Extension workers' perception of information and communication technology utilisation for extension services in Vietnam

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Abstract. The purpose of this study was to examine extension workers' views about the use of Information and Communication Technology (ICT) for extension services in Vietnam. A sample of 187 extension workers was randomly selected from a population of 354 extension workers in the South Coastal Central Vietnam. A questionnaire was employed to collect data. Descriptive and inferential statistics were used to analyse the data. The extension workers used mobile phones, internet-connected computers and magazines/newspapers as the common ICT tools, and considered these as effective ICT tools for extension services. There were statistically significant relationships between the extent of mobile phone use and the extension workers' age, gender, the type of extension systems, education levels, income and participation in ICT training programs. Similarly, statistically significant relationships were found between the extent of internet-connected computer use and the extension workers' age, gender, education levels and participation in ICT training programs. Finally, a statistically significant relationship was found between the extent of newspaper/magazine use and extension workers' gender and participation in ICT training programs. Extension strategies designed to promote extension workers' use of mobile phones and internet-connected computers should consider extension workers' socio-technical characteristics including age, gender, education levels, types of extension systems and participation in ICT training programs.

Keywords: extension workers, ICT, perception, relationships, South Coastal Central Vietnam.

Introduction

A key role of agricultural extension is the transfer of new technologies or innovations from research to agricultural producers in order to enhance agricultural production and productivity (Birner et al. 2009; Waddington & White 2014; Danso-Abbeam et al. 2018). Conventionally, agricultural extension delivery is predominantly implemented by extension workers visiting producers on farm or at producers' field schools (Van den Ban & Samanta 2006; Waddington & White 2014). Several new innovations, including information and communication technologies (ICTs) have been used to improve delivery of extension services in recent years (Birke & Knierim 2020; Akintonde et al. 2021). ICT is defined as a diverse set of technologies and resources used to transmit, store, create, share or exchange information. These technological tools and resources cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services, and other related information and communication activities (UNESCO 2009). ICT tools such as mobile phones, Internet, TV, computers and radio networks have enabled people to receive, process, and transmit information digitally using voice, text and digital imagery (Ajani 2014; Kaware & Sain 2015). Several ICT tools including radio, television, mobile phone, magazine/newspaper, computer, digital camera and internet services have also helped producers in developing countries to market their agricultural produce (Mwombe et al. 2014). ICT may be employed to, but not limited to: (1) facilitate better communication between extension workers and farmers; (2) enhance quality of delivering extension services to farmers; and (3) improve the effectiveness of agricultural extension programs (Ayisi Nyarko & Kozári 2021; Owolabi & Yekinni 2022).

In Vietnam, the Institute of Agricultural Sciences for Southern Viet Nam (2018) regard ICT tools including mobile phones, Internet, TVs, computers and radio as an important method for delivering extension services. This is because extension workers can be effective information sources for small-scale farmers (Marford 2016; Indraningsih et al. 2023). However, they are not the most efficient, as evidenced by the huge cost and limited extent of coverage (Van den Ban & Hawkins 1998). Therefore, no matter how effective an extension delivery service is, it can neither be efficient nor cost effective for Vietnam, with more than 10 million smallholder farmers, covering about 331 thousand square kilometres. Consequently, it is important that extension workers in Vietnam be well-positioned to utilise ICT to access up-to-date information and diffuse it to farmers quickly. The Ministry of Agriculture and Rural Development of the Vietnamese Government has put resourcing and effort into fostering ICT use, both for agricultural information distribution and its subsequent use by Vietnamese farmers (Ministry of Agriculture and Rural Development 2018).

Hence, ICT tools, including computers, internet, TV channels and mobile phones have been promoted for use by Vietnamese extension workers nationally (Ministry of Agriculture and Rural Development 2018). Yet, the extent of use of ICT tools by Vietnamese extension workers to deliver extension services is poorly documented scientifically. Extension workers within developing and emerging economies, including Vietnam, struggle with several associated challenges such as access, cost and connectivity to equipment and networks, which are compounded by the difficulties associated with the agricultural producers' literacy levels (Umar et al. 2015; Aldosari et al. 2019).

