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Rural development through Information and Communication Technology (ICT) in Telangana: A sociological study of farmers in selected villages.

Prof. Chinta Ganesh

Abstract:

ICT (Information Communication & Technology) resources for rural development in the Indian context are not a new experience. Many projects have been initiated, and even have been experimented with through their successful execution. Despite having all the objectives to live through the project life cycle, many pilot projects are either deserted midway or show a poor reaction from the major stakeholders. Recognizing the causes behind the poor operation of the projects and initiating a road map to achieve success, especially in agricultural ICT projects in particular is quite essential. ICT projects initiated for rural development can also have the perspective of "usability and user-centered design" the real task is to create a "demand-driven ICT initiative for the rural sector". Mainly the pilot projects are based on pure innovating frameworks eitherthrough a development agency or through the government. While innovation is essential for any model to be accepted, it is essential that projects need to move out of the "incubators" andtranslate their success through a transformation from "supply-driven" concepts to "demand-driven"

. ICT programs need to be "user-centric" and possess potential benefits to users. The projects face resistance from users due to cost-effectiveness or resisting change. Having the rightpolicy framework and providing the right strategy would perhaps lead to better "user-centered design". This paper tries to understand the ICT initiatives and their adoption by the farmers. It then tries to provide a suggestive framework that might lead to acceptance of the ICT.

Keywords: Rural user, ICT, Technology Acceptance, Innovation, Model, User-centered applications, Mobile.

Introduction:

Living society is changing Society. Technology indicates the implementation of knowledge in manufacturing tools of utility from natural resources (Schaefer and Lamm,1992). Technology is an important factor of Social Change. Society is the largest group of individuals who communicate with each other and are part of common culture and share a common life. Societyis metaphysical. R.M MacIver (1937) explains society as a "web of relations which is alwayschanging".

Today, E-Agriculture is an upcoming field for the enhancement of agricultural output and rural development. e-Agriculture is a relatively new word. The Food and Agriculture Organization (FAO) put forward the following definition: "

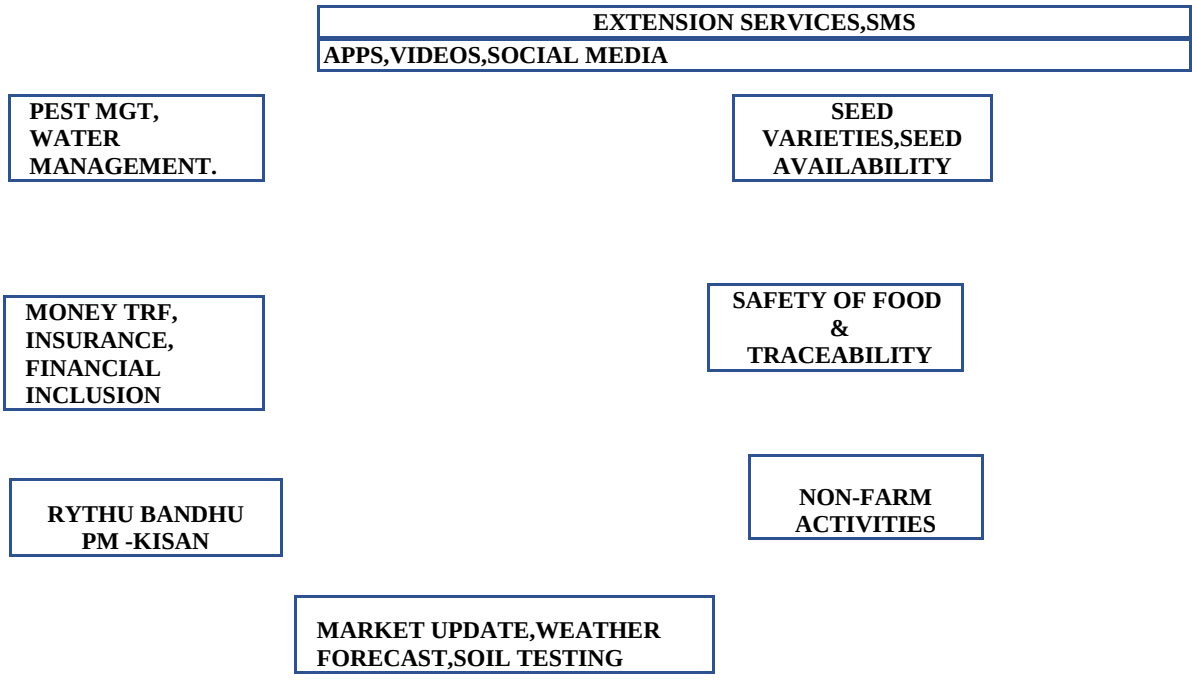
Head, Dept. of Sociology,
University College of Arts & Social Sciences
Osmania University-Hyderabad-500007
Email: ganesh.socio@gmail.com

e-Agriculture is an emerging field in the intersection of agricultural informatics, agricultural development, and entrepreneurship, technology dissemination, referring to agricultural services, and information delivered or enhanced through the Internet and related technologies. The Agriculture sector in India employs 59 % of the population. Agriculture provides 18.6 % of India's total GDP. Commercialization of Indian agriculture is due to initiatives like contract farming, green revolution, use of ICT, etc. Information technology is involved in crop cultivation, water management, pest management, fertilizer application, transfer of foods, harvesting, safety, quality managing, and marketing management. The Digital India initiative was launched by the Government of India on July 2, 2015, with the "Power to Empower" motto.

