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CHALLENGES IN THE ADOPTION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN RURAL AREAS OF HARYANA

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Abstract: Haryana is primarily an agricultural state. About 70% of residents are engaged in agriculture. Information and communication technology (ICT) is an important medium for accessing and transmitting information. Given the speed at which ICT is developing globally, it is very imperative for the state like Haryana which is self-sufficient in food production and the second largest contributor to India's central pool of food grains to remain updated with the new technologies, especially in the agricultural and rural sectors. Even with continuous efforts to further ICT development, there are significant obstacles to its practical use in rural Haryana. The goal of the study is to investigate the barriers preventing rural Haryana from embracing ICT applications. Data collection, mostly via surveys and interviews, served as the foundation for SPSS analysis. The results point to a less than ideal situation for ICT adoption in rural Haryana, as mobile phone use trumps other ICT forms in the agricultural sector. These results are consistent with studies conducted in comparable areas, highlighting common issues such as financial limitations, insufficient support from the government, loose implementation of ICT regulations, poor infrastructure, insufficient knowledge and information regarding ICT in agriculture, limited internet accessibility, poverty and resistance to change. The study's recommendation for increased government and stakeholder commitment to promote and improve the integration of ICT techniques in agricultural processes is made in its conclusion. Respondents to the survey suggest a number of actions, such as developing a strong ICT policy, improving ICT infrastructure and supplying electricity and ICT resources to all of Haryana's rural areas. These initiatives are essential in closing the current gap and accelerating the integration of ICT into Haryana's agricultural sector, which would guarantee sustainable development.

Keywords: ICT, Challenges, Adoption, Usefulness and Farmers.

INTRODUCTION

The implementation and progression of ICT in Haryana have been underway since the 2000s, making a substantial contribution to the socio-economic development of the nation, with a special focus on rural regions. The utilization and advancement of ICT in the state of Haryana significantly contribute to the promotion of material, intellectual and spiritual advancement throughout the country. It functions as a catalyst for the initiation of reform processes, accelerates the modernization of various economic sectors and augments the competitive potential of firms. Significantly, ICT plays a crucial role in actively promoting the inclusion of rural areas in the national, regional and global economy (Ghosh et al., 2018). This integration offers prospects for rapid progress and achievements in industrialization and modernization within rural sectors.

The government's goal prioritizes the growth of agriculture and the rural economy in Haryana, given that almost 70 percent of the population resides in rural areas. ICT not only presents potential advantages but also presents various problems for enterprises operating in rural regions, with the objective of narrowing the disparity between different geographical locations (Aker et al., 2016). The initiatives undertaken encompassed the development of the national ICT strategy in 2003 and the establishment of the Haryana Communication Regulatory Authority (TCRA). The government prioritized the enhancement of ICT infrastructure through the implementation of key measures such as the establishment of a nationwide fiber backbone, the allocation of licenses to a greater number of ICT enterprises and the establishment of more ICT institutions aimed at disseminating information to the general populace. The steps were implemented with the objective of establishing conducive circumstances and providing significant advantages for the utilization of ICT in the agricultural sector and the development of rural areas.

Despite the indisputable influence of the internet and ICT on fostering economic prosperity, the utilization of ICT in Haryana, namely in the domains of agriculture and rural regions, continues to exhibit a significant lag. The rate of advancement is currently characterized by a sluggish pace, which presents a potential hazard of exacerbating the disparity in relation to other nations in the process of development. Despite continuous efforts to enhance ICTs, the performance of ICT in the agricultural sector in rural areas is considered insufficient. Thus, the study focuses on the obstacles that affect the implementation of ICT in the agriculture industry in rural Haryana, with a specific emphasis on the Haryana state as a representative case study. The primary objective of this study is to investigate the utilization of ICT applications in the agricultural sector in rural regions.

LITERATURE REVIEW

The literature survey, also referred to as a literature review, is a crucial component of the research process. It involves the examination of existing secondary data to define the contextual framework of the specific study field being investigated. In the literature survey, secondary data is commonly utilized, with the occasional addition of original material at a limited level. The utilization of primary data becomes relevant in the following phases, particularly in the context of data analysis. Within the scope of this specific study, the aim is to conduct an extensive review of various relevant scholarly articles that discuss the obstacles related to the implementation of ICT in rural regions with regards to agricultural progress. The diverse range of sources included in this compilation aims to offer a comprehensive and comprehensive comprehension of the various aspects surrounding the difficulties encountered in implementing ICT in rural regions, with a specific focus on agricultural advancement. The literature evaluation will utilize a diverse range of sources to synthesize a comprehensive basis for the succeeding stages of the research inquiry.

USEFULNESS OF ICT IN AGRICULTURE

The utilization of ICT in the agricultural sector encompasses a diverse array of capabilities, exerting a substantial influence on multiple facets of the farming domain. ICT plays a crucial role in the monitoring of pest thresholds within integrated pest management strategies. It provides essential and timely information, facilitates the mapping of agro-biodiversity in

multiple-cropping systems, enables the forecasting of disasters and aids in the prediction of crop yields. The integration of technology plays a crucial role in reducing crop losses, as it enables farmers to receive timely information on insect infestations and climatic alerts using SMS messaging (Ghosh et al., 2018). Moreover, the usage of ICT plays a significant role in facilitating the efficient allocation of resources. Guillen et al. (2021) reports that It empowers farmers by providing them with valuable insights on several aspects such as water management, equipment utilization, adoption of improved seed varieties, appropriate fertilizer application and effective pesticide management. Consequently, these advancements in ICT contribute to the enhancement of agricultural practices on a global scale.

