Journal of Food and Agriculture
Volume 18, Issue 02, December 2025
Print ISSN: 1800-4288, E. ISSN: 2613-8530
DOI: https://doi.org/10.4038/jfa.v18i2.5350

Leveraging Mobile Telecommunication Technologies for Agricultural Information Access and Exchange among Small-Scale Cinnamon Growers in Galle District, Sri Lanka

H.A.C.K Jayathilake[1]* and L.M.J.K Lindara[2]

ABSTRACT

Agriculture remains a crucial part of Sri Lanka's economy, with cinnamon being a significant export. This research examined how mobile telecommunication technologies were used by small-scale cinnamon growers in the Galle District, Sri Lanka because they face several challenges, including limited access to vital agricultural information. A structured questionnaire was used to conduct a quantitative survey involving 240 farmers and 10 agriculture extension officers from six divisional secretariats. The findings revealed that although mobile phone ownership was widespread, up to 97%, there was a significant digital disparity, indicating that only 36% of farmers own smartphones. Although many people have mobile phones, their use in agriculture is still limited. The main barriers to effective utilization of mobile technologies included high costs, poor connectivity, operational difficulties, and language barriers. The research emphasized the importance of making mobile telecommunication technologies more affordable and accessible through infrastructure development, localized content, integrated services, peer-to-peer learning, and training programs to enhance their adoption and effectiveness. Additionally, there is a need for improved digital literacy programs and the expansion of mobile-based agricultural services to support the resilience and productivity of small-scale cinnamon farmers. This study indicated that addressing these challenges could significantly improve agricultural productivity, decision-making processes, and the socio-economic development of small-scale cinnamon growers in Sri Lanka.

Keywords: Agricultural information access, Cinnamon cultivation, Mobile telecommunication technologies, Small-scale farmers, Sri Lanka

1 ICT Center, Wayamba University of Sri Lanka, Makandura, Gonawila, Sri Lanka.

2 Department of Cinnamon Development, Borakanda, Gunarathna Weerakoon Mawatha, Karandeniya, Sri Lanka.

**jayathilake@wyb.ac.lk*

https://orcid.org/0000-0002-0629-6303

INTRODUCTION

Agriculture continues to be a crucial pillar of the Sri Lankan economy, making up 8.75 percent of the country's GDP and accounting for 25.75 percent of total employment in 2022 (Statista, 2024). Cinnamomum Zeylanicum, indigenous to Sri Lanka, produces the highest-grade pure cinnamon, in Sri Lanka being the world's largest producer and exporter, accounting for 90% of the global market share (Sri Lanka Export Development Board, 2024). Thus, among various agricultural sectors, cinnamon cultivation holds a distinctive position due to its historical and economic importance. However, Sri Lankan small-scale cinnamon growers encounter various obstacles.

In recent years, mobile communication technologies have increasingly reached rural areas, becoming more accessible for underserved communities. These technologies are now widely used for accessing and sharing agricultural information, as well as providing extension and advisory services. (Jayathilake *et al.*, 2017; World Bank, 2017). The potential benefits of mobile telecommunication technologies in agriculture are vast. Information and communication technologies provide farmers with high-quality and timely information, effective communication, reduce information access costs, eliminate institutional barriers to information provision, boosting agricultural productivity, and offer diverse opportunities for rural populations (Spielman *et al.*, 2021; FAO, 2017). The use of digital technologies will help to revolutionize agriculture and aid in poverty reduction (FAO & ITU, 2022). Aker (2011) has shown that the use of mobile phones in agriculture can lead to increased yields, reduced costs, and improved market access.

The advent of mobile telecommunication technologies has revolutionized information dissemination in agriculture, especially in developing countries like Sri Lanka. Since the deregulation of the telecommunications sector in Sri Lanka in the early 1990s, the industry has undergone significant transformation and improvement, achieving numerous major milestones (Silva and Yapa, 2013; Gamage and Halpin, 2007). As a result, Sri Lanka has made substantial progress in both ICT infrastructure and ICT literacy in recent years (Table 1).

Furthermore, Sri Lanka's mobile telecommunication infrastructure has expanded rapidly, supported by

government initiatives and private sector investments. According to the International Telecommunication Union (ITU), mobile cellular subscriptions in Sri Lanka have significantly increased, with a penetration rate exceeding 140% by 2022 (Statista, 2023).

