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Mobile Technology in Agriculture: A Systematic Literature Review of Emerging Trends and Future Research Directions

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ABSTRACT

This literature review examines the current trends and future research directions in the use of mobile technology in agriculture from 2014 to 2024. In 2024, a search was conducted on the SCOPUS database, resulting in 2,570 documents published between 2014 and 2024. These documents were analyzed to identify the most frequently cited articles in the SCOPUS database. The search used keywords such as mobile technology, mobile applications, smartphones, and mobile devices in combination with keywords like agriculture, farming, and crop production. The analysis of publication trends revealed a significant increase in the number of documents and citations. Notably, India, the United States, and China emerged as the leading contributors in agricultural technology research. Most publications were conference papers and journal articles, with notable contributions from institutions such as Bina Nusantara University and the Sri Lanka Institute of Information Technology. Through keyword analysis, major research clusters focusing on crops, the Internet of Things (IoT), and mobile applications were identified. Key journals in this field, such as Communications in Computer and Information Science, Sensors (Switzerland), and Agriculture (Switzerland), cover these topics. This review aims to highlight the global, dynamic, and interdisciplinary nature of research in mobile agricultural technology. It underscores the increasing importance of this field and emphasizes the need for further exploration.

1. INTRODUCTION

Mobile technology has significantly impacted agriculture, as it allows farmers to access information, monitor their operations, and make better decisions. A critical development in the agricultural sector is using mobile phone apps specifically designed for smallholder farmers [1]. These applications give farmers details about weather patterns, market dynamics in terms of crops, indications of pest and disease damage, and recommendations for fertilizers and chemical applications [1].

Farmers can also access centralized platforms through mobile applications. These include crop maps, real-time crop tracking features, notifications, and task management. This functionality allows them to access their farms from anywhere, even if they are not physically present [2]. Aside from that, mobile platforms enable direct sales, enhancing farmers' price discovery. Through these connections between growers and purchasers, they receive better returns for their produce, gradually boosting their income.

Mobile applications also help farmers to get connected to central platform where all required information can be obtained. These are crop maps, crop real-time tracking interfaces, notification as well as task handling modules. Even though farmers themselves might not be physically located on their farms, they can effortlessly use their phones to access these functionalities. Other than that, since mobile platforms include online marketing, it offers direct sale that improves farmers' price discovery. Due to this relationship established between growers and purchasers through this platform, returns on produce are improved, and over time, their incomes are enhanced.

The study reveals that there are three main categories of smartphone agricultural applications. The first group is Crop Operations, offering support to decisions related to crop protection, nutrition, irrigation, growth regulation, and harvesting [3, 4]. The second one is Farm Management, which concentrates on effectively managing resources like field mapping, soil analysis, machinery supervision, and activity coordination [4, 5]. The last category is Information Systems, which provide farmers with basic agriculture knowledge, market updates, news alerts through chatbots, and climate information. These apps enable better judgment in different farm practices. Furthermore, mobile technology is transforming agriculture by providing farmers more access to information tools and markets [3, 4, 6]. This leads to increased productivity as well as sustainability.

Additionally, these smartphone applications can also be beneficial for agricultural stakeholders. Farmers can make fact-based decisions using real-time data, leading to better crop management and lessened environmental damage. For example, IoT sensors have been implanted in fields to check soil moisture temperature, among others. This is then wirelessly transmitted to mobile devices owned by farmers, who will now use it for accurate farming techniques [7-9]. Improved connection, on the other hand, facilitates seamless interaction between the farmers on one side and extension services and markets on another end. This helps them respond on time to challenges such as pest outbreaks and market prices fluctuating [7, 8, 10].

Mobile phones have significantly reduced the cost of communicating with those who live in the countryside. This technology has opened new channels through which rural farmers can access information on agricultural issues. Using ICTs in agro-extension services, primarily through mobile phone services, has made it easy for people to communicate with relevant agencies and departments concerning market trends, weather forecasts, transport, and agriculture techniques [11].

Smartphones have transformed how people converse with each other and share data substantially [12]. As a result, around 70% of the global population uses a mobile phone, which accounts for six a billion consumers worldwide [13]. Integrating mobile technology into agriculture has created opportunities for growth and development within existing agricultural enterprises [14].