Research into extension officers' use of ICT for extension services has been conducted in some developing countries (Yakubu et al. 2013; Tata & McNamara 2018; Owolabi & Yekinni 2022). According to some scholars (Annor-Frempong et al. 2006; Tata & McNamara 2018; Owolabi & Yekinni 2022), the use of ICT varies among extension workers, while the extent of its use by farmers is likely to be associated with their socio-economic characteristics including age, gender and education level (Strong et al. 2014). For example, in a study conducted in Ghana by Annor-Frempong et al. (2006), the authors found that the ICT tools including computer hardware, audio-visual and mobile phones were the most suitable devices for extension service delivery. Ayisi Nyarko & Kozári (2021) also found that a majority of Ghanaian extension officers use mobile or smart phones in their work. Tata & McNamara (2018) reported that in South Africa cellular phones, Internet, radio and web-based applications were the major ICT tools used for sharing and disseminating information and knowledge among African agricultural extension officers. Mugwisi et al. (2015) found that Zimbabwean extension officers perceived mobile phones as effective ICT tools in the diffusion of information to farmers. Ayisi Nyarko & Kozári (2021) suggest that there is a relationship between gender and time spent using ICTs among Ghanaian extension officers. However, no known study has examined the extension workers' use of ICT for extension services and its effectiveness in Vietnam. To determine how extension worker can best be supported by ICT tools, the extent of ICT use by extension workers must be well understood. This research aims at: (1) describing the demographic and socio-economic characteristics of extension workers in South Coastal Central Vietnam; (2) defining the extent of use and effectiveness of ICT as perceived by the extension workers; and (3) determining relationships, if any, between the extension workers' characteristics and selected ICT tools (both usage and perception of effectiveness).

Methodology

This research was implemented in Quang Nam, Quang Ngai and Binh Dinh provinces in South Central Coastal Vietnam. The study population comprised all extension practitioners in the public and non-public organisations in the provinces. Extension workers were randomly selected for interview. A sample of 187 extension workers was randomly selected from a population of 354 extension workers, utilising the sample calculating formula described in the literature (Cochran 1977; De Vaus 2014).

A two-section organised questionnaire was created to gather data. The first section contained statements on: (1) the types of ICT tools used; (2) the extent of use of ICT tools; and (3) effectiveness of ICT tools used in delivering agricultural extension services as perceived by extension workers. The extent of use of ICT was measured on a five-point Likert scale, which ranged from "1 = never use" to "5 = very often use". The effectiveness of ICT use was measured on a five-point Likert scale, which ranged from "*1 = not very effective*" to "*5 = very effective*". The second section collected respondents' socio-economic information. The questionnaire was reviewed by a panel of experts for content validity.

Extension workers were interviewed in person. Six trained enumerators were hired to manage the questionnaires in the field, and the survey was conducted in 2023. Data were analysed in SPSS version 20. Descriptive statistics, such as frequency percentages and means, were used. Inferential statistics, such as Chi squares (χ^2) test and Kendall's tau-b (T_b), were applied to identify the relationships between characteristics of extension workers and the extent of their use of ICT tools (Agresti & Finlay 2009).

Results

Key characteristics of extension workers

Extension workers (41%) who participated in this research were aged between 35 and 44, followed by ages between 45-54 (23%), with only a small percentage (2%) aged 65 or older. About two-thirds of the extension workers were male. Most were in the 'state extension systems' (72%). The highest levels of education were technical certificate (58%), followed by university degree (25%). A small proportion of extension workers, had education levels of senior high schools (12%). A large proportion of extension workers (39%) had an average yearly income

between 31-45 VND million, followed by 1-30 VND million (34%) and 46-60 VND million (14%). Slightly over half (54%) had not participated in ICT training programs.

Table 1: Main characteristics of extension workers

Extension workers' characteristics		Value
Age (years)	25-34	30 (16.0%)
	35-44	76 (40.6%)
	45-54	43 (23.0%)
	55-64	34 (18.2%)
	65 or older	4 (2.1%)
Gender	Male	127 (67.9%)
	Female	60 (32.1%)
Types of extension systems	State extension systems	135 (72.2%)
	Private extension systems	52 (27.8%)
Education level	Junior high school	4 (2.1%)
	Senior high school	23 (12.3%)
	Technical certificate	108 (57.8%)
	University degree	46 (24.6%)
	Masters degree	6 (3.2%)
Income/year	Nil	3 (1.6%)
	1-30 VND[a] million	64 (34.2%)
	31-45 VND million	73 (39.0%)
	46-60 VND million	27 (14.0%)
	61-75 VND million	14 (7.5%)
	More than 75 VND million	6 (3.2%)
Participation in ICT training programs	Yes	85 (45.5%)
	No	102 (54.5%)

N=187

[a] VND is Vietnamese Dong. 16,000 VND equalled to 1 AUD in 2023.