Stienen (2007) asserts that agriculture plays a crucial role, especially in developing nations, since a significant portion of the rural populace relies on this industry. The agricultural sector faces considerable obstacles in increasing productivity in light of the declining availability of crucial natural resources required for farming activities. Notwithstanding these obstacles, the rising need for agricultural commodities offers prospects for producers to maintain and enhance their means of subsistence (Krone et al., 2016). In the given setting, the utilization of ICTs is recognized as an essential instrument for effectively solving difficulties and enhancing the quality of life for those residing in rural areas who are experiencing poverty.

The diverse advantages of utilizing ICT in the food and agricultural sector are apparent in numerous areas, encompassing livestock supervision, disease mitigation, poverty reduction, precision farming and digital financial services for farmers (Meena et al., 2021). Guillen et al. (2021) found that these applications play a collective role in enhancing profitability in the agricultural sector, reducing transaction costs, facilitating adaptation to climate change and ultimately improving the livelihoods of individuals living in rural areas who face economic challenges. The use of ICT within the agricultural sector not only serves to improve production and efficiency, but also assumes a crucial role in promoting sustainable farming practices and facilitating economic growth within rural regions.

CHALLENGES FACED BY FARMERS IN THE ADOPTION OF ICTs

ICT adoption refers to the systematic incorporation of ICT into the routine activities of a nation or community. The use of ICT in the agricultural sector exhibits variations in both extent and pace among countries, which can be attributed to the distinct economic, social and political conditions that characterize each nation (Akinola, 2017). Knowledge-based economies have widely adopted ICT in the agricultural sector since the mid-1990s. However, several regions, such as Haryana, are presently in the process of integrating this technology into their agricultural practices. The process of adoption is not characterized by spontaneity, but rather entails the acquisition and assimilation of technological information, its application to pre-existing experiences and its subsequent integration into production processes (Alant & Bakare, 2021). The primary objective of this research is to examine the barriers that impede the integration of ICT among small-scale farmers. Additionally, this study aims to investigate the consequences of this limited adoption on the agricultural sector in Haryana. To achieve these goals, insights from issues encountered in other countries will be utilized.

Numerous nations have been the object of research examining the use of ICTs, with a special focus on the incorporation of computers to enhance agricultural output. Kankanhalli et al. (2019)

conducted a study that established a distinct association between the adoption of ICT and the educational attainment of farmers, as well as the scale of their agricultural operations. The results of the study revealed a noteworthy correlation between the age of farmers and their adoption of ICTs, suggesting a detrimental effect. Significantly, there exists a discernible disparity in the rate of adoption between farms of varying sizes and classifications. Numerous scholarly investigations underscore the fact that the integration of ICT demands a substantial allocation of time and resources. The significance of comprehending and tackling these problems is emphasized by the research, as it contributes to the facilitation of the efficient incorporation of ICT in the agricultural industry. This, in turn, enhances productivity and sustainability in regions such as Haryana.

Taragola and Gelb (2005) have observed that the integration of ICT in the agricultural sector encounters many obstacles. The challenges encompass various aspects, such as a deficiency in ICT proficiency, a restricted understanding of its advantages, complexities in maneuvering intricate ICT systems, inadequate technological infrastructure, substantial costs associated with acquisition and maintenance, diminished trust in the ICT system, inadequate opportunities for training, hurdles in integration and a scarcity of appropriate software options.

According to Karanth et al. (2022), the adoption of ICT by small and medium-sized firms (SMEs) is not meeting the expected levels, as indicated by previous scholarly research. The constraints identified in this study include a lack of understanding of the potential advantages of ICTs, limited financial and expert resources and inadequate expertise in ICT-related skills (Katiyar & Farhana, 2021). Academic inquiries have also prioritized the identification of factors that exert influence on the use of ICTs. Abdelmeguid et al. (2022) have focused on the analysis of organizational components, particularly the provision of organizational support and managerial aid. Nevertheless, there has been a lack of extensive scholarly research focused on the abilities acquired by individuals who own something and how they subsequently employ those abilities. As a result, there exists a limited comprehension about the difficulties linked to the utilization of ICT among proprietors of small and medium-sized enterprises (SMEs). Additional investigation in this field is imperative in order to rectify these deficiencies and bolster the efficient incorporation of ICT in agricultural methodologies and small and medium-sized enterprises (SMEs) (Rajan et al., 2021).

According to Sindhwani et al. (2019), there is a tendency for small and medium-sized firms (SMEs) to demonstrate a sluggish adoption of ICTs. In their study, Benos et al. (2021) discovered that the incorporation and usage of ICT inside small and medium-sized enterprises (SMEs) are influenced by a multitude of characteristics associated with the business and industrial sectors. Sindhwani et al. (2022a) found a multitude of internal and external constraints that have a significant impact on the adoption of ICTs. Internal challenges refer to a range of factors that are inherent within a corporate organization. These issues can be categorized into three main areas: owner-manager traits, business characteristics and cost and return on investments. External impediments encompass a range of elements, such as infrastructure, social dynamics, cultural influences, political circumstances and legal and regulatory frameworks.