Nevertheless, the knowledge gap between farming societies and technical expertise is still huge [15]. This breach has arisen from a lack of resources and weak infrastructure. Furthermore, as the study [16] argued, "mobile phone-based applications have the potential to make a significant difference in bridging this knowledge gap". Mobile apps have lately become more popular than short messages as sources of information [17] due to the increased availability of smartphones.

This paper systematically reviews the literature on mobile technology in agriculture, with a focus on mobile applications. It seeks to determine current trends, assess research patterns, identify critical contributors, and map knowledge networks within Mobile Technology for Agriculture. Additionally, the review explores keyword evolution, regional impacts, and collaboration between researchers and institutions. Addressing gaps in the fragmented literature, this study provides a comprehensive understanding of mobile technology's adoption, benefits, and limitations, evaluating its influence on productivity, efficiency, sustainability, and economic outcomes across various farming sectors and regions. Ultimately, it aims to guide decision-makers in advancing agricultural technologies.

This study aims to systematically review the use of mobile technology in agriculture, providing a comprehensive analysis of its applications, trends, and impact. Specifically, the research seeks to:

- Examine the overall publication trends related to mobile technology in agriculture.
- Identify key countries and institutions that have contributed significantly to research in this field.
- Analyze the most frequently cited journals that form the foundation of knowledge in mobile technology for agriculture.
- Identify the most frequently occurring keywords in the most-cited studies related to this field.
- Synthesize key findings and emerging trends from selected research articles, highlighting the role of mobile technology in advancing agricultural practices.

To address the research objectives, the paper is structured as follows: Section 1 introduces the topic, highlights the research gap, and outlines the study's purpose. Section 2 examines related work in mobile technology in agriculture. Section 3 describes the systematic and bibliometric methodologies used, along with the flowchart and data analysis structure. Section 4 presents the findings and discusses future research directions. Section 5 covers the contributions, limitations, and suggestions for future research.

2. RELATED WORK

2.1 Mobile technology and agriculture

The rapid advancement of mobile technology has revolutionized a variety of industries including the agricultural sector. Researchers in the recent past have been concentrated on exploring how smartphone application can enhance agricultural practices and management [10]. Over time, there has been a proliferation of information and communication technologies (ICTs) in agriculture with mobile phones being prominent across Africa [18]. Nowadays, farmers own mobile phones which they use for obtaining a variety of services including financial, extension, advisory services, weather information, market prices and agricultural advice.

Smartphone apps can information based on the geographical place, access to information, capture images, and make recordings [10]. These applications can enhance agricultural management, reduce cost for labor, and boost yield production [10]. Moreover, a study found that exposure to agricultural smartphone apps boosts adoption and productivity among smallholder farmers in Southwest Nigeria. Key factors such as age, education, and farmer associations enhance app use, underscoring the role of awareness in improving farm efficiency [19].

According to another study, mobile phone adoption for agricultural marketing among Malawian smallholder farmers is influenced by factors such as literacy, market distance, and asset value, which enhance usage, while limited electricity access restricts it. The study recommends improving infrastructure, lowering tariffs, and addressing gender disparities to support farmers' market access [20].

On the other hand, it is noted that there has been a tremendous increase in the number of people who own mobile phones in underdeveloped countries [21]. Small-scale farmers have benefited from mobile tools that enable them to access services such as health care, education, farming, and money matters [22].

Furthermore, mobile phones have been discovered to benefit farming societies by providing them with information about how to improve their lives [23]. These devices enable farm owners to monitor their farm activities and communicate with other actors in the agriculture industry more effectively [24]. Smallholder farmers can improve their agricultural production systems with such applications. As an example, cloud-based decision support tools can help Senegalese smallholder farmers apply fertilizer more accurately [25].

A study conducted in Tanzania explored the designing of a mobile phone application system to provide support for farming decisions [26]. This system allowed two-way information sharing about farming among stakeholders thereby allowing farmer access to agriculture inputs, weather conditionings transportation services as well as markets crop production policies reports and research output in agriculture.

