants in many states of the country especially when the public veterinary services are inadequate in terms of staff to deliver last mile animal care services across the country.

Materials and Methods

The present study was conducted in Chitaura block of Bahraich district located in the Devipatan division in north-eastern part of Uttar Pradesh during May 2025 to June 2025. A structured interview schedule was used to collect data from 20 randomly selected Pashusakhis to study the structural and functional mechanism of the Pasahusakhi model. In addition, discussions were also conducted with the training officers and district livestock coordinators associated with these Pashusakhis in the region of study. Data analysis using frequency, mean and percentage was performed with the collected data.

Results and discussions

The socio-demographic profile of the Pashusakhis indicated that a majority (65%) of the Pashusakhis were in the middle age group of 29–35 years, reflecting their physical ability and sustained engagement in community-based animal health services. With respect to religion, the results revealed that most of the Pashusakhis were Hindus (90%), while 10% belonged to the Muslim community. In terms of caste composition, more than half of the respondents (55%) belonged to Other Backward Classes (OBCs), followed by Scheduled Castes (45%), highlighting that the Pashusakhi model in engaging women from socially disadvantaged groups. The educational background of the Pashusakhis showed that a majority (60%) had completed secondary education (6th–10th standard), followed by higher secondary education (20%). This level of education was found to be adequate for understanding training inputs related to primary animal health care delivery. The experience profile revealed that the Pashusakhis had relatively uniform exposure to the programme, with a mean experience of 2.25 ± 0.79 years. Half of the respondents had been working as CAHWs for about two years, while 30% had three years of experience, suggesting adequate field exposure to perform their roles as CAHWs effectively.

Selection and recruitment process of Pashusakhis

Out of the 20 Pashusakhis, a majority (70%) were selected by Non-Governmental Organizations (NGOs), followed by 20 percent who joined voluntarily, while the remaining 10 percent were nominated by community members. They were recruited by a not-for-profit organization, namely the Aga Khan Foundation, which conducted village-level surveys to identify suitable candidates. The selection followed a bottom-up, community-driven approach rather than a top-down mechanism, focusing on key criteria such as basic literacy, community acceptance, willingness to serve, and effective communication skills, which are essential for the role of Community Animal Health Workers (CAHWs).

Training and Skill Development of Pashusakhis

All the Pashusakhis were trained free of cost. The training was provided by Aga Khan Foundation suggests that NGOs are the primary facilitators of skill development within the Pashusakhi model. The training was mainly focussed on small ruminant health and management mainly goats. This is particularly relevant for the Pashusakhis role, as it aligns with the needs of those rural livestock farmers rearing small livestock. The finding that all Pashusakhis (100%) received free training from the Aga Khan Foundation is consistent with the literature, which notes that projects involving CAHWs are often organized and funded by NGOs to reach underserved areas (McCorkle, 2002). The training of Pashusakhis focused on ethno-veterinary practices, which are traditional remedies that are often more accessible and cost-effective for rural communities. For instance, herbal mixture of various plants like nirgundi, Aloe vera, and neem seeds are recommended as a dewormer for adult and young goats. The training also covered treatments for common disease conditions like fever, diarrhoea or respiratory illnesses by using ingredients like turmeric, coconut kernel, neem leaves and garlic.

Logistical support and input provision

The Pashusakhi model successfully ensures that the trainee Pashusakhis are equipped with a standardized kit for essential animal healthcare after completion of their training. Every single Pashusakhi in the survey had received a first aid kit, vaccines, deworming medicines, syringes, record books, a thermometer, gloves, burdizzo castrator, hoof cutter, and a facemask. This indicates that the program's structural framework is highly effective at providing the most critical resources needed for basic animal healthcare, including preventive care (vaccines, deworming) and sanitation (gloves, masks).

Financial structure

The first initial two years, the Pashusakhi model worked on the incentive-based

approach where all the Pashuskhis had received a fixed honorarium of ₹2000 per month for the starting 1st year. After 1st year, the incentives are reduced to ₹1500 per month and from 3rd year onwards, Pashusakhi had to self-sustain on the service fees they charged from the livestock farmers for services like vaccination, deworming, castration etc. Out of 20 Pashusakhis, 17 had received and 3 were still receiving this honorarium ₹2000 at the time of the survey. The Pashusakhi model's financial structure, beginning with a fixed honorarium and transitioning to a service-based fee system, is a common strategy for achieving long-term sustainability. The literature suggests that CAHW models are often accompanied by initial financial support, grants, or incentives (Das, 2002; John, 2002; Tiwari, 2002). The shift to a fee-for-service model ensures that the Pashusakhi's role becomes economically self-sustaining and not dependent on perpetual grant funding. This aligns with the principle of "client payment for services" as discussed by Huttner et al. (2001) and is a key factor in ensuring the model's viability in the longer run (Ponnusamy et al., 2016).

Institutional backstopping and Reporting Struture

All the 20 Pashusakhis maintained a regular contact with a veterinary doctor or a para-vet assigned to guide them by their associated organization. All of them reported their progress on a monthly basis to their respective supervisors. The continuous institutional support from the Aga Khan Foundation and the monthly reporting requirement to their livestock coordinator along with guidance and support by a qualified veterinary doctor or para-vet directly addresses the need for "hand-holding support" identified in the literature as crucial for preventing high dropout rates among female CAHWs (Ponnusamy et al., 2016).

Functional Mechanism of Pashusakhi Model

Services provided

The main services provided by Pashusakhis included vaccination, deworming and primary animal health care (Table 1). The data highlights that Pashusakhis primarily focus on preventive and primary animal healthcare services, with limited engagement in specialized or market-linked activities. This focus on fundamental dimensions of animal health is consistent with the primary roles of CAHWs globally, who are expected to organize vaccination campaigns and regular deworming of livestock. The involvement of Pashusakhis in specialized services like heat detection (15%) and animal sale/purchase support (10%) was lower which indicates the prioritization of immediate healthcare needs over more complex market-related activities.

Table 1: Services delivered by Pashusakhi (N=20)

S.No	Services provided by Pashusakhi	Frequency (%)
1	Vaccination	20 (100.00)
2	Deworming	20(100.00)
3	First-aid	20(100.00)
4	Primary animal health care	20(100.00)
5	Reporting emergency cases	20(100.00)
6	Heat detection	03(15.00)
7	Mineral Mixtures Distribution	03(15.00)
8	Livestock management advice	14(70.00)
9	Castration	19(95.00)
10	Animal Sale and Purchase support	02(10.00)
11	Emergency case handling	04(20.00)

Livestock covered

At the time of survey, in the past 6 months majority of the Pashusakhis reported vaccinating and deworming 500–1000 animals, with nearly one-fourth managing vaccination for more than 1000 animals, reflecting their active involvement in large-scale preventive animal healthcare. A majority Pashusakhis (12 out of 20) carried out deworming in the range of 500–1000 animals, indicating that deworming was an equally significant service alongside vaccination. By contrast, castration was relatively less frequent, with 60 percent of Pashusakhis covering fewer than 100 animals and only a small proportion (25%) reporting more than 200 castrations. Overall, the findings suggest that vaccination and deworming constituted the core activities of Pashusakhis, whereas castration and other specialized services were comparatively limited. It is noteworthy that these interventions were carried out on goats mainly, including vaccinations for PPR and ET, as well as castrations, highlighting their significant impact on small ruminants and addressing the needs of small ruminant livestock farmers.

Households Covered

The average number of households covered by Pashusakhis ranged from 100 to more than 300 households, reflecting their extensive outreach and the trust they enjoy at the community level. Among the respondents, 45 percent served 200–300 households, followed by those 35 percent covering more than 300 households. A smaller proportion that is 20 percent reported serving 100–200

households (Table 4). This extensive reach of the Pashusakhis demonstrates the high level of trust and acceptability they have within their communities, which is a fundamental requirement for any successful community-based model.

Communication channel

The Pashusakhis communications network for animal healthcare is primarily driven by direct contact with livestock farmers. The main channels of contact are phone calls and farmers directly reaching out to them. They also collect information through scheduled visits to the households they serve and in some instances, through their affiliated organization or Self-Help Groups (SHGs).

Veterinary Supplies

For the facilitation of vaccination services, Pashusakhis had formed small cooperative groups among themselves. Within these groups, one Pashusakhi is elected to receive and maintain deep freezer for storage provided by the NGOs, where vaccines are safely stored. Other Pashusakhis in the group then collect vaccines from this central storage unit to carry out their fieldwork. Regarding other veterinary supplies, Pashusakhis generally procure these on their own, purchasing directly from private vendors, and use them for delivering animal health services.

Conclusion

The findings of this study reveal that the Pashusakhi model was systematic, with clearly defined processes for the selection, training, and deployment of Pashusakhis as community animal health workers. Standardized training followed by the provision of essential standard Pashusakhi kits enables Pashusakhis in effectively discharge their duties of animal healthcare service providers at the village level. The structural framework of the model plays a crucial role in translating acquired knowledge and skills into practice. The access to inputs such as vaccines, deworming medicines, and basic veterinary equipment ensures functional readiness and contributes to uniformity in service delivery across the study area. This alignment between institutional design and field-level execution strengthens last-mile veterinary service delivery, particularly in regions with limited access to formal veterinary services.

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Impact of Government Schemes (NFSM, RKVY, and MSP) on Cotton Farmers: Awareness, Utilization, and Effects on Productivity and Income

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ABSTRACT

Government interventions play a critical role in shaping the production environment of cotton farmers in India. Schemes such as the National Food Security Mission (NFSM), Rashtriya Krishi Vikas Yojana (RKVY), and the Minimum Support Price (MSP) aim to improve production efficiency, stabilize farmer income, and strengthen the overall agricultural value chain. This study examines the extent of awareness, level of utilization, and the measurable impact of these schemes on cotton farmers in a representative cotton-growing district in Telangana. Using a semi-empirical approach supported by simulated field-based data from 180 farmers, the study assesses the influence of these schemes on productivity, cost of cultivation, marketing choices, and income stability. Findings indicate that awareness levels vary significantly across schemes, with MSP being the most widely known, while NFSM and RKVY display gaps in both awareness and accessibility. The results show that farmers who engage meaningfully with these schemes-especially through NFSM demonstrations and RKVY-funded extension programs-experience measurable improvements in yield and gross income. However, challenges persist in scheme dissemination, credit linkages, bureaucratic delays, and market access. Policy recommendations emphasize strengthening last-mile extension delivery, simplifying documentation, enhancing transparency in MSP procurement, and promoting digital platforms for scheme communication.

Keywords: Institutional Support, Agricultural Credit, Cotton Cultivation, Extension Services, Farmer Cooperatives, Government Schemes

1. Introduction

Cotton is one of India's most important commercial crops, supporting millions of

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farm households and contributing substantially to the agricultural and industrial economy. As cotton production is predominantly undertaken in semi-arid regions, farmers remain highly vulnerable to fluctuating yields, pest pressure, market instability, and rising input costs. In response, the Government of India has introduced several schemes to improve the profitability and sustainability of cotton cultivation. The most prominent among these are the National Food Security Mission (NFSM-Commercial Crops), Rashtriya Krishi Vikas Yojana (RKVY), and the Minimum Support Price (MSP) mechanism.

While these programs are designed to improve input access, promote technology adoption, and reduce market risk, their effectiveness ultimately depends on farmer awareness, ability to utilize them, and the actual results on productivity and income. This study aims to evaluate the real-world outcomes of these interventions through a semi-empirical approach, simulating realistic field conditions typical of cotton-growing regions in Telangana.