Alzoubi et al. (2017) revealed that obstacles to the use of ICT in the agricultural industry have undergone changes over time. Conventional barriers, such as inadequate training and exorbitant expenses, were deemed no longer substantial constraints. The challenges associated with slower

Internet connectivity in rural areas have been attributed to various variables, including limited proficiency in information technology, infrequent utilization resulting in unfamiliarity and a dearth of awareness of available sources of information.

Regional disparities in computer and internet accessibility have been seen to have an impact on the utilization of ICT via computerized decision support systems (DSS), notably within the realm of decision support systems. The scale and type of agricultural operations seem to be intricately associated with these characteristics. Large corporations possess the necessary resources to effectively incorporate ICT into their operational processes (Agrawal, 2020). Conversely, small and medium-sized agricultural organizations encounter limitations in terms of financial and human resources, which restrict their capacity to embrace ICT. Sindhwani et al. (2022b) emphasized a notable obstacle encountered by European nations, such as the United Kingdom, Poland and Portugal, in relation to small and medium-sized enterprises (SMEs) such as the dearth of ICT competencies and expertise.

In accordance with the findings of the International Telecommunication Union (ITU, 2010), Brazil exhibited a 39.2% Internet penetration rate among its populace in the year 2009. In the corresponding year, a total of 23.85% of homes indicated that they possessed Internet access, while a mere 5.92% reported having access to broadband connectivity. In pursuit of a comprehensive national plan, multiple governmental entities in Brazil have enacted legislation aimed at attaining universal digital inclusion (Sindhwani et al., 2022b). The policies outlined in the study by Ruben & Varthanan (2019) prioritize the promotion of personal computer adoption, guaranteeing equal access to digital resources in public schools and providing public access points for information and communication technologies.

Ryan (2022) has discovered various structural barriers that significantly impact the rate and efficacy of ICT adoption, particularly in rural regions where residents have unique and specific issues. The issue of physical accessibility to telecenters is of notable concern, mostly attributed to issues such as geographical distance, inadequate road infrastructure and the potential threat of theft. Moreover, the issue is further exacerbated by a range of problems, including the unreliability of power grids, the need for equipment maintenance and the constraints imposed by limited financial resources.

Said et al. (2021) conducted an analysis of the barriers faced by organizations and discovered several factors that significantly impact the adoption of ICT among small and medium-sized firms (SMEs) operating in the agriculture sector. These factors include financial resources, technical capabilities and company characteristics. In contrast, Kshetri (2020) revealed that certain factors related to the adoption process, such as relative advantages and compatibility, exert a substantial influence on the adoption of innovations within small and medium-sized commercial organizations. The emergence of telecenters has been identified as a crucial determinant in the adoption of telecommunication technology, namely within the realm of farmer associations. The associations that oversee these telecenters offer benefits that extend beyond the immediate vicinity of educated farmers, as they provide access to both technical and market information over the Internet (Bouguettaya et al., 2022). Blessy & Kumar (2021) provide an account of the initiatives undertaken by the Peruvian Centre for Social Studies in conjunction with farmer organizations in the Huaral Valley region to construct a network of local telecenters. The objective of the project is to establish information hubs that cater to the needs of farmers,

with the goal of improving agricultural practices and increasing resilience in the face of water scarcity. The local board of irrigation users administers a comprehensive information system that facilitates transparent monitoring of water usage.

Sharma et al. (2022) conducted a study in Sri Lanka to examine the utilization of ICT in the agricultural sector and its associated ramifications. According to the findings of the survey, a significant majority of respondents, specifically 76.1%, encountered difficulties pertaining to the adoption of ICT in the agricultural sector. The challenges associated with communication and Internet technologies were more prominent compared to those of Decision Support Systems (DSS), precision farming and production models. This was primarily due to the limited adoption of the latter technologies, which can be attributed to a lack of awareness and understanding among potential users. The biggest barrier affecting the adoption of ICT in the agricultural sector was the financial burden involved with implementing such technology. The cost factor played a significant role in influencing the usage of technology in 62.6% of cases within the tea sector and 42.9% within the chicken business. The second difficulty identified pertained to the insufficiency of training and the farmers' limited ability to proficiently utilize ICTs. Third-level variables that impede the adoption and utilization of ICT in agriculture encompass issues such as the extent of trust in the ICT system, insufficient technological infrastructure and a dearth of knowledge in ICT. The utilization of mobile phones was widespread in the tea and poultry sectors, surpassing other ICT applications such as the Internet, World Wide Web (WWW), email and decision support systems (DSS). The difficulties are closely linked to the domain of ICT training and expertise.

The World Bank's research conducted in 2018 provides insights into the obstacles affecting the adoption of ICTs among rural women, emphasizing notable gender differences. The differences observed in computer usage among women farmers can be attributed to cultural norms, hence raising concerns about its applicability in their context. In contrast to their male counterparts, women residing in rural areas exhibit a lower likelihood of possessing communication assets such as radios or mobile phones. Additionally, they demonstrate a reduced propensity to spend resources on the utilization of public communication facilities, provided such utilization is deemed important for the purpose of maintaining familial connections or facilitating money transfers. One significant difficulty lies in the hesitancy of rural women to utilize cyber cafes or public Internet centres, which are frequently male-dominated. The café culture often perpetuates the marginalization and exclusion of female patrons. Furthermore, rural women have constraints in terms of the little time they have available for studying and utilizing ICTs , primarily due to their extensive responsibilities and obligations within the household. However, acknowledging the potential advantages and efficiency-enhancing aspects of ICT utilization may enhance individuals' involvement with these technologies.

