

# Evaluating Smartphone Use in Caribbean Countries: An Exploratory Study

W. Ganpat<sup>1</sup>, L. Narine<sup>2</sup>, H. Batson<sup>3</sup>, J. Ramjattan<sup>4</sup>

## Abstract

Information and communication technologies (ICTs) are now central to modern extension and advisory services. Smartphones have become popular in the Caribbean, but their use in the farming sector remains largely unknown. A sample of 559 farmers from Barbados, Dominica, Grenada, Jamaica, St. Lucia, St. Vincent & the Grenadines, Suriname, and Trinidad and Tobago was conveniently selected. Demographic data, barriers, needs, perceptions, and intentions were assessed. Results showed that in every country investigated, most respondents were smartphone users, with use ranging from 58% to 89%. There was a significant association between user group and country of residence, and between age, education, and years in farming, with age and education showing moderate associations. Perceptions of barriers differed based on access to training, the time available to use the devices, and the cost of smartphones. Most farmers, regardless of user status, were interested in regular ICT training programs, assistance to purchase devices, and technical support for smartphones. The study provides implications for smartphone use, factors associated with use, and barriers to be overcome and support needed. Policy makers and Extension agencies can use the findings to help increase smartphone adoption for farming across the Caribbean.

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1. Wayne Ganpat, Professor, The University of the West Indies, Circular Rd, St. Augustine, Trinidad, W.I., wayne.ganpat@sta.uwi.edu,  <https://orcid.org/0009-0009-2813-3802>
  2. Lendel Narine, Extension Associate Professor & Evaluation Specialist, Utah State University, 4900 Old Main Hill, Logan, Utah 84322, lendel.narine@usu.edu,  <https://orcid.org/0000-0001-6962-2770>
  3. Howard Batson, International Development Consultant (Independent), 12750 SW 4th Court, Pembroke Pines, Florida, 33027, USA, howardfb@gmail.com,  <https://orcid.org/0009-0005-0088-5069>
  4. Jeet Ramjattan, PhD, Agriculture Agent II. University of Florida Institute of Food and Agricultural Sciences. St Johns County, Florida. Jramjattan@ufl.edu,  <https://orcid.org/0009-0007-3839-4526>

## Introduction and Problem Statement

The food import bill in the Caribbean exceeds USD 8 billion, an unsustainable burden for small-economy states (Forgenie et al., 2024). The Caribbean Community (CARICOM), the regional coordinating body, set a target to reduce the food import bill by 25% by 2030 (CARICOM Secretariat, 2025), making improved agricultural technologies and communication efficiency a regional priority.

Information and communication technologies (ICTs) are now central to how agricultural knowledge is produced, packaged, and shared, and are increasingly viewed as essential to modern extension and advisory services (Khan et al., 2025; Mulungu et al., 2025). Globally, ICT-enabled approaches strengthen farmer education, accelerate diffusion of improved practices, and reduce the cost and time constraints of face-to-face extension (Narine et al., 2019a). The International Telecommunication Union (ITU) reports that, in 2023, internet use in Caribbean Small Island Developing States (SIDS) had grown to 75 percent, a figure which varies by country (ITU, 2024). However, despite this enabling environment, some Caribbean countries struggle to modernize their extension communications services (Narine et al., 2019a).

The Capacity Building in Agricultural Extension (CAPA) regional extension-system assessment noted that digital tools are increasingly becoming embedded in regional extension efforts, with the use of smartphones by extension staff being 52.4% in 2024 (CAPA, 2025). Smartphones offer communication features (e.g., voice, messaging, WhatsApp), information access (e.g., search, videos), documentation function (e.g., photos), and apps (e.g., GPS, weather) (Narine et al., 2019a). Such capabilities enable extension workers to reach more clients and in a timelier manner than traditional extension methods. This is especially critical in the Caribbean, where the extension officer-to-farmer ratio averages 1:600 (Ganpat et al., 2014) and can be higher in some regional countries.