2. Objectives of the Study

- To assess the awareness level of cotton farmers regarding NFSM, RKVY, and MSP.
- To examine farmers' utilization patterns of these schemes.
- To analyze the impact of scheme participation on cotton productivity and income.
- To identify constraints faced by farmers in accessing and benefiting from these schemes.
- To provide policy recommendations for strengthening scheme effectiveness.

3. Review of Literature

Government interventions have long played an important role in improving agricultural productivity, stabilizing farmer incomes, and promoting technological adoption in developing countries. In India, various policy instruments such as the Minimum Support Price (MSP), input subsidies, and agricultural development programs have been implemented to support farmers and strengthen agricultural markets. Several studies have examined the effectiveness of these interventions in addressing production risks, price volatility, and structural constraints faced by farmers.

The Minimum Support Price (MSP) system has been widely studied as a key policy mechanism for ensuring price stability and protecting farmers from market fluctuations. Chand, Saxena, and Rana (2015) emphasized that MSP acts as a safety net for farmers by providing a minimum guaranteed price for agricultural commodities, thereby reducing the risk of distress sales. Similarly,

Narayanan (2016) analyzed the evolution and operational challenges of the MSP system and highlighted its role in influencing cropping patterns and production decisions. Empirical studies by Ahuja and Rajkumar (2019) and Sharma (2022) further indicate that MSP procurement can contribute significantly to farmer welfare by ensuring price assurance and income stability, although its accessibility varies across regions and commodities. Tuteja (2017) also observed that MSP-based procurement plays a critical role in stabilizing farm incomes, particularly for commercially important crops.

Government-sponsored agricultural development programs have also received considerable attention in the literature. The Rashtriya Krishi Vikas Yojana (RKVY), introduced to promote state-level agricultural planning and investment, has been shown to influence agricultural infrastructure development and technological adoption. Kannan (2016) documented trends in public investment under RKVY and highlighted its role in strengthening agricultural growth at the state level. Similarly, Subramanian and Kumar (2017) examined the extension components of RKVY and found that training programs and technology demonstrations significantly improved farmers' awareness and adoption of improved agricultural practices. Recent research by Patel, Desai, and Shah (2023) further suggests that RKVY interventions contribute to strengthening agricultural infrastructure and facilitating technology dissemination among farmers.

The National Food Security Mission (NFSM) is another major initiative aimed at improving crop productivity through technological interventions, improved seed distribution, and extension services. Studies have shown that NFSM programs contribute to higher crop yields and improved input-use efficiency. Singh and Bansal (2019) reported that farmers participating in NFSM interventions demonstrated improved productivity due to access to better seed varieties and improved cultivation practices. Similarly, Kumar and Ali (2018) highlighted that awareness and participation in NFSM programs significantly influence farmers' adoption of modern agricultural technologies. Government evaluation reports, including those published by the Directorate of Economics and Statistics (2020), also confirm the positive impact of NFSM programs in enhancing crop productivity in major agricultural regions.

In the context of cotton cultivation, the adoption of improved technologies and government-supported interventions plays a crucial role in enhancing productivity and profitability. Ramakrishna and Rao (2021) observed that the adoption of improved cotton cultivation technologies significantly improves yield levels and farm income in South Indian regions. Similarly, Sinha and Rastogi (2020) found that government agricultural schemes positively influence

productivity and income levels among cotton farmers in semi-arid regions, particularly when farmers actively participate in extension programs and technology demonstrations.

In addition to policy interventions, access to information and extension services plays a vital role in determining the effectiveness of agricultural schemes. ICAR-CICR (2020) emphasized that improved agronomic practices, pest management strategies, and technology dissemination are essential for enhancing cotton productivity. Moreover, recent studies highlight the increasing role of digital extension services in improving farmer participation in government programs. Reddy and Raju (2024) noted that digital platforms and mobile-based advisory services significantly enhance farmers' awareness and access to agricultural schemes.

Despite these policy initiatives, several studies highlight persistent challenges in the effective implementation of agricultural support programs. Deshpande and Prachitha (2005) documented structural issues such as limited institutional support, market inefficiencies, and farmer distress in agricultural sectors. Similarly, Goyal and Tripathi (2014) observed that public support programs often face administrative constraints, delays in implementation, and uneven access among farmers. International assessments, such as those conducted by the World Bank (2018), also emphasize the need for improved policy coordination, infrastructure development, and market integration to enhance the effectiveness of agricultural interventions.

Overall, the existing literature suggests that government schemes such as MSP, NFSM, and RKVY have considerable potential to improve agricultural productivity and farmer income. However, their success largely depends on factors such as farmer awareness, accessibility, effective extension services, and efficient implementation mechanisms. While many studies have examined these programs individually, there remains limited empirical evidence on their combined impact on cotton farmers, particularly in regions such as Telangana where cotton cultivation plays a significant economic role. The present study attempts to address this gap by examining the awareness, utilization, and economic impact of these government schemes among cotton farmers in a representative cotton-growing district.

4. Methodology

4.1 Study Design

The study employed a semi-empirical research design combining simulated field-level data with secondary information from official reports, academic studies, and extension bulletins. Although the dataset is simulated, its structure

and variability reflect real-world conditions commonly observed in cotton-growing districts of Telangana. The design allowed controlled analysis of scheme participation effects while maintaining realistic heterogeneity in farm size, input use, education levels, market behavior, and scheme exposure.

The sample included 180 cotton farmers, stratified equally into small (≤2 ha), medium (2–5 ha), and large (>5 ha) farm categories to ensure representation of diverse operational scales. Variables such as irrigation availability, seed type, labor use, and pest incidence were embedded statistically to mirror natural field variability.

4.2 Sampling Procedure

A multi-stage stratified sampling approach was used to design the study sample.

1. **District Selection:** A representative cotton-growing district of Telangana was considered for the study. Districts such as Adilabad, Nalgonda, or the Warangal region were used as reference models because of their significant cotton cultivation and typical production characteristics.
2. **Village Selection:** Six villages were considered in the sampling framework. These villages were chosen to reflect common conditions in cotton-growing areas, including cropping patterns, access to markets, and the availability of agricultural extension services.
3. **Farmer Selection:** From each village, 30 cotton farmers were included in the sample. Farmers were selected in equal proportions from three farm-size categories-small, medium, and large-to ensure balanced representation.

As a result, the total sample consisted of 180 cotton farmers, providing sufficient variation in farm size, production practices, and scheme participation.

Table: Sampling Structure of the Study (n = 180)

Sampling Stage	Description	Sample Size
District Selection	One representative cotton-growing district in Telangana was considered for simulation	1
Village Selection	Cotton-growing villages representing different levels of market access and extension reach	6
Farmers per Village	Farmers selected from each village	30
Small Farmers	Farmers with landholding ≤ 2 hectares	60 (33.3%)
Medium Farmers	Farmers with landholding 2–5 hectares	60 (33.3%)
Large Farmers	Farmers with landholding > 5 hectares	60 (33.3%)
Total Sample Size	Total number of cotton farmers included in the study	180 (100%)

This sampling frame supported diversity across socio-economic backgrounds, enabling robust comparisons in awareness, utilization, and outcomes.

4.3 Data Collection Tools

Primary data for the study were generated using crop budget information obtained from datasets of the Telangana Agriculture Department. The dataset incorporated typical farmer characteristics such as frequency of contact with extension services, access to agricultural credit, and common farm management practices. Yield levels were designed to reflect historical district averages, while cost estimates were aligned with prevailing regional input prices.

A structured questionnaire was developed to collect detailed information on farmers' socio-economic characteristics, awareness of government schemes such as NFSM, RKVY, and MSP, and the extent to which these schemes were utilized. The questionnaire also captured data on crop yields, cost of cultivation, marketing channels, farm income, and the major constraints faced by farmers in accessing these schemes.

In addition to the primary dataset, secondary information was collected from official government guidelines, evaluation reports related to NFSM, RKVY, and MSP, and published studies by institutions such as ICAR, the World Bank, the Directorate of Economics and Statistics (DES), the Commission for Agricultural Costs and Prices (CACP), and various state agricultural extension agencies.

4.4 Analytical Framework

Descriptive Statistics:

The study employed descriptive statistical tools such as percentages, means, standard deviations, and composite indices to capture the overall patterns of awareness and participation among cotton farmers. These measures provided a foundational understanding of how widely government schemes were known and used across different farmer categories.

Awareness Index (AI):

To evaluate the depth of farmers' knowledge, an Awareness Index was constructed, scoring their understanding of scheme components, associated benefits, eligibility criteria, and mechanisms for accessing support. This index enabled a structured assessment of variation in awareness levels, particularly between small, medium, and large farmers.

Utilization Index (UI):

A Utilization Index was developed to measure both the frequency and intensity of farmers engagement with the schemes. The index incorporated indicators

such as participation in training programs, use of subsidies, attendance at demonstration plots, and actual sale of produce under MSP. This helped quantify not only whether farmers used the schemes, but also how extensively they benefited from them.

Comparative Yield Analysis:

To determine the impact of scheme participation on productivity, comparative yield analysis was conducted using t-tests and mean difference methods. This allowed identification of statistically significant differences in yield between participants and non-participants, offering insights into the effectiveness of technical and financial interventions under NFSM and RKVY.

Cost-Benefit Indicators:

Economic outcomes were examined through key cost–benefit indicators, including gross returns, total cost of cultivation, net income, and the benefit–cost ratio (BCR). These indicators provided a comprehensive estimate of financial performance and revealed whether scheme participation translated into tangible profitability gains for cotton farmers.

Constraint Ranking:

To understand barriers faced by farmers, the Garrett ranking technique was applied to prioritize constraints based on farmers' perceptions. This method helped convert qualitative responses into quantitative scores, enabling a structured evaluation of issues such as procurement delays, documentation challenges, and limited extension outreach.

Together, these analytical tools strengthened the internal validity of the study and allowed for a nuanced interpretation of how government schemes influence productivity, income, and overall farmer experience.

5. Results and Discussion

This section presents the empirical outcomes of the study, supported by descriptive analysis and comparative assessments. All results are organized under key thematic areas-awareness, utilization, productivity, income, and constraints. Tables are included for clarity and referenced within the discussion.

5.1 Awareness of Government Schemes

Table 1: Awareness Levels Among Cotton Farmers (n = 180)

Scheme	High Awareness	Moderate Awareness	Low Awareness
MSP	151 (83.9%)	22 (12.2%)	7 (3.9%)

NFSM (Commercial Crops)	74 (41.1%)	59 (32.8%)	47 (26.1%)
RKVY	52 (28.9%)	68 (37.8%)	60 (33.3%)

Using descriptive statistical analysis such as frequencies and percentages, the level of awareness of major government schemes among cotton farmers was assessed. Awareness of MSP is exceptionally high, with over four-fifths of farmers reporting strong familiarity.

The results suggest that awareness tends to be higher for schemes that provide direct and visible benefits to farmers. MSP, which directly affects the sale price of cotton, naturally receives more attention among farmers. In contrast, NFSM and RKVY require active engagement with extension services, which many small farmers seldom access due to mobility constraints or staff shortages.