2.2 Current applications and innovations

The agricultural sector is embracing smart farming, wherein the IoT and AI are used to enhance productivity within the sector. AI and IoT comprise novel technologies and techniques like big data, sensing technology, networking, cloud computing, and applications for the end users [27, 28]. These applications increase production through optimization of resources, tracking of crops, estimation of yields, pests and diseases control to ultimately stabilize and increase yields.

A study found that Artificial Intelligence (AI) was widely used in the agricultural sector in recent years. This technology solves various difficulties, including poor soil treatment, disease, pest infestation, the need for large amounts of data, low productivity, and the knowledge gap between farmers and technology [29]. AI is highly regarded for its adaptability, superior efficiency, precision, and cost-efficiency, especially in many applications such as soil management, crop cultivation, weed control, and disease management [30].

Based on the systematic literature review that covered 67 papers from 2006-2019, IoT technologies in context of agriculture were classified based on applications, sensors, communication protocols and network. The consideration outlined here provided the broad structure that respected challenges and regulations and proposed future research and development for farming technologies [31]. At the same time, it is as well emphasized that the application of blockchain technology in agriculture improves traceability, transparency, and reliability of supply chain of agricultural commodities. Nevertheless, challenges like technology, education, and regulations hamper widespread adoption by farmers and systems [32].

Furthermore, some issues with mobile technology, AI, the Internet of Things (IoT), and blockchain are being implemented in the agriculture domain. For instance, the availability of real-time data is limited in the rural region; AI has privacy and data security challenges; IoT doesn't support the interoperability of devices; blockchain requires the capability to process great volume and create trust [23, 33, 34].

In a nutshell, these challenges must be addressed so that new infrastructure can be constructed for AI algorithms that are more trustworthy, internet of things protocols can attain compatibility standards, and block chain becomes more scalable and reliable. These challenges have to be solved in order to improve agricultural production, its sustainability, and its environmental stability on a global level.

3. METHODOLOGY

3.1 Search strategy

The researcher chooses to use the Scopus database for this methodical investigation because it provides extensive coverage of various scientific articles in different fields such as technology and agricultural domains. Since Scopus is already famous for indexing academic papers and peer-reviewed journals, it comprises a valuable instrument in any systematic literature review on the topic of mobile technologies in farming and agriculture.

The researcher employed a blend of search terms: ("Mobile technology" OR "Mobile applications" OR "Smartphones" OR "Mobile devices") AND ("Agriculture" OR "Farming" OR "Crop production"). Each of these keywords was chosen with reference to a wide literature that is relevant to changes and effects on farming and agricultural productivity. The goal was to find articles with the focus on strategies, novelty technology, legislation on the enhancement of agricultural issues by specifying these keywords.

The search was done using the databases with the earliest date being 2014 to the end date of 2024 to ensure that it captured the most relevant articles within the selected period. Only articles, conference papers, reviews and conference reviews that were published solely in English language were considered for the study. This is because these papers usually undergo a strict peer review process and offer a comprehensive analysis of research results in the respective field.

3.2 Selection criteria

The inclusion criteria for this systematic review were guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement [35]. Initially, 2570 papers were identified as the result of our meticulous examination. The search was limited to studies published between 2014 and 2024. This resulted in the elimination of 185 research articles. In order to refine the search, researchers limited the document type to articles, conference papers, reviews, and conference reviews. Thus, 142 publications were eliminated from the analysis. By including articles from multiple nations around the world, we included 2192 items in the final stage of the search.

3.3 Quality assessment

As part of this study, a thorough quality assessment approach was used to examine original research articles, conference papers, conference reviews, and review papers to ensure their reliability. Throughout the review, researchers ensured that there were no instances of duplication to maintain the quality. As a result, each unique item was thoroughly examined.