Table 1:Number of rural & urban subscribers (July 2021)

Rural telesubscribers (Wireline+Wireless)	539.14 million =53.9 crore
Urban telesubscribers (Wireline+Wireless)	664.34 million =66.4 crore
Rural Tele-density (Wireline+Wireless)	60.44%
Urban Tele-density(Wireline+Wireless)	140.93%
Share of Rural Subscribers (Wireline+Wireless)	44.80%
Share of Urban Subscribers (Wireline+Wireless)	55.20%

Table 2:Role of ICT in Agriculture and Rural Development.



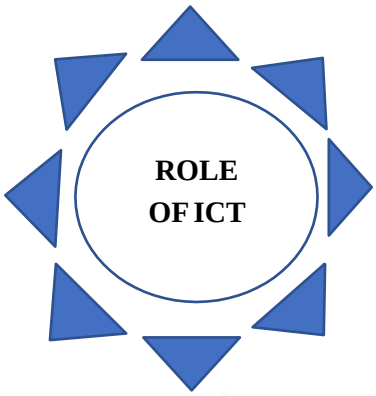


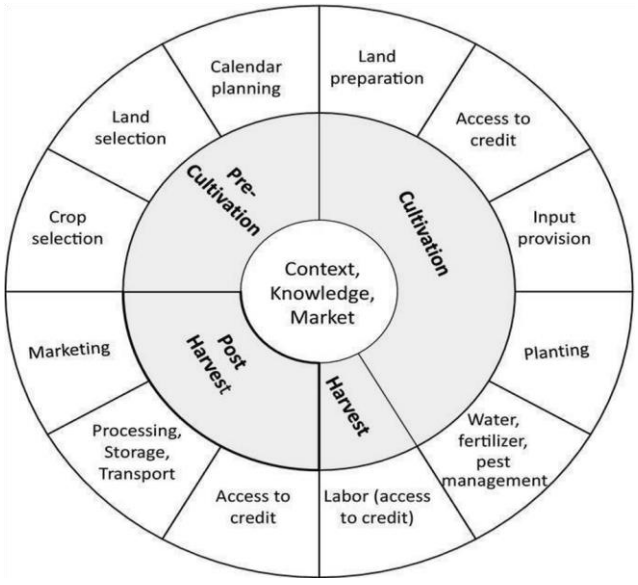
Table 3: Agriculture zones in Telangana State.

Agro-climatic Zone	Districts(33)
Northern TelanganaZone	Nizamabad ,Adilabad, Nirmal, Komurambheem Asifabad, Jagityal,Mancherial, Peddapalli,Karimnagar,Rajanna Sircilla,Kamareddy.
Central Telangana Zone	Sangareddy,Siddipet,Jangaon,WarangalUrban(Hanamkonda),Warangal Rural, Mahabubabad,Bhadradri Kothegudem,Khammam, Jayashanker Bhupalpalli, Mulugu, Medak.
Southern TelanganaZone	Vikarabad,Rangareddy,Hyderabad,YadadriBhuvangiri,Mahabubnagar, WanaparthyJogulambaGadwal,Nagarkurnool,Nalgonda,Suryapet,MalkajgiriMedchal,Narayanpet.

Farmer's Requirement: The main priority of ICT in agriculture is to cater t o the farmers' information needs.

1. Crops: Farmers are intended to know about seeds, soil type for different crops, seed sowingtime, harvest time, yields, etc. They can make their plans based on prior information.
2. Production techniques: Farmers are interested to know the information prepared by agricultural research and development.
3. Tools & Equipment: Farmers are eager to know about new types of equipment and other agricultural inputs.
4. Market information: Farmer's goal is to know the prices for their products by approaching the market online.
5. Other information: The information such as weather forecast, logistics, whereabouts of warehouse & cold complex, financial services, early warning of pest and diseases and advice of agricultural experts, etc.
6. Marketing information: farmers are interested to know the current market information regarding prices of agricultural commodities etc.
7. Online Access to land records/ online registration: farmers strongly feel the need for onlineaccess to land records and perform online registration. The government schemes like PM- Kisan, and Rythu Bandhu demand online access.
8. Question-and-answer service: The online availability of expert advice in the form of frequently asked questions(FAQs) about agriculture and its allied activities.
9. New schemes and subsidies: The information dissemination about development programmes is the need of the hour.
10. Weather prediction: The information about hail, storm, rainfall, temperature, and humidity.
11. Know-how: The best agriculture practices should be disseminated among the farming community.
12. Post-harvest technology: The Information about storage, processing, packaging logistics,etc.
13. General agricultural news: obtaining general information and news of various agricultural events
14. Crop insurance: Farmers should have knowledge of insurance premiums to be paid, compensation, etc.

