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ICT adaption among urban farmers of Medchal district in Telangana state

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Abstract

Information and Communication Technology (ICT) is playing an important role in modern agriculture by helping farmers access timely information related to weather, crop management, pest control, and market prices through mobile phones, internet services, social media, and agricultural applications. In urban farming regions like Medchal-Malkajgiri District, farmers are increasingly exposed to digital technologies, though the level of ICT utilization differs among individuals.

The present study was conducted to examine ICT utilization among urban farmers, analyze the relationship between profile characteristics and ICT usage, study farmers' attitude toward ICT tools, and identify the constraints faced in using these technologies for agriculture.

The study revealed that smartphones, WhatsApp, YouTube, and agricultural mobile applications were commonly used sources of agricultural information. Factors such as education, age, digital literacy, annual income, and training exposure significantly influenced ICT utilization among farmers. However, constraints like lack of technical knowledge, poor internet connectivity, and inadequate training limited the effective use of ICT tools.

The study concludes that ICT has considerable potential to improve agricultural communication, decision-making, and productivity among urban farmers. Strengthening digital literacy and extension support can further enhance effective ICT utilization in agriculture.

Keywords: CT adoption in agriculture, ICT utilization, urban farmers, profile characteristics, socio-economic factors, digital literacy

Introduction

Agriculture remains one of the most important sectors in India, playing a key role in employment generation, food security, and overall economic development. A significant share of the population still depends directly or indirectly on agriculture and related activities for their livelihood. Over time, the agricultural sector has witnessed major changes due to technological progress, globalization, urbanization, and improvements in communication systems. Traditional farming practices, which earlier relied mainly on indigenous knowledge, personal experience, and conventional extension services, are now gradually being replaced by information-driven agricultural systems. In the present digital context, Information and Communication Technology (ICT) has emerged as an essential tool for enhancing agricultural productivity, communication, and farmers' decision-making processes (Naik *et al.*, 2020) ^[2].

Information and Communication Technology (ICT) includes a wide range of digital and communication tools such as mobile phones, smartphones, internet services, mobile applications, social media platforms, SMS services, television, radio, and online advisory platforms used for generating, processing, and disseminating information. In agriculture, ICT serves as an effective medium for delivering timely and reliable information on weather forecasts, crop production practices, pest and disease

control, irrigation management, fertilizer use, market prices, and government schemes. These tools enable farmers to access relevant information at the right time, thereby improving farm efficiency and productivity (Panda *et al.*, 2019) ^[1].

The widespread availability of smartphones and internet connectivity in India has significantly boosted the adoption of digital tools in agriculture. Farmers are increasingly using mobile applications, YouTube channels, WhatsApp groups, and various digital advisory platforms to obtain agricultural information and communicate with experts. ICT-based extension services have helped bridge communication gaps between farmers and extension personnel by ensuring faster dissemination of scientific and practical farming information. Research indicates that digital advisory systems improve information access and support better farm-level decision-making among farmers (Naik *et al.*, 2020) ^[2].

The importance of ICT in agriculture has further increased due to climate variability, market uncertainties, and the growing need for sustainable farming practices. ICT tools provide farmers with real-time information on weather conditions, market fluctuations, crop health, and modern agricultural techniques. This enables farmers to reduce risks, enhance productivity, and make informed decisions. In addition, ICT promotes knowledge exchange among

farmers, scientists, extension workers, and research organizations, thereby strengthening the agricultural extension system (Hassan *et al.*, 2011) ^[4].

In India, various government initiatives and digital agriculture programs have been introduced to promote ICT adoption among farmers. Mobile-based advisory systems, online marketing platforms, digital weather forecasting services, and agricultural helplines are being widely implemented to enhance information accessibility. The increasing availability of affordable smartphones and internet services has further accelerated the spread of ICT in both rural and urban farming systems. However, despite this growth, ICT adoption among farmers is still uneven due to variations in education, digital literacy, income levels, training exposure, and access to infrastructure (Panda *et al.*, 2019) ^[1].

