

The Role of Mobile Phones in Production and Agricultural Information Access for Farmers in Dhamar Governorate, Yemen

Hamza Farwan^{1*}; Edi Syams Zainudin²

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University Putra Malaysia, Malaysia

*Corresponding Author

Received:- 15 September 2025/ Revised:- 21 September 2025/ Accepted:- 29 September 2025/ Published: 05-10-2025

Copyright @ 2025 International Journal of Environmental and Agriculture Research

This is an Open-Access article distributed under the terms of the Creative Commons Attribution

Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted

Non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract— Farmers in Dhamar Governorate, Yemen, face persistent challenges in accessing timely and relevant agricultural information due to limited extension services, poor infrastructure, low digital literacy, and constrained mobile network coverage. These limitations hinder informed decision-making, reduce agricultural productivity, and restrict the adoption of modern farming techniques. This study investigates how mobile phones are utilized to access production and agricultural information and identifies the factors and challenges that affect their usage among farmers in Dhamar. To achieve these goals, the study conducted a thorough analysis of the existing literatures. A quantitative research design was employed through a structured questionnaire distributed to 181 agricultural holders in Jabal Ash sharq District. Data analysis using SPSS included descriptive statistics, factor analysis, and reliability tests. The study used the Kaiser-Meyer-Olkin (KMO = 0.851) and Bartlett's Test of Sphericity ($p < 0.001$) to assess sampling adequacy and suitability for factor analysis, and the Cronbach's alpha ($\alpha = 0.920$) confirmed strong internal consistency. In descriptive statistics test, results were carried out of maximum value of 5. Key findings indicate that mobile phones play a modest yet significant role in improving access to farming techniques and agricultural services. Two dominant utilization components were identified: (1) direct access to agricultural information and enhanced decision-making, and (2) participatory communication, including networking with input suppliers and fellow farmers. The highest reported use was communication with input suppliers (Mean = 3.87), followed by access to farming techniques (Mean = 2.55). However, the study revealed substantial barriers, classified into three main categories: (1) Individual Capability Constraints such as lack of training and digital skills (Mean = 4.20), (2) Institutional and Economic Barriers including insufficient promotion by extension agents and lack of organizational support (Mean = 4.59 and 4.48, respectively), and (3) Infrastructural Barriers like poor network coverage and limited access to charging facilities (Mean = 3.52 and 3.64). The study concludes with recommendations aimed at enhancing digital inclusion and agricultural development. These include localized content development in native languages, capacity-building programs for farmers, and significant investments in infrastructure to support broader and more effective use of mobile technologies in rural Yemen.

Keywords— Mobile Phones, Agricultural Information Access, Smallholder Farmers, ICT in Agriculture, Dhamar Governorate, Agricultural Extension Services.

I. INTRODUCTION

Agriculture is the cornerstone of livelihoods and economic stability in Dhamar Governorate, Yemen, where smallholder farmers form the backbone of food production. However, the agricultural sector faces numerous systemic challenges, including limited access to modern agricultural techniques, unreliable extension services, inadequate infrastructure, and insufficient dissemination of market information. These challenges are exacerbated by Yemen's ongoing political instability, climate variability, and socio-economic conditions. One of the most pressing problems is the lack of timely and accurate agricultural information available to farmers. Traditional information channels such as direct extension services are limited in their reach, especially in remote rural areas. As a result, farmers are often left without critical knowledge about farming techniques, pest control, weather forecasts, market prices, and post-harvest practices. This information gap leads to suboptimal decision-making and reduced agricultural productivity.

In recent years, the proliferation of mobile phones has presented new opportunities to bridge this information gap. Mobile phones offer farmers an accessible platform to receive, share, and interact with agricultural content and extension services.

Despite the growing penetration of mobile technology in Yemen, there is limited empirical evidence on how smallholder farmers in regions like Dhamar Governorate utilize mobile phones for agricultural purposes, and what obstacles they encounter in doing so. The integration of Information and Communication Technologies (ICTs), particularly mobile phones, into agricultural systems has received considerable scholarly attention. Numerous studies have highlighted how mobile phones facilitate real-time communication, improve market transparency, and enable farmers to make informed decisions regarding crop management, pest control, and input use. For instance, research in India revealed that mobile access to agricultural call centers significantly improved productivity by enabling farmers to adopt high-yielding seed varieties and manage inputs more effectively (Gupta et al., 2020). Similarly, Munawaroh (2023) found that farmers using mobile services in East Java reported an average increase in rice yields of 841.3 kg per hectare compared to non-users.