Table 4:Typical Cycle of agriculture event



Objectives: The main objectives of the present study are as follows:

1. To find the association between agriculture and ICT usage.
2. To estimate the percentage of farmers using ICT in agriculture.
3. To analyse the purpose of using ICT in agriculture operations.
4. To analyse the advantages of ICT utilization in the field of agriculture for increasing productivity marketing for agro-products

Literature Review:

The study of **Chandra, S., & Singh, A. K.(2021)** found that in a state like Uttar Pradesh, Each extension personnel handles 1156 farmers. So it is determined that ICTs can compensate for the shortage of extensional personnel.

The study of **Daum et al .,(2021)** determines farm mechanization possibilities for small farmers. It is theoretically discussed that an Uber-like hiring model for tractor hiring in agriculture. The study analysis two case studies firstly EM3, which operates in India, EM3 is a popular tractor renting agency. Secondly, hello tractor which operates in Nigeria. The study opines that the entry of uber can cut down the transactional cost for consumers as well as service providers due to its scalability.EM3 currently operates in central& western India.EM3 uses the Samadhan app to pool tractor service providers and service seekers. Apps cut down paperwork besides increase transparency.

The study of **Hoang, H. G. (2021)** found that Vietnamese small landholders use ICT tools such as mobile and T.V more frequently. It is also noted that a single ICT tool is not sufficient. Mobile and T.V are the most used ICT by smallholders, so mobile and T.V should be used to diffuse agriculture information. The key barrier to using mobile by Vietnamese farmers is a lack of knowledge and skills.

The study of **Krell et al .,(2021)** examined that though featured mobile phones are more commonly found even in the low-income group it is not the same case for smartphones, which are only associated with higher incomes. In Kenya M-services (mobile services) are popular in the farming community. M-services include m-agriculture, m-commerce, m-payments, and m-banking, which also includes SMS alerts. M-services can be operated through featured phones.

A study by **Reddy et al., (2020)** observed that farmers widely depend on T.V and mobile for agriculture information. New ICTs like the internet, computers, smartphones and video conferenceswere less used when compared to T.V and mobile. The study was conducted in the Wardha district of Maharastra state, India.

The study by **Revathy, B.(2020)** examines that women farmers prefer traditional ICTs like TVandRadio more than modern ICTs due to digital illiteracy. This study was conducted in the Tirunelveli district of Tamil Nadu. The 420 woman farmers were randomly selected and surveyed through an interview schedule. Technology should fit into farmer's activities and multiply their efforts for easy and quick completion of the task.

According to **Das, P., & Sangma, N. C. (2020)** the attitude of tribal farmers towards the use of ICT.

The study was conducted in Meghalaya state among tribals. Out of 200 respondents, 100 were male and

100 were female respondents. According to the study female respondents are more favorable toward ICTs than their male counterparts. Age and Gender have a negligible effect on ICT adoption.

According to **Belakeri et al.,(2017)** mobile cut travel costs and pass on real-time market prices. This will reduce the wastage that occurred during the transportation of perishable goods.(Overa, 2006). A mobile phone gives information in various modes like SMS, and MMS(Multimedia Messaging Service). This makes mobile more effective and attractive among different ICTs (Mittal et al., 2010).

The study by **Jain, P. (2017)** examined TAM(Technology Acceptance Model). It revealed thatage, income, gender, and educational qualifications have a significant impact on mobile acceptance.The marital status had no significant impact on mobile

usage. The behavioral intention to usetechnology, perceived usefulness of Technology, and ease of use are the constructs of the TAM model. The study was conducted in the villages of Karnal and Sonipat districts of Haryana State.

The study of **Sanwal et al., (2015)** was conducted in Uttarakhand, India. The study observedthat hilly states lack ICT infrastructure. A farmer collects information from sources like financial institutions, pesticide shops, livestock feed shops, etc. Farmers prefer face-to-face interactions. Bringing individual farmers into networking was found fruitful in extending extension services rapidly (Singh, 2011).