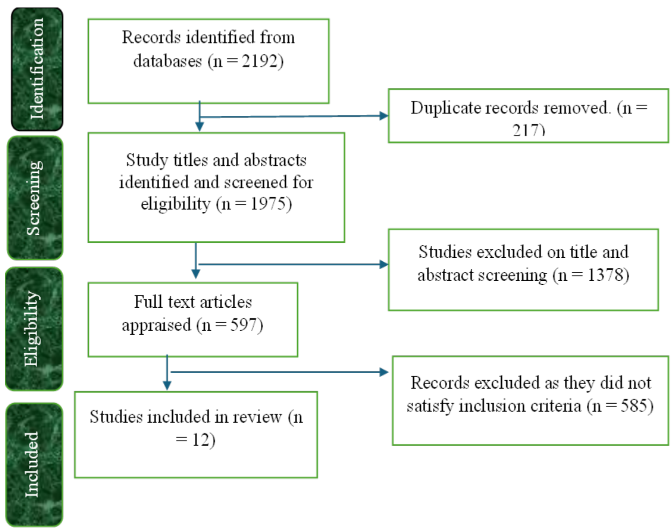

Figure 1. Selection process

Researchers excluded the papers which contain the same data (duplication), or which were inadequate after the careful consideration of the papers' abstracts, in the process of conducting the study, the papers worth 217 were left out. To determine the papers' relevance for the review, researchers screened all the located papers based on various attributes of their abstracts. This entailed assessment with the aim of arriving at the priority of the identified scholarly articles and the quality of articles to be used in the review process. The current paper reveals that as many as 1,378 items were removed by the researchers after employing a screening procedure based on a set of exclusion criteria.

Before the articles can be included in the review, each article was critically appraised on specific inclusion and exclusion criteria. After critically evaluating the articles identified, the researchers chose 12 articles for this review. Thus, the whole process followed the PRISMA statement while ensuring a clear procedure and methodological rigor. Figure 1 presents an illustration of the literature inclusion/exclusion criteria adhering to PRISMA guidelines for each of the steps in the review process.

4. RESULTS AND DISCUSSION

4.1 Yearly publication trend

The chart in Figure 2 illustrates the annual count of documents and their corresponding citations from 2014 to 2024. In 2014, there were 61 documents with 1845 citations, followed by 89 documents and 1440 citations in 2015. The year 2016 recorded 97 documents and 2050 citations, while 2017 saw 130 documents and 2169 citations. In 2018, 149 documents were published, accumulating 3054 citations. Subsequently, 2019 had 221 documents and 4433 citations, and 2020 saw 271 documents with 4414 citations. By 2021, 296 documents were published, generating 3559 citations. The year 2022 reported 361 documents and 2204 citations, and in 2023, 392 documents received 895 citations. Finally, 2024 had 125 documents published, with 52 citations.

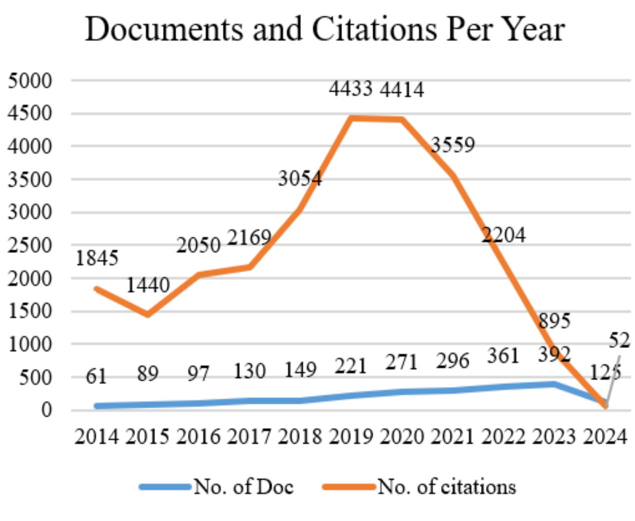

Figure 2. Yearly documents and citations

Figure 3 summarizes the publications related to Mobile Technology in farming. It reveals that 53% of the papers are conference papers facilitating active knowledge exchange, while 42% are scholarly journal articles offering detailed research insights. Additionally, 3% contribute to the broader literature through conference proceedings, and 2% provide reviews summarizing existing research findings.