ICT tools used by extension workers

In general, the extension workers who participated in this study utilised a wide range of ICT tools for extension services (see Table 2). Mobile phones, TVs and magazines/newspapers were the ICT tools used by 100%, 98%, and 97% of extension workers. Radio networks/broadcasts (87%), internet-connected computers (85%), office/home phones (77%) and calculators were other ICT tools used.

Table 2: The distribution of respondents by ICT tools

ICT tools	Responses		% of respondents
	Frequency	%	
Mobile (smart) phones	187	14.4	100.0
TVs	184	14.1	98.4
Magazines/newspapers	181	13.9	96.8
Radio networks/broadcasts	162	12.7	86.6
Internet-connected computers	158	12.1	84.5
Office/home phones	143	11.0	76.5
Calculators	115	8.8	61.5
Printers	76	5.8	40.6
Photocopiers	73	5.6	39.0

Note: frequencies reflect multiple responses; N = 187.

The extent of use of ICT by extension workers

The extension workers were asked to rate the extent of use of ICT tools on a 5-point Likert scale, ranging from "1 = never" to "5 = very often". Table 3 describes the extent of extension workers' use of ICT tools for extension services. In general, most extension workers frequently used mobile (smart) phones, internet-connected computers, magazines/newspapers and TVs for extension services. In terms of mobile phone use, almost all (93%) of extension workers reported using mobile phones "often" or "very often". About 56% of extension workers reported that they frequently used internet-connected computers for extension services. This figure for magazines/newspapers was about 64%, and for TVs was about 52%. In contrast, other ICT tools

including radio networks/broadcasts, office/home phones, printers were not used by most extension workers for extension services.

Table 3: The extent of use of ICT tools by extension workers

Name of ICT tools	The extent of use of ICT tools (%)				
	Never	***Rarely***	***Sometimes***	***Often***	***Very often***
Mobile (smart) phones	0.0	2.1	4.8	48.7	44.4
Internet-connected computers	15.5	7.0	20.9	43.3	13.4
Magazines/newspapers	3.2	1.6	31.6	58.8	4.8
TVs	1.6	4.3	42.2	48.1	3.7
Radio networks/broadcasts	12.3	20.9	48.7	17.6	0.5
Office/home phones	24.1	1.6	55.6	14.4	4.3
Printers	59.4	10.2	9.1	10.7	10.7
Photocopiers	61.0	13.9	11.2	8.0	5.9
Calculators	38.5	8.0	33.3	5.3	4.8

N = 187

Effectiveness of ICT tools as perceived by extension workers

The extension workers were asked to rate their perceptions of the effectiveness of ICT use, when using for extension services, on a 5-point Likert scale, ranging from "1 = not very effective" to "5 = very effective" (Table 4). Combining the ratings of "very effective" and "effective" indicates that they considered mobile (smart) phones (92%), internet-connected computers (60%), magazines/newspapers (56%) and TVs (48%) as the most effective ICT tools for extension work. In contrast, radio networks/broadcasts, office/home phones, printers, photocopiers and calculators were not perceived as effective tools for extension services.

Table 4: The effectiveness of ICT tools as perceived by extension workers

Name of ICT tools	The extent of effectiveness (%)				
	Not very effective	***Not effective***	***Somewhat effective***	***Effective***	***Very effective***
Mobile (smart) phones	0.0	2.7	5.5	48.1	43.9
Internet-connected computers	13.9	8.6	17.6	45.5	14.4
Magazines/newspapers	2.7	7.5	34.2	50.8	4.8
TVs	1.1	8.0	42.8	44.9	3.2
Radio networks/broadcasts	1.6	29.4	49.7	17.1	2.1
Office/home phones	6.4	21.4	54.0	13.4	4.8
Printers	0.5	65.8	16.6	10.7	6.4
Photocopiers	0.0	63.6	20.9	8.6	7.0
Calculators	0.5	44.9	42.2	6.4	5.9