The study of **Kansana et al., (2015)** was conducted in the Bundelkhand region of Madhya Pradesh. It was observed that only 6% of farmers are in regular contact with KVK. The year ofstudy is 2011-12. The KVK(Krishi Vigyan Kendra) introduced KMA(Kisan Mobile Advisory)which delivers weekly 2 agriculture-related SMS during (2011-12). A single mode of communication cannot be sufficient to cater needs of a large diverse farming community.

The study of **Afroz et al (2014)** discussed Digital Green. The Digital Green is a homegrown online agriculture video library, now spread to different continents. Videos are locally shot at aworksite in open fields on local issues in the native language. New skills, techniques, and technologies are explained. T.V or Pico projector during evening hours. Digital green instilled faith in ICTs and extension services.

The study of **Miwanda et al.,(2014)** observed that the main source of agriculture market information in Western Uganda was middlemen. Middlemen twist the information in their favour to exploit farmers. Radio became the chief source of information in the region due to(1) long radio waves (2) affordability (3)Requires low cost to set up its infrastructure when compared to other ICTs.

The study of **Baumüller, Heike. (2012)** examines that m-services are mobile phone-enabled services that offer agricultural services to poor people dispersed across different socio-economic backgrounds. m-Services lower inequalities such as gender inequalities, income, and education inequalities. A few examples of m-services are Kisan the app, Push-pull SMS alerts, the Kisan call center(1800-180-1551), Kisan suvidha Mobile apps, etc.

A China-based study by **He et al., (2011)** analyzed that agriculture income grows when equal weightage is given to agriculture information dissemination on par with technology and human capital

Table 5: Theories related to the diffusion of technology.

Theory	Year	Developed by	Constructs
Diffusion of InnovationTheory	1960	Rogers	Innovation, communication channels, time, and social system.
Theory of Reasoned Action(TRA)	1975	Ajzen and Fishbein	Behavioral intention, Attitude,and subjective Norm
Theory of Planned Behaviour(TBP)	1985	Ajzen	Behavioral intention, Attitude, Subjective Norm, and PerceivedBehavioral Control
Social Cognitive Theory	1986	Bandura	Affect, Anxiety

Technologyacceptance	1989	Fred D Davis	Perceived usefulness and perceivedease of use
PC Utilization	1991	Thompson et al.	Job-fit, Complexity, Long-term consequences, Utilization Affect Towards Use, Social Factors, Facilitating Conditions.
Motivation Model	1992	Davis et al.	Perceived usefulness, perceivedease of use, subjective norm,perceptions of pleasure and satisfaction
Extended TAM Model	2000	Venkatesh and Davis	Subjective norm, voluntariness, image, job relevance, output quality, result demonstrability, and perceived ease of use
Unified Theory of acceptance and use of Technology(UTAUT)	2003	Venkatesh et al.	Performance expectancy, effort expectancy, social influence, andfacilitating conditions
Model of Acceptance with Peer support (MAPS)	2009	Sykes et al.	Behavioral intention, System use, Facilitating conditions, Network density, Network centrality, Valued network centrality, and Valued networkdensity.

Source:https://shodhganga.inflibnet.ac.in/bitstream/10603/234627/10/11.%20chapter%204.pdf

Table 6:Pan India's popular ICT initiatives

Initiative	Since	Purpose
Agmarknet	2000	Day-to-day prices of agriculture commodity.
KCC	2004	To provide extension services to farmers.
eSaagu	2004	Village level agro-advisory in Telugu-speaking states.
Digital Green	2006	Makes videos on agriculture. Videos screened for farmers.
e-Choupal	2007	Direct procurement from farmers by ITC.
e-NAM	2016	Integration of APMC's across India for one common e-market.

Table 7:Popular e-Governance projects

Project	Year	State	Purpose
AKSHAYA	2002	Kerala	For IT literacy in Malappuram Dist.
FRIENDS	2000	Kerala	Citizen's single window payment for all types of govt. payments.
BHOOMI	2001	Karnataka	The first state to digitize land records in free India.
WARANA	1998	Maharastra	Providing ICT to 70 sugarcane- growing villages of Warana district
DHARANI	2020	Telangana	Land records management portal

Research Methodology: The present study has been carried out in the selected villages from Nizamabad, Siddipet, Vikarabad, Ranga Reddy, and Sangareddy Districts in Telangana State. On the whole, the respondents are drawn from the nine villages in the above-mentioned districts. Nine villages are grouped under 3 categories namely a) NGO adoptedvillages b) KVK villages c) Progressive villages.

In each village, farmers were randomly selected. The data were collected using a pre-tested interview schedule with 138 questions. A pilot study was conducted with a randomly selected sample of 30 farmers. Thereafter there were a few additions and deletions made to the interview schedule. The researcher collected data from 354 farmers. In each village, 10 % of the total number of farmers were selected as sample respondents through a simple random sampling method.

The final sample size was 354 farmers.