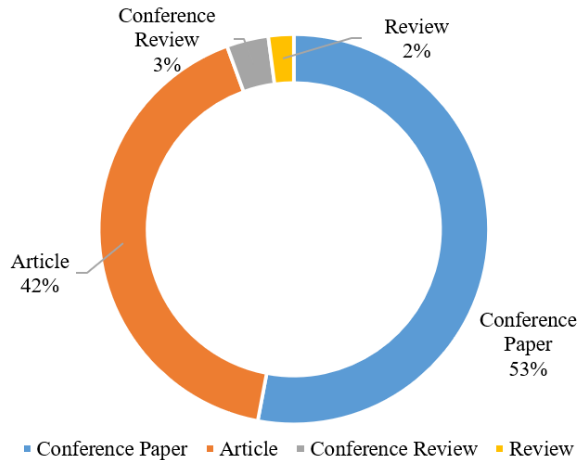

Figure 3. Types of publications

4.2 Research contributions by countries and affiliations

The chart in Figure 4 provides a detailed overview of research documents categorized by country, showing their respective publication counts. India leads with 544 documents, demonstrating a strong research presence. Following closely, the United States contributes 224 publications, with China also prominent at 163. Indonesia follows with 141 documents, and Malaysia, Germany, Italy, and Thailand each have 83, 72, 67, and 66 documents respectively. Lastly, the United Kingdom and Australia have the lowest publication counts, with only 59 and 56 documents respectively. This chart underscores the global diversity in research participation concerning Mobile technology in farming, illustrating varying levels of engagement and contributions from different countries.

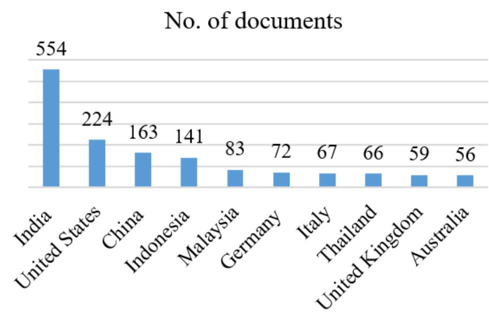

Figure 4. Country contributions

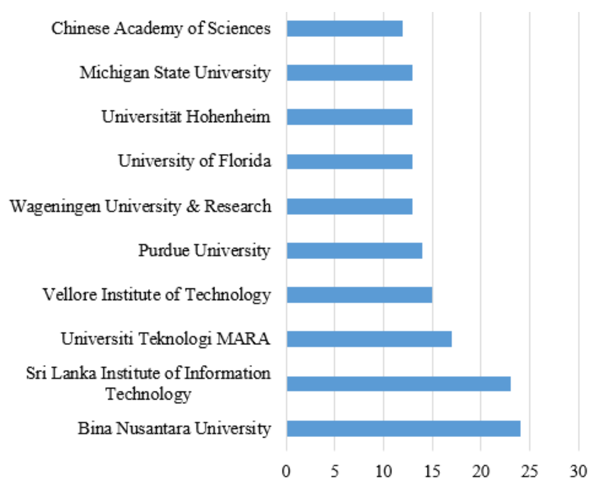

Figure 5. Document by affiliation

Figure 5 identifies the top affiliations contributing to research in a specific field and the number of publications associated with each institution. Bina Nusantara University leads with 24 publications, followed closely by Sri Lanka Institute of Information Technology with 23 publications. Universiti Teknologi MARA has 17 publications, while Vellore Institute of Technology and Purdue University each have 15 publications. Wageningen University & Research, University of Florida, and Universität Hohenheim each contribute 13 publications. Michigan State University follows closely with 13 publications, and the Chinese Academy of Sciences has 12 publications. According to this distribution, these institutions are actively engaged in research, scholarly publications, and other activities related to this field.

4.3 Most cited journals in mobile technology for agriculture

Table 1 outlines the top 14 journals and conference proceedings with the highest number of citations, detailing each conference and journal's name, average Citations per Publication (CPP), Total Publications (TP), Total Citations (TC), Citescore, Source Normalized Impact per Publication (SNIP), Scimago Journal & Country Rank (SJR). SNIP serves as a metric to assess a journal's CPP relative to its citation potential within its field [31]. A journal is considered to exceed its field's citation potential if its SNIP score is greater than 1.

The journal "Communications in Computer and Information Science" leads with 2410 citations, followed by "Sensors (Switzerland)" with 851 citations and "Agriculture (Switzerland)" with 207 citations.

"Computers and Electronics in Agriculture" has the highest number of publications at 52, followed by "Lecture Notes in Networks and Systems" with 42 publications, and "ACM International Conference Proceeding Series" with 41 publications.