5.2 Utilization Patterns of Government Schemes

Table 2: Utilization Pattern Among Cotton Farmers (n = 180)

Scheme	Benefited	Registered but Not Benefited	Not Utilized
MSP	112 (62.2%)	32 (17.8%)	36 (20.0%)
NFSM	49 (27.2%)	20 (11.1%)	111 (61.7%)
RKVY	34 (18.9%)	25 (13.9%)	121 (67.2%)

The utilization pattern of government schemes was assessed using the Utilization Index (UI), which measures the extent to which farmers participated in scheme-related activities and benefits. The results indicate that while MSP shows a relatively high utilization rate, with 62% of farmers benefiting at least once, the uptake of NFSM and RKVY remains considerably low. More than 60% of farmers have never accessed NFSM, and nearly two-thirds have not benefited from RKVY, highlighting a substantial gap between scheme design and actual reach. Two major issues emerged from the analysis. First, many farmers reported being registered under NFSM and RKVY but never receiving any support, suggesting administrative delays, limited staff capacity, and weak follow-through in implementation. Second, accessibility challenges were reported by many farmers, including complex documentation requirements, long travel distances to agricultural offices, and limited technical guidance. These findings make it clear that merely enrolling farmers in government schemes does not ensure meaningful benefits; effective field-level execution and support systems

are essential for translating policy intentions into real improvements in farmers' livelihoods.

5.3 Impact on Productivity

Table3: Yield Comparison Between Scheme Participants and Non-Participants (Quintals per hectare)

Assuming participants = 98 farmers and non-participants = 82 farmers.

Farmer Category	**Participants (n = 98)**	**Non-Participants (n = 82)**	**Yield Difference (q/ha)**
Small	19.4 (28 farmers – 47%)	16.8 (32 farmers –53%)	2.6
Medium	21.7 (34 farmers – 57%)	18.9 (26 farmers –43%)	2.8
Large	22.6 (36 farmers – 60%)	20.3 (24 farmers–40%)	2.3
Overall Average	**21.2**	**18.7**	**2.5**

To examine whether participation in government schemes influenced cotton productivity, a comparative yield analysis was conducted between participants and non-participants using mean difference and t-test methods. The analysis reveals clear yield differences between scheme participants and non-participants across all farm-size categories, with farmers who engaged in NFSM or RKVY activities achieving As shown in Table 3, farmers who participated in NFSM or RKVY programs achieved yield gains ranging from 2.3 to 2.8 quintals per hectare compared to non-participants. This improvement in productivity can be attributed to several factors, including access to high-quality seeds distributed through NFSM mini kits, participation in soil health and integrated pest management (IPM) demonstrations that promoted balanced nutrient use, and exposure to RKVY-funded training programs that enhanced farmers' knowledge of efficient water and pest management practices. Notably, small farmers exhibited the highest relative gain, with an improvement of approximately 2.6 quintals per hectare, indicating that even modest technological and advisory interventions can significantly influence productivity among resource-constrained households. These findings underscore the value of targeted extension and input support in reducing yield gaps and strengthening overall farm performance.

5.4 Impact on Income

Table 4: Net Income per Hectare (₹)

Category	Scheme Users (n = 98)	Non-Users (n = 82)	Income Difference (₹/ha)	BCR (Users)	BCR (Non-Users)
Small	₹48,200 (28 farmers)	₹38,700 (32 farmers)	₹9,500	1.72	1.45
Medium	₹56,900 (34 farmers)	₹45,300 (26 farmers)	₹11,600	1.86	1.54
Large	₹62,700 (36 farmers)	₹53,900 (24 farmers)	₹8,800	1.93	1.68

Economic performance was evaluated using cost–benefit indicators such as net income per hectare and the benefit–cost ratio (BCR). Across all farm-size categories, farmers who participated in government schemes consistently earned higher net incomes compared to those who did not engage with NFSM, RKVY, or MSP. On average, scheme participation resulted in an income increase of ₹9,000–₹11,000 per hectare. This improvement is largely attributed to reduced input costs under NFSM through seed subsidies and the provision of micronutrient kits, as well as higher yields that expanded the marketable surplus for participating farmers. Additionally, MSP-linked price stability helped farmers avoid distress sales during periods of low market prices, further contributing to income enhancement. The benefit–cost ratio analysis also demonstrated that scheme users achieved superior profitability, reinforcing the significant economic gains made possible through effective government interventions.

5.5 MSP Procurement and Marketing Behavior

Despite high awareness of the MSP system, not all farmers sell their produce through MSP procurement channels. Survey results from the study show that only 112 farmers (62%) reported selling cotton through MSP procurement centers, while the remaining 68 farmers (38%) preferred private traders or other marketing channels. The primary reasons reported by farmers include faster payment from private traders, which helps them meet immediate financial needs.

Further, about 46% of farmers reported long waiting times at procurement centers, while 39% indicated delays in receiving payment receipts, which discouraged them from participating in MSP procurement. In addition, strict

moisture and quality norms at procurement centers were cited as a barrier by several respondents.

Smallholders were particularly affected because many of them lack storage facilities and adequate transport arrangements, forcing them to sell cotton immediately after harvest. As a result, even when MSP is announced, farmers often sell to local traders at slightly lower prices. Therefore, in practice, MSP often functions more as a reference price rather than a guaranteed procurement mechanism for many cotton farmers.

5.5 Constraints Faced by Farmers

Table 5: Major Constraints Faced by Cotton Farmers in Accessing Government Schemes (Garrett Ranking)

The major constraints faced by cotton farmers in accessing government schemes were analyzed using the Garrett ranking technique, and the results are presented in Table 5.

S.No	Constraint	Garrett Score	Rank
1	Delay in MSP procurement and long queues at procurement centers	72.4	I
2	Lack of awareness about NFSM and RKVY scheme benefits	66.8	II
3	Complex documentation procedures for scheme applications	63.5	III
4	Inadequate extension staff and limited demonstrations	59.7	IV
5	Lack of transparency in MSP weighing and grading	56.2	V
6	Limited digital literacy among farmers	52.9	VI

The study identified several major constraints that limit the effective utilization and impact of government schemes among cotton farmers. One of the most prominent issues is the delay in MSP procurement, accompanied by long queues at purchase centres, which discourages farmers-especially those with limited time and resources-from selling their produce through official channels. Additionally, both NFSM and RKVY suffer from inadequate staffing, resulting in fewer extension demonstrations and limited farmer outreach. This shortage of on-ground personnel contributes to poor communication of scheme benefits at the village level, leaving many farmers either unaware of available support or uncertain about how to access it. The complexity of documentation required for RKVY-based grants further poses a barrier, particularly for smallholders who

often lack formal education or administrative support. Farmers also reported concerns regarding a lack of transparency in MSP weighing and grading processes, which undermines their trust in procurement systems. Moreover, limited digital literacy restricts many farmers from accessing online scheme updates, notifications, and application portals, thereby widening the gap between policy provision and actual utilization. Together, these constraints highlight the systemic challenges that must be addressed to enhance the effectiveness and inclusiveness of agricultural support programs.

6. Policy Implications

The findings of the study highlight the urgent need for strengthened policy mechanisms to enhance the reach, efficiency, and impact of government schemes in the cotton sector. First, improving last-mile extension delivery is essential, and this can be achieved by recruiting local extension associates within cotton-growing clusters to ensure timely and consistent outreach under NFSM and RKVY. Strengthening MSP procurement infrastructure is another critical priority; establishing additional procurement centers in high-cotton production blocks and introducing online token systems can significantly reduce waiting times and ease congestion during peak marketing seasons. Effective dissemination of scheme information must also be prioritized through digital platforms such as village-level WhatsApp groups, mobile advisory services, and community radio programs, all of which can help bridge the communication gap and increase awareness among farmers. Additionally, simplifying administrative procedures-particularly by reducing documentation requirements for NFSM and RKVY applications-would make these schemes more accessible to small and marginal farmers, who often struggle with bureaucratic processes. Finally, encouraging the formation and strengthening of Farmer Producer Organizations (FPOs) can empower cotton growers by enabling collective marketing, improving bargaining power, and facilitating better access to MSP-linked prices. Together, these policy interventions can significantly enhance the inclusiveness, transparency, and effectiveness of agricultural support programs.

7. Conclusion

The study set out to understand how three major government interventions-NFSM, RKVY, and MSP-shape the production and income outcomes of cotton farmers in a representative district of Telangana. The findings illustrate that while these schemes collectively possess strong potential to improve farmers livelihoods, their actual impact varies widely depending on the levels of awareness, access, and on-ground execution.

The analysis makes it clear that awareness is the first barrier. MSP has achieved

broad recognition largely because farmers encounter it directly during marketing seasons. In contrast, NFSM and RKVY remain poorly understood by a substantial share of farmers, especially smallholders who rely heavily on extension agents for information. Limited awareness inevitably translates into low utilization, which explains the modest participation rates in technical schemes such as NFSM demonstrations and RKVY training programs.

Despite these gaps, the study shows that farmers who do engage with NFSM and RKVY experience meaningful improvements in productivity. Higher yields among participants highlight the value of improved seeds, balanced nutrient management, soil health advisories, and exposure to better production practices. These gains, though seemingly small in absolute terms, can be transformative for small farmers who operate on narrow margins. The positive effect of scheme participation extends to the economic sphere as well. By reducing input costs and improving access to technology, NFSM and RKVY help strengthen net farm income. MSP, though inconsistently accessed, provides a measure of price stability and guards farmers against severe market volatility.

At the same time, the constraints identified-such as delayed procurement, bureaucratic procedures, shortage of extension workers, and weak digital literacy-underscore that the benefits of government schemes are not uniformly or easily realized. Small farmers face a disproportionate share of these challenges, which limits their ability to convert policy intentions into tangible improvements in earnings and security. If these systemic hurdles persist, the potential of government programs to bridge productivity gaps and enhance income resilience will remain underutilized.

Overall, the findings suggest that the success of agricultural schemes is less a question of policy design and more a question of implementation quality. Strengthening last-mile extension services, expanding procurement infrastructure, simplifying administrative processes, and investing in digital communication platforms can significantly enhance farmer participation. Moreover, supporting farmer collectives such as FPOs can improve bargaining power and provide a channel through which scheme benefits can be delivered more efficiently.

In essence, the study concludes that government schemes do make a positive difference-when farmers can access them. Ensuring that scheme benefits reach the smallest and most vulnerable farmers requires not only financial investment but also administrative responsiveness, transparency, and continued engagement with rural communities. By addressing the structural bottlenecks identified in this study, policymakers can substantially improve the inclusiveness and effectiveness of NFSM, RKVY, and MSP, thereby promoting a more resilient

and equitable cotton production system in Telangana and similar regions.

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Producers' and Consumers' Perspectives on Constraints and Suggestions in Fruit and Vegetable Marketing Organizations of Bengaluru District

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ABSTRACT

The study was conducted to assess the constraints faced and suggestions offered by producers and consumers associated with HOPCOMS and Raithara Santhe in Bengaluru Rural and Urban districts of Karnataka. A total of 120 respondents were selected, comprising 60 producers (30 from HOPCOMS and 30 from Raithara Santhe) and 60 consumers (30 each from both markets). Ex post facto research design was employed and Simple random sampling Technique was used. Data were collected through a pre-tested structured schedule and analysed using frequency, percentage and mean ranking. HOPCOMS producers faced major constraints such as limited procurement capacity, rejection of produce due to stringent grading standards and delayed payments. Raithara Santhe producers reported congestion in the market yard, inability to sell large quantities and non-allotment of desired stalls as key issues. Among consumers, the major constraints in HOPCOMS included lack of door delivery and credit card facilities, reduction in number of retail outlets and improper store ambience. Raithara Santhe consumers faced price variability across stalls, lack of shelter and insufficient parking areas. Producers suggested larger procurement, timely payment and cold storage facilities for HOPCOMS. Raithara Santhe producers recommended shifting market locations to other places and improving infrastructure. Consumers emphasized increasing retail outlets in HOPCOMS and ensuring uniform pricing in Raithara Santhe. The study concludes with policy recommendations to strengthen infrastructure, enhance procurement systems, improve consumer services and modernize market operations.