Table 8: Sampling Procedure

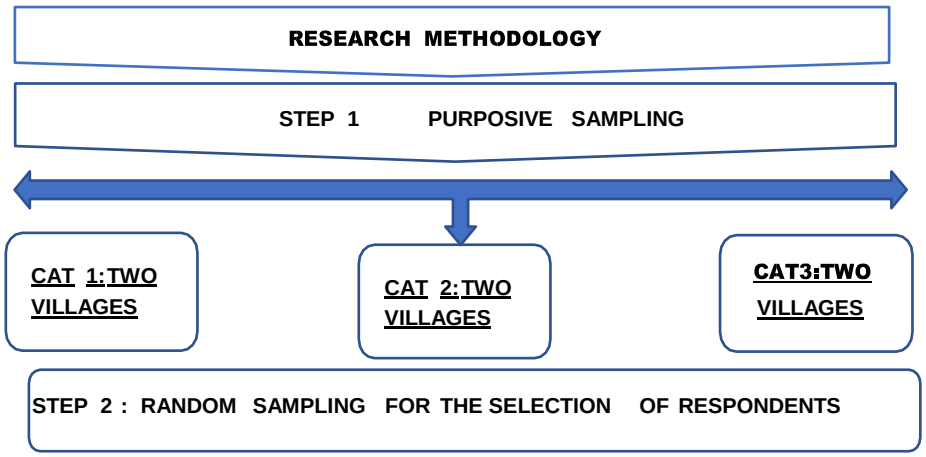


Table 9:Field area and selection of Respondents

Village Category	Village name	Mandal Name	District Name	Total Farmers	Sample	Sample Percentage
Progressive Villages	Ankapur	Armoor	Nizambad	628	62	10%
	Ibrahimpur	Narayanraopet	Siddipet	621	62	10%
KVK Villages	Kandlapally	Pudur	Vikarabad	533	53	10%
	Gaddamalliahgudem	Yacharam	Rangareddy	572	57	10%
NGO Villages	Potpally Bidekanna	Jharasangam Zaheerabad	Sangareddy	611	61	10%
	a) Arjun NayakThanda b) Jamnagar Bai Thanda G.D Thanda	Zaheerabad Mogudampalli Zaheerabad		593	59	10%
Total	Nine villages	Seven mandals	Five Districts	3558	354	10%

Sampling: For the purpose of this study the above-mentioned villages have been selected by using the purposive sampling technique. After that, the farmers are selected from the above-mentioned villages by using a simple random sampling technique to obtain the primary data related to the use of information and communication Technologies in agricultural activities. Sampling is a statistical method where predetermined observations are taken from a large population. Sampling represents the larger population.

Purposive Sampling : Each villages is purposively selected by consulting various authorities. For example the KVK villages are selected after considering 16 KVKs (list of KVKs available on icar.org.in) in Telangana state, The CRIDA-KVK (Central Research Institute for Dryland Agriculture), Hayathnagar is chosen because the Deccan plateau topography on which Telangana is situated is dry. The CRIDA-KVK is working for dryland farmers. The KVK villages are chosen based on the list provided by ICAR-CRIDA-KVK, Hayathnagar sent through e-mail. The KVK villages which have completed 3 to 5 years of KVK adoption tenure successfully were considered for the study by the researcher. Kandlapally village and Gaddamalliah gudem have completed the 3 to 5 years of KVK adoption tenure successfully. The 3 to5 years is a window period that reflects the socio- economic changes in villages before and after adoption by KVK.

Before choosing NGO adopted villages, the researcher shortlisted the NGOs working in the agriculture sector in Telangana State. The Deccan Development Society (NGO) is working in more than 30 villages in Zaheerabad Mandal. The DDS terminates the adoption tenure of a few villages after fulfilling certain criteria set by DDS. The researcher chose five DDS villages numerically dominated by SC's and ST's. The selected study villages are the oldest adopted villages of DDS. The population of five DDS villages fulfilled the required number of respondents criteria because the population of 5 DDS villages is approximately equal to the population of 2 villages selected under KVK villages or Progressive villages. The population of DDS villages is small, for easy comparison, The five DDS villages are equalized with two villages of the KVK or Progressive category.

The Progressive villages are selected by the researcher based on the rewards and awards by state and central governments. The facts from media and other printed sources were cross-checked by the researcher during a personal visit by the researcher. The farmers of Progressive village were selected using a simple random technique. The selected nine villages were dispersed in 3 agro-climatic zones of Telangana State. Eventually, the study villages are dispersed in 5 districts of Telangana State.

a) Random Sampling: The farmers in the study villages are randomly selected.

Considering the Krejcie-Morgan formula the researcher took 10 percent of farmers from each village as the sample. After rejecting two incomplete samples the total sample size is 354. Theresearcher has studied demography according to the 2011 census and the Samagra Kutumba Survey(2014) of Telangana State. The panchayath secretary's of each village helped the researcher by providing the list of total farmers in the village.