Unfortunately, little evidence exists on farmers' use of smartphones for agricultural advisory services, with unanswered questions such as the extent and patterns of smartphone use by small farmers, and the barriers and support needs that determine use and non-use. These have not been examined across Caribbean countries, and this knowledge gap limits policymakers' ability to create the policies and incentives and to meet the communication efficiency goal as mandated. This exploratory study was undertaken as a first-time, multi-country investigation of issues related to smartphone use and non-use among small farmers in selected CARICOM countries.

## Theoretical and Conceptual Framework

This study was guided by the Technology Acceptance Model [TAM] (Davis & Venkatesh, 1996). It establishes levels of smartphone use and examines relevant socio-demographic differences in use behavior, perceived barriers to use/increased use and support needs, perceptions of smartphones among users, and intentions to adopt (non-users) or increase use (users).

According to the TAM, technology use behavior is determined by perceived usefulness (PU) and perceived ease of use (PEOU). PU is the degree to which an individual believes that using a technology will enhance their performance. PEOU is the degree to which the technology is perceived as free of effort (Davis & Venkatesh, 1996). Rogers' (2003) referred to these factors as Relative Advantage and Complexity in the Diffusion of Innovation, a foundational model for agricultural extension. Rogers indicated both characteristics were most important to adoption. In the TAM, an individual's belief shapes their attitudes toward the technology, which in turn influences their behavioral intentions and eventual adoption. TAM has been widely applied to explain farmers' adoption of ICT-based innovations (e.g., Arangurí et al., 2025; Gouroubera et al., 2026; Kabir et al., 2022).

Consistent with TAM, farmers are more likely to engage smartphone use when they perceive tangible benefits (i.e., PU) such as improved access to market information, weather forecasts, and advisory services (Khan et al., 2025). However, barriers such as limited digital literacy, cost, and time constraints may negatively influence perceived ease of use (PEOU), thereby reducing adoption likelihood. The literature show that demographic factors such as age, education, and farming experience influence how individuals evaluate both usefulness (PU) and ease of use (PEOU) (Amoussouhoui et al., 2024; Aparo et al., 2022). The authors noted facilitating conditions, such as access to training and affordability of devices, function as antecedents that influence adoption. Therefore, this study operationalizes TAM constructs, socio-demographic factors, perceived barriers, and support needs to explain variation in smartphone use and non-use among Caribbean farmers.

## Purpose

The purpose of this study was to generate practical recommendations to accelerate the effective adoption and expansion of smartphones use among farmers. The main objectives of this study were to describe: (a) the extent of smartphone use by farmers; (b) the socio-demographic differences between smartphone users and non-users; (c) the support needed and barriers to use (non-users) and increased use (users); (d) perceptions of selected characteristics of the innovation impacting use; and (e) and intentions to adopt (non-users) and increase use (users).

## Methods

### Data Collection

Data were collected in 2025 from a convenience sample of 559 farmers across eight CARICOM countries, including Suriname (n = 559). The recruitment was facilitated by Regional Extension officers, who were pursuing an advanced, blended degree in Agricultural Extension at the Faculty of Agriculture at the University of the West Indies. As part of their practicum, these officers were required to invite at least 25 farmers from their work area to attend a training session. Extension officers employed a variety of communication methods, including traditional channels (e.g., notices in community centers and on district bulletin boards), legacy ICTs (SMS), and internet-based channels (e.g., WhatsApp) to reach the widest audience. Following the

training session, participants were invited to complete a survey on their smartphone use. Participation was voluntary. Data were collected in June and July of 2025.

Participants were initially screened with the question: "Do you have access to and use a smartphone?" Those who answered "yes" were directed to self-complete a survey via a provided Google Form link. Conversely, those who responded "no" were surveyed by the extension officer, either immediately or scheduled for a date no later than July 2025. Non-users were surveyed in person using a questionnaire that, while similar to the instrument used for smartphone users, was adjusted to align with the study's specific objectives. These included the barriers to adoption of the device and the support they perceived will be needed to enable use. The majority of the questions had fixed response options, and the extension officer entered the respondents' answers directly into a Google Form.