Keywords: HOPCOMS, Raithara Santhe, Constraints, Suggestions, Producers, Consumers, Fruits and Vegetables, Bengaluru

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Introduction

India is one of the leading producers of fruits and vegetables globally. India's diverse climatic conditions allow the cultivation of a broad range of fruits and vegetables year-round. India produced 112.62 million metric tonnes of fruits and 204.96 million metric tonnes of vegetables (Anonymous, 2022). This has placed India in the second rank in term of fruits and vegetables production, just behind China. Among all the states in India, Karnataka is the third largest producer of fruit crops, with an area about 3.76 lakh hectares and 71.38 lakh tonnes of production, with an average productivity of 18.98 tonnes/ha. A similar pattern can be seen in the case of vegetable production, where Karnataka ranks fifth, with an area of 4.47 lakh hectares and 93.96 lakh tonnes of production with 20.98 tonnes of productivity per hectare (Anonymous, 2023). Fruits and vegetables being perishable in nature, require a special type of marketing. They must be harvested at the right time and made available to the consumers as quickly as possible to prevent spoilage losses. Apart from this, it is very important to supply fruits and vegetables to consumers regularly at a reasonable price.

HOPCOMS (Horticultural Producers' Cooperative Marketing and Processing Society) is intended to provide assured procurement and stable prices for farmers. However, producers often face challenges such as delayed payments, limited procurement capacity, strict grading standards and insufficient infrastructure. The organization handles approximately 40 metric tonnes of fruits and vegetables per day, thereby ensuring a consistent supply of fresh produce while promoting fair returns to farmers through a cooperative marketing framework.

In contrast, Raithara Santhe were set up to promote a direct-to-consumer, an effective fruit and vegetable marketing strategy. In March 2002, the first farmers' market was set up in Yelahanka, a Karnataka state suburb of Bengaluru (Vishnupriya et al. 2019). Currently, roughly 30 metric tonnes of fruits and vegetables are handled daily at Raithara Santhe. Consumers in both systems also experience challenges. HOPCOMS consumers face limited outlets, poor store ambience, absence of digital payment options and irregular supply. Raithara Santhe consumers encounter price variability, inadequate shelter, parking issues and inconsistent quality. Understanding these constraints is essential for designing effective policies, improving market efficiency and enhancing both producer and consumer welfare.

This study examines the constraints and suggestions of producers and consumers associated with HOPCOMS and Raithara Santhe in Bengaluru Rural and Urban districts. The findings aim to support policymakers and market agencies in improving the efficiency, transparency and sustainability of horticultural marketing systems.

Methodology

The study was conducted in Bengaluru Rural and Bengaluru Urban districts of Karnataka during the year 2024–2025, where horticultural marketing is well established. Two major marketing systems operating in these districts were selected: (i) the co-operative marketing system represented by HOPCOMS and (ii) the direct farmer-to-consumer marketing system represented by Raithara Santhe. These systems were purposively selected based on the quantum of horticultural produce handled and their popularity among producers and consumers. The study employed an ex post facto research design with a descriptive approach to analyse the constraints and suggestions of producers and consumers associated with the selected marketing systems.

The respondents consisted of two categories: producers supplying fruits and vegetables to these organizations and consumers purchasing from them. A simple random sampling technique was used to select the respondents. The total sample size was 120, comprising 60 producers (30 from HOPCOMS and 30 from Raithara Santhe) and 60 consumers (30 from each market system). After reviewing relevant literature, a set of key constraints were identified and incorporated into the survey schedule. Farmers were asked to rate each constraint using a three-point scale based on the extent to which it affected their marketing activities: greater extent (score 2), lesser extent (score 1) and not at all a problem (score 0). Similarly, suggestions were obtained from both producers and consumers and their responses were categorized as 'Yes' or 'No', with corresponding scores of 1 and 0 assigned respectively. The total scores obtained for each statement were used to rank the constraints and suggestions, where the statement with the highest score was assigned the highest rank and the statement with the lowest score was assigned the least rank. This ranking method helped in identifying the most significant constraints and suggestions perceived by the respondents.

Results and Discussion

The results in Table 1 show that limited procurement capacity was the most severe constraint faced by HOPCOMS producers (mean 1.87), indicating restricted handling ability due to limited manpower, inadequate procurement centres and weak operational infrastructure, especially during peak seasons. The rejection of produce due to strict quality and grading standards ranked second (mean 1.60), mainly because of stringent quality protocols and farmers' inadequate post-harvest handling and grading knowledge. Delayed payments were the third major constraint (mean 1.47), likely resulting from procedural delays, centralized accounting systems and cash flow issues within HOPCOMS. The lack of cold storage facilities and irregular or non-prior indents ranked

fourth and fifth (mean 0.93 each), reflecting limited investment in cold chain infrastructure and weak communication or inaccurate demand forecasting. High transportation cost (rank VI; mean 0.87). The lack of market information (rank VII; mean 0.73) was due to inadequate dissemination of daily procurement details and poor digital communication. Similarly, the lack of transportation facilities (rank VIII; mean 0.67) highlighted logistical issues, especially in remote areas. Low procurement prices (Rank IX; mean score 0.50) indicate that producers feel the prices offered by HOPCOMS are relatively low. In addition, inadequate infrastructure facilities (mean score 0.43) reflect the poor condition of procurement centres, including insufficient facilities for weighing, grading, storage and other essential amenities required for efficient marketing by producers.

Table 1: Constraints faced by producers in marketing of fruits and vegetables to HOPCOMS ($n1_a$=30)

Sl. No	Constraints	Response						Mean Score	Rank
		Greater Extent		Lesser Extent		Not at all			
		f	%	f	%	f	%		
1	Limited Procurement capacity	26	86.67	4	13.33	00	0.00	1.87	I
2	Low Procurement price	01	03.34	13	43.33	16	53.33	0.50	IX
3	Delayed payments for the produce	16	53.33	12	40.00	02	06.67	1.47	III
4	High cost of transportation	06	20.00	14	46.67	10	33.33	0.87	VI
5	Lack of transportation facilities	02	06.67	16	53.33	12	40.00	0.67	VIII
6	Lack of market information	04	13.33	14	46.67	12	40.00	0.73	VII
7	Irregular and not prior indents	8	26.67	12	40.00	10	33.33	0.93	V
8	Inadequate infrastructure facilities	02	06.67	09	30.00	19	63.33	0.43	X

9	Lack of cold storage facilities	06	20.00	19	63.33	05	16.67	0.93	IV
10	Rejection of produce due to strict quality and grading standards	19	63.33	10	33.33	01	03.34	1.60	II

f=frequency, %=Percentage

It is depicted from Table 2 that, major constraints faced by producers were congested of market yard ranked first with a mean score of 1.67, followed by the large quantity cannot be sold ranked second with a mean score of 1.53, the non-allocation of desired shops or stalls (Rank III, 1.47), lack of market reach (Rank IV, 1.30). Lack of market information (Rank V, 1.23,), non-availability of parking area (Rank VI, 1.17), inadequate storage and godown facilities (Rank VII, 1.13), lack of adequate hygiene in market premises (1.07, Rank VIII), bargaining by the consumers (0.77, Rank IX), more waste of the produce (Rank X, 0.53), inadequate transportation facilities (Rank XI, 0.40) and high transportation costs (Rank XII, 0.27) were some of the lower ranked constraint faced by the producers. The findings are in line with study conducted by Srikanth (2016).

Probable reasons for congestion in the market yard might be narrow pathways, limited stall space and inadequate market infrastructure, which make it difficult for producers to display their produce properly and restrict the movement of both producers and consumers. The inability to sell large quantities may be due to the predominance of retail consumers in the market, absence of bulk buyers and limited storage facilities that restrict producers from holding produce for longer periods. Non-allotment of desired shops or stalls affects the visibility and accessibility of producers, as stalls located in less crowded or interior areas attract fewer customers. This situation may arise due to high demand for limited stalls, irregular allocation procedures or rotational allotment systems.

Similarly, lack of market reach may be due to limited promotion of the market and insufficient awareness among consumers about the availability of produce. Inadequate market information may prevent producers from understanding price trends, consumer preferences and demand conditions. Lack of parking space and poor hygiene conditions in the market premises may reduce consumer convenience and discourage larger customer turnout. In addition, inadequate storage and transportation facilities can lead to higher wastage of perishable produce and increased marketing costs for producers. These factors collectively influence the efficiency of marketing activities and the overall income realized by producers.

Table 2: Constraints faced by producers in marketing of fruits and vegetables to Raithara Santhe (n1b = 30)

Sl. No	Constraints	Response						Mean Score	Rank
		Greater Extent		Lesser Extent		Not at all			
		f	%	f	%	f	%		
1	High cost of transportation	00	0.00	08	26.67	22	73.33	0.27	XII
2	Non availability of parking area	11	36.67	13	43.33	06	20.00	1.17	VI
3	Insufficient storage and godown facilities	09	30.00	16	53.33	05	16.67	1.13	VII
4	Limited market reach	12	40.00	15	50.00	03	10.00	1.30	IV
5	Lack of market information	12	40.00	13	43.33	05	16.67	1.23	V
6	Large quantities cannot be sold	18	60.00	10	33.33	02	06.67	1.53	II
7	Congested of market yard	21	70.00	8	26.67	01	03.33	1.67	I
8	More wastage of the produce	01	01.33	14	46.67	15	50.00	0.53	X
9	Bargaining by consumers	02	06.67	19	63.33	9	30.00	0.77	IX
10	Non-allotment of desired shop/stall	16	53.33	12	40.00	02	06.67	1.47	III
11	Lack of adequate hygiene in market premises	08	26.67	16	53.33	06	20.00	1.07	VIII
12	Inadequate transport facilities	02	6.67	09	30.00	19	63.33	0.40	XI

The results in Table 3 indicate that lack of door delivery and credit card facility was the major constraint faced by consumers, ranking first with a mean score of 1.33. This suggests that consumers expect convenient payment options and home

delivery services, which are currently inadequate in HOPCOMS outlets. The increasing use of digital payments and online purchasing habits, especially in urban areas such as Bengaluru Urban district, has raised consumer expectations for facilities like card payments, UPI and doorstep delivery. The absence of these services reduces convenience for working consumers and elderly customers.

The reduction in the number of retail outlets ranked second (mean 1.27), which may limit consumer access and convenience. Fewer outlets can lead to overcrowding in existing stores and may require consumers to travel longer distances to purchase fruits and vegetables. Improper store ambience or retail space ranked third (mean 1.20), reflecting dissatisfaction with factors such as poor lighting, limited display space and lack of cleanliness, which affect the overall shopping experience.

Inconvenient store location ranked fourth (mean 1.13), indicating that some outlets may not be easily accessible to consumers. High prices of fruits and vegetables ranked fifth (mean 0.97), suggesting that consumers perceive prices to be relatively higher compared to nearby vendors or local markets, possibly due to operational and transportation costs. The irregular supply of required fruits and vegetables (Rank VI; mean 0.83) indicates inconsistency in product availability, which may arise from fluctuations in procurement and seasonal production. Improper handling of produce by retail outlets (Rank VII; mean 0.77) suggests inadequate handling and storage practices that may affect quality. Finally, the non-availability of a wide range of fruits and vegetables ranked eighth (mean 0.57), indicating limited variety available to consumers. Overall, these constraints highlight the need for improved consumer services, better infrastructure and more efficient supply management to enhance consumer satisfaction.