Notably, "Lecture Notes in Computer Science" (including subseries in Artificial Intelligence and Bioinformatics) holds the highest SNIP score of 2.6 and an SJR of 0.59. It also achieves a Citescore of 2.6. Additionally, "Agriculture (Switzerland)" achieves a Citescore of 0.607, highlighting its impact within this list.

Table 1. Top 14 journals with most-cited publications

No	Top Journals and Conferences	TP	TC	CPP	Citescore	SNIP	SJR
1	ACM international conference proceeding series	41	206	5	1.5	0.233	0.253
2	Advances in intelligent systems and computing	40	170	4	N/A	0.373	N/A
3	Agriculture (switzerland)	16	207	13	4.9	1.041	0.607
4	AIP conference proceedings	30	24	1	0.5	0.291	0.152
5	Ceur workshop proceedings	18	18	1	1.1	0.235	0.191
6	Communications in computer and information science	24	52	2	1.1	0.246	0.203
7	Computers and electronics in agriculture	52	2410	46	15.3	2.344	1.735
8	IOP conference series: earth and environmental science	32	51	2	1	0.325	0.199
9	Journal of physics: conference series	21	119	6	1.2	0.303	0.18
10	Lecture notes in computer science (including subseries lecture notes in artificial intelligence and lecture notes in bioinformatics)	32	95	3	2.6	0.59	0.606
11	Lecture notes in electrical engineering	21	50	2	0.7	0.145	0.147
12	Lecture notes in networks and systems	42	59	1	0.9	0.282	0.171
13	Proceedings of SPIE - the international society for optical engineering	20	77	4	0.5	0.202	0.152
14	Sensors (switzerland)	18	851	47	7.3	1.247	0.786

4.4 Top frequent author's keywords

VOSviewer software was used to analyze keyword co-occurrences within the study of mobile technology in agriculture, revealing significant progress in recent research. Based on the study findings, four major clusters of knowledge were identified. It is noteworthy that the most significant keywords associated with these clusters are "crops," "internet of things," "agriculture," and "mobile applications." According to Figure 6, these clusters emerged from 36 items containing at least four co-occurring keywords. The fist cluster (red, 12 items) consists of keywords relating to agriculture, artificial intelligence, convolutional neural networks, crops, cultivation, farms, image processing, learning systems, machine learning, precision agriculture, and soils.

A second cluster (green, 10 items) features keywords such as Internet of Things (IoT), agricultural robots, automation, irrigation system, moisture control, monitoring, sensors, smart agriculture, smart farming, and soil moisture.

The third cluster (blue, 11 items) contains keywords like agriculture, android (operating system), application programs, decision-making, digital storage, information management, mobile devices, mobile phones, mobile telecommunication, and smart phone applications. There are 3 items in Cluster 4 (Yellow): This cluster covers mobile applications, mobile technology, and mobile computing keywords.

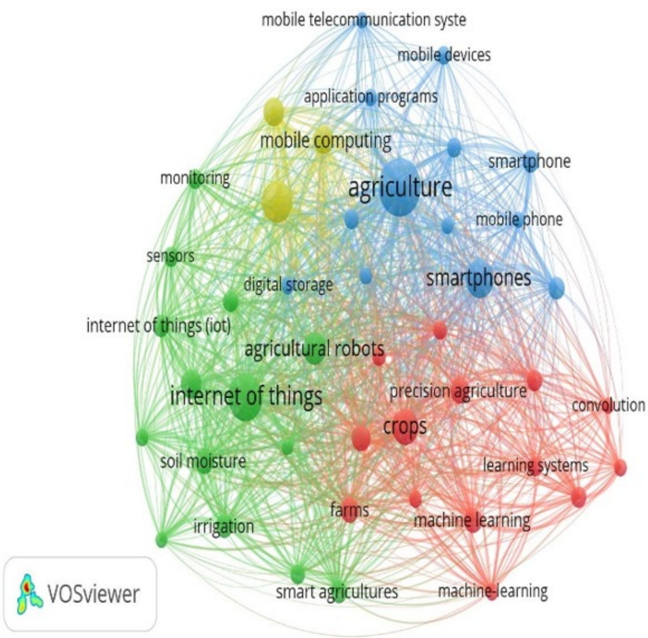

Figure 6. Keyword co-occurrence

4.5 Content review of selected articles

Table 2 presents a content review of selected research articles that examine the role of mobile technology in agriculture. It highlights the research purpose, methodologies, key findings, target audience, and suggests future research directions in the domain of mobile technology for agricultural practices.

