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Mobile Telephony as an ICT Tool for Agricultural Information Dissemination in Developing Countries: A Review

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In emerging nations, the use of information and communication technology has considerably benefitted the advancement of agriculture, health, rural development, and education. This technique has had a considerable impact on the way agriculture is developed in third-world countries. For information on the weather and prices, farmers now have direct access to the market, buyers, customers, and the metrological department. Information and communication technology has increased farmer incomes all over the world. It is now vital to provide access to facilities and introduce technology to rural areas where farmers lack knowledge, information, and skills regarding this technology. Several studies have also demonstrated that the adoption of information and communication technology tools in agricultural production has increased agricultural productivity. A few of the major problems and challenges that farmers encounter includes inadequate information transfer, poor agricultural practices, record reconciliation between farmers, the government, and traders, and a lack of understanding of the best farming techniques.

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INTRODUCTION

The economies of most developing countries are primarily reliant on agriculture. The agricultural industry has several challenges, including poor agricultural practices, ineffective information sharing, record-keeping between farmers and dealers, and a lack of knowledge about optimal practices for farmers. In many third-world countries, the majority of people reside in rural areas and rely on agriculture for their livelihoods either directly or indirectly (Chhachhar & Hassan, 2013). Information and Communication Technology (ICT) presents novel approaches to interpersonal communication as well as to the sharing, enhancing, and dissemination of information among multiple populations. ICT may supplement, reinforce, or replace existing networks and information systems. Computers, fax machines, mobile phones, the internet, landlines, and iPad video voice information systems are all included under the umbrella word "ICT" (Rangayasami & Kannan, 2022). The gap between people and places has shrunk because of ICT, which is also everyone's main source of information. It could be seen as both an enabler and a motivator. (Pade et al., 2009). ICT has facilitated the growth of knowledge societies in rural areas of emerging nations, which can lead to enhanced agricultural and rural development (Alam & Uddin, 2018). The use of online email, Microsoft PowerPoint, and other websites to improve communication abilities for agricultural information (ICTs) including e-mail, mobile devices, and the Internet, is necessary for farmers to get effective extension information (Yakubu et al., 2013). It has been demonstrated that the absence of infrastructure and restricted access in the developing world is the primary cause of poverty, illiteracy, and information sharing between developing countries. Information scarcity also played a role in limiting the ability to developing nations to advance economically. Obtaining new information regarding market

prices, weather forecasts, and other relevant issues are particularly difficult for the agricultural sector (Kumar et al., 2020). Different technology companies were unable to offer agriculture technology that is so highly useful and simple for the farming communities in these countries to adopt. Additionally, ICT infrastructure might be developed by utilizing existing infrastructures, which would allow farmers to cut expenses and make the technology more accessible to farmer communities while also increasing the acceptability of the new technology (Van Biljon & Kotzé, 2007).

Without a doubt, ICT presents opportunities and challenges for developing nations. It is one of the major forces that have fuelled globalization. ICT is an effective means of handling and disseminating information. It affects every element of life by closing the information and time gaps. ICT usage is growing daily to provide more rapid communication between various social groups, particularly farmers (Chhachhar & Hassan, 2013). ICT is a strong and important tool for enhancing productivity, spurring economic growth, and easing trade, transportation, and financial concerns. It also helps to create jobs and raise the standard of living for people in various societies in emerging nations. Additionally, ICT may contribute to the reduction of poverty by generating job opportunities and boosting productivity. ICT may be crucial in connecting with residents of rural and far-off places (Ali et al., 2014). One could argue that ICTs can increase rural people's understanding, adoption, and access to information about the contemporary agricultural system. Additionally, it can boost agricultural output, processing, and marketing, resulting in higher farm revenue, improved nutritional status, and a greater variety of agro-based product consumption, processing, and marketing in developing nations (Opata et al., 2011). Mobile phones and other ICT tools have given farmers new ways to make provisional

decisions much more easily than in the past. Using a mobile device improves social ties and social cohesion. However, audio recordings and short message services SMS have improved social interactions. Mobile phone-based social networking in emerging nations is evidence of the expanding significance of this factor (Razaque & Sallah, 2013).