N=187

Relationship between extension workers' characteristics and the use of ICT tools

There were statistically significant relationships between the extent of use of ICT tools and some extension workers' characteristics (Table 5). Interestingly, the extent of mobile phone, internet-connected computer and newspaper/magazine use was statistically significant in association with extension workers' gender (χ^2 = 11.36, p ≤ 0.01; χ^2 = 9.82, p ≤ 0.05 and χ^2 = 9.53, p ≤ 0.05) and participation in ICT training programs (χ^2 = 11.44, p ≤ 0.01; χ^2 = 11.89, p ≤ 0.05 and χ^2 = 9.82, p ≤ 0.05) respectively, although the direction of the relationship can't be assessed using this test (because gender and participation are nominal variables). Similarly, there were statistically significant relationships between the extent of both mobile phone and internet-connected computer use and extension workers' age (χ^2 = 19,78, p ≤ 0.1, T_b = -0.08 and χ^2 = 26.87, p ≤ 0.05, T_b = -0.18) and education levels (χ^2 = 18.79, p ≤ 0.05, T_b = 0.02 and χ^2 = 27.88, p ≤ 0.05, T_b = 0.10) respectively, suggesting that young extension workers who have higher education levels are in a better position to use mobile phones and internet-connected computers compared with the counterparts. A statistically significant relationship was found between the use of mobile phones and extension workers' income (χ^2 = 24.35, p ≤ 0.1, T_b = 0.06), which suggests that the use of mobile phones was positively associated with extension workers' income. Also, a statistically significant relationship was found between the extent of

mobile phone use and extension systems (χ^2 = 8.10, p ≤ 0.05), although the direction of the relationship can't be assessed using this test as it is a nominal variable.

Table 5: Relationship between extension workers' characteristics and the extent of ICT use

Variables	Mobile (smart) phones		Internet-connected computers		Newspapers/ Magazines	
	χ^2	*p-value*	χ^2	*p-value*	χ^2	*p-value*
Age (years)	19.78*	0.071	26.87**	0.043	19.02	0.268
Gender	11.36***	0.010	9.82**	0.043	9.53**	0.049
Extension systems	8.10**	0.044	6.04	0.196	3.06	0.546
Education level	18.79**	0.016	27.88**	0.033	20.04	0.218
Income/year	24.35*	0.059	25.52	0.182	21.82	0.350
ICT training	11.44***	0.010	11.89**	0.018	9.82**	0.043

* p ≤ 0.1; ** p ≤ 0.05; *** p ≤ 0.01

Relationship between extension workers' characteristics and the effectiveness of ICT tools

There was a statistically significant relationship existing between the effectiveness of ICT tools and some extension workers' characteristics (Table 6). Importantly, the effectiveness of mobile phones, internet-connected computers and newspapers/magazines was statistically significant in association with extension workers' participation in ICT training programs (χ^2 = 11.21, p ≤ 0.05; χ^2 = 12.56, p ≤ 0.05 and χ^2 = 11.23, p ≤ 0.05 respectively), although the direction of the relationship can't be assessed using this test. There was a statistically significant relationship existing between the effectiveness of both mobile phones and internet-connected computers and extension workers' age (χ^2 = 19,89, p ≤ 0.1, T_b = -0.22 and χ^2 = 28.97, p ≤ 0.05, T_b =-0.10), implying that young extension workers tend to have a positive perception on effectiveness of mobile phones and internet-connected computers for extension services than older extension workers.

There were statistically significant relationships between the effectiveness of both mobile phones and internet-connected computers and gender (χ^2 = 15.19, p ≤ 0.01 and χ^2 = 11.56, p ≤ 0.05 respectively) and between the effectiveness of mobile phones and extension systems (χ^2 = 8.52, p ≤ 0.05), although once again the direction can't be assessed. A statistically significant relationship was found between the effectiveness of internet-connected computers and extension workers' education levels (χ^2 = 20.04, p ≤ 0.1, T_b = 0.05), which means that the effectiveness of internet-connected computers was positively related to extension workers' education levels.

Table 6: Relationship between extension workers' characteristics and the effectiveness of ICT tools

Variables	Mobile (smart) phones		Internet-connected computers		Newspapers/ Magazines	
	χ^2	*p-value*	χ^2	*p-value*	χ^2	*p-value*
Age (years)	19.89*	0.069	28.97**	0.024	23.22	0.108
Gender	15.19***	0.002	11.56**	0.021	7.24	0.123
Extension systems	8.52**	0.036	7.59	0.108	2.03	0.729
Education level	16.99	0.150	20.04*	0.053	19.64	0.237
Income/year	20.91	0.139	24.19	0.234	19.56	0.485
ICT training	11.21**	0.011	12.56**	0.014	11.23**	0.024