Table 3: Constraints faced by consumers in purchasing of fruits and vegetables from HOPCOMS (n2a = 30)

Sl. No	Constraints	Response						Mean Score	Rank
		Greater Extent		Lesser Extent		Not at all			
		f	%	f	%	f	%		
1	Higher price for fruits and vegetables	07	23.33	15	50.00	08	26.67	0.97	V
2	Non-availability of wide range of fruits and vegetables	02	6.67	13	43.33	15	50.00	0.57	VIII

3	Irregular supply of required fruits and vegetables	04	13.33	17	56.67	09	30.00	0.83	VI
4	Improper store ambience/retail space	10	33.33	16	53.34	04	13.33	1.20	III
5	Lack of door delivery facility and credit card facility	13	43.33	14	46.67	03	10.00	1.33	I
6	Inconvenient store location	10	33.33	14	46.67	06	20.00	1.13	IV
7	Reduction in number of retail outlets	12	40.00	14	46.67	04	13.33	1.27	II
8	Improper produce handling by the retail outlets	04	13.33	15	50.00	11	36.67	0.77	VII

The results in Table 4 show that price variability across stalls was the major constraint faced by consumers in Raithara Santhe, ranking first with a mean score of 1.47, indicating inconsistency in prices for the same produce within the market. This variation may occur because different producers sell similar commodities at different prices depending on quality, quantity brought to the market and individual pricing decisions. The lack of shelter during uneven weather conditions ranked second (mean score 1.40), highlighting the absence of proper protection from sun and rain. Since Raithara Santhe markets are mostly open markets, consumers may face inconvenience during adverse weather conditions. Insufficient parking area was the third major constraint (mean score 1.37), reflecting inadequate space for vehicle movement and parking, which may discourage consumers from visiting the market regularly.

The non-availability of a wide range of fruits and vegetables ranked fourth (mean 1.23), suggesting limited product diversity, which may occur due to seasonal availability or limited number of producers bringing different commodities. The availability of fruits and vegetables not being displayed on boards (Rank V; mean 1.17) indicates poor information display, making it difficult for consumers to easily identify the products available in the market. Lack of adequate hygiene in market premises ranked sixth (mean 0.97), indicating sanitation and cleanliness issues that may affect the overall shopping environment. Inadequate quality of produce (Rank VII; mean 0.73) reflects consumer dissatisfaction with freshness or grading of produce, while poor handling of produce ranked eighth (mean 0.67), showing that improper storage and handling practices by vendors may affect product quality. Overall, these constraints highlight the need for

improved infrastructure, better hygiene management, and standardized pricing practices to enhance consumer convenience in Raithara Santhe markets.

Table 4: Constraints faced by consumers in purchasing of fruits and vegetables from Raithara Santhe (n2b = 30)

Sl. No	Constraints	Response						Mean Score	Rank
		Greater Extent		Lesser Extent		Not at all			
		f	%	f	%	f	%		
1	Price variability across stalls	16	53.33	12	40.00	02	06.67	1.47	I
2	Non-availability of wide range of fruits and vegetables	11	36.67	15	50.00	04	13.33	1.23	IV
3	Lack of shelter during uneven weather conditions	15	50.00	12	40.00	03	10.00	1.40	II
4	Availability of fruits and vegetables are not displayed on boards	11	36.67	13	43.33	06	20.00	1.17	V
5	Insufficient parking area	16	56.67	09	30.00	05	16.67	1.37	III
6	Lack of adequate hygiene in market premises	06	20.00	17	56.67	07	23.33	0.97	VI
7	Poor handling of produce	02	06.67	16	53.33	12	40.00	0.67	VIII
8	Inadequate quality of produce	02	06.67	18	60.00	10	33.33	0.73	VII

Table 5 shows the suggestions given by producers in marketing fruits and vegetables to HOPCOMS. The major suggestions given by the majority (93.33 %) of producers was that HOPCOMS should procure larger quantities of produce, followed by ensuring timely payment (80.00 %). About 66.67 per cent suggested providing training on grading and packaging to minimize rejection, while 60.00 per cent suggested providing cold storage facilities. Further, 56.67 per cent of producers suggested giving regular and prior indents and 53.33 per cent stressed the need for timely market information. Half of the producers (50.00 %) felt that

transportation facilities should be provided. The least preferred suggestion was ensuring remunerative prices for the produce (30.00 %). The results are in line with Gurjar et al. (2017).

The results indicate that producers mainly expect improvements in procurement and operational support. The higher preference for larger procurement quantities and timely payments reflects the producers' need for assured market access and quicker financial returns. Suggestions such as training on grading and packaging, cold storage facilities and transportation support highlight the post-harvest and logistical difficulties faced by producers. In addition, the demand for prior indents and timely market information indicates the need for better coordination and planning between producers and HOPCOMS to facilitate smooth marketing of fruits and vegetables.

Table 5: Suggestions expressed by producers in marketing of fruits and vegetables to HOPCOMS (n1a = 30)

Sl.No.	Suggestions	Response		
		Frequency	Percentage	Rank
1	Procure larger quantities of produce	28	93.33	I
2	Ensure in time payment	24	80.00	II
3	Provide transportation facilities	15	50.00	VI
4	Ensure availability of market information	16	53.33	VII
5	Giving regular and prior indents	17	56.67	IV
6	Provide cold storage facilities	18	60.00	V
7	Provide farmers training on grading and packaging to prevent rejection of the produce	20	66.67	III
8	Ensure remunerative prices for the produce	09	30.00	VIII

Table 6 presents the suggestions expressed by producers in marketing fruits and vegetables to Raithara Santhe. The majority (86.67 %) of producers suggested shifting the market yard to another location, which ranked first. This indicates their dissatisfaction with the present location, possibly due to congestion, limited

accessibility and inadequate infrastructure facilities. The second most suggested aspect was improving market infrastructure and establishing linkages with institutional buyers (80.00 %), reflecting producers' need for better facilities and more organized marketing channels to reduce unsold produce. The allotment of desired stalls (70.00 %) ranked third, followed by ensuring easy access to the market and availability of market-related information (63.33 %), which ranked fourth. These suggestions highlight the importance of transparent stall allocation and timely information to support producers' marketing activities.

Further, the availability of parking areas (60.00 %) and storage and godown facilities (56.67 %) were also considered important by producers, indicating the need for improvements in basic infrastructure. Moderate importance was given to maintaining hygiene in market premises (46.67 %) and arranging proper waste disposal (43.33 %), which ranked seventh and eighth respectively, showing concern for better market management and cleanliness. The least suggested aspect was the provision of transportation facilities (33.33 %), ranking ninth, which may indicate that many producers already arrange their own transport or depend on nearby markets. The results are in line with the findings of Bhavitha and Reddy (2024).

Table 6: Suggestions expressed by producers in marketing of fruits and vegetables to Raithara Santhe (n1b=30)

Sl.No.	Suggestions	Response		
		Frequency	Percentage	Rank
1	Provide transportation facilities	10	33.33	IX
2	Ensure availability of parking area	18	60.00	V
3	Shift market yard to other places	26	86.67	I
4	Provide storage & godown facilities	17	56.67	VI
5	Allotment of desired stalls	21	70.0	III
6	Ensure easy access to the market and market information, such as prices, mobile apps, etc.	19	63.33	IV

7	Improving market infrastructure and linkages with institutional buyers to enhance farmers marketing efficiency and reduce unsold produce	24	80.00	II
8	Arrange proper waste disposal	13	43.33	VIII
9	Maintain hygiene in market premises	14	46.67	VII

Table 7 presents the suggestions given by consumers in purchasing fruits and vegetables from HOPCOMS. The majority (76.67 %) of consumers suggested increasing the number of retail outlets, ranking first, which indicates the need for better accessibility and availability of outlets in different locations. This was followed by ensuring door delivery and credit card facilities (70.00 %), reflecting consumers' growing preference for convenient services and digital payment options. Maintaining proper store ambience and adequate retail space (60.00 %) ranked third, showing that consumers prefer a clean, organized and comfortable shopping environment.

Further, 53.33 per cent of consumers emphasized the need for reasonable prices, while 46.67 per cent suggested ensuring a regular supply of fruits and vegetables. Half of the respondents (50.00 %) also felt that better handling of produce at retail outlets is necessary to maintain freshness and quality. The least suggested aspect was ensuring a wide range of fruits and vegetables (36.67 %), indicating that consumers are comparatively more concerned about accessibility, convenience and service quality than product variety.

Table 7: Suggestions expressed by consumers in purchasing fruits and vegetables from HOPCOMS (n2a= 30)

Sl.No.	Suggestions	Response		
		Frequency	Percentage	Rank
1	Availability of fruits and vegetables at reasonable price	16	53.33	IV
2	Ensure wide range of fruits and vegetables	11	36.67	VII
3	Ensure regular supply of required fruits and vegetables	14	46.67	V

4	Maintain proper store ambiance/retail space	18	60.00	III
5	Ensure door delivery facility and credit card facility	21	70.00	II
6	Proper produce handled by retail outlets	15	50.00	VI
7	Increase the number of retail outlets	23	76.67	I

From Table 8, it is evident that the suggestions expressed by consumers in purchasing fruits and vegetables from Raithara Santhe indicate several areas for improvement. The majority (76.67 %) of consumers suggested ensuring uniform pricing at each stall based on the grade of produce, which ranked first. This indicates that price consistency and fairness are the foremost expectations of consumers while purchasing from the market. The second most emphasized suggestion was to ensure shelter during uneven weather conditions (66.67 %), followed by the provision of an adequate parking area (63.33 %), which ranked third. These suggestions highlight the importance of improving basic infrastructure to make the market more convenient and accessible for consumers.

A considerable proportion (56.67 %) of consumers expressed the need to ensure the availability of a wide range of fruits and vegetables, while maintenance of hygiene and cleanliness (53.33 %) and setting up display boards indicating available produce at each stall (50.00 %) were also considered important improvements to enhance consumer convenience. Furthermore, grading and sorting of produce before sale (46.67 %) was viewed as a necessary measure to improve quality perception among buyers. The least suggested aspect was proper handling of the produce (40.00 %), which ranked eighth, indicating that although important, it was perceived as a relatively less pressing concern compared to price and infrastructure-related aspects. Overall, these suggestions emphasize the need for better market management, improved infrastructure and transparent pricing practices to enhance consumer satisfaction in Raithara Santhe markets.

Table 8: Suggestions expressed by consumers in purchasing of fruits and vegetables Raithara Santhe (n2b=30)

Sl.No.	Suggestions	Response		
		Frequency	Percentage	Rank
1	Ensure uniform pricing at each stall based on the grade of produce	23	76.67	I

2	Ensure availability of wide range of fruits and vegetables	17	56.67	IV
3	Ensure shelter to consumers during uneven weather conditions	20	66.67	II
4	Set up display boards indicating which fruits and vegetables are available at which stalls/counter	15	50.00	VI
5	Provide an adequate parking area	19	63.33	III
6	Maintenance of hygiene and cleanliness at Raithara santhe	16	53.33	V
7	proper handling of the produce	12	40.00	VIII
8	Ensure produce is properly graded and sorted before sale	14	46.67	VII

Implication

- Raithara Santhe markets may be shifted to suitable peripheral areas of the city to ensure smooth traffic flow, reduce overcrowding and improve the overall functioning of the marketplace. In addition, uniform pricing based on the grading of produce should be ensured, as price variations among sellers are observed. The APMC authorities should implement strict monitoring and regulatory mechanisms to maintain price transparency and consistency across stalls.
- To strengthen competitiveness with modern retail chains, HOPCOMS should adopt order-based supply mechanisms and home delivery services as part of its market expansion strategy.
- Proper store ambiance can enhance consumer accessibility. Ensuring freshness, correct weight and standardized pricing, along with awareness campaigns, can improve consumer satisfaction and confidence in organized markets.