ICT AND MARKETING INFORMATION

Mobile phone use for agricultural operations, such as receiving information about crop pricing at various marketplaces, learning about seed varieties, and contacting veterinarians, has had a significant impact on the growth of numerous nations. Mobile phones in India have been crucial to farmers' day-to-day operations by supplying them with the agricultural information they want regarding current farming practices and market prices (Mittal & Mehar, 2012) and the farming community is responding enthusiastically to mobile-based agriculture services. According to a different survey, farmers in the Philippines started using mobile phones to advance their fields. Whereas agricultural extension programs and other means of communication technology give fertilizer advice by text message to farmers in various farmer communities, mobile phones assist farmers in feeding their fields (Kashem, 2010). The usage of Grameen phones in Bangladesh also enhanced farmers' income, and research revealed that farmers were obtaining technological and commercial information through their preferred communication channels from relevant authorities. Farmers in India today are strongly connected to the media and receive market information from a variety of sources, including mobile phones, radio, and television. Farmers today use a variety of information sources to access markets and deliver high-quality goods to consumers (Kashem, 2010; Adhiguru et al., 2009). Farmers receive guidance and knowledge about the importance, uses, and benefits of new technologies from input and technology providers.

The interests of input providers and agro-purchasers are intertwined. Similarly, farmers

gather knowledge about the market to sell their goods for a profit (Ferroni & Zhou, 2012). Farmers claimed that the usage of ICT had a significant impact on how easy it was to get information about agriculture. This may indicate that farmers access market information via mobile phones in rural locations (Mehrabi et al., 2021). A trading platform that is based on the Ghana Trade Net has been built, enabling farmers to sign up for short messaging service (SMS) for information on commodities and markets where they can sell the products of their choice. Additionally, farmers in West Africa could request and get real prices for a variety of goods from various markets. A significant benefit in 2006 was the Ghana Agricultural Producers and Traders Organization, which bought goods from farmers via email or cell phone (Chhachhar & Hassan, 2013). This business buys products like tomatoes, onions, and potatoes (Khidir, 2020). Farmers and other members of the majority of communities have access to digital technologies, which can foster creativity and boost productivity. Farmers could improve the quality of their life by using such technology. ICT is a potent instrument for creative expression and direction, assisting farmers in making their own decisions on where to sell their produce. ICT has a crucial role in the growth of the economy by improving market efficiency, productivity, and competitiveness (Samah et al., 2010).

The Agricultural Market Information System (AMIS) initiative was started in Bangladesh to aid small farmers and disseminate knowledge about regional agricultural markets to increase on sales. This project's goal was to provide farmers with market information so they could strengthen their position along the value chain by becoming more informed and able to negotiate higher prices for their produce (Islam & Grönlund, 2007). Many of the main wholesale agricultural marketplaces in Sri Lanka feature a produce list of various commodities, with pricing made available by an automated speech system that is accessible via mobile devices. It was discovered that the majority of farmers thought the system enabled them to learn about prices. They were able to

haggle for greater pricing because of their mobile phones (de Silva & Zainudeen, 2006). Farmers were provided with market and agricultural information through a variety of communication and media outlets in different locations of Nigeria. In developing nations, communication tools such as farm magazines, flyers, newsletters, newspapers, pamphlets, radio, television, the internet, and mobile phones are essential (Ntambi, 2016). ICT, particularly modern mobile phones, could improve access to and use of information on agricultural technologies, possibly enhancing farmers' learning and information marketing.

At each stage of the agricultural production process, it was demonstrated that farmers need information on a variety of subjects. Many developing nations still receive their knowledge in traditional ways, such as through conversations with others, the radio, and sometimes newspapers. Mobile devices could greatly lower the costs associated with acquiring marketing and agriculture data regarding cost and price information for various types of search mechanisms. Weekly price updates are provided for particular products and markets in the majority of the nation's regions via radio. Mobile phones were shown to be among the best tools for spreading and gathering data on agricultural technology yields and pricing in poor countries (Aker, 2011). The study on transaction costs was carried out at Matale, Sri Lanka. It was found that majority of farmers used their mobile phones to gather information while traveling to their markets or other locations. Additionally, the overall cost savings would be in the neighbourhood of 3% (De Silva & Ratnadiwakara, 2008). According to the scenario of media usage, numerous national and international organizations were using ICT tools in new media to connect the potential of new technology in diverse ways.