Table 1. Telecommunication usage statistics and performance of Sri Lanka in 2022

T**elecommunication Types**	**Percentage**
Fixed line phones	11.64
Mobile subscriptions	143.83
Broadband subscriptions	9.92
Computer owned household	21.9
Household Internet usage	48.3
Household email usage	17.6
Performance Indicators	**Percentage/ Rank**
Computer literacy	36.1
Network Readiness Index (NRI) ranking	80 (out of 134 countries)
ICT Development Index (IDI) ranking	112 (out of 169 countries)
E-Government Development Index (EDGI) ranking	95 (out of 193 countries)

Source: Department of Census and Statistics Sri Lanka (2022); United Nations (2024)
Adopted from Mahindarathne (2022)

This widespread availability of mobile phones presents a unique opportunity to leverage these technologies for agricultural development even in remote rural areas. Mobile phones can play an important role in advancing knowledge sharing, particularly in an agricultural context, mainly because they are seen as low-cost and widely available communication tools in the agriculture sector (Jayathilake *et al.*, 2015; Qiang *et al.*, 2011). Mobile phones are essential for small-scale farmers who use them to access weather

updates, pest and disease alerts, market prices, and best agricultural practices. This availability is crucial for enhancing the resilience and productivity of smallholder farmers by improving decision-making processes.

The use of mobile-based information services leads to advancements in both knowledge and income, indicating a strong correlation between them. Those who utilize these services discover them to be extremely beneficial for the advancement of agriculture. In 2013, the Ministry of Agriculture, in collaboration with Mobitel Sri Lanka (Pvt) Ltd, launched a mobile phone-based agri-produce price information service called the Mobitel "6666" Agri Price Information Index to provide market price information for agricultural commodities (HARTI, 2013). Shanadi *et al.,* (2022) showed that implementing the "Govi Nena" real-time mobile app for potato farmers in Sri Lanka helped to improve potato production by guiding Good Agricultural Practices (GAPs) and addressing improper farming practices. Programs like the Govi Mithuru service by Dialog Axiata PLC, a mobile-phone-based information dissemination platform, have been instrumental in providing real-time agricultural information to farmers, thereby improving their productivity and income (GSMA, 2017)). Moreover, the Climate Smart Irrigated Agriculture Project (CSIAP), initiated in 2019, exemplifies the integration of mobile telecommunication technologies in enhancing agricultural resilience. This project, supported by the World Bank, aims to improve the productivity and climate resilience of smallholder agriculture in Sri Lanka. By incorporating mobile-based information systems, CSIAP has helped smallholder farmers access critical information on irrigation practices, climate adaptation strategies, and market trends, thereby mitigating the adverse impacts of climate change and improving livelihoods (World Bank, 2021). Furthermore, farmers can significantly benefit from these technologies by receiving timely information on weather conditions, pest management, and market prices, which are crucial for making informed decisions and optimizing their farming practices. Additionally, mobile platforms can facilitate peer-to-peer knowledge exchange among farmers, fostering a community of practice that enhances collective learning and innovation (Jayathilake *et al.*, 2015).

Meanwhile, several authors have discovered that even though many

rural farmers in Sri Lanka have access to mobile phones, they do not utilize them extensively for obtaining agricultural information due to their attitudes, lack of knowledge, and use of standard or regular mobile phones. Most farmers use mobile phones for personal purposes rather than farming tasks (Mahindarathne, 2022; Jayathilake *et al.,* 2017; Perera *et al.,* 2015). Mohamed et al. (2019) highlighted that in the Sri Lankan cinnamon industry, around 90% of stakeholders were interested in receiving relevant information related to weather, agro-technology, support services, market information, etc. through a mobile-based application. Therefore, the development of ICT-based solutions to enhance the cinnamon industry in Sri Lanka is beneficial. However, small-scale cinnamon growers in Sri Lanka face various obstacles such as restricted availability of crucial agricultural data, unpredictable market conditions, and changing climate patterns. Moreover, there are still significant barriers to the effective utilization of mobile telecommunication technologies among Sri Lankan farmers. Issues such as limited digital literacy, digital divide, high costs of mobile data, and inadequate network coverage in some rural areas hinder the full potential of these technologies (Mohamed *et al.,* 2019).

Although many studies have concluded over time that mobile telecommunication has an impact on agricultural development and knowledge sharing, it was questionable in the Sri Lankan context because there were very few researches investigating the use, access, and implications of mobile telecommunication technologies among small-scale cinnamon growers. This paper presents the current state of mobile telecommunication technologies among small-scale cinnamon growers in Sri Lanka in facilitating the access, use, and exchange of agricultural information.