Table 10: Independent & Dependent Variables: The following variables have been identified as independent variables and dependent variables for the analysis of data.

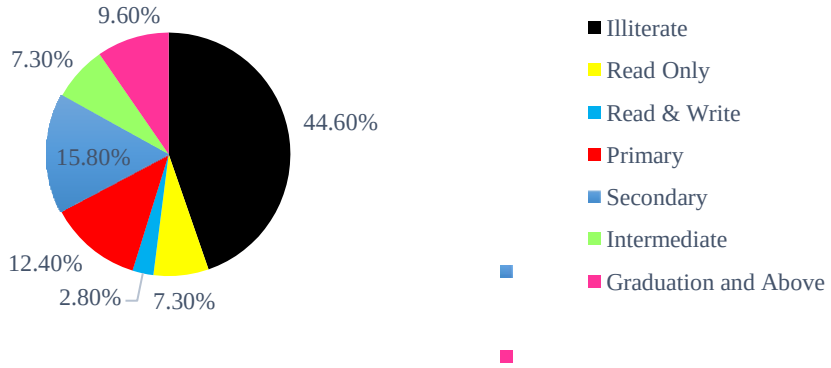
INDEPENDENT VARIABLES	DEPENDENT VARIABLE
Farming Experience	Household Income
Gender	Extension Participation
Education status	Financial Inclusion
Farm Size	Agriculture Awareness
Landholding	Social Participation
Age, Marital status.	Smartphone skills

Objective 1:There is a positive association between the education and adoption of ICT.

Table 11: Educational Status of Farmers (Respondents)

S.no	Education Qualification	Frequency	Percentage
01	Illiterate	158	44.60%
02	Read Only	26	7.30%
03	Read & Write	10	2.80%
04	Primary	44	12.40%
05	Secondary	56	15.80%
06	Intermediate	26	7.30%
07	Graduation & above	34	9.60%
08	Total	354	100%

Chart 1: Education Status of farmers.



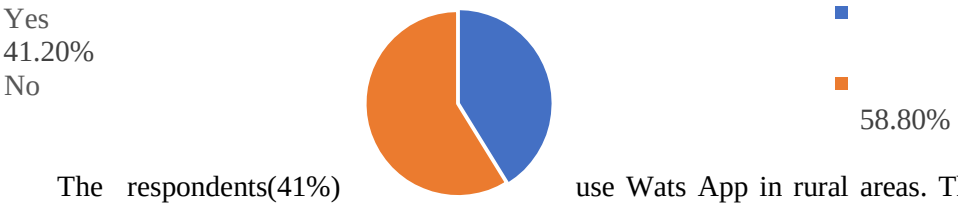
Association between the educational status of the farmers and adoption of ICT. There is a positive association between the educational status of the farmers and the adoption of ICT.

Objective 2:Role of Social media (Whats App) in agriculture.

Table 12: Watts App users

Watts App				
S.no		**users**	**non-users**	**Total**
01	Frequency	146	208	354
02	Percentage	41.20%	58.80%	100%

Chart 2:Watsapp users (n=354)



The respondents(41%) use Wats App in rural areas. There are agriculture Wats App groups created by agriculture extension officers. The local indigenous agriculture practices are shared in the group. The other social media platforms are also used. Majority of the educated farmers are using ICT, especially Whats app for agriculture-related activities.

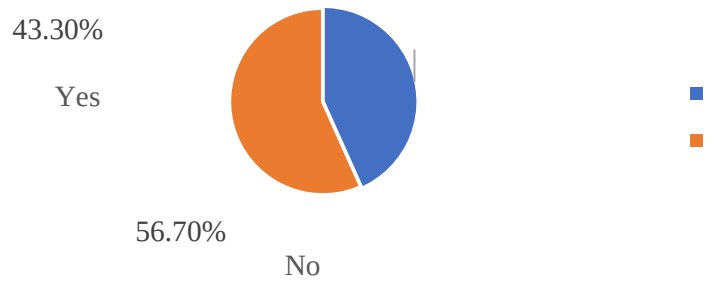
Objective 3: Weather Information through ICT

Table 13: Use of ICT for knowing weather information.

Weather Information through mobile				
S.No		**users**	**non-users**	**Total**

01	Frequency	153	201	354
02	Percentage	43.30%	56.70%	100%

Chart 3:Weather Information through mobile



43% of them use mobile (ICT) for knowing the weather information. Weather prediction is critical for agriculture.

Objective 4: The ICT-based extension services.