Communities of farmers have benefited from the development of new technologies, such as the usage of mobile phones for information gathering and communication. ICT keeps farmers informed about market prices and the most recent market

information, enabling them to offer their products for higher prices. Farmers were increasingly using the internet. Farmers were getting more marketing information in this context for selling their goods in various markets (Rath & Hermawan, 2020). Instead of relying just on radio or television for the broadcast of agricultural information, the mobile phone has provided farmers with new methods and ideas for selling their produce in the market. Farmers may receive the most recent and timely information from mobile phone technology in several ways. Mobile phones have evolved into versatile, cost-effective tools for accessing various forms of agricultural-related information, from marketing strategies to production methods. The short service message (SMS) in this context could be used efficiently for the most recent agricultural information, such as marketing information that helps the farmer make sane judgments (Murthy & Nath, 2009). Farmers and rural residents have both been introduced to mobile phone technology, which allows them to communicate and exchange information about many challenges. Similarly, farmers could get in touch with agriculture officers and specialists to acquire knowledge of agriculture.

The Economic Survey of Pakistan cites by Pakistan Telecommunication Authority (PTA) informed there are currently 91.4 million mobile phone subscribers nationwide, and that the number is steadily rising (Abbas et al., 2009). According to some reports, the rise in mobile service customers is a sign that even those living in remote rural areas find this technology to be useful. To obtain information about their products, farmers can easily engage with customers in the marketplace. There is no denying that telecommunications are crucial to national economic development, as well as advancement of agriculture, health, and education. By enabling rural farmers to access markets, healthcare, and other government services, ICT helps to reduce poverty in those areas. According to Pakistan, ICT in agriculture was becoming more and more accepted. It gave poor farmers and various rural groups' access to information, which served as a twofold benefit since Pakistan is mostly a pre-paid

market, where rural residents and farmers could afford this technology like mobile phones, total tele-density has reached 65% (Siraj, 2010).

Farmers, buyers, and producers could receive up-to-date information regarding market rates for products through the usage of ICT. The ability of farmers to negotiate has risen as a result of this technology. To enable these farmers and villagers to obtain information on agriculture and medicine using the internet, a project was started in 70 villages in Maharashtra, India. This project was beneficial to farmers and villagers by raising their revenue and enhancing their knowledge (Meera et al., 2004). The prices that suppliers might charge for their commodities could be reduced if buyers and farmers had access to price information through ICT. ICT may also lessen the value of the location's competitive advantage and enable a foreign investor to undercut a domestic rival on pricing (Sohag et al., 2021). The study was carried out in Tanzania, where the group sent out farmers who were dubbed "market spies" to gather information about product availability and the most recent price via mobile phones close to cities. A considerable profit was made for the farmers thanks to this method, which also increased market access. The market trends were altered by this insight, and farmers were given new chances and to bring farmers and buyers together to discuss developing strategies and share information and experience to meet their recognized requirements, the first mobile initiative was launched in Tanzania. With the advent of the mobile phone, farmers started collaborating more, exchanging ideas, and finding new ways to increase their income (Rakhra & Singh, 2021).

Information on the Climate and Pesticides

Many satellite systems have been set up all over the world to connect farmers and deliver the most recent, pertinent information (Prahald & Hammond, 2002). However, the majority of these have concentrated on giving farmers access to particular knowledge resources, such as information about the weather and seeds. Additionally, India transmitted a variety of

announcements of general interest, including programming pertinent to animal husbandry and meteorological information for farmers to protect their farms from calamity (Chhachhar, n.d.). If farmers have experience using other mobile applications like social network apps, mobile banking apps, money transfer apps, and weather apps, using their phones for agriculture applications could have a favourable outcome. The study by (Singh & Rana, 2017) revealed that 57% of the respondents were mobile phones and had used other mobile applications, for instance, money transfer applications.

Farmers use ICT in different ways to get their information and communicate with people. In the context of cattle farming farmers request various veterinary services and pesticide payments to workers' extension officers obtaining weather conditions by use of the mobile phone. Similarly, farmers contact transport services and get information on diseases and suggestions and their control through different tools of ICT (Gichamba & Lukandu, 2012). In remote locations of Australia, the wireless sensor network powered by solar energy delivered weather data. Farmers may get information about weather, Tsunamis, and other disasters by using this technology, as this application server conveyed data from sensor networks to local users via Wireless Local Area Network (WLAN) and to remote users via the cellular network and the Internet: crossbow technology (Lawton, 2004). Products made from agricultural resources, like Nokia phones, were inexpensive in India in 2008, Indonesia in 2009, and China in 2010. SMS messages were sent to subscribers in one of two service tiers and ten different languages. The majority of the information concerned crop and seed prices. While weather predictions and other farming advice were texted to the subscribers, the information also contains local prices for the subscribers' selected crops and seeds and the farmers effectively utilized this technology to boost their output and revenue ((Ferroni & Zhou, 2012).