In African contexts, mobile phones have demonstrated transformative potential as tools for agricultural development. Studies by Mwaseba et al. (2024); Kiseni & Kwesigabo, (2023) in Kenya and Tanzania, respectively, show that widespread mobile adoption among smallholder farmers has been linked to improved market access, enhanced extension services, and the adoption of climate-smart practices. Notably, applications such as mFarms, Kilimo Salama, and M-Farm have helped farmers to reduce transaction costs, receive localized weather forecasts, and access mobile insurance schemes. These tools not only address information asymmetry but also bolster farmers' resilience to economic and climatic shocks.

Despite their promise, several barriers hinder the full utilization of mobile phones in agriculture. Language remains a critical barrier especially in regions where mobile content is predominantly in English. Dissanayeke & Wanigasundera, (2014); Ajani & Agwu, (2012) emphasized that the lack of localized language content limits the utility of mobile-based services. Additionally, the technical literacy of users plays a major role in determining effective usage. Farmers unfamiliar with mobile applications or SMS-based systems may struggle to access the benefits of digital tools. The role of mobile service providers is also significant. In countries such as Bangladesh and Tanzania, telecom companies have partnered with agricultural institutions to develop targeted mobile services. For example, Grameen Phone in Bangladesh established dedicated agricultural call centers that deliver expert advice directly to rural users, as noted by Al Kibria et al. (2023).

In contrast, the situation in Yemen is complicated by infrastructural deficits and political instability. Although companies like Yemen Mobile and MTN Yemen operate in the region, their coverage and service reliability are inconsistent, particularly in remote farming communities. According to Al-Baltah et al. (2024), there is a growing reliance on mobile platforms such as WhatsApp among Yemeni farmers, despite limited formal extension support. However, widespread adoption is curtailed by low smartphone penetration, intermittent electricity, and the absence of structured support systems. Khalil et al. (2022) asserted that the increasing demand for real-time agricultural information signals the urgency for scalable, locally adapted mobile solutions that cater to the needs of smallholder farmers.

This body of literature collectively underscores the relevance of mobile phones as a mechanism for improving agricultural information access, while also drawing attention to persistent gaps in infrastructure, training, and institutional backing. It provides a foundational basis for the current study, which seeks to contextualize and evaluate mobile phone use among farmers in Dhamar Governorate, Yemen, through empirical field data. While these global and regional studies affirm the potential of mobile phones in transforming agricultural extension, they often focus on contexts with relatively stable infrastructure and governance. Yemen, in contrast, faces a unique convergence of constraints including economic fragility, weak institutional capacity, and geographic disparities in mobile network coverage. Moreover, prior research tends to generalize mobile phone usage without distinguishing between its communicative functions (e.g., contacting input suppliers) and informational functions (e.g., receiving weather or market data), especially among smallholder farmers in underserved regions. Hence, there remains a significant gap in localized empirical studies that systematically explore how mobile phones are actually used by farmers in marginalized contexts like Dhamar, and what specific factors hinder or promote their usage.

Accordingly, this study aims to address this gap by focusing on two main objectives: first, to assess the role of mobile phones in accessing agricultural information; and second, to identify the factors and challenges that influence their utilization among farmers in Dhamar Governorate. The research provides crucial insights for policymakers, agricultural development organizations, and digital service providers seeking to enhance the impact of mobile-based interventions in rural Yemen.