MATERIALS AND METHODS

Cinnamon is cultivated for commercial purposes mainly in the southern coastal areas of Sri Lanka and has also expanded to the country's inland regions with elevations of up to approximately 250 meters above sea level. The research was conducted in the highest cinnamon-grown District, Galle (Fonseka *et.al.,* 2018). Cinnamon cultivation in Galle is predominantly small-scale, with holdings often below

0.5 ha. This structure fosters employment, sustains rural livelihoods, and preserves traditional knowledge systems (Jayakodi and Pushpakumara, 2024). Wijesinghe et al. (2017) have reported that the cinnamon cultivation in Galle District is dominated by smallholder farmers, with over 70% of growers owning less than 3 acres of land and an average holding of 3.7 acres. The majority of these farmers are older adults with 87% of over 40 years of age and largely educated up to the secondary level, with minimal youth engagement in the sector. While cinnamon is a key income source, only a one third of farmers earn over 50% of their household income from it, indicating a dependence on multiple income streams (Wijesinghe *et al.,* 2017).

The study employed a survey research methodology, utilizing a structured questionnaire within a descriptive survey design, drawing on previous studies of a similar nature (Mahindarathne, 2022 Aldosari, 2019; Jayathilake *et al*., 2017; Dissanayeke and Wanigasundere, 2014, LIRNEasia, 2012). The population of the study was comprised of small-scale cinnamon growers from six Divisional Secretariats of Galle District and agricultural extension officers attached to the Department of Cinnamon Development (DCD), Sri Lanka.

A multi-stage random sampling method was used to select 240 smallholder cinnamon farmers from an estimated population of over 8,000 in Galle District. The sample was proportionally allocated across six key Divisional Secretariats based on cinnamon farming intensity: Ambalangoda (N=50), Balapitiya (N=40), Elpitiya (N=35), Hikkaduwa (N=25), Gonapinuwala (N=10) and Karandeniya (N=80). Within each division, farmers were randomly selected from registries maintained by local extension offices. Of the 12 Extension Officers assigned to the Southern Province under the Department of Cinnamon Development, 10 were purposively selected for the study based on their availability and their current or prior experience working in the selected Divisional Secretariats. Data were collected through face-to-face interviews using a pre-tested, structured questionnaire, adapted from the LIRNEasia Teleuse@BOP4 toolkit (LIRNEasia, 2012). The 'LIRNEasia Teleuse@BOP4' toolkit was adopted specifically to prepare a questionnaire aimed at gathering information on the socio-economic and demographic data

of respondents, as well as their behaviour in seeking agricultural information and perception about the information sources and access. The survey provided insights as to how, when, and why mobile communication technologies were uses in their daily lives

RESULTS AND DISCUSSION

Demographic Factors of the Cinnamon Growers

According to the demographic characteristics presented in Table 2, male farmers constitute approximately 87 percent of the total sample. The mean age of respondents was 51 years and classified into the 40–60-year age group. About 60 percent of farmers were classified under the income category of the lowest annual income, i.e. less than Rs. 200,000 per annum. Regarding education levels, less than 1 percent (2 respondents) are illiterate or have no schooling, 30 percent have only gone up to grade 8, approximately 40 percent have completed Ordinary Levels (OLs) exams, and 29 percent have finished Advanced Levels (ALs) exams or higher.

Current State of Mobile Telecommunication Technology Usage

Based on the survey findings (Table 3), 97 percent of the respondent farmers and all extension officers use mobile devices. Roughly 94 percent of farmers have at least one mobile device on their own. Mobile communication devices come in various designs, differing mainly in their features, storage capacity, and processing speed. Out of the mobile owners, 64 percent use basic mobile phones, whereas smartphones are owned by only 36 percent. Smartphones provide advanced functions like cameras, Global Positioning System (GPS), Multimedia Messaging Service (MMS), Internet access, and the option to download different apps (World Bank, 2017). The rise in mobile phone ownership is credited to the ongoing growth of telecommunication infrastructure andthe availability of mobile phones to low-income families (Hannah and Minishi-Majanja, 2024; World Bank, 2017). In this survey, both men and women showed a high level of ownership of mobile devices. According to the International Telecommunication Union (2020), owning a mobile phone is essential for empowering women. Therefore, a balanced distribution of mobile

ownership among small-scale farmers indicates that there is no disparity in the use of mobile technology between males and females within this group. Considering the mobile connection type, 96 percent of farmers reported pre-paid mobile connections.