Table 2. Content review of the selected articles

Author and Year	Research Purpose	Methods /Application Used	Main Findings	Target Audience	Future Research
[36]	Assess the feasibility of using smartphones for real-time agricultural data collection.	application	The study found that using a smartphone app for longitudinal activity data collection was feasible and had good compliance among farmers over six months.	Farmers	Evaluate broader populations, improve app performance, explore new applications beyond farming, and refine exposure assessment.
[37]	Examine farmers' adoption and engagement with digital technologies, including smartphone apps.	Quantitative	The study found that 89% of farmers used smartphones; 90% saw value in citizen science. 54% of British farmers were willing to participate in wildlife recording.	Farmers	Develop applied citizen science projects, provide financial support, leverage smartphones for data collection, and address connectivity/digital skills gaps.
[38]	Assess and categorize agricultural mobile applications in Germany.	Qualitative content analysis	The study found that the market for agricultural mobile applications in Germany had grown significantly, but there is a gap in apps for livestock farming.	Agriculture	Focus on livestock farming apps, identify trends, and offer utilization recommendations.
[4]	Review and compare mobile applications in smart/precision agriculture.	Review	The study found that smartphone-based agricultural apps are categorized into crop operations, farm management, and information systems, with a scarcity of decision-support apps	Agriculture	Develop professional yet user-friendly apps, establish usability standards, enhance offline functionality, and explore advanced imaging.
[39]	Examine smartphone influence on agricultural production outsourcing.	Novel genetic matching approach	The study found that smartphones positively influenced outsourcing of labor- and tech-intensive tasks.	Farmers	The authors suggest that future research could examine the effects of smartphone use on the degree of outsourcing for different agricultural production tasks, rather than just looking at whether tasks are outsourced or not.
[40]	Review smartphone applications using built-in sensors for agriculture.	Review	The study found that 25 smartphone-based agricultural applications were categorized into farming, farm management, information systems, and extension services. GPS and cameras were the most used sensors.	Farming	Explore unused sensors, improve algorithms, optimize battery usage, and enhance UI/UX.
[41]	Map ICT research trends in agriculture.	Bibliometric review	The study found that ICT in agriculture research was predominantly from India, UK, and USA, with minimal contributions from Africa. Key themes included ICT, agriculture, and sustainability.	Agriculture	Use broader databases, include more publications, and conduct further bibliometric studies.
[42]	Develop a smartphone application called CocoaGuard to help cocoa farmers in Ghana.	Qualitative and Quantitative method	The study found that 87.5% of users perceived CocoaGuard as useful; 96.88% were satisfied and willing to recommend it	Farmers	Conduct a study over two consecutive cocoa production seasons to determine if the use of the CocoaGuard mobile application has a direct or indirect effect on increasing cocoa yields.
[43]	Develop an Integrated Approach to Dairy Farming (IA-DF) using AI, IoT, and edge computing.	Deep learning application	The study found that the IA-DF approach achieved high accuracy (96.65%) and computational efficiency (96.36%).	Dairy farming /	The authors recommend future research to implement the IA-DF system in practical agricultural contexts, to assess its potential for expansion and ability to adapt to different environmental conditions.
[44]	Develop a mobile app for spectral analysis of weeds in rice fields.	Application	The study found that the spectral ranges identified could differentiate weed species; the app educates users on weed control.	Rice farming	Apply statistical analysis and ML techniques for better weed classification.
[45]	Explore Chamwino farmers' smartphone use in farming.	Qualitative	The study found that smartphone ownership was low; younger farmers used secondhand devices mainly for SMS and calls. Farmers needed info on inputs, weather, markets, and finance.	Farmers	Study smartphone use for knowledge acquisition, provide training, and establish mobile-enabled farming services.
[46]	Investigate factors influencing IoT adoption	Quantitative	The study identified that the trust, government support, and price	Farmers	Examine the role of users' values in app adoption and the potential unintended

in Bangladeshi agriculture.	value influenced IoT adoption; performance expectancy had no impact.	consequences of addressing negative values.