II. MATERIAL AND METHODS

2.1 Research Design:

A quantitative research approach was utilized in this study to address the problem statement and achieve the study objectives. Data collection was conducted through a structured questionnaire, which is designed to ensure consistency and reliability in

sampling and information gathering from the study area. The questionnaire was developed through a rigorous process that included a comprehensive review of related literature and previous studies in the field of agricultural information systems and mobile phone usage. To ensure the effectiveness of the questionnaire in meeting the research objectives, a pilot study was conducted prior to the main data collection which involved an academic expert, and other experts in agricultural engineering field whose feedbacks were used to refine the questionnaire and confirm its suitability for capturing the required quantitative data. This preliminary step was essential for enhancing the validity and reliability of the research instrument, ensuring that the subsequent data collection accurately reflects the perspectives and conditions of the target population. The survey included 22 questions designed to measure respondents' perceptions of mobile phone utilization in agricultural information access, and factors and challenges affecting usage. The final instrument was divided into sections covering socio-demographic profiles, types of agricultural information accessed, mobile phone functions utilized, frequency of use, and perceived challenges. Responses were rated using a five-point Likert scale ranging from 1 (Not Existing) to 5 (High) to measure respondents' perceptions and experiences with greater accuracy.

2.2 Data Collection Methods:

The targeted population for this study consists of agricultural holders who work in the farming sector in Dhamar Governorate, Yemen. According to General Authority for Agricultural Researches and Extension (AREA), the total number of agricultural holders in the governorate is 12641 distributed across 9 different administrative districts (AREA, 2024). Due to the various limitations of the research, including time and funding, Jabal Ash sharq District was chosen as the study area because it has the lowest percentage of agricultural holders in the governorate with 343 agricultural holders, and it is also a predominantly rural area, characterized by its mountainous terrain and fertile valleys suitable for agriculture. Moreover, most of the region's residents work in agriculture, which facilitates access to the study community and data collection. According to Krejcie & Morgan, (1970); sample size determination, for a population of 343, the sample size should be 181. Relatively, the sample size for the survey will be 181 agricultural holders.

The survey was conducted using Google Forms to facilitate the distribution and a timely collection of responses from farmers across the study area. This digital approach guaranteed accessibility and efficiency in managing the data collection process, particularly in areas with reliable internet connectivity. Furthermore, an academic researcher was trained and authorized to oversee the fieldwork, which involved distributing questionnaires to selected farmers in remote and rural locations where digital access was limited. For respondents with limited literacy, the researcher provided verbal explanations and filled in responses based on their input. This approach improved the inclusiveness and reliability of the data. To ensure quality control and swiftly resolve any logistical or methodological concerns, the data collection procedure was facilitated by periodic online sessions, maintaining consistent communication and guidance between the principal investigator and the field researcher. This collaborative approach helped streamline operations and uphold the integrity of the research process.

2.3 Data Analysis Methods:

Once data collection was completed, the data were analyzed using Statistical Package for the Social Sciences (SPSS). The analysis included descriptive statistics (mean, standard deviation, frequency, and percentage) to summarize the demographic profile and usage patterns. To assess the internal consistency and validity of the measurement items, the Kaiser-Meyer-Olkin (KMO) test, Bartlett's Test of Sphericity, and Cronbach's alpha were applied. Exploratory factor analysis (EFA) was conducted to identify latent variables influencing mobile phone usage and to categorize key challenges into distinct dimensions.

III. RESULT AND DISCUSSION

3.1 Demographic Analysis of Respondents:

3.1.1 Gender Distribution:

The demographic analysis initiates with the gender distribution of participants. The analysis revealed that the majority of respondents 174 (96.1%) were male, whilst only 7 (3.9%) were female. This gender imbalance reflects the traditional agricultural practices in the study area, where farming is predominantly managed by men. Such a distribution also suggests that men are more involved in decision-making related to agricultural activities and possibly more exposed to technological tools like mobile phones.

3.1.2 Age Category Distribution:

The age distribution showed that among agricultural holders polled, the predominant age group was 26–35 years, consisting of 91 individuals (50.3%). The subsequent age group was 36–45 years, comprising 39 respondents (21.5%), followed by 18–25 years with 36 respondents (19.9%), and those aged 46 years and above with 15 respondents (8.3%). This distribution indicates that more than 70% of respondents are aged between 18 and 35 years, demonstrating a primarily youthful agricultural demographic in Jabal Ash sharq District. This demographic insight is crucial for analyzing mobile phone usage patterns in agriculture, as younger farmers are generally more predisposed to embrace modern technology, including mobile phones, than their older counterparts.