Bhargava et al. (2021) found that developing nations encounter a substantial challenge in the form of limited literacy levels, which impede the effective utilization of ICT within these societies. A significant proportion of developing countries, with a particular focus on Sub-Saharan Africa, demonstrate low levels of e-readiness as indicated by their rankings. The absence of community comprehension of the potential advantages and capabilities of ICT is a notable obstacle. The ability to fully engage in the interconnected global society is dependent on holding a significant level of ICT comprehension.

Bhat & Huang (2021) conducted a study that investigated the adoption of ICT among small and medium-sized enterprises (SMEs) and farmers in Nigeria. The findings of the study highlighted a notable barrier that impedes the widespread implementation and extensive utilization of ICT: the insufficient condition of physical infrastructure. The adoption of ICT in developing nations presents a range of challenges that span different areas, including legal and regulatory issues, insufficient ICT strategies, limited research and development capacities, excessive reliance on foreign technology and ongoing deficiencies in the implementation of ICT (Kumar et al., 2017).

Mobile phone-based currency transfer systems, such as M-PESA in Kenya, have gained significant popularity, as seen by their user base of over 13 million individuals (The Economist, 2011). These services facilitate the provision of supplementary services by farmer organizations, such as the sale of agricultural inputs and the implementation of more easy payment mechanisms for agricultural produce. Zambia is now implementing a pilot project known as the "e-voucher" initiative. Under this program, enrolled farmers are provided with prepaid mobile phone vouchers worth around US$ 50. These vouchers can be utilized by farmers to get agricultural goods exclusively from authorized agro dealers (Sibanda, 2010).

Sott et al. (2020) found that the implementation of ICT in poor countries is typically hindered by the substantial expenditure needed for infrastructure development. This financial requirement often surpasses the available resources, rendering it either prohibitively expensive or commercially unviable. This argument holds special relevance when analyzing the bulk of African states. Telecommunications infrastructure in developing nations is often limited and incurs disproportionately high costs. The current infrastructure is predominantly focused in prominent metropolitan areas, leading to a dearth of assistance for rural farmers and enterprises that necessitate regular access to information and more extensive commercial connections (Fabregas et al., 2019). The current circumstances are unfavourable due to the high concentration of the world's most underprivileged inhabitants in rural and economically disadvantaged areas, which are characterized by insufficient or non-existent ICT infrastructure (Faure et al., 2018).

According to Kumar et al. (2019), the matter of affordable accessibility continues to be a significant concern in the majority of developing countries, despite the presence of established infrastructure. Li et al. (2022) argue that a significant barrier to access for personal computers, faxes, printers and specific ICT equipment in developing nations, including middle-class households, is their high cost. The constrained accessibility of this technology imposes limitations on the potential user base. According to (Liakos et al., 2018), the financial implications of implementing and maintaining ICT systems are significant, making them inaccessible to a considerable segment of the population due to their high initial expenses and continuous upkeep costs.

METHODOLOGY

This study is designed to cater to those living in rural areas, with a specific focus on Haryana state. It utilizes qualitative methodologies to investigate the research inquiries. The research conducted in this study involved the entirety of the people residing in Haryana. A random selection method was employed to pick participants for the study. Two separate methods of data gathering, specifically questionnaires and documentary reviews, were utilized. Primary data was collected through the use of questionnaires, while secondary data for analysis was obtained

through documentation review. A total of 480 questionnaires were delivered across the six districts of Haryana. The utilization of primary data, in conjunction with the implementation of statistical analysis methods, amplifies the strength and comprehensiveness of the research.

DATA ANALYSIS

The data analysis is partitioned into two distinct sections. The initial section presents a thorough depiction of the participants' demographic characteristics, including gender, age and educational attainment. The inclusion of demographic information is essential in order to gain a comprehensive knowledge of the makeup and features of the individuals involved in the study.
The subsequent section explores the primary discoveries obtained from the gathered data. The aforementioned findings represent the fundamental results of the research and are expected to provide insights into the research inquiries formulated at the inception of the investigation.

Respondents' profile

The findings of the study reveal that a substantial majority of the participants, amounting to 87 percent, were of the male gender, while the remaining 13 percent were identified as females. The observed imbalance in the gender distribution of respondents indicates that male individuals in rural Haryana exhibited a higher degree of accessibility or willingness to engage in the study as opposed to their female counterparts, despite the provision of equal chances to both genders.

The study revealed that 17.5 percent of participants belonged to the age group of less than 30 years, while 40.8 percent fell within the age range of 30-40 years. The percentage exhibits a decline with older age cohorts, with 32.8 percent observed among individuals aged 40-50 and 24.8 percent among those aged 50 years and above. Furthermore, the findings indicate that individuals in the younger demographic exhibit higher levels of involvement in ICT activities compared to other age cohorts. This observation aligns with the prevailing pattern wherein young people are prominent adopters of ICT services.