Table 2: Demographic factors of the sample used in the study

Factor	Indicators	Number of Respondents	Kruskal-Wallis statistic and Probability
Age	20 - 40 yrs	33	16.92
	40 - 60 yrs	168	P (0.001)*
	> 60 yrs	39	
Education	Illiterate	2	10.42
	Up to grade 8	72	P (0.015)*
	O/L completed	96	
	A/L completed	66	
Income	Less than Rs:20000	143	35.225
	Rs:200,001-400,000	95	P (0.1132)
	>Rs:400,000	2	
Gender	Male	209	24.34
	Female	31	P (0.134)

**Statistically significant*

Table 3. Telecommunication device usage statistics of the respondents (n=240)

Telecommunication usage statistics	Percentage
Radio	92
Television	95
Computer	14
Tablet	03
Fixed line phones	18
Mobile phones (smartphone + basic phone)	97
Smartphones	36
Ownership of Mobile phones	94

The study showed an increase in farmer's use of mobile devices as opposed to traditional sources like radio and TV.

Farmers generally have easier access to basic mobile phones due to their simplicity and affordability. However, these regular phones limit their functional ability to obtain information, as they do not support the mobile services offered by smartphone apps (Hannah & Minishi-Majanja, 2024; Adikari,2014). When assessing how well farmers can use the basic features of a mobile phone (Figure 1), it was found that all participants could make phone calls independently, more than 60 percent used text messaging, and approximately 34 percent could take photos and record videos. Many smartphone users are capable of browsing the Internet and social media apps like WhatsApp and Facebook. However, findings indicated that farmers had limited ability to Internet use (search, online purchases, pay bills, etc.), use emails, and especially use mobile services (m-services). Though the m-services have reported increased efficiency in service delivery by providing a quick and inexpensive way to communicate with farmers, we couldn't find reliable m-services related to cinnamon farming. This indicates that the Sri Lankan DCD needs to incorporate the use of m-services into its agricultural offerings. Similar findings were reported by Mahindarathne, (2022) and Bodhikotuwa et al. (2012) in Sri Lanka, suggesting that the farmers' capacity to use these basic functions significantly affects their acceptance of modern communication technologies in agriculture sector.

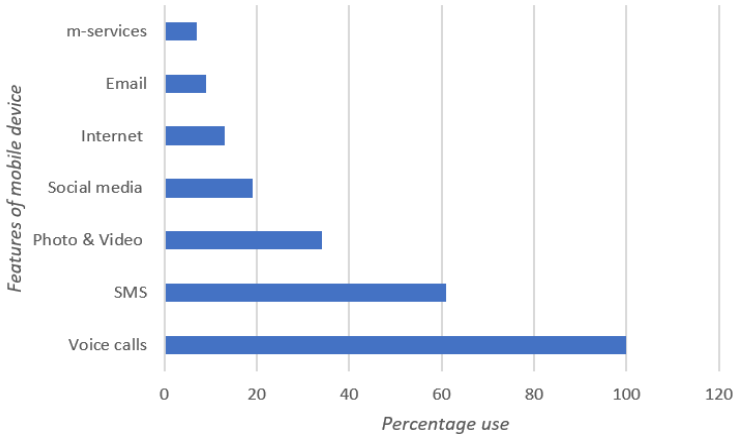

Figure 1. Percentage of mobile device-features used by the respondents (n=240

Status of Agricultural Information Accessed Through Mobile Telecommunication Technologies

Typically, cinnamon farmers obtained a range of agricultural information such as market updates, potential buyers and collectors, new farming techniques, chemicals and fertilizers, labor details, and financial advices from various sources. And also, agricultural extension officers utilized mobile phones to communicate and exchange information with these farmers. Our main focus is on providing access to agricultural information through mobile devices. The study evaluated the different types of data that farmers accessed via mobile phones by calculating their usage score (Frequently access=2, Occasionally access =1, Never access = 0). Based on Table 4 results, cinnamon farmers most commonly searched for market prices of cinnamon (ranked 1) and details on buyers, collections, and traders (ranked 2). Peelers and field workers were third in terms of access to labor-related information. Information related to production inputs, including seeds, agrochemicals, financial data, and pest and disease control, were ranked between ranks 4 and 7, respectively. Information about value-added products, farming techniques, and weather updates were found to be the least requested types of information by mobile devices. Mahindarathne (2022), Jayathilake *et al.,* (2015), Adikari (2014), and Dissanayeke & Wanigasundara (2014) have also found comparable results when researching the utilization of mass media and mobile information systems among Sri Lankan farmers.