3.1.3 Educational Level Distribution:

In terms of education, a majority of the farm holdings, 95 persons (52.5%), indicated that they have completed primary education. Subsequently, there were 57 respondents (31.5%) with secondary education, 20 respondents (11.0%) with university education, and merely 9 persons (5.0%) who indicated no formal education. This distribution indicates that a substantial percentage of farmers in the study area had at least basic literacy, with more than 95% having attained some sort of formal schooling. The prevalence of primary education suggests that although numerous respondents can comprehend fundamental information, they may encounter difficulties in deciphering intricate or technical agricultural content, particularly when presented via digital platforms or in non-native languages. In contrast, the existence of farmers lacking formal education (5.0%) signifies a demographic that may have difficulties in utilizing mobile-based services, especially text-intensive forms such as SMS. For these individuals, different approaches such as voice-based services or assistance from agricultural extension agents to bridge the gap between agricultural information systems and farmers with low literacy or no formal education to ensure inclusive access to information.

3.1.4 Years of Experience in Farming:

Regarding farming experience, the majority of surveyed farmers had substantial experience in agriculture. Most notably, 32.0% had 11 to 15 years of farming experience, followed by 29.8% with 5 to 10 years, and 28.7% with over 15 years. Only 9.4% had less than 5 years of experience. This distribution reflects a strong presence of mid-career and experienced farmers in the region, suggesting a high level of practical agricultural knowledge. Those with 11–15 years of experience are especially well-positioned to adopt mobile-based agricultural innovations, balancing traditional practices with openness to new technology. Farmers with 5–10 years are similarly adaptive and likely to benefit from mobile information services. Meanwhile, the least experienced group may lack exposure to both traditional and digital extension tools, and the most experienced group may encounter challenges related to digital literacy or resistance to change.

3.2 Factor Analysis:

The empirical factor analysis (EFA) was conducted using principal components factor analysis with Varimax rotation to identify a limited number of factors that accurately represented the relational structure among the variables related to utilization, factors, and challenges. Hair et al. (2010) asserted that, to validate factorability, the following criteria must be satisfied: all communalities must exceed 0.3, the Bartlett's Test of Sphericity (BTS) must show significance at $p < .05$, and items within the same scales must exhibit correlations of at least 0.3 with other items.

3.2.1 Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity

To ensure the data collected from respondents was suitable for factor analysis, preliminary assessments were conducted using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. These tests were essential to confirm whether the variables under study were adequately interrelated to justify a factor analysis approach. The KMO value for the role of mobile phones in agricultural information access was 0.917, categorizing it as 'marvelous'. This outcome verifies that the dataset possesses sufficient variation to facilitate factor extraction. Bartlett's Test of Sphericity produced a chi-square value of 1843.445 with 66 degrees of freedom and a significance threshold of $p < 0.001$, indicating that the correlation matrix is not an identity matrix and that the variables are adequately correlated for factor analysis. The KMO value analysis for factors and challenges in mobile phone utilization was 0.815, classified as 'meritorious', signifying satisfactory sample adequacy.

Bartlett's Test of Sphericity yielded a chi-square value of 851.213 with 45 degrees of freedom and a significance threshold of $p < 0.001$, further affirming the appropriateness of the data for factor analysis. The elevated KMO values indicate a considerable degree of common variance among the variables, rendering them suitable for factor analysis. Additionally, the significant

outcomes from Bartlett's Test of Sphericity in both instances confirm that the correlation matrices are not identity matrices, thereby affirming the interrelatedness of the variables and their appropriateness for structural detection.

The results from the KMO and Bartlett's tests corroborate previous studies emphasizing the importance of an adequate sample size and significant inter-variable correlations for effective factor analysis. Murmura et al. (2024) stated that, KMO values above 0.8 denote extremely sufficient sampling, while the highly significant Bartlett's tests affirm the structural links within the dataset. The results affirm the reliability and validity of the survey data, suggesting that subsequent analyses, such as factor extraction and Cronbach's alpha reliability tests, will yield valuable insights into farmers' utilization of mobile phones for agricultural information access in Dhamar Governorate. Therefore, based on these statistically significant findings, it is appropriate to proceed with factor extraction to identify specific constructs or dimensions influencing farmers' use of mobile phones for agricultural information distribution and acquisition.