Urban and peri-urban farming areas offer a distinct context for studying ICT adoption, as farmers in these regions are more exposed to modern infrastructure and digital technologies. Urban agriculture refers to farming activities carried out within or around cities and semi-urban areas, where farmers typically face conditions such as limited land availability, high demand for produce, and rapid urban development. Compared to rural farmers, urban farmers generally have better access to smartphones, internet services, transport facilities, and extension support systems. As a result, awareness of ICT tools is comparatively higher in urban farming communities (Patel and HM, 2021) ^[5].

The Medchal-Malkajgiri District is one of the fast-developing districts located near Hyderabad in Telangana state. Owing to its proximity to the metropolitan city, the district has experienced rapid urbanization, infrastructural growth, and increased exposure to digital technologies. Despite this urban expansion, agricultural activities continue to be practiced in several mandals and villages such as Dundigal, Shamirpet, Bowrampet, Bahadurpally, Thumkunta, and Devaryamjal. Farmers in these areas engage in crop cultivation, vegetable farming, and allied activities while simultaneously adapting to urban technological influences.

Farmers in Medchal district are increasingly relying on ICT tools such as smartphones, WhatsApp groups, YouTube channels, agricultural mobile applications, and SMS-based advisory services for obtaining agricultural information. These platforms assist farmers in gaining knowledge about improved farming techniques, pest and disease management, market price updates, and weather forecasts. Among these, social media platforms like YouTube and WhatsApp have become particularly popular due to their visual learning content and easy communication features (Patel and HM, 2021) ^[5].

Although awareness of ICT tools is growing among farmers, the extent of actual utilization for agricultural purposes differs widely. Several socio-economic, personal, and technological factors influence ICT adoption behavior. Education is one of the most important determinants, as better-educated farmers are generally more capable of understanding and effectively using digital technologies. Similarly, younger farmers are more inclined toward ICT

adoption due to their familiarity with smartphones and internet-based applications (Hassan *et al.*, 2011) ^[4].

Digital literacy and training exposure are also critical factors that influence ICT utilization among farmers. Those who receive proper training in digital tools and agricultural applications tend to use ICT more confidently and effectively. On the other hand, limited technical knowledge, inadequate digital skills, and low awareness act as major barriers to ICT adoption. Factors such as income level, availability of internet connectivity, access to smartphones, and frequency of extension contact also play a significant role in determining ICT usage among urban farmers (Naik *et al.*, 2020) ^[2].

Despite the advantages offered by ICT tools in agriculture, farmers still encounter several challenges in their effective use. Major constraints include poor internet connectivity, language barriers, lack of technical assistance, high cost of smartphones, absence of region-specific information, and insufficient awareness of agricultural applications and online services. Many farmers are aware of ICT tools but do not possess the required confidence or technical skills to use them effectively for agricultural decision-making (Mishra *et al.*, 2020) ^[7]. Additionally, the lack of localized content in regional languages reduces the effectiveness of digital advisory systems (Mukherjee *et al.*, 2023) ^[8].

The government of Telangana has been actively promoting digital agriculture through ICT-based extension services, weather forecasting systems, and mobile-based information platforms. Studies conducted in various districts of Telangana indicate that farmers find mobile-based agrometeorological advisory services useful for weather forecasting, crop protection, and farm management activities (Srilaxmi *et al.*, 2023) ^[6]. However, the effectiveness of these services largely depends on farmers' awareness, accessibility, and ability to use ICT tools efficiently.

In this context, understanding the relationship between farmers' profile characteristics and ICT utilization becomes highly important. Variables such as age, education, annual income, landholding size, training exposure, digital literacy, extension contact, and innovativeness significantly influence the adoption and usage of ICT tools among farmers. Identifying these relationships helps in designing targeted interventions, training programs, and user-friendly digital services for improving ICT utilization.

Considering the increasing importance of digital agriculture and the varying levels of ICT utilization among farmers, the present study titled "Relationship between Profile Characteristics and ICT Utilization among Urban Farmers of Medchal District in Telangana State" was undertaken. The study focuses on assessing ICT utilization levels, examining the influence of selected profile characteristics, understanding farmers' attitudes toward ICT tools, and identifying the constraints faced in their usage. The results are expected to provide valuable insights for strengthening ICT-based agricultural extension systems and promoting sustainable digital agriculture among urban farming communities in Telangana.