The perception of the usefulness of mobile phones for accessing farming information was almost 69 percent, indicating that farmer respondents believed that mobile phones could enhance their farming practices, while approximately 31 percent disagreed. Given that a high number of farmers already see the value in mobile phones, there is a strong opportunity to encourage and assist them in using mobile phones effectively for their farming needs.

Furthermore, when we inquired about the perception of the usefulness of the Internet, only 12 percent of farmers stated that it could improve their farming activities.

Table 4. Types of information accessed using mobile phones (n=236)

Types of information	Usage			
	Frequently	Occasionally	Never	Usage Score (rank)
Market prices of Cinnamon	168	54	14	390 (1)
Information on buyers, collectors and traders	173	35	28	381 (2)
Labour information (peelers and workers)	105	41	90	251 (3)
Seeds/seedlings	80	45	111	205 (4)
Agrochemicals (Fertilizer, pesticides, fungicides)	33	61	142	127 (5)
Financing information (subsidies, loans)	27	55	154	109 (6)
Pest and diseases and controlling methods	18	64	154	100 (7)
Value added products	9	38	189	56 (8)
New farming methods, equipment and tools	6	44	186	56 (9)
Weather information	5	28	203	38 (10)

Another 20 percent disagreed about the Internet's usefulness, while a large majority were undecided. Besides the low level of smartphone usage and Internet usage among farmers, a lack of awareness and experience were the main reasons contributing to their skepticism about the efficacy of the Internet. When asking about their satisfaction level in accessing farming information via mobile devices, nearly half of the farmers surveyed reported being unsatisfied. Thus, the Department of Cinnamon Development can make initiatives to use low-cost, user-friendly mobile-based information transfer for the cinnamon growers in the country.

In previous studies, authors have mentioned that disparities in wealth, gender, age, and education among small-scale farmers can impact their utilization of mobile devices to access information (Matto, 2018). One example is that the possession of smartphones plays a significant role in the utilization of mobile services and women own smartphones at slightly lower rates than men. Nyakudya et al. (2024) highlighted that limited literacy levels can hinder the effective use of mobile devices, while variations in

language within mobile applications may further create barriers. Accordingly, this study examined whether demographic characteristics influence farmers' perceptions of accessing modern information sources.

The Kruskal-Wallis test is used to assess whether farmers' agricultural information access through mobile devices is correlated with their age groups, levels of education, and household income levels. Based on the Table 2, results show that the three levels of age groups were statistically significant. This implies that farmers' agricultural information seeking/access behavior changes with their level of age. These results support the claim made by Lwoga *et al.* and Jayathilake *et al*. that age influences the desire to acquire knowledge (Lwoga, 2011; Jayathilake *et al*., 2010). Similarly, the four levels of education were statistically significant. This implies that farmers' agricultural information-seeking behavior changes with their level of education. Also, the three categories of annual income levels were not statistically significant implying that respondents, irrespective of their wealth, seek agricultural information to the same extent in this. Further, results show that the gender used in the analysis were not statistically significant.

Barriers to effective utilization of the mobile telecommunication technologies in information access, use, and sharing in the Cinnamon sector. Numerous authors have highlighted that a combination of demographics, socio-economic status, and technical issues restrict the adoption of mobile communication by small-scale farmers in various countries (Hannah and Minishi-Majanja, 2024; Nyakudya *et al.,* 2024; Landmann et al., 2021; Matto, 2018). This survey also inquired about the difficulties encountered by the farmers when using mobile phones to access information. The barrier score was calculated using these criteria (high = 3, moderate = 2, low = 1). Based on Table 5 results, the main difficulties or barriers experienced by the small-scale cinnamon farmers were the price of mobile devices (rank 1), connectivity issues like poor signal reception (rank 2), operational issues (rank 3) and issues in charging mobile device due to insufficient access to electricity (rank 4). Landmann *et al.,* (2021) also highlighted that in the absence of repair services in isolated regions, may limit access to information. Next, the language barrier all rates, repairing issues, data rates,

physical damages, toping up/ reloading were all given rankings of 5, 6, 7, 8, 9, and 10, in that order. The farmers' least severe issues included the theft of devices and lack of training and support. The farmers' least severe issues included the theft of devices and lack of training and support. Mahindarathne, (2022) and Jayathilake et al., (2010) also identified a range of comparable issues experienced by farmers in Sri Lanka when utilizing mobile and other ICT technologies. These results indicate that farmers had a hard time when buying mobile phones, especially smartphones, because they were too expensive. Additionally, there are challenges present when using mobile phones because some of them are of low quality. The obstacles mentioned above impede farmers from adopting and using mobile devices. Hence, farmers are not taking advantage of the opportunities offered by mobile technologies.