### Survey Instrument

The instrument was reviewed by a panel of four regional experts, three in extension and one in ICTs. Then, it was pretested among 10 farmers in Trinidad, after which adjustments were made to the language and response categories. For use in Suriname, the instrument was translated into the local language, Dutch Surinamese, by the local extension officer. Both survey instruments (for non-users and users) included similar questions on personal, demographic, and farm-related information. Additionally, the survey for non-users specifically gathered responses on their perceived barriers to smartphone use, the type of support they felt was necessary, and their intentions to access and use smartphones. Additional questions for users covered their perceptions of barriers and necessary support, their perceptions of selected characteristics of smartphones, and their intentions to increase their use of smartphones. The instruments contained single-item questions for personal, demographic, and farm-related measures, and multiple items for barriers and needs, with binary responses. Five-point Likert-type agreement scales were used to measure the technology characteristics constructs. These scales were assessed for reliability using Cronbach's alpha (PU  $\alpha = 0.92$ ; PEOU  $\alpha = 0.82$ ).

### Data Analysis

The exploratory study was guided by the Technology Acceptance Model (TAM) with respect to the perceived usefulness (PU), attitudes, and perceived ease-of-use (PEOU) constructs. Results were reported as descriptive statistics: country smartphone use levels; socio-demographic and farm-related variables; barriers and needs; and farmers' perceptions based on TAM constructs. Comparisons of selected characteristics and differences in other variables were assessed using the Chi-square test with associated Cramer's V effect size. All data collected were analyzed using SPSS version 31.

The regional sample ( $n = 559$ ) was distributed across 8 countries: Barbados ( $n = 88$ ); Dominica ( $n = 114$ ); Grenada ( $n = 118$ ); Jamaica ( $n = 30$ ); St Lucia ( $n = 66$ ); St Vincent and the Grenadines ( $n = 51$ ); Suriname ( $n = 44$ ); Trinidad and Tobago ( $n = 48$ ).

## Findings

### **Objective (a): The extent of smartphone use by farmers**

Of the total respondents, 70.8% (396) reported using a smartphone, and 29.2% (163) were non-users. Across all countries, the majority of respondents were smartphone users, ranging from 58% to 89%. The highest use was observed in Suriname (89%) and Jamaica (80%), followed by St Vincent and the Grenadines (75%), St Lucia (74%), and Dominica (73%). The lowest use was in Trinidad and Tobago (58%) and Grenada (63%).

### **Objective (b): The socio-demographic differences between smartphone users and non-users**

Table 1 shows the differences in socio-demographics between smartphone users and non-users. A Chi-square test with Cramer's V effect size was used to determine statistically significant differences between groups. There was a significant association between user group and country of residence, age, education, and years in farming. Particularly, age ( $\chi^2 = 76.80$ ,  $V = .37$ ) and education ( $\chi^2 = 119.76$ ,  $V = .46$ ) which had moderate and statistically significant associations with farmers' use of smartphones.

**Table 1**  
*Characteristics of Users and Non-Users*

Factor	Level	% Within Factor		$\chi^2$ (Cramer's V)
		Non-User (n = 163)	User (n = 394)	
Country	Barbados	17	15	16.43* (.17)
	Dominica	19	21	
	Grenada	27	19	
	Jamaica	4	6	
	St. Lucia	10	12	
	St. Vincent & the Grenadines	8	9	
	Suriname	3	10	
	Trinidad & Tobago	12	7	
Age	<25	4	5	76.80*** (.37)
	25-35	9	20	
	36-45	12	31	
	46-55	15	19	
	56-65	33	19	
	>65	28	6	
Sex	Male	64	56	3.70 (.08)
	Female	36	44	
Education	Primary	53	11	119.76*** (.46)
	Secondary	28	33	
	Tertiary	13	33	
	Graduate degree	6	23	
Years in farming	<5	10	15	36.59*** (.26)
	5-10	11	26	
	11-15	9	16	
	16-20	16	12	
	>20	53	30	
Farm size	<1 ac	28	37	7.78 (.12)
	1-5 ac	53	45	
	6-10 ac	10	13	
	>10 ac	9	5	
Farm type	Non-livestock	53	55	0.13 (.02)
	Livestock	47	45	

Note. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

**Objective (c): The support needed and barriers to use (non-users) and increased use (users)**

Table 2 summarizes the barriers to smartphone use across user groups. Based on the Chi-square test and Cramer's V effect size, there were moderate, statistically significant differences between users' and non-users' perceptions of barriers related to access to training, the time

available to use the devices, and the cost of smartphones. While a small number of smartphone users perceived access to training, time to use devices, and cost of smartphones as barriers to using them, nearly half or more of non-users thought these were major barriers.