Research Methodology

Objective: Relationship between Profile Characteristics and ICT Utilization

The present investigation was undertaken to study the association between the profile characteristics of urban farmers and their utilization of Information and Communication Technology (ICT) in agriculture. A systematic methodological approach was followed for the collection, organization, analysis, and interpretation of data to achieve the objectives of the study effectively.

Research Design

The study adopted a mixed research design that combined descriptive and exploratory methods. The descriptive approach was useful in understanding the socio-economic profile and ICT utilization patterns of farmers, whereas the exploratory approach helped in identifying the various factors affecting ICT usage among urban farming communities.

Study Area

The research was conducted in Medchal-Malkajgiri District, an urbanizing agricultural district situated near Hyderabad. Two mandals, namely Dundigal and Shamirpet, were purposively selected for the study. From these mandals, four villages were chosen:

- Bowrampet
- Bahadurpally
- Thumkunta
- Devaryamjal

These villages were selected because farmers in these areas actively practice agriculture and have varying levels of exposure to ICT tools and digital services.

Sampling Procedure and Sample Size

A stratified random sampling method was employed to select respondents from different socio-economic categories. The stratification was done based on variables such as age, education, landholding pattern, and locality to ensure proper representation of farmers.

The total sample consisted of 120 respondents, distributed equally among the selected villages:

- 30 farmers from Bowrampet
- 30 farmers from Bahadurpally
- 30 farmers from Thumkunta
- 30 farmers from Devaryamjal

Nature and Sources of Data

The study primarily relied on primary data collected directly from the respondents. Information was gathered through personal interviews using a structured and pre-tested interview schedule. Data related to farmers' profile characteristics, ICT usage, access to digital tools, and training exposure were collected during the survey.

Variables Included in the Study

Dependent Variable

Level of ICT Utilization

Independent Variables

- Age
- Educational status
- Annual income
- Landholding size
- Access to ICT tools
- Training exposure
- Innovativeness

Statistical Techniques Used

Different statistical methods were applied for analyzing the collected data and interpreting the findings.

Descriptive Statistics

Percentage analysis, tabular presentation, and charts were used to summarize and describe the characteristics of respondents and their ICT utilization patterns.

Arithmetic Mean

Arithmetic mean was used to determine the average values of different variables included in the study.

$$\bar{X} = \frac{\sum X_i}{n}$$

Where:

- $\bar{X}$ = Mean
- X_i = Individual observations
- n = Total number of observations

Standard Deviation

Standard deviation was calculated to measure the extent of variation among respondents.

$$\sigma = \sqrt{\frac{1}{n} \left(\sum x^2 - \frac{(\sum x)^2}{n} \right)}$$

Multiple Linear Regression Analysis

Multiple Linear Regression (MLR) analysis was employed to determine the influence of profile characteristics on ICT utilization among farmers.

$$Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

Where:

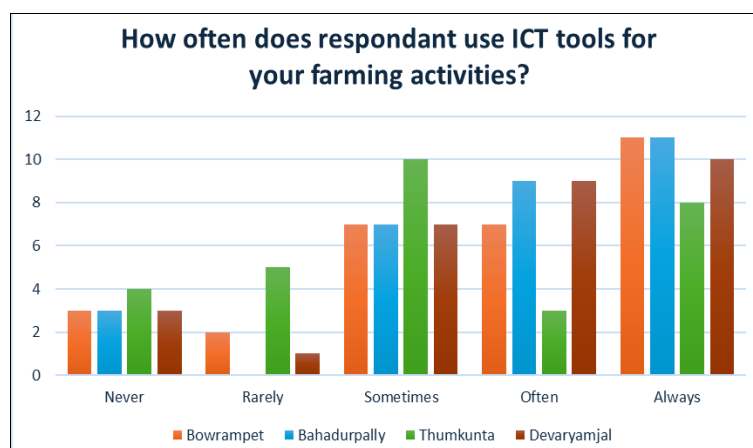
- Y = ICT utilization level
- a = Constant term
- b = Regression coefficients
- X = Independent variables

The regression model helped in identifying the extent to which selected profile variables influenced ICT utilization among urban farmers.