Recommendations for Enhancing the Adoption and Effectiveness of Mobile Telecommunication Technologies

Affordable Access: The high costs of mobile devices, particularly smartphones, and data services for farmers were a major barrier. Providing cost-effective smartphones and data plans for farmers allows them to utilize advanced mobile services and apps. Further, affordable data plans would enable farmers to use internet-based agricultural services more frequently. This includes providing subsidies or financial support to reduce the cost of

mobile phones and data plans for farmers.

Infrastructure Development: The study identified connectivity issues, such as poor signal reception, as significant barriers for farmers. Enhancing mobile network infrastructure would address these issues, making it easier for farmers to access and use mobile services effectively. This involves upgrading existing infrastructure and expanding coverage to underserved areas

Relevant Content: Language obstacles were discovered when utilizing various functions on smartphones. Developing and disseminating localized content (tailored to the needs of cinnamon growers) would make m-services more accessible and useful for farmers. This includes information on best practices, market prices, and pest management.

Integrated Services: The study found that farmers used mobile phones primarily for personal use, not for farming tasks. Incorporating mobile services into the existing agricultural extension services provided by the Department of Cinnamon Development could ensure that farmers receive timely and accurate information. *Peer-to-Peer Learning:* Promoting peer-to-peer knowledge-exchange among farmers could be done through mobile platforms. This can foster a community of practice and enhance collective learning and innovation.

Training and Support: Limited digital literacy was a barrier to working with new features of mobile devices. Training programs would empower farmers to use mobile devices for accessing agricultural information, improve their digital literacy, and help them using mobile technologies effectively, thus improving their farming practices. *Public-Private Partnerships:* Encouraging collaborations between the government, private sector, and nongovernmental support.

Table 5. Types of barriers to use mobile communication technologies (n=236)

Types of barriers	**Occurrence**			
	Low	Moderate	High	Barrier Score (Rank)
Cost of devices	29	115	92	535 (1)
Connectivity (signal / reception) issues	30	146	60	502 (2)
Operational issues	27	196	13	458 (3)
Battery/charging issues	80	126	30	422 (4)
Illiteracy / language barrier	87	131	18	403 (5)
Call rates	96	115	25	401 (6)
Repairing issues	102	110	24	394 (7)
Data rates	100	114	22	394 (8)
Physical Damages	106	116	14	380 (9)
Toping up/ Reloading	97	135	4	379 (10)
Theft of devices	115	119	2	359 (11)
Training and support	121	113	2	353 (12)

CONCLUSION

The study provide insight on the current state of mobile telecommunication technology usage among small-scale cinnamon growers in Sri Lanka, showcasing its potential and challenges. The demographic analysis shows a mostly male farming community, with a large number in the lower income range and different education levels. The widespread ownership of mobile devices, with 97% of farmers using them, indicates a strong foundation for leveraging mobile technology in agricultural practices. However, the disparity in smartphone ownership, with only 36% of farmers owning smartphones, points to a digital divide that needs to be addressed.

Even though a large number of individuals possess cell phones, their application in farming remains limited. The primary barriers identified include the high cost of mobile devices, poor connectivity, operational difficulties, and language barriers. Additionally, a significant number of farmers face challenges related to digital literacy and lack of localized content, which hinders the effective use of mobile technologies for accessing agricultural information. The study underscores the importance of tailored agricultural information that meets the specific needs of cinnamon growers. This includes information on best practices, market prices, and pest management. The role of mobile phones in facilitating peer-to-peer knowledge exchange is also highlighted as a crucial aspect of fostering a community of practice among farmers.

The findings indicate that while mobile telecommunication technologies have the potential to revolutionize agricultural information access and exchange among small-scale cinnamon growers, several critical issues must be addressed. These include improving digital literacy, enhancing mobile infrastructure, and providing localized and relevant content. Addressing these challenges will require concerted efforts from the government, private sector, and non-governmental organizations to develop and disseminate mobile-based agricultural services tailored to the needs of small-scale farmers in Sri Lanka. agricultural practices, ultimately contributing to the socio-economic development of small-scale cinnamon growers in Sri Lanka.

REFERENCES

Adikari, M. P. (2014). Usage of mass media by farmers in Sri Lanka. Developing Country Studies, 4(4), 2–5.

Aker, J. C. (2011). Dial "A" for agriculture: A review of information and communication technologies for agricultural extension in developing countries. Agricultural Economics, 42(6), 631-647.