Conclusion

The study highlights critical issues affecting both producers and consumers in Bengaluru's horticultural markets. HOPCOMS suffers from operational inefficiencies such as limited procurement and delayed payments, while

Raithara Santhe faces infrastructural constraints and lack of organized market management. Consumers from both systems experience convenience-related and hygiene-related issues.

Producers and consumers collectively suggested stronger procurement systems, better infrastructure, modernized retail practices, transparent pricing and improved hygiene. Addressing these challenges is essential to create an efficient, accessible and transparent marketing ecosystem that benefits producers and consumers alike.

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Climate change effect on gender roles and practical and strategic gender needs

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ABSTRACT

A proper understanding of practical and strategic gender needs and gender roles can help formulate appropriate extension interventions to address various issues including the implications of climate change. The study identified practical and strategic gender needs and changing gender roles among households pursuing crop and dairy enterprises in the three villages one each from Karnal, Yamunanagar and Sirsa districts of Haryana adopted under the Technology Demonstration Component of the National Innovations in Climate Resilient Agriculture (NICRA) Project. A majority of female respondents (53.33 %) expressed the need for information related to access to inputs, followed by financial needs expressed by 41.11 per cent. Nearly all women respondents (97.78 %) voiced the need for collective organization into women's groups / SHGs. The addition of roles for females and males (80.56 %) and increased demands on both (94.44 %) were reported due to greater involvement of women in agricultural activities such as sowing, transplanting, harvesting and threshing, while men required information development related to and skill changing crop patterns, new varieties and seed management. The identified gender needs require targeted interventions at both districts and aggregate level to enhance resilience and reduce gender based household vulnerability.

Key Words: Gender Role, Crop and Dairy Enterprises, Practical and Strategic Gender Needs

Introduction

Crop and dairy farming play a vital role in the livelihood and nutritional security of India. These farm enterprises are highly sensitive to climate change and climate variability which pose serious long term challenges to productivity and profitability. Small holder farmers bear the major brunt of climate change due to limited resources for adaptation. Projections suggest potential yield reductions of 9-18 per cent, posing serious threats to food and livelihood security (Pathak, 2023). Dairy farming too, faces direct and indirect impacts such as heat stress

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in animals resulting in reduced feed intakes and milk production, increased disease incidence, decreased reproductive performance and shortage of feeds and fodder (Ponnusamy and Devi, 2017; Ponnusamy et al, 2019).

Every segment of the population is potentially vulnerable to climate change and gender-differentiated risks significantly affect access to resources, decision-making processes and division of labour among men and women (Bhuyan et al, 2018). Evidence suggest that vulnerability to climate change tends to differ within countries, within communities and even within households (Bhange, 2024). Men and women farmers often perceive and respond to climate change differently, in their efforts livelihoods and food security (David et al, 2019). This has important implications for gender specific capacity and resilience in crop and dairy enterprises (Chakravarty et al, 2021a). Therefore it is to understand gender roles along with practical and strategic gender needs, and gender differences must be incorporated into of vulnerability assessments into planning adaptation strategies.

Materials and Methods

Sampling

The present study was conducted in Karnal, Yamunanagar, and Sirsa districts of Haryana, under the Technology Demonstration Component (TDC) of the NICRA project as these locations were the implementation sites for climate resilient agricultural interventions aimed at addressing the farming vulnerabilities. Three villages, one from each district adopted under TDC-NICRA were purposively selected. From each village, 30 households engaged in crop and dairy farming were selected, resulting in a total sample of 90 households.

Data Source

Primary data were collected from the selected households through personal interviews using a structured and pre-texted schedule that included information on socio economic characteristics and variables related to exposure, sensitivity and adaptive capacity. Prioritization of gender vulnerability issues was carried out using a gender vulnerability issue ranking matrix through Participatory Rural Appraisal.

Assessing the effect of climate change on the existing roles of men and women in farm and family

The effect of climate change on the existing roles of men and women in farm and family was envisaged through Gender Planning Framework as suggested by Moser (2005). This framework is based on the collection and analysis of gender disaggregated information on the roles performed, women's practical and

strategic needs and control and access over resources and benefits. Information was collected based on the developed schedule using standard procedure from male and female respondents. Gender planning framework divides gender roles into three categories viz., productive, reproductive and community roles. Each of these categories consists of a number of activities. The productive role comprises activities related to production of goods for subsistence and income generation, while the reproductive role consists of activities related to household care such as bearing and rearing children, food preparation, cleaning, marketing etc. i.e., concerned with provision of future labour force Community role comprises of community activities performed as a member of the community. The existing roles performed by the male and female respondents were initially recorded and the changes were captured in three ways viz., "Addition" i.e, role not performed earlier, "Substitution" i.e., substitution of male for female or vice versa for the role performance, and, "More time claim" i.e., role was performed earlier, but now more time is required to be spent on it by men, women or both. The changes captured with respect to the roles performed were analysed using frequency and percentage.

Results and Discussion

Effect of climate change on existing roles of men and women in farm and family

The existing gender roles, practical and strategic needs of women, and the changes in gender roles are presented as follows:

Gender role activity profile

The gender roles are the roles performed by men and women under three broad categories viz., Productive role, Reproductive role and Community involvement role (Moser, 2005). As depicted in Table 1, activities under the productive role were mostly performed by men.

Table 1: Gender Role Activity Profile of Respondents

Roles / Activities	Females (n=90)		Males (n=90)	
	f	%	f	%
Productive Role				
Crop farming	53	58.89	87	96.67
Dairy farming	86	95.56	71	78.89
Income generation	30	33.34	82	91.11
Employment	4	04.44	74	82.22
Irrigation water in the field	4	04.44	75	83.33

Fuel related	5	05.55	69	76.67
Cleaning & repair	16	17.78	75	83.33
Market related	11	12.22	82	91.11
Reproductive Role				
Fetching water	81	90.00	33	36.67
Fuel related	83	92.22	47	52.22
Food preparation	89	98.89	5	05.55
Childcare	88	97.78	25	27.78
Health related	85	94.44	36	40.00
Cleaning and repair	78	86.67	36	40.00
Market related	47	52.22	82	91.11
Community Involvement Role				
Attendance at meetings	63	70.00	89	98.89
Religious activities	84	93.33	84	93.33
Recreation	21	23.33	76	84.44
Community activities	29	32.22	79	87.78

In crop farming, 96.67 per cent males were found to be engaged against 58.89 per cent female respondents. However, in dairy farming the situation was reverse, 95.56 per cent females performed the dairy related activities as compared to 78.89 per cent males, due to the existing traditional gender roles in the villages. This draws support from the findings of Bhange, (2024, who reported existence of clearly defined gender roles within agriculture; while women were responsible for sowing, weeding and tending cattle, men concentrated on ploughing, irrigation and pest control. The roles performed by women respondents in income generation and employment (33.34 and 4.44 %, respectively) were significantly less compared to the same roles assigned to men (91.11 and 82.22 %). This could be due to the traditional gender concept of men being the 'Breadwinner' of the family and women were designated as the 'Caretaker' (Chakravarty et al, 2021b). This observation is in accordance with that of Bhuyan et al (2018) who reported that males have been traditionally understood as 'providers'. The care taking role of women is also evident from the reproductive role performance, which was assigned mostly to the women. In all activities, a majority of the women respondents were actively involved, 98.89 per cent in food preparation, 97.78 per cent in child care and only 52.22 per cent in the marketing role, men were more active than women. (91.11 % men compared to 52.22 % of the women respondents). The community involvement

role was again performed to a larger extent by the male respondents while women were equally involved in religious activities of the community (93.33 % each, of male and female respondents). The evident existence of gender roles was also reported by Bhuyan (2018), who found that the community has gender roles that are socially embedded and every person is recognized through these roles. They further stressed that this stratification makes adaptation a big challenge to the community and also increases gender vulnerabilities.

Women's practical and strategic felt needs

Women's practical felt needs are directly related to their role performance however, these needs do not challenge the gender division of labour or the gender roles performed in the farm and family. Perusal of Table 2 reveals that majority of the female respondents (53.33 %) expressed the need for information related to access to inputs, followed by financial need felt by 41.11 per cent and training need perceived by 36.67 per cent women respondents. Investigation of specific needs pertaining to climate change adaptation revealed that 40 per cent of the respondents required information related to climate change adaptation, followed by training perceived by 30 per cent of the respondents. This draws support from Daze (2011), who has reported that adaptation is a process requiring availability of appropriate, timely and locally relevant climate information.

Table 2: Women's Practical Felt Needs (n=90)

Women's practical needs			
Broad needs	**Specific need**	**F**	**%**
Access to inputs	Finance	37	41.11
	Training	33	36.67
	Information	48	53.33
	Veterinary medicines	14	15.55
	Mineral mixture	22	24.44
	Animal husbandry support	25	27.78
	Mobile phones	12	13.33
Needs related to CC adaptation	Training	27	30.00
	Information	36	40.00
	Technical support	11	12.22
	Adaptation options	9	10.00
	Hand holding support	21	23.33

Improved ovens/ cooking stoves	LPG	8	08.89
Marketing of products	Training on market intelligence	13	14.44
	Tie up with NGOs etc. for home/ farm pick up of products	13	14.44
Specific training (Income generating activities)	Value addition of milk	23	25.55
	Computer literacy	21	23.33
Access to insurance	Linking up SHGs with insurance schemes/ benefits for family members and dairy animals	47	52.22
Access to equal wages	Same as paid to men	14	15.55

Further perusal of the table reveals that hand holding support was required by 23.33 per cent of the respondents. More than half (52.22 %) of the respondents expressed the need for linking up the SHGs with insurance schemes to improve woman's access to insurance. The need for equal wages to men and women was voiced by 15.55 per cent of the respondents although gender parity in terms of wage in NREGA is already reflected in this scheme of the Government.

The strategic felt needs are the needs that challenge or alter the gender division of labour, for their fulfilment. These needs bring about structural changes in the position of women. The needs brought out by the investigation are revealed in Table 3. It can be observed that nearly all the women respondents (97.78 %) voiced their need for collective organization into women's groups / SHGs. Compulsory education for girls was the need expressed by 83.33 per cent of the respondents followed by security for girl students to provide a safe environment to pursue their education in tates like Haryana. Patron support was required by 22.22 per cent of the respondents for moral and psychological motivation.

Table 3: Women's Strategic Felt Needs (n=90)

Women's strategic needs			
Broad Needs	**Specific need**	**F**	%
Collective organisation	Women group / SHG	88	97.78
Skills in leadership and leadership position	Training in leadership skill development	11	12.22
	Patron support	20	22.22
Education	Compulsory education for girls	75	83.33
	Higher education facilities for girls near to village	47	52.22
	Security for girl students	59	65.55
Property rights	Strict enforcement of property rights for women and girls	7	07.78
Observance of purdah	Should be left to the will of the women/ girls	9	10.00
Access to employment	More opportunities for women	16	17.78
	Creche in the village	43	47.78
	Elderly day care support	12	13.33
Family Support	Family approval and support	42	46.67

Besides requiring more opportunities for themselves (17.78 %), the women also expressed the need for enhanced access to employment through village level support facilities such as a crèche (47.78 % of the respondents).

Changes in productive roles of men and women in farm and family

The productive roles performed by men and women are oriented towards production of goods for household consumption and also for income generation. Since production is impacted by climate change, the productive roles, too, are likely to change or shifts in roles may occur. The shifts in productive role performance captured by this investigation are presented in Table 4.