3.2.2 Communalities Analysis:

In order to determine the extent to which each variable shared common variance with the extracted factors, a communalities analysis was conducted as shown in Table 1 and 2. This procedure is a crucial step in exploratory factor analysis (EFA), as it reveals how much of the variance in each observed variable is explained by the underlying factors extracted during the analysis. The communalities for the mobile phone utilization variables were initially set at 1.000, indicating that the total variance for each variable was considered before extraction. After extraction, all variables retained substantial communalities, with values well above the commonly accepted threshold of 0.30, signifying that the variables were adequately explained by the identified factors. For instance, "Access to Farming Techniques via Mobile Phone" exhibited a high communality score of 0.770, suggesting that a significant proportion of its variance was captured by the extracted factors. Similarly, "Participation in Mobile-based Farmer Networks" and "Access to Weather Forecasts and Market Prices" showed strong communalities of 0.751 and 0.719, respectively. These results highlight the integral role of these components in shaping the latent constructs related to mobile phone use in agricultural information access.

TABLE 1
COMMUNALITIES ANALYSIS (MOBILE PHONE UTILIZATION)

Variable	Initial	Extraction
Access to Farming Techniques via Mobile Phone	1	0.746
Access to Market Price Information	1	0.687
Communication with Agricultural Extension Agents	1	0.554
Access to Weather Forecasts	1	0.783
Receiving Agricultural Advice through Mobile Platforms	1	0.733
Pest and Disease Management Information Access	1	0.761
Communication with Input Suppliers	1	0.814
Enhanced Farming Decision-making	1	0.809
Participation in Mobile-based Farmer Networks	1	0.72
Awareness of Agricultural Support Programs	1	0.726
Improved Crop Productivity through Mobile Use	1	0.775
Reduced Dependence on Physical Extension Services	1	0.669

In terms of challenges and constraints associated with mobile phone use, the communalities also reflected meaningful levels of explained variance. Variables such as "Lack of Training and Guidance" and "Insufficient Promotion by Agricultural Extension Agents" displayed particularly strong communalities of 0.812 and 0.799, respectively. These values indicate that these challenges are not isolated issues but are deeply embedded within broader systemic or institutional constraints influencing mobile phone utilization. Even variables with comparatively lower communalities, such as "Language Barriers" and "Affordability of Mobile Phones," still retained acceptable levels of explanation, affirming their relevance in the model. Collectively, the communalities analysis demonstrates the robustness of the factor structure, as all items retained in the analysis contributed meaningfully to the variance captured by the factor solution. This finding validates the inclusion of the observed variables in subsequent components and supports the reliability of the factor model in examining both the utilization patterns and the challenges associated with mobile phone use among farmers in Dhamar Governorate.

TABLE 2
COMMUNALITIES ANALYSIS (FACTORS AND CHALLENGES)

Variable	Initial	Extraction
Literacy Barriers to Mobile Usage	1	0.821
Mobile Network Accessibility	1	0.762
Mobile Data Affordability	1	0.563
Lack of Training and Guidance	1	0.612
Power and Charging Constraints	1	0.615
Lack of Promotion by Agriculture Extension Agents	1	0.753
Technical Skill Limitations	1	0.794
Language Accessibility of Agricultural Information	1	0.832
Awareness of Mobile Agricultural Services	1	0.789
Institutional Support Deficiency	1	0.508

3.2.3 Cronbach's Alpha

The reliability analysis of survey variables, including roles, factors, and challenges in mobile phone utilization scales, demonstrates high internal consistency, verifying the coherence of the underlying constructs. In the first context of mobile phone utilization, the Cronbach's Alpha score was exceptionally high at 0.947, indicating excellent reliability and suggesting that the variables consistently measure aspects pertinent to mobile phone usage in agriculture. The second context; factors and challenges in mobile phone utilization, attained an Alpha of 0.836, indicating good reliability within the range of 0.8 to 0.9. The results confirm that the items effectively reflect the participants' perceptions of barriers and enabling conditions influencing their mobile phone use for agriculture information access.