Results and Discussion

How often do you use ICT tools for your farming activities?

Options	Frequency	Percentage
Farmers from Bowrampet		
Never	3	10.0%
Rarely	2	6.7%
Sometimes	7	23.3%
Often	7	23.3%
Always	11	36.7%
Total	30	100%
Farmers from Bahadurpally		
Never	3	10.0%
Sometimes	7	23.3%
Often	9	30.0%
Always	11	36.7%
Total	30	100%
Farmers from Thumkunta		
Never	4	13.3%
Rarely	5	16.7%
Sometimes	10	33.3%
Often	3	10.0%
Always	8	26.7%
Total	30	100%
Farmers from Devaryamjal		
Never	3	10.0%
Rarely	1	3.3%
Sometimes	7	23.3%
Often	9	30.0%
Always	10	33.3%
Total	30	100%



The use of ICT tools is widespread among farmers in all villages, though the level of use differs. In Bowrampet, a large majority (83.3%) use ICT tools regularly, with only a few using them rarely or not at all. Bahadurpally records the highest usage at 90.0 percent indicating very strong adoption among farmers.

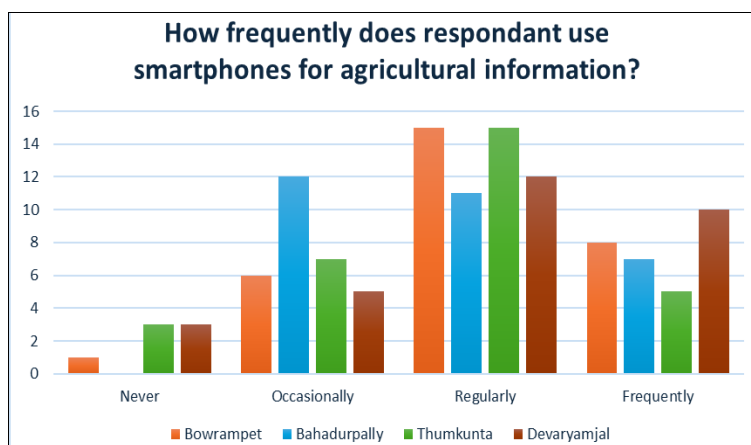
Devaryamjal also shows a high level of usage at 86.6%, reflecting good acceptance of ICT tools. In comparison,

Thumkunta has a lower usage rate of 70.0%, with a greater proportion of farmers using ICT tools infrequently or not using them, indicating moderate adoption. Overall, ICT usage is common across the villages, though it is relatively lower in Thumkunta.

How frequently do respondent use smartphones for agricultural information?

Options	Frequency	Percentage
Farmers from Bowrampet		
Never	1	3.3%
Occasionally	6	20.0%
Regularly	15	50.0%
Frequently	8	26.7%
Total	30	100%
Farmers from Bahadurpally		
Occasionally	12	40.0%
Regularly	11	36.7%
Frequently	7	23.3%
Total	30	100%

Farmers from Thumkunta		
Never	3	10.0%
Occasionally	7	23.3%
Regularly	15	50.0%
Frequently	5	16.7%
Total	30	100%
Farmers from Devaryamjal		
Never	3	10.0%
Occasionally	5	16.7%
Regularly	12	40.0%
Frequently	10	33.3%
Total	30	100%

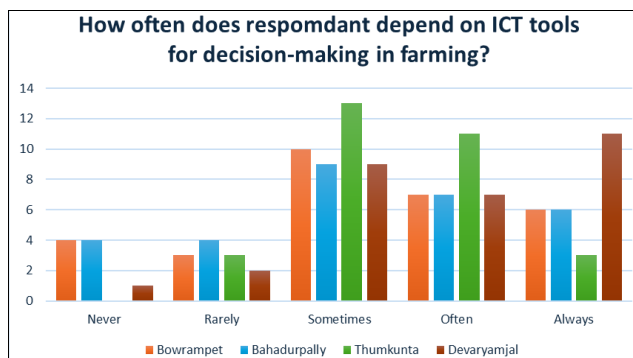


The more use of smartphones for agricultural activities is common in all villages, although the extent of usage differs. Bowrampet shows a high level of usage, with 76.7% of farmers using smartphones regularly or frequently, and only a few using them rarely. Devaryamjal also reflects strong usage at 73.3 percent suggesting good dependence on smartphones.