In terms of educational attainment, it was found that 22.5 percent of the participants were illiterate, 28.5 percent had completed matriculation, 35.4 percent of participants were senior secondary and 13.5 percent possessed degree & above. The results of the study indicate that the respondents had different levels of education. This implies that most of the participants possessed the requisite knowledge and competence to furnish pertinent data, demonstrating a sound comprehension of the research aims. The findings of this study highlight the correlation between education levels and the propensity to accept ICTs . Specifically, those with atleast a secondary education exhibit a greater inclination towards ICT adoption and are considered to be potential adopters of ICT within the region.

MAJOR FINDINGS

The examination of the collected data on crucial inquiries has provided significant findings pertaining to the implementation of ICT tools in agricultural practices within rural regions. These findings are in accordance with the predetermined research goals. It is worth noting that a substantial majority of participants, up to 81 percent, acknowledged the existence of obstacles to obtaining ICT in the field of agriculture. Conversely, 19 percent expressed a contrasting perspective. Upon further examination of the aforementioned obstacles, a number of repeating

themes have surfaced. Several factors contribute to the limited adoption of ICT tools in rural areas. Firstly, the literacy level of farmers (Rank 1) is the major factor creating the hindrance in ICT adoption, as around one-fourth of the farmers were illiterate and not exploiting the full benefit of ICT, Additionally, no government assistance (Rank 2) was provided to farmers i.e., financial assistance, awareness programs etc. Moreover, there is a deficiency of awareness among farmers (Rank 3) about the benefits of ICT. Furthermore, High investment of ICT tools (Rank 4) also curtails the ability of farmers to get the benefit from ICT. Lastly, there is a resistance to change (Rank 5) among individuals in these areas, which further impedes the adoption of ICT solutions and relatively minor, a language barrier (Rank 6) has also been identified as a contributing factor to the limited uptake of ICT in rural areas as most of the information provided is in only English language in ICT tools. The combined results of these studies provide insight into the complex obstacles encountered when incorporating ICT into agricultural methods in rural areas. This comprehensive understanding is essential for the development of specific approaches aimed at increasing the adoption of ICT and effectively overcoming these hurdles.

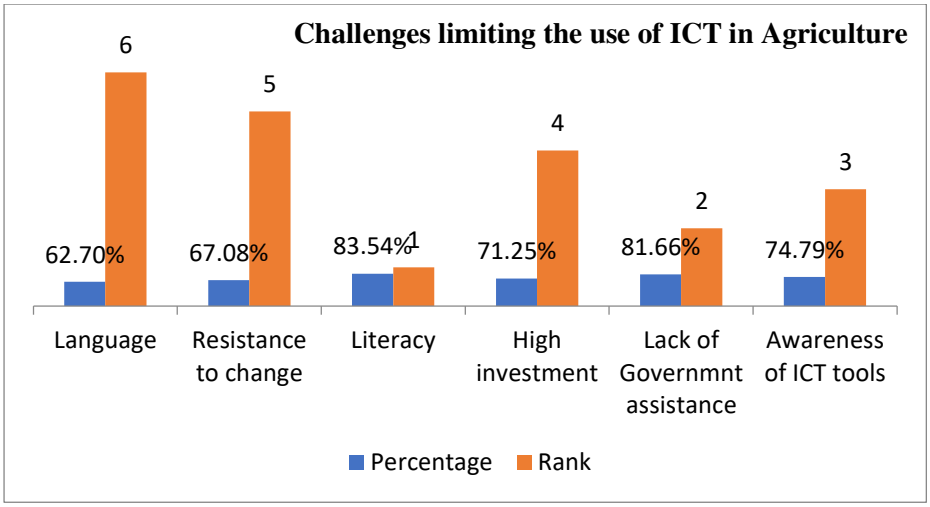

Figure 1: Factors restricting the usage of ICT in agriculture
Source: Author's calculation from primary survey

Figure 1 depicts the obstacles that are impeding the extensive use of ICT within the agriculture industry. The depiction of each challenge is determined by the frequency at which respondents express worry and their accompanying rank. The primary obstacle, as indicated by a substantial 83.54% of respondents and given the highest ranking, pertains to the illiteracy of farmers in rural regions. The participants' educational background holds significant importance as it has the potential to impact their capacity to comprehend and employ ICT tools proficiently within the context of agriculture. The second most prominent challenge, as indicated by 81.66% of respondents, is the unavailability of financial assistance from the government, most of the farmers residing in rural areas belongs from the low level of income category and the purchase of high cost ICT tools is unbearable for them. The third major barrier is insufficient availability of information about the utilization of ICT within the agricultural domain. This underscores the significance of awareness efforts and educational activities. Efforts ought to be focused on the dissemination of information pertaining to the advantages of ICT in the agricultural sector, the

implementation of training programs and the establishment of platforms for knowledge sharing. These measures are crucial for addressing the current information deficit (Crane-Droesch, 2018). The fourth difficulty, as indicated by 71.25% of the participants, pertains to the financial limitations experienced by those residing in poverty, which hinder their capacity to finance expenses associated with ICTs. This elucidates the economic barriers that impede farmers from making investments in ICT solutions. Potential strategies to tackle this difficulty could encompass the implementation of financial inclusion efforts, the provision of subsidies and the facilitation of inexpensive financing choices. These measures are specifically designed to augment the accessibility of ICT for farmers who possess low resources (Delgado et al., 2019).