According to Nunnally (1975); SÜRÜCÜ & MASLAKÇI, (2020); the minimum reliability coefficient of 0.7 for exploratory research and 0.8 for applied studies. Both scales surpass these benchmarks, confirming their appropriateness for empirical analysis. The disparity in reliability coefficients between the two objectives is noteworthy. The mobile phone utilization scale's Cronbach's Alpha value, nearing 0.95, suggests a highly cohesive construct; nonetheless, it is essential to consider the trade-off between reliability and item distinctiveness. The factors and challenges scale (Alpha = 0.836) effectively encompasses various dimensions, including technical literacy, language constraints, and infrastructural limitations, while maintaining coherence. The combined Cronbach's Alpha analysis indicates that the survey items for both contexts are psychometrically robust, providing a reliable basis for interpreting factor analysis results and supporting valid conclusions regarding farmers' mobile phone usage and the factors influencing that usage in Dhamar Governorate.

3.2.4 Ranking Analysis

In descriptive statistics analysis illustrated in Table 3 and 4, results were measured on a scale ranging from 1 to 5, with 1 representing the minimum value and 5 representing the maximum value. This scale facilitated a standardized interpretation of respondents' perceptions and allowed meaningful comparisons across different variables according to the study.

For the first objective; the role of mobile phones in accessing agricultural information, Key findings indicate that mobile phones play a modest yet significant role in improving access to farming techniques and agricultural services. Two dominant components were identified. The first component; information access and decision-making, showed that "Access to Farming Techniques via Mobile Phone" scored the highest mean (2.55), followed by "Communication with Agricultural Extension Agents" (2.33), indicating their importance in delivering technical knowledge. The second component; participatory and communication functions, highlighted "Communication with Input Suppliers" as the highest-scoring variable (3.87), suggesting mobile phones are more actively used for logistical coordination. However, "Participation in Mobile-based Farmer Networks" received a lower mean (2.32), pointing to limited engagement in peer communication networks.

TABLE 3
DESCRIPTIVE STATISTICS (MOBILE PHONE UTILIZATION)

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Information Access and Immediate Decision-Making Benefits					
Access to Farming Techniques via Mobile Phone	181	1	5	2.55	1.137
Communication with Agricultural Extension Agents	181	1	5	2.33	0.948
Improved Crop Productivity through Mobile Use	181	1	5	2.32	1.109
Access to Market Price Information	181	1	5	2.17	0.928
Reduced Dependence on Physical Extension Services	181	1	5	2.15	0.924
Access to Weather Forecasts	181	1	5	2.15	0.992
Receiving Agricultural Advice through Mobile Platforms	181	1	5	2.11	0.888
Interactive or Participatory Functions of Mobile Technology					
Communication with Input Suppliers	181	1	5	3.87	1.256
Pest and Disease Management Information Access	181	1	5	3.1	1.265
Enhanced Farming Decision-making	181	1	5	2.59	1.1
Awareness of Agricultural Support Programs	181	1	5	2.5	1.047
Participation in Mobile-based Farmer Networks	181	1	5	2.32	0.959

Objective 2 addressed the factors and challenges constraining effective mobile phone use. Three major categories emerged. First, Individual Capability Constraints were led by “Lack of Training and Guidance” (mean = 4.20), indicating poor digital literacy among farmers. Second, Institutional and Economic Barriers showed strong negative influence, with “Insufficient Promotion by Agricultural Extension Agents” (4.59) and “Deficiency in Institutional Support” (4.48) being dominant issues. These findings underscore the lack of systemic support structures. Third, Infrastructural Barriers included “Power and Charging Constraints” (3.64) and “Mobile Network Accessibility” (3.52), both of which limited consistent access to mobile-based services. The results indicate that while mobile phones offer promising avenues for enhancing agricultural information access in Dhamar Governorate, their full potential remains constrained by digital skill gaps, insufficient institutional support, and infrastructural limitations. Addressing these barriers through targeted capacity-building, localized content development, and improved service infrastructure is essential to optimizing mobile phone utilization for rural agricultural development.