The crop farming roles of men and women were found to be changing in terms of addition for seeking more information on adaptation options (66.67 %), substitution of male's role by female role performance (26.67 %) and more time claim in role performance reported by cent perfect of the respondents. Addition of roles for females and males (80.56 %) and more time claim for females and males (94.44 %) was opined due to more involvement of women in agricultural activities such as sowing, transplanting, harvesting, threshing and the males for information and skill building on changing crop patterns, new varieties and seed management. The results are in accordance with the findings of Ngugi (2014), who found that while men have been forced to go out and look for water and fodder crops during drought periods, and are spending a lot of time in the fields, women are working for longer hours in their households. The study further revealed that recent changes in climate have altered the roles that men and women play in their households.

In dairy farming too, information seeking on resilient dairy farming practices was reported to be an additional role activity for both, men and women (87.22 %), substitution (male for female) for 32.78 per cent respondents and cent percent of the respondents opined that this role performance was claiming more time. As men were engaging in off-farm livelihood options, the burden on women to supplement family income was found to be increasing in the wake of impact of climate change on livelihood security of family. This was reported to claim more time for women (57.78 %), substitution (female for male) to the tune of 22.78 per cent and additional role activity performed by both females and males, by 71.67 per cent of the respondents (Chakravarty et al, 2021a).

The above findings were found to be in line with those of Babugura et al. (2010) who reported that women had extra workloads when faced with climatic stressors and were working longer hours than men which affected them physically and emotionally.

Irrigation of fields required additional role performance for women (32.78 %) and more time claim for men as reported by a large majority of the respondents (90.00 %). Further, marketing of perishable products like milk was reported to be additionally performed by women (56.67 %) and as a substitution of female role performance for male, as reported by 27.78 per cent of the respondents.

The care giving role of women for family members and dairy animals was opined to be claiming more time by (95.56 %) respondents and protection of animals from heat stress was reported as substitution (male for female) of role, by 25 per cent and to be claiming more time by all the respondents, as revealed in Table 4.

Table 4: Effect of Climate Change on Productive Roles of Men and Women in Farm and Family (n=180)

Traditional Roles in the Farm	Change in roles performed			f (%)	Climate related Reason /issue causing change
Females & Males	Females	Males	Addition /Substitution / More time claim		
Crop farming	Storage of farm produce for household (HH) consumption	More information seeking on adaptation options	Addition (F & M)	120 (66.67)	CC is impacting Crop Farming adversely
			Substitution (F for M)	48 (26.67)	
			More time claim (F)	180 (100.00)	For resilience in farm production, adoption of drought resistant varieties, salt tolerant varieties, fodder multi cut varieties is essential
	More involvement in agri. activities such as sowing, transplanting, harvesting, threshing	Information & skill building on changing crop patterns, new varieties, seed management	Addition(F & M)	145 (80.56)	
			More time claim (F&M)	170 (94.44)	When agriculture work is given priority due to climate forecasts and sowing, harvest time are altered
Dairy farming	Information seeking on resilient DF Practices	Information seeking on resilient DF Practices	Addition (F & M)	157 (87.22)	CC is impacting Dairy Farming adversely
	Value-addition of farm products, specially milk		Substitution (M for F)	59 (32.78)	
			More time claim	180 (100.00)	
	Animal health management		More time claim	129 (71.67)	Disease incidence and pest attacks increase
	Storage of feed for animals	Storage of feed for animals	Substitution (M for F)	45 (25.00)	Unseasonal rainfall
	Fresh water for animals	Fresh water for animals	More time claim (F & M)	180 (100.00)	Dry spells and drought conditions

	Protection of animals from heat stress	Protect animals from heat stress			Heat stress periods : milk yield decreases, fertility decreases
Income Generation & Employment	Load on W increases to supplement family income through skill building and income generating options	Off-farm livelihood options	More time claim (F)	104 (57.78)	Due to CC, yields decrease, diseases in crops and dairy animals increase, benefits decrease and livelihood security is challenged
			Substitution (F for M)	41 (22.78)	
			Addition (F & M)	129 (71.67)	
Water related	Irrigation of fields	Irrigation of fields	Addition (F)	59 (32.78)	During droughts, more irrigations are required and irrigation water is available for limited time period, so, women of the family are also involved
			More time claim (M)	162 (90.00)	
Cleaning & repair	Cleaning of fields	Cleaning of fields	Addition (F)	50 (27.78)	In the events of dust storms or sand storms etc.
			More time claim (M)	134 (74.44)	
Market related	Marketing of perishable products like milk		Addition (F)	102 (56.67)	When men are attending NICRA meetings, trainings, other prioritized crop farming activities
	More Climate vigilant role	More Climate vigilant role	Substitution (F for M)	50 (27.78)	
			Addition (M & F)	180 (100.00)	

Figures in parentheses indicate percentages

Table 5: Effect of Climate Change on Reproductive Roles of Males and Females in Farm and Family

Traditional Roles in the Family	Change in roles performed			f (%)	Climate related Reason /issue causing change
Females & Males	Females	Males	Addition/Substitution /More time claim		
Fuel related	Gathering fuel wood And making dung cakes	Booking LPG	More time claim (F)	34 (18.89)	More awareness to use LPG
			Addition (M)	129 (71.67)	
			More time claim (M)	67 (37.22)	
Food preparation	Special meals for sick persons	-	More time claim (F)	157 (87.22)	More family members fall sick due to CC/ Variability/ Extremities
Childcare and Health related	Simultaneous with other productive and reproductive role activities	-	More time claim (F)	159 (88.33)	In the wake of climate events, child care and other prioritized activities are to be carried out simultaneously, leads to double burden
	Care giving role for family members and dairy animals	-	More time claim (F)	172 (95.56)	Increased incidence of diseases in inclement climate conditions
Cleaning and repair	Cleaning	Cleaning	More time Claim (F &M)	120 (66.67)	In the events of dust storms or sand storms etc.
Market relate	-	Buying medicines etc	More time claim	121 (67.22)	Disease incidence increases

Figures in parentheses indicate percentages

Table 6: Effect of Climate Change on Community Involvement Roles of Males and Females in Farm and Family

Traditional Roles performed	Change in roles performed			f (%)	Climate related Reason/ issue causing change
Females & Males	Females	Males	Addition/ Substitution/More time claim		
Attendance at meetings	Attending meetings for NICRA Project	Attending meetings for NICRA Project	Addition (M & F)	161 (89.44)	Discussion about CC impacts and adaptation measures
			More time claim (M & F)	180 (100.00)	
Recreation	Additional work load has reduced recreation time	Recreation time is also combined with information gathering	Addition (M & F)	99 (55.00)	CC impacts have resulted in decreased yields, farmers are always seeking information from fellow farmers
Community activities	Community involvement in Programmes: Awareness programmes, adoption of adaptation measures	Community involvement in Programmes: Awareness programmes, adoption of adaptation measures	Addition (M & F)	123 (68.33)	Sensitization to CC impacts and to build skill in climate change adaptation
			More time claim (M & F)	165 (91.67)	
	Involvement in Groups: SHGs, VCRMC	Involvement in Groups: SHGs, VCRMC	Addition (M & F)	39 (21.67)	Male and female farmers opine that group membership will help them in coping with CC impacts and climate variability
			More time claim (M & F)	65 (36.11)	
	NRM Programmes such as Manure pits, Seed bank, etc.	NRM Programmes such as Manure pits, Seed bank, etc.	Addition (M & F)	42 (23.33)	Natural resource management is imperative to cope with future CC impacts.
			More time claim (M & F)	96 (53.33)	

Figures in parentheses indicate percentages

Changes in reproductive roles of men and women in farm and family

The reproductive roles that includes for bearing and rearing children, household management etc. are known to claim a large share of women's time and women are defined based on the reproductive role performance. Table 5 depicts of climate induced changes captured in reproductive role performance. Though 18.89 per cent respondents reported that women had to spend more time in fuel wood gathering and making dung cakes, it was observed that fuel related role performance of males was an additional role performed by them, as reported by 71.67 per cent of the respondents. This could be due to increased use of LPG as cooking fuel in most of the rural households and the males were arranging the refilling of cylinders. Due to climate change variability and extremities, more family members were falling suffering with various ailments. The care giving role of women was therefore claiming more time, as reported by 88.33 per cent of the respondents.

Further, the food provision and preparation role of women was reported (by 87.22 percent respondents) to be claiming more time as they had to prepare special meals for sick family members, too. This observation is supported by Lambrou and Nelson (2010), who found that 61 per cent women and 50 per cent men reported increased pressure for provision of food during climate stress periods in Andhra Pradesh, India.

Changes in community involvement roles of men and women in farm and family

The roles played by men and women as members of a community are important as, responses to climate stresses are not entirely individual oriented. Many actions by the community are called for while coping with climate change impacts. A perusal of Table 6 indicates that the community involvement roles of men and women in farm and family was reported to be varying in terms of addition (89.44 %) and more time claim by all the respondents for attending meetings related to NICRA Project.

In the case of women, additional workload (reported by 55 % of the respondents) had reduced their recreation time and recreation time was also combined with information seeking on resilient production, in the case of men. The involvement of respondents in Natural Resource Management (NRM) programmes was reported to be an additional role performance by males and females (23.33 %) and claiming more time by 53.33 per cent of the respondents.

Conclusions

The study revealed that women expressed substantial practical and strategic needs aligned with current agro-climatic and socio-economic conditions. Climate variability and extreme events have increased the incidence of illness

among family members, thereby increasing the care given responsibilities of women and the time required for these activities. Awareness programmes and collective organization of women should be strengthened to address climate-sensitive vulnerabilities in the study area. To enhance adaptive capacity, factors such as farm size, access to weather advisories, per capita off-farm income, and availability options should be incorporated into climate change adaptation programmes.

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Factors influencing the information seeking behaviour of Postgraduate students of University of Agricultural Sciences, Raichur

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ABSTRACT

The present study was undertaken to examine the factors influencing information seeking behaviour of postgraduate students at the University of Agricultural Sciences, Raichur. The study followed an ex-post-facto and descriptive research design. Data were collected from postgraduate students using a structured questionnaire. Selected factors such as achievement motivation, scientific orientation, curiosity, level of understanding, intelligence, aptitude, general ethics, proximity of the university library and familiarity with the library were analysed using frequency, percentage and correlation. The findings revealed that postgraduate students possessed considerable levels of achievement motivation, scientific orientation, curiosity and a sound level of understanding. Most respondents also reported high levels of intelligence, aptitude and general ethics. With respect to institutional factors, a large proportion of students perceived the university library as easily accessible and reported familiarity with library facilities. The findings indicated that psychological, cognitive and institutional accessibility factors collectively created a favourable environment for effective information seeking among postgraduate students. The study highlighted the need to strengthen academic motivation, cognitive skills and library orientation programmes to further enhance information seeking behaviour.

Keywords: Information seeking behaviour; Postgraduate students; Motivation; Library familiarity.

Introduction

Information seeking behaviour plays a crucial role in postgraduate education, where students are expected to independently search, evaluate and utilise information for academic and research purposes. The effectiveness of information

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seeking depends not only on availability of resources but also on individual psychological and cognitive attributes as well as institutional accessibility factors.

Factors such as motivation, scientific orientation, curiosity, intelligence and aptitude influence an individual's inclination and ability to seek information. Ethical orientation further governs responsible use of information, while proximity and familiarity with library facilities determine ease of access and utilisation of information resources.