The introduction of information and communication technologies (ICTs) played a significant role in services and overall rural development initiatives as farmers were changing and needed new ways to give extended information and services. ICTs could supply information that was crucial for the long- and short-term development of rural communities, such as information on agriculture and education. ICT could supply farmers with weather information and lucrative cash (Chapman et al., 2003). For climate change adaptation and timely weather information, weather information is particularly important. The initiative, which was started in Burkinafaso in 1982, assisted farmers in getting information and better managing climate risk and it produced significant results (Fonta et al., 2018). ICT's arrival was intimately tied to the subject of education and may help farmers receive crucial information about the weather, pesticides, seeds, and various diseases (Byerlee & Lynam, 2020). Young farmers who work in agriculture are becoming more and more reliant on their mobile phones as infrastructure upgrades boost national economies and agricultural production.

The use of mobile devices to access meteorological data and launch new SMS-based services for farm information (Krell et al., 2021) and ICT users employ a variety of methods to inform diverse groups. In developing nations, weather and agricultural news are frequently featured on radio and television programs, and telecentres offer price information in addition to meteorological updates. It has been noted that governments in many developing nations have set up ICT centres to inform farmers of impending calamities like tsunamis, rain, or terrible weather. Some of these centres also provide information on the usage of pesticides in agriculture and the precautions that should be taken. Many conventional approaches, such as voice mail, SMS, and internet-based services, have expanded to include mobile telephony as a result of the proliferation of mobile phones (Mittal et al., 2019). E-learning initiatives have also introduced farmers to new methods, such as internet kiosks that provide them access to computers and the

internet for agricultural information. Weather, technical assistance, and suppliers and buyers in local markets are just a few examples of the information that may be found on the internet through various techniques. Most likely because this information is simple to gather and broadcast via the internet, the majority of these services concentrate on weather and transportation expenses.

The type of information provided determines how ICT is used in agricultural extension most of the time. Farmers could readily receive information about prices and weather via mobile phone and nowadays, mobile technology has taken the role of more conventional methods of information distribution (Aker, 2011). Farmers must offer unique information on effective communication technology methods in light of the globalization of trade, the economy, and agriculture. Farmers may pick the right kind of seeds, fertilizer, insecticides, and other agricultural information. Similarly, farmers must possess effective knowledge of crop production, water management, and most importantly, weather information before beginning to use pesticides in their farming (Zakar & Zakar, 2009). Farmers might give accurate advice and instructions on how to use pesticides by using a mobile phone. Farmers could also receive information from the concerned department about the proper combination and application of pesticides in their fields.

The metrological department could provide information on the local farming area's weather, pests, and other specialized factors. The appropriate application of pesticides could save agricultural crops from a variety of diseases. But correct pesticide application and dosage can assist to lessen environmental contamination (Yang et al., 2014). Farmers most frequently use mobile phones as ICT tools to access information on crop and livestock husbandry, optimal seed use, and livestock breeds. Based on information about the time and weather when planting crops, people specifically mentioned using mobile phones to explain agricultural methods in rural areas of

Uganda (Martin & Abbott, 2011). Farmers in the majority of developing nations, including Kenya, Nigeria, Tanzania, Zambia, and Uganda, utilize mobile phones to access information and technical guidance from extension agents who specialize in agriculture. These farmers use mobile phone technology to learn about severe weather, the prices of seeds, fertilizer, and pesticides and so on in almost all developing countries (Kahasha & Zuva, 2020).

CONCLUSION

Information and communication technology has narrowed the knowledge gap between communities and among farmers in developing nations, but there is still a gap between farmers, buyers, and extension services, and most farmers need ICT training, resources, and skills to improve their output in the future. Lack of infrastructure and inadequate government service delivery are problems in many developing nations. For information to be delivered to farming communities with appropriate structural arrangements and links at all levels of the agricultural supply chain, modern ICT-based models must be expanded in developing nations.

Conflict of Interest

The authors declare no conflict of interest.

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