TABLE 4
DESCRIPTIVE STATISTICS (FACTORS AND CHALLENGES)

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Individual Capability Constraints					
Lack of Training and Guidance	181	1	5	4.2	1.015
Language Accessibility of Agricultural Information	181	1	5	3.72	1.066
Awareness of Mobile Agricultural Services	181	1	5	3.64	1.064
Technical Skill Limitations	181	1	5	3.13	1.185
Literacy Barriers to Mobile Usage	181	1	5	2.98	1.39
Institutional and Economic Barriers					
Lack of Promotion by Agriculture Extension Agents	181	1	5	4.59	0.698
Institutional Support Deficiency	181	1	5	4.48	0.814
Mobile Data Affordability	181	1	5	4.31	0.832
Infrastructural Barriers					
Power and Charging Constraints	181	1	5	3.64	0.85
Mobile Network Accessibility	181	1	5	3.52	1.031

IV. CONCLUSION

This study has comprehensively assessed the use of mobile phones to access agricultural information for farmers in Dhamar Governorate, Yemen. These findings clearly demonstrate the significant benefits that mobile technology provides in improving agricultural output, decision-making, and market access. Farmers primarily utilized mobile phones to access timely information on market prices, weather forecasts, pest and disease management, and to communicate with agricultural extension agents. These applications have significantly enhanced farming practices and decision-making processes, underscoring mobile technology as a vital instrument in modern agriculture. Despite those benefits, the study identified numerous critical factors and challenges that impede the effective utilization of mobile technology by local farmers.

Significant obstacles comprised restricted literacy, inadequate technical proficiency, insufficient network availability, elevated expenses related to mobile devices and internet data plans, linguistic difficulties, and a deficiency in suitable institutional support. These constraints collectively hinder the deployment of mobile technology and limit its potential influence on agricultural productivity in the region. Overcoming these obstacles is essential for optimizing the advantages of mobile phones in rural agricultural environments. The study highlights the transformative capacity of mobile phones in disseminating agricultural information and their substantial positive effects on rural livelihoods and agricultural productivity in Dhamar Governorate. Successfully addressing identified obstacles through focused interventions can markedly improve the efficacy of mobile technologies, equipping farmers with essential and timely agricultural information.

V. RECOMMENDATIONS FOR FUTURE WORK

This study establishes a robust foundation for future research by highlighting the role of mobile phones in facilitating agricultural information access among farmers in Dhamar Governorate. Nonetheless, several critical dimensions remain insufficiently examined and warrant deeper investigation. Future research should focus on the longitudinal impacts of mobile phone utilization on agricultural productivity, income stability, and rural livelihoods. By implementing long-term studies, scholars can uncover the sustained influence of mobile-based information access on crop yield improvements, market participation, and household economic resilience. These longitudinal insights are essential to inform policy and development programs aimed at leveraging digital tools for sustainable agricultural growth. Furthermore, comparative assessments between mobile-based agricultural extension services and conventional face-to-face extension methods should be prioritized. Such studies should systematically evaluate effectiveness in terms of knowledge transfer, behavioural change, cost efficiency, and user satisfaction among smallholder farmers. Insights from these comparisons can help determine the relative strengths and limitations of each approach and support the design of hybrid models that blend traditional and digital extension methods to maximize outreach and impact.

Future research should also adopt a broader geographic scope by conducting similar studies in other governorates across Yemen. Regional disparities in mobile infrastructure, literacy levels, agricultural practices, and socio-political stability may influence the effectiveness of mobile phone adoption for agricultural information dissemination. Comparative regional analysis would provide a nuanced understanding of context-specific challenges and opportunities, thereby enhancing the scalability and relevance of mobile-based interventions nationwide.

Additionally, researchers should explore the integration of advanced and emerging digital technologies into mobile agricultural services. The incorporation of Artificial Intelligence (AI) for predictive analytics, the Internet of Things (IoT) for real-time environmental monitoring, and blockchain for transparent and secure transactions could significantly enrich the functionality and trustworthiness of mobile platforms. Investigating the feasibility, inclusivity, and sustainability of such technologies within the Yemeni agricultural context is crucial, particularly considering infrastructure limitations, digital literacy gaps, and socioeconomic constraints. Moreover, research should evaluate the extent to which these innovations can be localized and adapted to meet the unique needs of smallholder farmers, with a focus on ensuring equitable access and minimizing digital exclusion.

ACKNOWLEDGEMENT

This research was not funded by any grant.