**Table 2**

*Perceived Barriers to Using Smartphones Between Users and Non-Users*

Barrier	% Yes Within Barrier		$\chi^2$ (Cramer's V)
	Non-User	User	
Poor internet connection	41	27	10.14*** (.14)
Insufficient access to training	45	14	63.27*** (.34)
Insufficient time available to use the devices	56	12	123.98*** (.47)
High cost of smartphones	58	12	127.17*** (.48)

Table 3 shows the type of support users and non-users want from extension services. Most farmers, regardless of user status, were interested in regular training programs, assistance to purchase devices, and technical support for smartphones. However, there was a weak but statistically significant difference between users and non-users for technical support; 60% of users wanted technical support in using smartphones and 41% of non-users wanted support ( $\chi^2 = 17.03$ ,  $V = .18$ ). Intuitively, non-users are less likely to know the potential problems (e.g., updates, app support, etc.) of using smartphones for agriculture compared to users.

**Table 3**

*Support in Using Smartphones between Users and Non-Users*

Support Type	% Yes Within Support Type		$\chi^2$ (Cramer's V)
	Non-User	User	
Regular training programs	60	57	0.27 (.02)
Assistance to purchase devices	57	50	2.14 (.06)
Technical support	41	60	17.03*** (.18)

#### **Objective (d): Perceptions of selected characteristics of the innovation impacting use**

As guided by the TAM, the study explored three factors of technology use: perceived usefulness, attitudes, and perceived ease of use. All three demonstrated acceptable internal consistency, with Cronbach's alpha estimates of 0.95, 0.92, and 0.82, respectively. Table 4 provides a descriptive summary of each construct and their respective items. Overall, 60% of users reported usefulness of smartphones across all tasks examined. The highest reported functions were using WhatsApp (80%) and accessing and utilizing Wi-Fi (75%). Conversely, the most significant difficulties were reported for using mobile banking features and employing GPS for location tracking. Attitudes were assessed using a 5-point agreement scale, with the majority of respondents (82%) expressing agreement across all measured items. A large portion of respondents agreed that smartphones enable access to educational materials, videos, and online information (68%), are generally important for the future of farming (59%), and help improve farm productivity and profitability (54%). Regarding perceived ease of use, 74% of respondents agreed with the items assessed (57% strongly agreed and 20% agreed). Most

believed that the devices were easy to use due to their convenience for communication (74%) and user-friendly features (58%).

**Table 4**  
*Perceptions of Technology Factors by Users*

Perceived Usefulness <i>I am able to...</i>	%				
	Unable	Slightly able	Somewhat able	Able	Very able
..make and receive calls on a Smartphone	1	2	7	11	79
..access and use Wi-Fi	3	2	8	12	75
..send messages using WhatsApp	2	2	7	10	80
..join and participate in WhatsApp groups	4	3	11	11	71
..watch YouTube videos (e.g., farming videos)	3	2	7	11	77
..share your location	13	5	15	17	50
..take pictures (e.g., insects or plants)	3	2	9	17	69
..download files from the internet	9	6	14	16	54
..upload files	13	6	15	19	46
..search online for farming information	7	4	9	19	62
..check weather information	6	4	14	20	56
..use GPS or reading locations on my phone	18	9	20	17	37
..use mobile banking (sending or receiving money)	22	7	15	13	43
..use farming apps on my phone (If applicable)	16	8	20	17	40
Overall %	8	4	12	15	60
<b>Attitudes</b>	<b>SD</b>	<b>D</b>	<b>U</b>	<b>A</b>	<b>SA</b>
<i>Smartphones...</i>					
..are important for the future of farming.	1	3	11	25	59
..can help me improve my farm productivity and profitability.	3	2	14	28	54
..allow me to access and use online farming tools (applications)	3	5	15	29	48
..allow me to connect with other farmers and extension services.	3	3	13	24	58
..allow me to access educational materials, videos and information online	2	2	11	18	68
Overall %	2	3	13	25	57
<b>Ease of use</b>					
<i>Smartphones...</i>					
.. are very convenient for communication	2	2	10	13	74
..are user-friendly	3	4	15	22	58
..require minimal training to use.	5	5	20	24	47
I can fix simple problems on my smartphone by myself	11	10	21	20	39
Overall %	5	5	16	20	54