Aldosari, F., Al Shunaifi, M. S., Ullah, M. A., Muddassir, M., & Noor, M. A. (2019). Farmers' perceptions regarding the use of Information and Communication Technology (ICT) in Khyber Pakhtunkhwa, Northern Pakistan. Journal of the Saudi Society of Agricultural Sciences, 18(2), 211–217. DOI: https://doi.org/10.1016/j.jssas.2017.05.004

Department of Census and Statistics Sri Lanka. (2022). *Annual bulletin of computer literacy - 2022*. Available online at https://www.statistics.gov.lk/Resource/en/ComputerLiteracy/Bulletins/AnnualBuletinComputerLiteracy-2022.pdf [Accessed Aug 15, 2024].

Dissanayeke, U., & Wanigasundera, W. A. D. P. (2014). Mobile based information communication interactions among major agriculture stakeholders: Sri Lankan experience. The Electronic Journal of Information Systems in Developing Countries, 60(1), 1-12.

FAO & ITU (2022). Status of digital agriculture in 47 Sub-Saharan African countries. Available online at http://www.fao.org/3/cb/943en.pdf [Accessed Aug 20, 2024].

FAO, (2017). Information and communication technology (ICT) in agriculture: a report to the G20 agricultural deputies. Available online at http://www.fao.org/publications [Accessed Aug 20, 2024].

Fonseka, D. L. C. K., Aluthgamage, H. N., & Wickramaarachchi, W. W. U. I. (2018). Present situation of cinnamon industry in Southern Sri Lanka. International Journal of Current Research in Biosciences and Plant Biology, 5(8), 63-70.

GSMA. (2017). *Govi Mithuru: Mobile agriculture service, Dialog, Sri Lanka*. Available online at https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2017/06/govi-mithuru-mobile-agriculture-service-dialog-sri-lanka.pdf [Accessed Aug 15, 2024].

Hannah, K. and Minishi-Majanja, M. K. (2024). Use of mobile telecommunication technologies in access, use, and exchange of agricultural information among small-scale farmers in Ol'joro-Orok sub-county, Nyandarua County, Kenya, International Journal of Humanities & Social Science Studies. Available online at

https://www.ijhsss.com/files/24.-Kimani-Hannah.pdf

Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI). (2013). *Mobitel 6666 agri-price information index*. Available online at https://www.harti.gov.lk/index.php/en/news-events/mobitel-6666-agri-price-information-index [Accessed June 15, 2024].

International Telecommunication Union, (ITU). (2020). Measuring digital developments facts and figures. Available online at http://www.itu.int/en/itu-d/statistics [Accessed Aug 20, 2024].

Jayakodi, J.A.S.H., & Pushpakumara, T.A.M. (2024). Technical efficiency analysis of the cinnamon cultivation sector in Galle District of Sri Lanka," *Colombo Economic Journal.* 2(1), 89–109. Available online at https://www.researchgate.net/publication/382817178_Technical_Efficiency_Analysis_of_the_Cinnamon_Cultivation_Sector_in_Galle_District_of_Sri_Lanka. [Accessed June 15, 2025]

Jayathilake, C. K., Jayasinghe-Mudalige, U., Perera, R., Gow, G., & Waidyanatha, N. (2017). Converging free and open-source software tools for knowledge sharing in smallholder agricultural communities in Sri Lanka. Journal of Agriculture and Environment for International Development (JAEID), 111(2), 351-359.

Jayathilake, H. A. C. K., Jayaweera, B. P. A., & Waidyasekera, E. C. S. (2010). ICT adoption and its' implications for agriculture in Sri Lanka. Journal of Food and Agriculture, 1(2). DOI: https://jfa.sljol.info/articles/10.4038/jfa.v1i2.1799

Jayathilake, H. A. C. K., Mudalige, J. U., Gow, G. A., Waidyanatha, N., & Perera, L. D. R. D. (2015). Use of low-cost information communication technologies for knowledge mobilization in agricultural communities in Sri Lanka. Proceedings of 8th International Research Conference, KDU, Sri Lanka, 67-72

Landmann, D., Lagerkvist, C. J., & Otter, V. (2021). Determinants of small-scale farmers' intention to use smartphones for generating agricultural knowledge in developing countries: evidence from rural India. The European Journal of Development Research, 33, 1435-1454. DOI: https://doi.org/10.1057/s41287-020-00284-x

Mahindarathne, D. P. (2022). Exploring the Use of Modern Sources of Information in Agriculture: Usage and Perception of Sri Lankan Farmers. International Journal of Management and Economics Invention, 8(4), 2406-2417.

Matto, G. (2018). Agricultural information access and the use of ICTS among smallholder farmers.