REFERENCES

- [1] Gupta, A., Ponticelli, J., Tesei, A., Anderson, S., Cole, S., Comin, D., Gennaioli, N., Gollin, D., Guriev, S., Howell, S., Karlan, D., Manacorda, M., Miquel, P., Rasul, I., Santangelo, G., & Udry, C. (2020). Nber working paper series language barriers, technology adoption and productivity: evidence from agriculture in india. <http://www.nber.org/papers/w27192>

- [2] Munawaroh, S. (2023). Does The Use of Mobile Phones by Farmers Have an Impact on Agricultural Productivity in East Java? *East Java Economic Journal*, 7(1), 52–68. <https://doi.org/10.53572/ejavec.v7i1.96>
- [3] Mwaseba, S., Dimoso, P., & Timothy, S. (2024). Drivers of Small-Scale Farmers' Adoption of Mobile Phone Technology for Rice Production and Marketing in Dodoma Region. *Rural Planning Journal*, 26(1), 1–12. <https://doi.org/10.59557/rpj.26.1.2024.75>
- [4] Kisenia, M. T., & Kwesigabo, E. M. (2023). Assessing the Contribution of Mobile Phone Agricultural Information on Maize Productivity: A Case Study of Kilolo District, Tanzania. *European Journal of Theoretical and Applied Sciences*, 1(6), 1096–1105. [https://doi.org/10.59324/ejtas.2023.1\(6\).106](https://doi.org/10.59324/ejtas.2023.1(6).106)
- [5] Dissanayeke, U., & Wanigasundera, W. A. D. P. (2014). Mobile based information communication interactions among major agriculture stakeholders: Sri Lankan experience. *Electronic Journal of Information Systems in Developing Countries*, 60(1), 1–12. <https://doi.org/10.1002/j.1681-4835.2014.tb00422.x>
- [6] Ajani, E. N., & Agwu, A. E. (2012). Information Communication Technology Needs of Small-Scale Farmers in Anambra State, Nigeria. *Journal of Agricultural and Food Information*, 13(2), 144–156. <https://doi.org/10.1080/10496505.2012.663694>
- [7] Al Kibria, G. M., Hashan, M. R., Hanif, A. A. M., Maniar, V., & Shawon, M. S. R. (2023). Mobile phone use for pregnancy-related healthcare utilization and its association with optimum antenatal care and hospital delivery in Bangladesh. *PLOS Global Public Health*, 3(4). <https://doi.org/10.1371/journal.pgph.0001762>
- [8] Al-Baltah, I. A., Al-Sultan, S. Y., Al-hadi, M. A., & Zahary, A. T. (2024). Factors Influencing the Adoption of Mobile Banking Applications in Yemen Using an Extended Technology Acceptance Model. 2(2), 134–146. <https://doi.org/10.59628/jast.v2i2.890>
- [9] Khalil, A., Hezber, A., Ali, R., Al-Arabi, H., & Mohammed, A. (2022). Exploring the Availability and Use of Agricultural Extension Services by Small-Scale Coffee Farmers in Al-Udein District, Ibb Governorate, Yemen. *New Valley Journal of Agricultural Science*, 2(4), 182–195. <https://doi.org/10.21608/nvjas.2022.141754.1061>
- [10] AREA. (2024). Annual agricultural statistics book for 2023. Agricultural Research and Extension Authority (AREA), Yemen.
- [11] Krejcie, R. V., & Morgan, D. W. (1970). Sample size determination. *Business Research Methods. Educational and Psychological Measurement*, 4(5), 34–36.
- [12] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson Prentice Hall.
- [13] Murmura, F., Musso, F., Bravi, L., & Pierli, G. (2024). The role of quality management systems in fostering the international competitiveness of companies. *International Journal of Quality & Reliability Management*, 41(7), 1979–1999. <https://doi.org/10.1108/IJQRM-02-2023-0040>
- [14] Nunnally, J. C. (1975). Psychometric theory—25 years ago and now. *Educational Researcher*, 4(10), 7–21.
- [15] Sürücü, L., & Maslakçı, A. (2020). Validity and reliability in quantitative research. *Business & Management Studies: An International Journal*, 8(3), 2694–2726. <https://doi.org/10.15295/bmij.v8i3.1540>.