The fifth most significant obstacle identified by 67.08% of the participants is the reluctance stemming from individuals' cultural beliefs towards change. This opposition poses a significant challenge to the widespread adoption of ICTs . This emphasizes the significant importance of socio-cultural variables within the process of technological adoption. The mitigation of resistance to change may encompass the implementation of customized awareness campaigns, active engagement of the community and the demonstration of demonstrable advantages linked to the integration of ICT in agricultural operations (Gill, 2021). The sixth most prominent concern, as indicated by 62.70% of respondents, is the presence of language obstacles. This statement underscores the significance of creating linguistically inclusive and culturally sensitive ICT tools and training programs. The ability to overcome linguistic barriers is crucial in facilitating farmers' acquisition of a full understanding and proficient application of available technology.

In brief, the chart offers significant insights into the various complex barriers that impede the extensive incorporation of ICT within the agriculture industry. To effectively tackle these difficulties, a comprehensive approach encompassing infrastructure development, educational programs, socio-cultural factors and financial inclusion strategies is necessary. The resolution of these difficulties is of utmost importance in order to fully harness the potential of ICT in changing and upgrading agricultural practices.

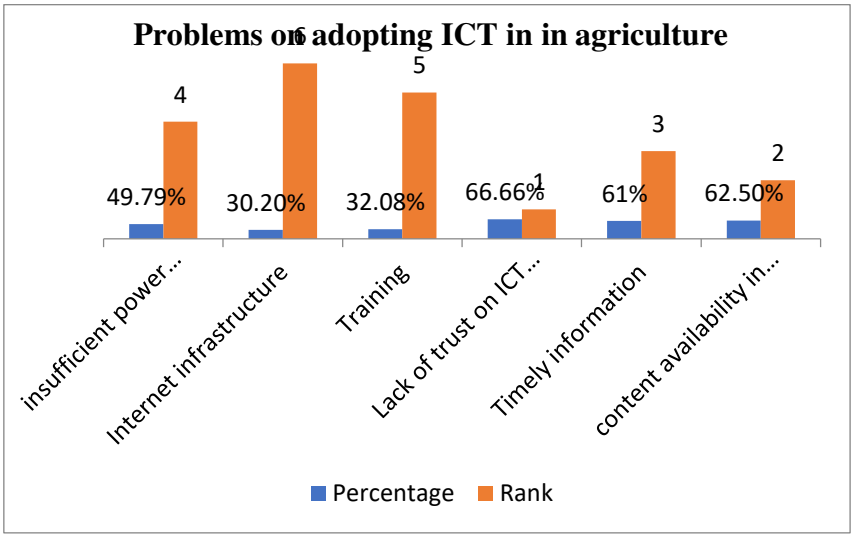

Figure 2 Problems on adopting ICT in agricultural
Source: Author's calculation from primary survey

Figure 2 depicts the main challenges faced during the adoption of ICT in the agriculture sector. It offers a visual representation of the distribution of participants and their corresponding ranks for each highlighted obstacle. The primary issue, as evidenced by a substantial majority of 66.66% of participants ranking highest in importance, is the lack of trust on ICT tools. This highlights the crucial necessity of educational initiatives and substantial awareness programs to tackle the deficit in knowledge, equipping farmers with a thorough understanding of ICT instruments and their potential advantages in improving agricultural methods. Efforts in this domain should focus on the elucidation of technology and the provision of experiential learning opportunities to enhance the digital literacy of agricultural practitioners (Page et al., 2021).

The second rank was obtained by the availability of content only in english language. All the internet sites, portals and agriculture applications provide data only in english language which curtails the acceptance of ICT in rural areas. The agriculture data must be provided in regional languages so that the full benefit of ICT can be taken by farmers. The third rank provided by farmers is timely information, This highlights the urgent requirement for improving infrastructure and fostering specialized knowledge in these areas (Chatterjee, 2020). To properly tackle this challenge, it is imperative to not only provide the requisite equipment but also ensure the availability of proficient experts who can offer guidance and support to farmers in effectively harnessing ICTs. The difficulty listed fourth, as indicated by 49.79% of the respondents, relates to the accessibility and dependability of electricity. The absence of consistent electricity provision is a significant barrier to the effective application of ICT technologies. This highlights the necessity for reliable energy supplies and viable alternative solutions, such as the integration of solar-powered technologies in the agriculture industry.

The respondents regarded lack of training, as a significant impediment, with 32.08% of them rating it fifth among the problems that were mentioned. From time to time training programs should be arranged by the government and universities so farmers can know the practical applicability of ICT tools in the agriculture domain.

The sixth rank conveyed apprehensions over impediments relating to infrastructure, including connectivity (30.20%) and allied infrastructure, The effective utilization of ICT tools and technologies is contingent upon the reliability and availability of robust infrastructure (Paudel et al., 2022). The imperative to confront this dilemma highlights the significance of allocating resources towards the advancement of rural infrastructure, including improvements in connectivity and the provision of essential gear.

The figure presents a thorough examination of the diverse obstacles faced while implementing ICT in the agriculture industry. To effectively implement digital solutions in the agricultural sector, it is imperative to develop a methodical approach that can effectively solve the problems associated with this process. This necessitates the implementation of a comprehensive array of interventions across various domains, including education, policy, infrastructure and finance. The successful implementation of ICT in sustainable agricultural development requires a collective and cooperative approach involving governments, technology providers and agricultural stakeholders (Su et al., 2011). The collaborative effort is of utmost importance in creating an environment that fosters and advances the efficient utilization of information and communication technology in the field of agriculture. This statement emphasizes the significance

of implementing a comprehensive and well-coordinated strategy to address the obstacles that impede the extensive integration of ICT in the agriculture industry.