**Objective (e): Intentions to adopt (non-users) and increase use (users).**

The majority (88.90%) of current smartphone users expressed intentions to increase their device usage. Among non-users, just over half (57.1%) indicated an intent to adopt a smartphone in the future.

## Conclusions, Discussion, and Recommendations

This study provided insights on smartphone use, identified factors associated with use, and outlined barriers and key support needed. Policy makers and Extension agencies can use the findings to help increase smartphone use across the Caribbean, which is urgently needed as Artificial Intelligence (AI) is being promoted as a more efficient way for Caribbean extension to interact with data and information.

The results of this exploratory study indicate that smartphone use is fairly high in Caribbean smallholder agriculture, with adoption ranging from 89% in Suriname to 58% in Trinidad and Tobago. The Caribbean's adoption rate compares favorably with many sub-Saharan African contexts, at 60% (Xaba et al., 2026). The inter-island spread suggests that adoption decisions may be shaped more by localized institutional conditions and the maturity of digital extension offerings, than by device availability and infrastructure (Narine et al., 2019b).

The chi-square comparisons indicated that education and age are the primary drivers of the digital divide. Both patterns align with the literature which identifies education and age as consistent determinants of mobile technology adoption, with younger, more educated farmers reporting greater ease of use and relative advantage (Amoussouhoui et al., 2024; Aparo et al., 2022). While this augurs well for the future of smartphone use in agriculture, farmers in the Caribbean are aging; in most countries, more than 50 percent of farmers are between 35 and 65 years old (Food and Agriculture Organization of the United Nations [FAO] & Caribbean Development Bank [CDB], 2020). The future of agriculture in the Caribbean will be driven primarily by young farmers and their use of technology. As such, policies to support this category of farmers should be for purchasing and training to use devices. Further, gender was non-significant with use, a finding that contrasts with global reporting, which is a positive sign for Caribbean farming, where women make up a significant share, up to 30 percent of the region's registered farmers (FAO & CDB, 2020).

Non-users cite high device cost and insufficient time as the dominant barriers to use, and both users and non-users expressed the need for training, firstly to use and then to use it more effectively. Also, noting that a large majority of users (89%) intend to increase their use and a significant percentage of non-users (57%) expressed an intention to adopt, governments can seek to provide incentives or grants to increase access to devices and data plans. Extension staff should also be tasked with developing and implementing digital literacy programs for all farmers as a first step. This will help farmers stay more frequently in touch with extension services, receive timely information, and access information to address farm-related problems.

Findings were consistent with the Technology Acceptance Model (Davis & Venkatesh, 1996). The favorable responses to perceived usefulness, attitudes, and perceived ease of use offer suggest facilitating conditions to smartphone adoption already exist and can complement extension's efforts to hasten adoption by non-users.

The study has limitations that should guide the interpretation of findings. Firstly, data were gathered from a convenience sample of farmers attending a training session. Some farmers may have received the survey invitation via a group texting app on their smartphones. A larger, stratified sampling procedure is recommended for any follow-up studies to ensure both users and non-users are proportionally reflected in the sample. This study demonstrates the existing gap of smartphone use in Caribbean agriculture. ICTs will continue to play a central mediating the relationship between farmers and extension. With the proliferation of generative AI, modern ICTs are more likely to be a transformative factor in agricultural progress and rural sustainable development. However, generative AI can also exacerbate the digital divide if developing countries lag in ICT adoption.

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