Mohamed, M. A., Indika, W. A., Sugathadasa, L., & Senaratne, R. (2019). Minimizing issues and information gaps in value chain of cinnamon industry in Sri Lanka through ICT based intervention: A case study. Journal of the University of Ruhuna, 7(2), 63-75.

Nyakudya, S., Jambo, N., Madududu, P., & Manyise, T. (2024). Unlocking the potential: challenges and factors influencing the use of ICTs by smallholder maize farmers in Zimbabwe. Cogent Economics & Finance, 12(1). DOI: https://doi.org/10.1080/23322039.2024.2330431

Perera, D. G. D., Mahaliyanaarachchi, R. P., Sivashankar, P., & Hettiarachchi, I. C. (2015) Mobile phone as a mode of information provident to up country vegetable farmers in sri lanka, Proceedings of the Peradeniya University International Research Sessions, Sri Lanka, Vol.19, 2015

Shanadi, A. T., Samaraweera, G. C., Wathugala, D. L., Indika, W. A., & Munasignhe, S. M. (2022). Development of mobile-based guideline model of good agricultural practices for potato farmers in Sri Lanka. Available online at https://tare.sljol.info/articles/10.4038/tare.v25i2.5580 [Accessed Aug 20, 2024].

Silva, K. A., & Yapa, S. T. W. S. (2013). Customer retention: with special reference to telecommunication industry in Sri Lanka.

Spielman, D., Lecoutere, E., Makhija, S., & Van Campenhout, B. (2021). Information and communications technology (ICT) and agricultural extension in developing countries. Annual review of resource economics, 13, 177-201.

Sri Lanka Export Development Board. (2024). *Cinnamon cultivation in Sri Lanka*. Available online at https://www.srilankabusiness.com/spices/about/cinnamon-cultivation-sri-lanka.html [Accessed Aug 15, 2024].

Statista., (2023). *Mobile cellular subscriptions per 100 inhabitants in Sri Lanka from 2000 to 2023*. Available online at https://www.statista.com/statistics/510604/mobile-cellular-subscriptions-per-100-inhabitants-in-sri-lanka/ [Accessed Aug 20, 2024].

Statista.,(2024). Employment by economic sector in Sri Lanka. Available online at https://www.statista.com/statistics/728543/employment-by-economic-sector-in-sri-lanka/ [Verified June 10, 2024]

United Nations. (2024.). *UN e-Government Knowledgebase: Datacenter*. Available online at https://publicadministration.un.org/egovkb/en-us/data-center [Accessed June 15, 2025]

Wijesinghe, R., Perera, S., & Wijesinghe, P. (2017). Present Situation and Prospects of Cinnamon Industry in Sri Lanka. *HARTI Research Report No: 203*. Available online at https://www.harti.gov.lk/images/download/reasearch_report/report_203.pdf. [Accessed June 15, 2025].

World Bank (2017). ICT in agriculture connecting small holders to knowledge networks and institutions (updated edition). Washington, DC: The World Bank. Available online at https://www.worldbank.org/ext/en/home. [Accessed June 10, 2024].

World Bank. (2021). Climate Smart Irrigated Agriculture Project Helped Sri Lanka's Smallholder Farmers Weather the COVID-19 Pandemic. Available online at https://www.worldbank.org/en/results/2021/04/19/climate-smart-irrigated-agriculture-project-helped-srilanka-smallholder-farmers [Accessed Aug 20, 2024].

Gamage, P., & Halpin, E. F. (2007). E-Sri Lanka: bridging the digital divide. *The Electronic Library*, *25*(6), 693-710.

Qiang, C. Z., Yamamichi, M., Hausman, V., Altman, D., & Unit, I. S. (2011). Mobile applications for the health sector. *Washington: World Bank*, *2*.

Bodhikotuwa, T. B. K., Mahindarathne, M. G. P. P., & Kumara, W. A. G. S. (2012). Feasibility Study on Use of Mobile Technology for Agriculture in Sri Lanka. Proceeding of the Research Symposium of Uva Wellassa University, Sri Lanka, 581

Lwoga, E.T. (2011). Knowledge management approaches in managing agricultural indigenous and exogenous knowledge in Tanzania, Journal of Documentation 67(3), 113 -122.

LIRNEasia, (2012). Teleuse at the Bottom of the Pyramid 4 (Teleuse@BOP4) [online]. Available online at https://lirneasia.net/wp-content/uploads/2012/01/TaBOP4-BKK-v11.pdf [Accessed June 10, 2024].