SUGGESTIONS FOR IMPROVING THE ADOPTION OF ICT AMONG FARMERS

After completing a comprehensive examination of the issues affecting the adoption of ICT applications in agriculture in rural parts of Haryana, we will now shift our focus to the overarching elements that jointly influence users to adopt ICT applications for their agricultural activities. The findings, which have been condensed and are displayed in Figure 3, provide a comprehensive overview of the primary factors influencing users' decision-making processes when adopting ICT applications in the agricultural sector of Haryana.

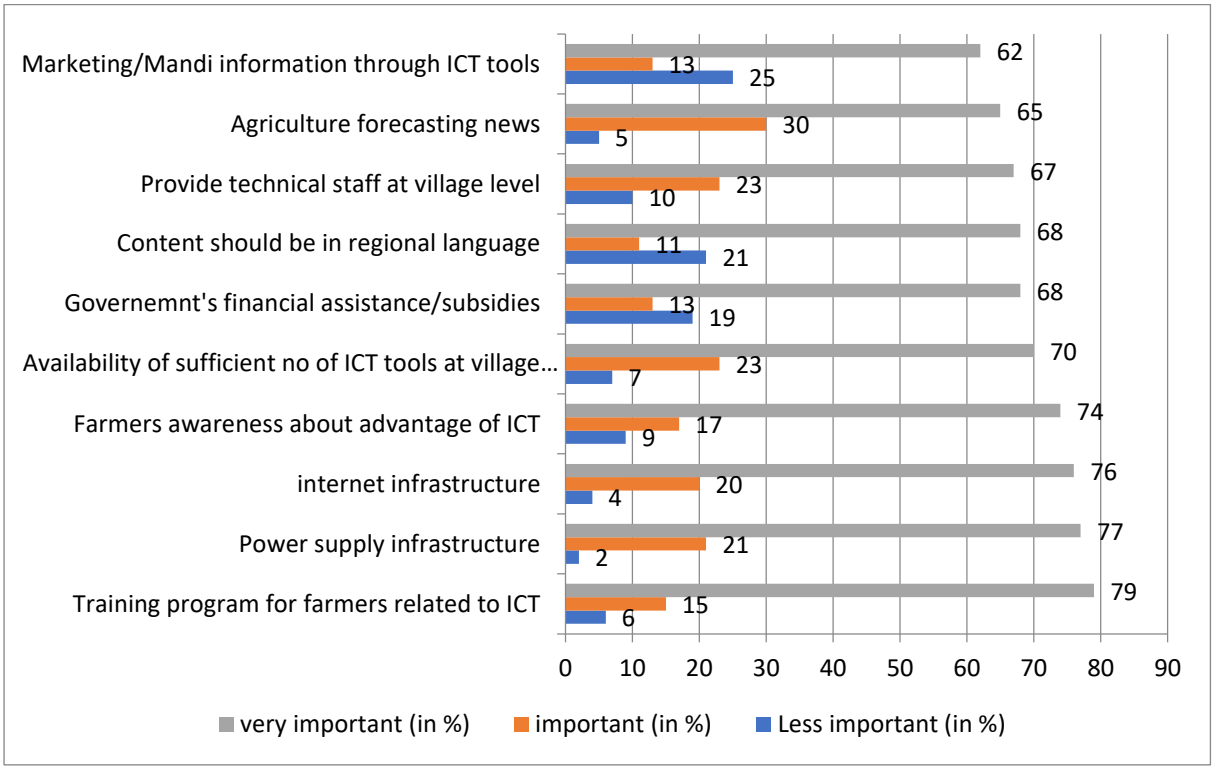

Figure 3: Suggestions for improving the adoption of ICT among farmers
Source: Author's calculation from primary survey

Figure 3 presents a thorough depiction of the unique perspectives given by farmers about the availability and utilization patterns of ICTs within the agricultural sector. The incorporation of appropriate significance levels for each recommendation provides a comprehensive comprehension of farmers' viewpoints regarding the integration of ICT into their agricultural practices. Training programs centered around ICT have emerged as the primary area of focus for farmers, garnering the highest level of importance according to 79% of respondents, who ranked it as their top priority (Rank I). This highlights the urgent necessity for capacity-building initiatives aimed at providing farmers with the necessary skills to properly utilize ICTs. The enhancement of electrical supply is widely recognized as the most highly esteemed advice by farmers, ranking second in terms of importance. The idea in question is regarded as highly significant by approximately 77% of farmers. This emphasizes the crucial need for a reliable

electrical power supply to facilitate the effective exploitation of ICT equipment in agricultural environments. The necessity of improving internet access is widely recognized as being of utmost significance, as indicated by a substantial majority of 76% of respondents. This highlights the necessity of implementing comprehensive infrastructure development in order to guarantee consistent and uninterrupted internet access in rural regions (Thomas & Uminsky, 2022).