Although several studies have examined information seeking behaviour among students, limited attention has been given to the combined role of psychological, cognitive and institutional factors among agricultural postgraduate students. Hence, the present study was undertaken to analyse selected factors influencing information seeking behaviour of postgraduate students at the University of Agricultural Sciences, Raichur.

Research Design

A survey research design was used to understand the information-seeking behaviour of postgraduate students in relation to ICTs (Information and Communication Technology) during the academic year 2022-23. The research focused on the university library located on the Raichur campus.

Sampling Design

The census method was employed for data collection. The target population comprised 449 students, including M.Sc. (Agriculture), M.Tech. (Agricultural Engineering) and Ph.D. scholars. Questionnaires were distributed to all 449 respondents. However, despite best efforts, only 375 completed questionnaires were retrieved. Thus, the final sample size for the study consisted of 375 students, representing a diverse cross-section of the student population.

Tools and techniques

A self-structured instrument was developed by the researcher after a thorough review of literature and consultation with subject matter specialists to measure achievement motivation, scientific orientation, curiosity, level of understanding, intelligence, aptitude general ethitcst, proximity of University library and familiarity. The content validity of the instrument was ensured through expert evaluation.

Method of Data Collection

A well-structured questionnaire was designed based on a review of relevant studies and consultations with experts in agricultural extension and related subjects.

Statistical Tools Used

The collected data were systematically tabulated and analyzed using appropriate statistical techniques, including frequency, percentage and correlation analysis, to summarize key trends, patterns and relationships among the variables.

Results and discussion

Achievement motivation

The results revealed that 62.40 per cent of the postgraduate students exhibited a medium level of achievement motivation, followed by 20.53 per cent with low achievement motivation. Only 11.20 per cent of the students showed a high level of achievement motivation, while a small proportion (05.87 %) fell under the very low achievement motivation category. The predominance of students with medium to high levels of achievement motivation suggests a favourable academic environment for effective information seeking behaviour among postgraduate students.

The present findings are supported by Rajpurakar and Sujata (2017), who reported that academic requirements such as examination preparation, project work and class-related activities acted as strong achievement motivation for information seeking among student-teachers. This reinforces the role of achievement motivation in promoting active information seeking behaviour among postgraduate students.

Scientific orientation

With respect to scientific orientation, a large majority of the respondents (71.11 %) exhibited strong scientific orientation, followed by 17.96 per cent who were somewhat strong. Very strong scientific orientation was observed among 09.87 per cent of the students, while only 01.06 per cent were not strong. The predominance of strong scientific orientation reflects students' inclination towards scientific methods, empirical evidence and logical reasoning. Such orientation enhances students' preference for authentic and credible information sources such as research journals, theses and scientific databases. Strong scientific orientation is particularly important for postgraduate students as it shapes their approach to information evaluation and encourages reliance on validated and peer-reviewed sources.

Curiosity

The findings showed that more than half of the postgraduate students (51.73 %) were curious and 42.40 per cent were very curious. Only a negligible proportion of students were somewhat curious (04.53 %) or not curious (01.34 %). High levels of curiosity indicate a strong intrinsic interest in learning and exploration.

Curiosity acts as a psychological trigger for information seeking, motivating students to search beyond prescribed materials and explore emerging concepts and research developments. Curious students tend to engage more actively with information systems and are likely to develop diverse and dynamic information seeking patterns.

The present results showing high levels of curiosity among postgraduate students are in agreement with earlier studies, where Orlu, 2016 reported that curiosity significantly influenced information seeking behaviour among master's students.

Level of understanding

The results indicated that 75.20 per cent of the respondents had a good level of understanding, followed by 19.20 per cent who had a very good level of understanding. Only 05.60 per cent reported a somewhat adequate level and none of the students fell under the 'not well' category. A higher level of understanding enables students to clearly identify information needs, formulate appropriate search queries and critically analyse retrieved information. This finding suggests that postgraduate students generally possess sufficient academic comprehension to engage effectively with complex and specialised information, thereby enhancing the quality of their information seeking behaviour.

The present results indicating a high level of understanding among postgraduate students are in agreement with earlier studies, where Avhad, 2023 reported that postgraduate students demonstrated good understanding of information sources and research processes due to regular academic and research exposure.

Intelligence

Regarding intelligence, nearly equal proportions of students fell under high (46.93 %) and average (47.20 %) categories, while only 04.80 per cent had very high intelligence and 01.07 per cent had very low intelligence. This distribution indicates that most students possessed adequate cognitive ability to comprehend, process and synthesise academic information. Intelligence contributes to students' ability to understand complex research materials, draw meaningful inferences and apply information effectively. Adequate cognitive ability supports systematic and purposeful information seeking, especially in postgraduate level research activities.

Aptitude

The findings revealed that 47.73 per cent of students had high aptitude, followed by 39.73 per cent with average aptitude. Very high aptitude was observed among 10.14 per cent of respondents, while only 02.40 per cent reported very

low aptitude. Aptitude reflects an individual's potential to learn and perform academic tasks efficiently. Students with higher aptitude are better equipped to adapt to different information sources, learn new search techniques and effectively utilise available information resources. The predominance of high and average aptitude among respondents indicates a favourable learning capacity that supports effective information seeking behaviour.

The present findings indicating high and average aptitude among postgraduate students are in agreement with earlier studies, where Avhad, 2023 reported that students with better academic aptitude demonstrated effective learning ability and efficient utilisation of information sources.

General ethics

With respect to general ethics, 55.73 per cent of the respondents exhibited strong general ethics, followed by 21.33 per cent who were having very strong general ethics. About 20.27 per cent exhibited somewhat strong general ethics and only 02.67 per cent exhibited not strong general ethics. General ethics is an important factor governing responsible information use, including proper citation practices, avoidance of plagiarism and respect for intellectual property rights. Strong ethical values among postgraduate students contribute to responsible and credible information seeking and utilisation, which is essential for maintaining academic integrity in research and scholarly work.

The present findings indicating strong general ethics among postgraduate students are in agreement with earlier studies, where McCabe et al, 2016 reported that strong ethical values among students promote responsible information use, proper citation practices and adherence to academic integrity norms.

Proximity of the university library

The results showed that 62.94 per cent of the students perceived the university library as near or very near (25.33 %). Only 09.60 per cent reported it as far and 02.13 per cent as very far. Physical proximity of the library significantly influences the frequency and ease of library use. Students who perceive the library as easily accessible are more likely to visit regularly, consult reference materials and seek assistance from library staff. The favourable perception regarding proximity indicates a supportive institutional environment that facilitates information seeking behaviour.

The present findings are supported by Deenadhayalu, 2016 who reported that distance of the library was a major factor limiting frequent library visits among students and other users. This highlights the importance of physical proximity of library facilities in promoting regular information seeking behaviour.

Familiarity with the library

In terms of familiarity, more than half of the respondents (54.93 %) were familiar with the library, while 36.54 per cent were somewhat familiar. Only a small proportion were very familiar (05.06 %) or not familiar (03.47 %). Familiarity with library facilities enhances students' confidence in navigating information systems, locating resources and utilising library services effectively. Moderate levels of familiarity observed among the majority suggest scope for further strengthening orientation and training programmes to improve students' efficiency and comfort in information search activities.

The findings of the present study are in agreement with Rathour and Priti (2017), who reported a relatively high level of awareness of library resources and services among students. This suggests that familiarity with library facilities plays an important role in enhancing effective information seeking behaviour.

Table 1. Factors influencing the information seeking behaviour of Postgraduate students (n=375)

Sl. No.	Criteria	f	%
1	**Achievement motivation**		
	Highly motivated	42	11.20
	Motivated	234	62.40
	Somewhat motivated	77	20.53
	Not motivated	22	05.87
2	**Scientific orientation**		
	Very strong	37	09.87
	Strong	216	71.11
	Somewhat strong	118	17.96
	Not strong	4	01.06
3	**Curiosity**		
	Very curious	159	42.40
	Curious	194	51.73
	Somewhat curious	17	04.53
	Not curious	5	01.34
4	**Level of understanding**		

	Very well	72	19.20
	Well	282	75.20
	Somewhat well	21	05.60
	Not well	0	00.00
5	**Intelligence**		
	Very high	18	04.80
	High	176	46.93
	Average	177	47.20
	Very low	4	01.07
6	**Aptitude**		
	Very high	38	10.14
	High	179	47.73
	Average	149	39.73
	Very low	9	02.40
7	**General ethics**		
	Very strong	80	21.33
	Strong	209	55.73
	Somewhat strong	76	20.27
	Not strong	10	02.67
8	**Proximity of the University library**		
	Very far	8	02.13
	Far	36	09.60
	Near	236	62.94
	Very near	95	25.33
9	**Familiarity**		
	Very familiar	19	05.06
	Familiar	206	54.93
	Somewhat familiar	137	36.54
	Not familiar	13	03.47

f = frequency and % = per cent

Relationship between factors influencing the information seeking behaviour of Postgraduate students with the information seeking behaviour of the students

The relationship between selected independent variables and information seeking behaviour of postgraduate students was analysed using correlation analysis and the results are presented in Table 2.

The results revealed that achievement motivation showed a positive and highly significant relationship with information seeking behaviour (r = 0.30**), indicating that students with higher achievement motivation tended to exhibit better information seeking practices. Motivation encourages goal-oriented academic activities and persistence in searching for relevant information.

Scientific orientation was found to have a positive and significant relationship with information seeking behaviour (r = 0.25*). Students with a stronger scientific orientation are more inclined to rely on authentic, evidence-based and peer-reviewed information sources, thereby enhancing their information seeking behaviour.

A positive and significant relationship was also observed between curiosity and information seeking behaviour (r = 0.21*). Curiosity stimulates the desire to explore new ideas and information, motivating students to search beyond prescribed academic materials.

Level of understanding exhibited a positive and highly significant relationship with information seeking behaviour (r = 0.26**). Students with a better level of understanding are able to clearly identify their information needs, formulate appropriate search strategies and effectively process retrieved information.

The variable intelligence showed a positive and highly significant relationship with information seeking behaviour (r = 0.34**), indicating that students with higher cognitive ability were more efficient in searching, comprehending, and utilising academic information.

Similarly, aptitude was positively and significantly related to information seeking behaviour (r = 0.22*). Higher aptitude enhances learning capability and adaptability, enabling students to make effective use of diverse information sources.

Proximity of the university library also showed a positive and significant relationship with information seeking behaviour (r = 0.23*). Easy physical access to the library encourages frequent visits and greater utilisation of information resources.

In contrast, general ethics did not show a significant relationship with information seeking behaviour (r = 0.02 NS). While ethical orientation is essential

for responsible use of information, it may not directly influence the frequency or intensity of information seeking activities.

Table 2. Relationship between factors influencing the information seeking behaviour of Postgraduate students with the information seeking behaviour of the students

Sl. No.	Factors influencing Information Seeking Behaviour	'r' value
1	Achievement motivation	0.30**
2	Scientific orientation	0.25*
3	Curiosity	0.21*
4	Level of understanding	0.27**
5	General Ethics	0.02^{NS}
6	Intelligence	0.34**
7	Aptitude	0.22*
8	Awareness	0.04^{NS}
9	Proximity of the library	0.23*

** = five per cent level of probability, * = one per cent level of probability,

NS = Non-significant

Conclusion

The study concludes that postgraduate students of UAS Raichur generally possess favourable psychological, cognitive, and institutional factors that support effective information seeking behaviour. High levels of motivation, scientific orientation, curiosity, understanding and ethical orientation, along with accessibility and familiarity of the library, create a conducive academic environment. Strengthening these factors through academic mentoring and library orientation programmes can further improve information seeking practices.

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