Table 14: Need of ICT based extension services

Need of ICT based extension services					
S.no		**Yes**	**No**	**Can't Say**	**Total**
01	Frequency	336	2	16	354
02	Percentage	94.90%	0.60%	4.50%	100%

Chart 4:Need of ICT based extension services

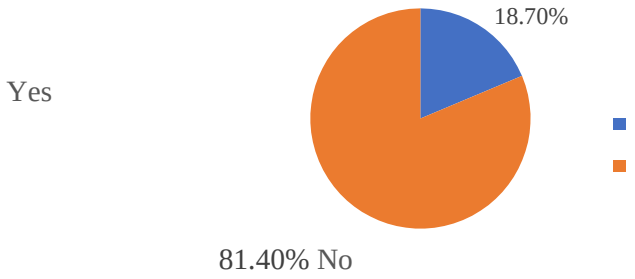
The majority of the respondents (95%) felt that there is a need for extension services for agricultural development. They also felt that there is a need for the amalgamation of traditional knowledge of agriculture with modern technology.

Objective 5:Use of ICT for market information.

Table 15: ICT and Market Information.

Market Information through Mobile				
S.no		**Yes**	**No**	**Total**
01	Frequency	**66**	**288**	**354**
02	Percentage	**18.70%**	**81.40%**	**100%**

Chart 5:Market Information through Mobile



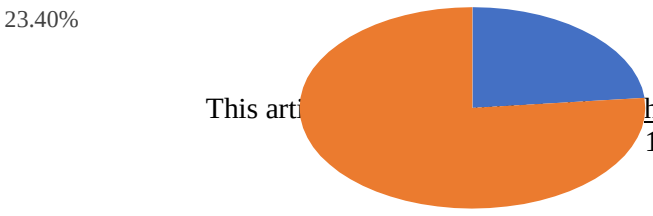
The market information such as day-to-day commodity prices ,minimum support price, logistics etc are essential for agriculturists,However only few respondents (19%) follow market information on mobile due to lack of awareness and few other respondents follow information on different ICT devices.

Objective 6 : Relationbetween use of ICT and pesticidein formation

Table 16: ICT and Information about pests and pesticides.

Pests and Pesticides information through Mobile				
S.no		**Yes**	**No**	**Total**
01	Frequency	**84**	**270**	**354**
02	Percentage	**23.40%**	**76.50%**	**100%**

Chart 6:Pests and Pesticides information throughMobile



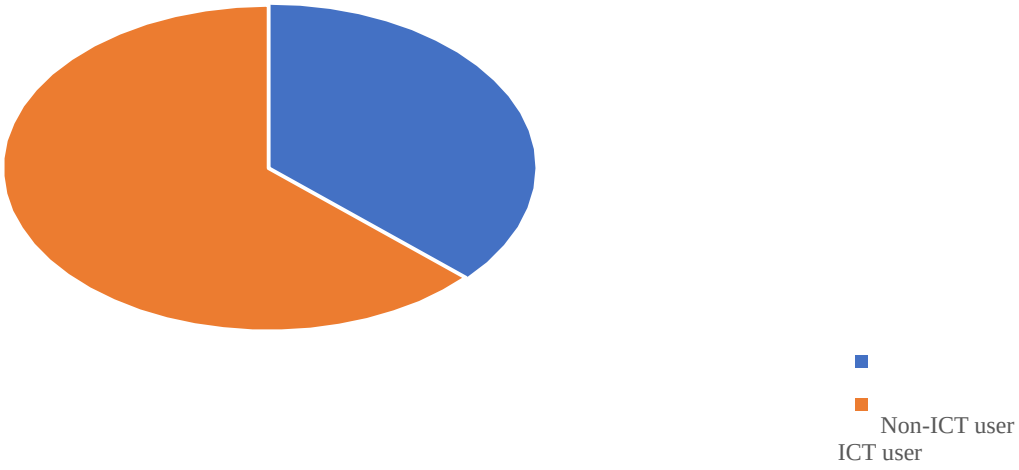
The respondents (23%) know information about pests and pesticidesthrough mobile(ICT). Even today most respondents rely on the local vendor.

Objective 7 :Relation between farming experience and ICT usage.

Table 17: ICT users and mean farming years

	N	Mean(years)
Non-ICT user	130	27.7462
ICT(s) user	224	22.0915
Total	354	24.1681

Chart 7 :ICT users in association with Farming experience

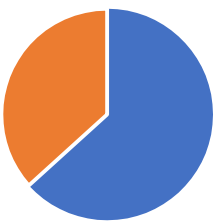


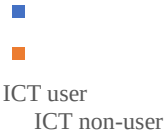
The total sample of respondents(is 354). The mean farming experience of non-ICT users is higher than ICT users because (1) ICT users are young farmers who have less experience compared to non-ICT farmers who are older (>40 years of age) farmers.

Objective 8:Association between ICT usage and land holding Table 18:Impact of ICT on landholding patterns.