In Thumkunta, about 66.7% of farmers use smartphones

regularly or frequently, indicating a moderate to high level of use, though some still rely on them only occasionally or not at all. Bahadurpally has a comparatively lower usage rate of 60.0%, with a larger share of farmers using smartphones occasionally. Overall, smartphones are widely adopted, but the frequency of use varies among the villages. How often do respondents depend on ICT tools for decision-making in farming?

Options	Frequency	Percentage
Farmers from Bowrampet		
Never	4	13.3%
Rarely	3	10.0%
Sometimes	10	33.3%
Often	7	23.3%
Always	6	20.0%
Total	30	100%
Farmers from Bahadurpally		
Never	4	13.3%
Rarely	4	13.3%
Sometimes	9	30.0%
Often	7	23.3%
Always	6	20.0%
Total	30	100%
Farmers from Thumkunta		
Rarely	3	10.0%
Sometimes	13	43.3%
Often	11	36.7%
Always	3	10.0%
Total	30	100%
Farmers from Devaryamjal		
Never	1	3.3%
Rarely	2	6.7%
Sometimes	9	30.0%
Often	7	23.3%
Always	11	36.7%
Total	30	100%

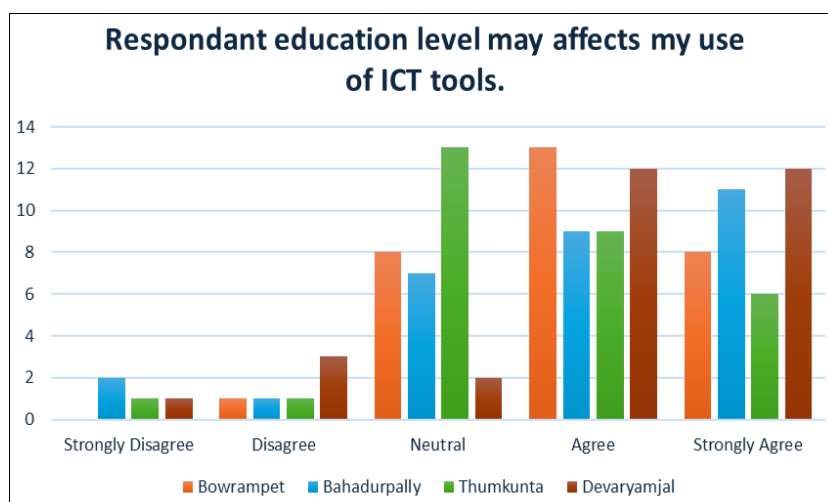


All village farmers make notable use of ICT tools, though

the degree of reliance differs. In Bowrampet, around 76.6% of farmers use these tools at least occasionally, showing a good level of dependence, while only a few seldom or never rely on them. Bahadurpally shows a slightly lower figure at 73.3%, indicating a moderate level of dependence.

On the other hand, Thumkunta and Devaryamjal demonstrate very high reliance, with about 90.0% of farmers in both villages depending on ICT tools regularly. Only a small percentage report limited or no use. Overall, ICT tools have become an important part of farming practices in these villages, with stronger dependence seen in Thumkunta and Devaryamjal. Respondent education level affect on the use of ICT tools.

Options	Frequency	Percentage
Farmers from Bowrampet		
Disagree	1	3.3%
Neutral	8	26.7%
Agree	13	43.3%
Strongly Agree	8	26.7%
Total	30	100%
Farmers from Bahadurpally		
Strongly Disagree	2	6.7%
Disagree	1	3.3%
Neutral	7	23.3%
Agree	9	30.0%
Strongly Agree	11	36.7%
Total	30	100%
Farmers from Thumkunta		
Strongly Disagree	1	3.3%
Disagree	1	3.3%
Neutral	13	43.3%
Agree	9	30.0%
Strongly Agree	6	20.0%
Total	30	100%
Farmers from Devaryamjal		
Strongly Disagree	1	3.3%
Disagree	3	10.0%
Neutral	2	6.7%
Agree	12	40.0%
Strongly Agree	12	40.0%
Total	30	100%