4.6 Discussions

Through systematic literature review of mobile technology applications in agriculture landscape, several key themes and findings can be drawn from the chosen articles. This discourse summarizes the learning outcomes from this research, looking at how mobile technologies have influenced various agricultural aspects like farmer empowerment, improved production rates, and technological adoption difficulties.

Firstly, the systematic review brings into focus different uses for mobile technologies in agriculture. For example, studies [4, 44] explain how smartphone applications are useful in precision farming and identification of weed species respectively. However, the study [4] stress on the role played by mobile apps towards enhancing precision farming activities through real time data collection and analysis as well as decision-making processes while the study [44] also consider such kind of case where technology-based methods have been used to develop mobile systems optimized for spectral signature analysis in rice farms leading to improvement in weed control strategies.

Secondly, the literature shows that farmers' use of mobile technology varies significantly by region and has adoption challenges. For example, the study [39] on smartphone usage in litchi farming in southern China shows the positive effect of mobile technologies on production outsourcing decisions, focusing on better communication and market access. Conversely, the study [45] discusses the experiences of small-scale farmers in Chamwino, Tanzania where few people own smartphones and others face connectivity problems thus making the majority not have agricultural apps.

Moreover, this discussion transcends into socio-economic implications as well as potential empowerment from mobile technology in farming. The research [46] looked at incorporating users' values, especially among Bangladeshi women farmers during the mobile app creation process. This finding suggests that if the functionalities of an App are made to fit with users' values; then it will lead to increased engagement and adoption rates hence maintaining sustainable agriculture practices and good livelihoods for farmers.

Also, this research study identifies what is referred to as citizen science projects and the ways in which these projects are based on mobile phone technology for data collection and community development. Agricultural participatory citizen science initiatives that promote collaborative data acquisition and knowledge transfer between stakeholders should be encouraged [37]. The significance of such an approach is not limited to scientific understanding only, as it allows farmers' active involvement in research and decision-making processes.

Besides, the article also highlights some recent developments in agricultural apps and the market forces behind their emergence. In Germany, the study [38] compared various mobile apps used for agriculture thus capturing market movements and preferences of usership towards online farming platforms. Their research underlines that app customization options and user interface design are critical factors that can increase popularity among users who download them.

Moreover, this research also examines the way artificial intelligence (AI) integrates with IoT in dairy farming and how these mobile apps can change the way livestock is monitored and managed as a result [43]. Mobile enabled AI based monitoring systems helps farmers to enhance productivity, utilize resources effectively and improve animal welfare.

However, there are challenges related to digital divide, connectivity issues and socio-cultural barriers that limit adoption of mobile technology for agricultural purposes in Africa. To maximize the benefits of mobile technologies for sustainable development of agriculture in Africa future research should prioritize context-specific technology interventions tailored for different categories of farmers socio-economic profiles while also enhancing capacity building programs through training.

4.7 Limitations

There are several limitations to this systematic review, which must be acknowledged. Our initial literature search was confined to one SCOPUS database because of its extensive coverage of agricultural mobile technologies. However, employing alternative databases or a combination of them may produce slightly different results. To enhance the comprehensiveness of future reviews in this area, consider expanding the search strategy to include additional databases relevant to agriculture and technology.

5. CONCLUSIONS

There is no doubt that the systematic review of mobile technology in agriculture reveals significant trends and future research directions. From 2014 to 2024, there is a clear upward trend in both the number of publications and citations, highlighting growing interest and advancements in this field. Conference papers and journal articles dominate the publication types, with India leading in research output, followed by the United States and China. Prominent institutions contributing to this research include Bina Nusantara University and the Sri Lanka Institute of Information Technology. Key journals such as "Communications in Computer and Information Science" and "Sensors (Switzerland)" are central to the field, demonstrating high citation counts. Keyword analysis identifies major research clusters around crops, the Internet of Things (IoT), mobile applications, and various technological advancements in agriculture. These findings hi highlight the global and multifaceted nature of research in mobile technology in agriculture, indicating robust engagement and a dynamic landscape of knowledge development. Future work should focus on addressing identified research gaps, exploring innovative applications of mobile technology, and assessing the real-world impacts on agricultural practices across different regions.

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