N=354	Respondents	Land Holding
ICT users	224	4 .9 (acres)
Non-ICT users	130	4.3(acres)

Chart 8:ICT usage and Land holding





The total size of the sample respondent (354), the total sample of ICT users 224(63%), and their mean land holding is 4 acre-9 gunta, which is lesser than to mean the land holding of 4 acres 32 gunta of the non-ICT user. There is no association between land holding and ICT usage.

Challenges of ICT adoption in Rural Development:

1) Illiteracy: Lack of reading and writing skills made ICT adoption difficult among the farming community.
2) Poverty: Due to land fragmentation, most farmers fear of expenditure burden and resist change.
3) Lack of Awareness: Most farmers are unaware of ICT use in farming.
4) Infrastructure: Lack of funds for new infrastructure. The private and public partnership is critical for installing and maintaining the infrastructure.
5) e-Content: Due to more language diversity in India, there is a demand for e-content in regional languages for easy learning.
6) Digital Divide in Rural Areas: There is a gap in accessing modern communication technologyamong farmers due to factors such as illiteracy, land ownership, etc.
7) Connectivity & Bandwidth: Interior pockets and rough terrains make rural inhabitants face difficulties in internet connectivity.
8) Lack of motivation: Few tech-savvy farmers, although aware of new methods but lack motivation in implementing good agriculture practices.
9) Farmers resisting the change: Naturally, humans resist change. Same is true in the case of farmers.
10) Unstable agriculture income: Due to irregular monsoons, the incomes of farmers are uneven , this keeps farmers in constant fear of failing while trying new methods.

Results & Discussions:

1. Of the total number of respondents 55 % of them are literate Of which the highest number of farmers are educated up to secondary educational level 56 (16%). The 45% of the farmers are illiterates, this is mainly due to women farmersfrom NGO-adopted villages.
2. The total sample is 354(100%), of which 95% of farmers confirmed that social participationhas increased due to the use of ICTs (For ex: WhatsApp group). 93% of farmers agreed that decision- making capacity has improved due to the use of ICTs and other factors.
3. Of the total number of farmers (354), around 76% of farmers disagree with social media as a platform for buyers and sellers. 70% of farmers disagree with cashless transactions. The 85% of farmers disagree with the agriculture-related online content. The 23%of farmers agree that smartphone is the preferred ICT among ICTs. The 22 % of farmers agree that two-way communication through mobile gives a real-time solution.
4. Of the total sample respondent (354), around 29% of farmers believe that social media-based farmer's groups help in gaining awareness about agriculture. The 83% of farmers stated that SMS and voice updates from agriculture extensions are untimely, generalized, and not useful for them. The 27% of farmers believe that the future of agriculture is a mobile-centered ecosystem. The 30% of farmers use mobile to arrange(1) daily-wage agriculture labour and (2) arrange agriculture equipment. 5. The total ICT users are 244(100), of which

there are 41 % WhatsApp users,21% Facebook users,
3% use Plantix app & 3% use Kisan Suvidha app. The users of FinTech apps are Paytm 3%, Gpay 27%, phone Pay 30% respectively. The users of search engines are Yahoo(3%), Google(25%) are used by farmers.

6. The total sample is 354(100%). The farmer uses ICTs to know market information regarding commodity prices. 19% of farmers use a smartphone, while 6% use TV, 3% of farmers use radio, and 5% of farmers use NM.
7. 44% of farmers agree with the statement that" ICT diminishes the role of middlemen and brings transparency in the agriculture sector".
8. 81% of farmers sell their crops without waiting for well-priced due to (1) lack of storage(2) to clear the debts (3)fear of market volatility.
9. 81% of farmers agreed to grow according to market demand to avoid a price crunch. The farmers suggested that government should intervene and provide data about crops in demand before the initial phase of sowing.
10. The total sample is 354(100%), of which 95% of farmers confirmed that social participation has increased due to the use of ICTs (For ex: WhatsApp group). 93% of farmers agreed that decision- making capacity has improved due to the use of ICTs and other factors.

Suggestions:

1. Three things are required to increase the ICT users base a) Creating awareness about ICTs extensively .b) Active persuasion by AEOs about new technology c)Encouraging active participation of farmers by AEOs.

2. Newly established Rythu vedikas should have land for crop demonstration, a place for exchanging ideas for best agricultural practices, hands-on training to alleviate the digital divide,conduct seminars, and field visits, etc.

3. Governments should frame new policies by understanding citizens' needs. The recently framed Telangana drone policy-2019 is in the right direction for the medical logistics supply chain. Drones are also used in agriculture. Agri-sector needs new policies that impact its growth. The scope of agriculture is huge and cross-linked with other sectors. Holistic policies should be framed by the government.

4. Agriculture is a state subject. State governments should frame e-Agriculture policies which will also impact directly or indirectly e-Commerce, e-logistics, e-governance, and other supply chains.

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