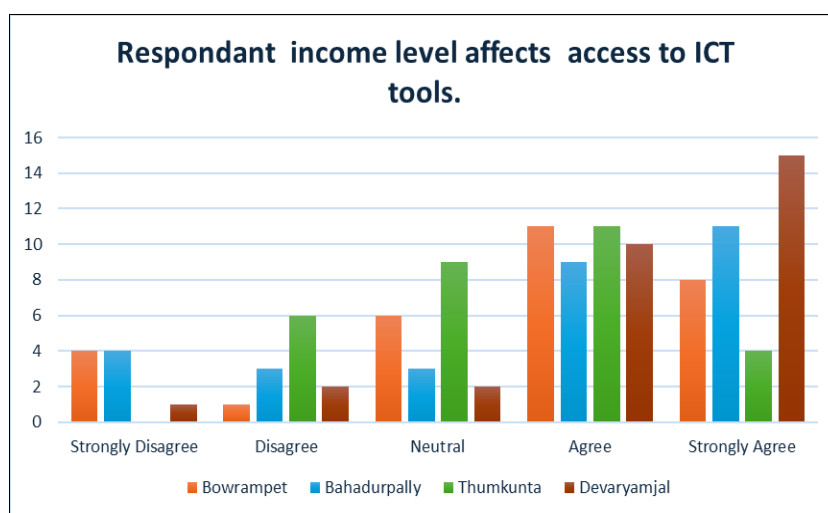


The results suggest that education is widely viewed as an important factor influencing ICT usage among farmers, although the level of impact differs across villages. In Bowrampet, around 70.0% of farmers believe education affects ICT use, indicating a strong influence. Bahadurpally shows a similar trend, with 66.7% of farmers expressing agreement, highlighting the role of education.

The influence is less pronounced in thumkunta village, with

only 50.0% agreement and a large share of neutral responses, suggesting a moderate effect. In contrast, Devaryamjal records the highest level of agreement at 80.0%, showing a strong perception of education's impact. Overall, education is considered an important factor in ICT usage, though its influence varies among the villages. Respondent income level affects my access to ICT tools.

Options	Frequency	Percentage
Farmers from Bowrampet		
Strongly Disagree	4	13.3%
Disagree	1	3.3%
Neutral	6	20.0%
Agree	11	36.7%
Strongly Agree	8	26.7%
Total	30	100%
Farmers from Bahadurpally		
Strongly Disagree	4	13.3%
Disagree	3	10.0%
Neutral	3	10.0%
Agree	9	30.0%
Strongly Agree	11	36.7%
Total	30	100%
Farmers from Thumkunta		
Disagree	6	20.0%
Neutral	9	30.0%
Agree	11	36.7%
Strongly Agree	4	13.3%
Total	30	100%
Farmers from Devaryamjal		
Strongly Disagree	1	3.3%
Disagree	2	6.7%
Neutral	2	6.7%
Agree	10	33.3%
Strongly Agree	15	50.0%
Total	30	100%

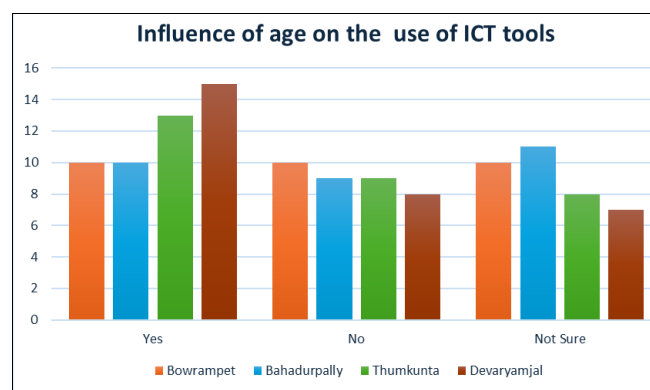


Income is considered an important factor influencing access to ICT tools, though its impact varies across villages. In Bowrampet, about 63.4% of farmers agree that income affects ICT access, suggesting a noticeable influence, while some remain neutral or disagree. Bahadurpally shows a slightly higher level of agreement at 66.7%, reflecting a strong perception of income's role.