Farmers strongly emphasize the utmost significance of promoting awareness regarding the advantages of ICT technologies, considering it to be the most critical aspect. A significant majority of participants, up to 74%, emphasize the necessity of establishing awareness initiatives aimed at educating farmers about the benefits and practical uses of ICT in the agricultural sector. This highlights the importance of implementing targeted activities that focus on improving farmers' understanding. While, the incorporation of a comprehensive range of ICT instruments at the village level holds great importance, as indicated by 70% of the respondents who placed it as the fifth most crucial aspect. This underscores the significance of ensuring a sufficient stock of devices to accommodate the growing demand. Furthermore, a significant majority of participants (Rank VI) recognize the significance of possessing sufficient financial resources for the successful adoption of ICT at the village level. The allocation of financial aid is widely recognized as a critical factor in the establishment and maintenance of ICT infrastructure in rural regions. The significance of communicating information in the local language is underscored by 68% of participants, as indicated by their ranking in the seventh position. This highlights the need for offering region-specific material and distributing information in languages that are commonly understood by agricultural workers.

The significance of allocating technical personnel at the village level has been acknowledged by 67% of respondents, as evidenced by their placement at position eighth in the ranking. The statement highlights the necessity of providing on-site support to adequately tackle the technical obstacles faced by farmers. Although not considered the highest priority, forecasts on agricultural news retain a moderate level of value for farmers, as indicated by 65% of participants acknowledging their importance (Rank IX). This implies that the prompt and precise dissemination of information pertaining to agricultural patterns continues to hold significance for farmers. The acquisition of marketing information using ICT tools does not rank as their highest priority. This suggests that although knowledge pertaining to the market is valuable, there are other aspects that are given greater importance.

The rankings reported in this survey are indicative of the inclinations of farmers with regards to the incorporation of ICT within the agricultural industry (Dharmaraj et al., 2018). The rankings highlight the importance of increasing awareness, delivering training, improving infrastructure and allowing the dissemination of localized information. The implementation and utilization of ICT tools within rural agricultural communities can be significantly improved by considering these recommendations.

CONCLUSION

The main aim of this study was to examine the difficulties encountered in the implementation of ICT applications in the agricultural sector within rural regions of Haryana. The study investigated the practical application of ICT in the state of Haryana, with a specific focus on

gathering perspectives from individual farmers regarding the adoption of ICT in rural regions. The primary factors that impact farmers in Haryana in their decision to not adopt ICT applications can be classified into three distinct categories. The initial category encompasses various factors, including little understanding of ICTs, the absence of necessary ICT resources and competence and inadequate governmental backing. The second category encompasses various obstacles, including deficient rural infrastructure, insufficient knowledge regarding ICT in agriculture, cultural norms and behaviors, opposition to adopting new practices and a dearth of effective implementation of ICT rules pertaining to agricultural applications. The third category encompasses several obstacles associated with the absence of electrical infrastructure in rural regions, restricted availability of internet connectivity, financial constraints hindering the adoption of ICT in agricultural practices among rural inhabitants and language difficulties, notably the prominence of the English language.

The study findings suggest a positive correlation between the limited understanding and awareness of ICT and the utilization of ICT applications in the state of Haryana. The degree of awareness of ICT in the state of Haryana is quite low and this is reflected in the levels of adoption. The implementation of ICT has limitations in rural regions of Haryana as a result of inadequate ICT infrastructure. However, the government and other stakeholders in the ICT sector are currently making efforts to tackle these difficulties pertaining to infrastructure.

RECOMMENDATIONS

The integration of ICT applications in the agricultural sector necessitates substantial investments in financial resources and human expertise. The rigorous evaluation of potential adopters and the implementation of steps to promote the general adoption and utilization of ICT services in Haryana are crucial for both ICT players and the government. The survey that was done has successfully identified the primary challenges that are affecting the adoption of ICT applications in rural Haryana. Hence, it is imperative for the sector to conduct comprehensive inquiries into each difficulty, utilizing them as prospects to enhance the utilization of ICT in the rural regions of Haryana with the aim of achieving agricultural prosperity (Guo et al., 2018). The successful resolution of these challenges necessitates conducting a comprehensive study on each obstacle, wherein the acquired knowledge is subsequently utilized in pragmatic approaches to expedite the rates of adoption.

A discernible disparity exists in the perception held by individuals who have adopted ICT compared to those who have not. Adopters typically hold a more favourable perception of ICT, whereas non-adopters tend to harbor a negative perspective, which is impacted by the aforementioned problems. In order to foster a favourable perception of ICT as a catalyst for agricultural development among non-adopters and the general populace, it is imperative for both the ICT sector and the government to collaboratively implement comprehensive and enduring strategies (Hrustek, 2020). These measures should aim to promote the widespread and long-term adoption of ICT in the agricultural sector, thereby ensuring its beneficial impact on the country's agricultural development and the well-being of its population. The obstacles encountered in the use of ICT should be perceived as favorable circumstances for ICT stakeholders to improve their services, thereby promoting the adoption and utilization of ICT in the region of Haryana.

The good effects of ICT advancement in rural regions, including Haryana, have become apparent in multiple facets of agriculture. These include agricultural extension services, improved access to market information, enhanced access to financial resources and increased availability of meteorological information (Iiyama et al., 2018). Hence, it is recommended in this study that the government enhance the agricultural environment by implementing a strong ICT infrastructure across all rural regions of Haryana. This recommendation is since around 80 percent of agricultural activities are concentrated in these areas. The objective can be attained through the implementation of last-mile connectivity for farmers to use the internet, the establishment of an adequate number of telecentres and the assurance of a consistent supply of electricity.

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