Only 50.0% of farmers agree in thumkunta village, with a

higher proportion of neutral and disagreeing responses, indicating a moderate level of influence. In contrast, Devaryamjal records the highest agreement at 83.3%, showing a very strong belief that income affects ICT access. Overall, income is widely seen as a key factor, but its perceived importance differs among the villages. Does your age influence your use of ICT tools?

Options	Frequency	Percentage
Farmers from Bowrampet		
Yes	10	33.3%
No	10	33.3%
Not Sure	10	33.3%
Total	30	100%
Farmers from Bahadurpally		
Yes	10	33.3%
No	9	30.0%
Not Sure	11	36.7%
Total	30	100%
Farmers from Thumkunta		
Yes	13	43.3%
No	9	30.0%
Not Sure	8	26.7%
Total	30	100%
Farmers from Devaryamjal		
Yes	15	50.0%
No	8	26.7%
Not Sure	7	23.3%
Total	30	100%



Farmers have differing views on whether age affects the use of ICT tools. In Bowrampet, opinions are evenly divided among those who believe age has an impact, those who do not, and those who are unsure, showing no clear agreement. Bahadurpally also presents a similar pattern, with responses spread across all categories.

In Thumkunta, a larger share of farmers feel that age influences ICT usage, suggesting a moderate level of agreement. Devaryamjal shows the strongest belief, with half of the farmers supporting this view, while fewer farmers disagree or remain uncertain. Overall, there is no consistent opinion across the villages regarding the effect of age on ICT usage.

Summary

This study examined how the personal and socio-economic characteristics of urban farmers influence their use of Information and Communication Technology (ICT) in agriculture in Medchal-Malkajgiri District, Telangana. It aimed to assess the level of ICT usage, understand the factors affecting its adoption, and explore farmers' attitudes toward digital agricultural tools.

The results show that ICT tools such as smartphones, WhatsApp, YouTube, mobile applications, and SMS-based advisory services are commonly used by farmers to obtain agricultural information. However, the extent of usage differs across villages. Farmers in Bowrampet and Bahadurpally demonstrated comparatively higher use of

ICT tools, whereas Thumkunta recorded moderate usage levels.

The findings also indicate that several profile characteristics, including education, income, age, landholding size, training exposure, and digital literacy, have a significant impact on ICT utilization. Among these, education and income were found to have a particularly strong influence. Younger and more educated farmers generally showed greater interest and ability in using digital technologies for farming purposes.

Farmers reported that ICT tools are helpful in making farming decisions, especially for obtaining information related to weather conditions, crop management, and market prices. However, the level of dependence on ICT varied across different villages.

Despite increasing awareness and usage, several challenges still limit effective ICT adoption. These include lack of digital skills, insufficient training opportunities, poor internet connectivity, limited technical knowledge, and language-related difficulties.

Conclusion

The study concludes that ICT has become an important component in improving agricultural practices and supporting decision-making among urban farmers in Medchal district. The use of digital tools has improved access to timely and relevant agricultural information, thereby enhancing farming efficiency.

It is also clear that ICT utilization is strongly influenced by farmers' profile characteristics such as education, income level, age, and digital literacy. Farmers who are more educated, economically better off, and more familiar with digital tools tend to adopt ICT more effectively in their agricultural activities.

However, the study also highlights that the benefits of ICT are not fully realized due to several constraints. Issues such as inadequate training, limited awareness, weak internet connectivity, and lack of technical support continue to restrict the effective use of ICT tools among farmers.

Therefore, there is a strong need to improve digital literacy, strengthen agricultural extension systems, and develop region-specific ICT services that are easy for farmers to use. Policymakers and development agencies should focus on reducing the digital gap between farmers to ensure wider and more effective adoption of ICT in agriculture.

Overall, enhancing ICT utilization can play a vital role in promoting sustainable agriculture, improving productivity, and supporting better livelihoods for urban farmers in Telangana.

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