* p ≤ 0.1; ** p ≤ 0.05; *** p ≤ 0.01

Discussion

The research results reveal that the characteristics of extension workers in South Coastal Central Vietnam varied, reflecting a diverse nature of extension workers. Vietnamese extension workers use several ICT tools for extension services including mobile (smart) phones, internet-connected computers, magazines/newspapers and TVs. This result suggests that mobile (smart) phones, internet-connected computers, magazines/newspapers and TVs are required to provide extension services for farmers and other agricultural producers in this region of Vietnam. It was found that a large proportion of extension workers use mobile (smart) phones, internet-connected

computers, magazines/newspapers and TVs. In general, this finding is partially consistent with findings reported in the literature (Mugwisi et al. 2015; Ayisi Nyarko & Kozári 2021; Owolabi & Yekinni 2022). Accordingly, Ayisi Nyarko & Kozári (2021) found that a majority of Ghanaian extension officers use mobile or smart phones in their work. However, the authors also report that only a small number of the Ghanaian extension workers make use of computers, which is not consistent with the results of this study. A high proportion of extension workers perceived mobile (smart) phones, internet-connected computers, magazines/newspapers and TVs were the most effective ICT tools for extension services. This suggests that extension services delivered to farmers through these ICT tools can work well. In the mainstream literature (Mugwisi et al. 2015; Owolabi & Yekinni 2022), little is written about extension workers' perceptions of effectiveness of ICT tools. However, the results from this research partially support the findings by Mugwisi et al. (2015), who found that Zimbabwean extension officers perceived mobile phones as effective ICT tools in the diffusion of information to farmers in Zimbabwe.

This research found that the extent of mobile (smart) phone use was significantly associated with extension workers' age, gender, type of extension systems, education levels, income, and participation in ICT training programs. This means that the difference of these characteristics of extension workers significantly influence their use of mobile phones for extension services. In a study conducted by Ayisi Nyarko & Kozári (2021), the authors suggest that there is a relationship between gender and time spent using ICTs among Ghanaian extension officers, which is partially corroborated by the results of this study. However, the finding that the use of mobile phones by Vietnamese extension workers for extension services is statistically significant associated with the type of extension system, has not been reported in previous studies. The possible reason for this is that Vietnamese systems of state and private agricultural extension have different human and financial resources, which may affect the extent of their mobile phone use for extension services. The study also found that the extent of internet-connected computer use by extension workers was statistically significant associated with their age, gender, education levels and participation in ICT training programs. This suggests that the dissimilarity of these characteristics of extension workers affect their use of internet-connected computers for extension services. The findings from this study provide specific empirical evidence to support the findings of Ayisi Nyarko & Kozári (2021), that the more extension officers participate in ICT training, the more ICT tools they use for future extension services. It was found that the extent of newspaper/magazine use by extension workers was statistically significant associated with their gender and participation in ICT training programs. This implies that the variation of these characteristics of extension workers impact their use of newspaper/magazines for extension services. This suggests the Government of Vietnam could support the development of local infrastructure such as providing technical and financial assistance for communes, districts and provinces' telecommunication systems for development and use of mobile phones and internet-connected computers by extension workers.

The present research found that that the effectiveness of mobile (smart) phone, internet-connected computer and newspaper/magazine use was statistically significant in association with extension workers' participation in ICT training programs. Although some researchers (Yakubu et al. 2013; Tata & McNamara 2018; Owolabi & Yekinni 2022) have investigated the use of ICTs by extension officers, the findings from this research have not been reported in any previous study. The development and provision of training courses for commune, district and provincial extension workers on the use of mobile phones and internet-connected computers for extension workers are some of extension strategies that could foster extension workers' use of ICTs for extension services. Extension strategies designed to promote extension workers' use of mobile phones and internet-connected computers should consider extension workers' socio-technical characteristics including age, gender, education levels, types of extension systems and participation in ICT training programs.

It is acknowledged that this research has limitations. The research has provided a significant understanding of relationships between the extension workers' characteristics and selected ICT tools (both usage and perception of effectiveness). However, the data of this research was concentrated on only extension workers in South Central Coastal Vietnam. There is need for more research to generalize these findings. In addition, the study design used in this research was cross-sectional. It only measured extension workers' perceptions at a single point in time. Clearly, extension worker's perceptions change over time as the extension workers gain practical experience. For anyone interested in examining ICT use and effectiveness by extension workers over time, this change has implications. Thus, more effort to evaluate validity of the findings from this research is required.

This study examined perceptions of extension workers on the use and effectives of ICTs, but it did not differentiate between traditional and electronic forms of ICT tools. Further research could be conducted to compare the use and effectiveness between traditional and electronic forms of

ICT tools as well as look at changes about the use from more traditional tools (such as radio & newspapers) to more modern electronic methods (such as smart phone and internet-connected computers). The present research concentrates on commune, district and provincial extension workers. Further research could be conducted to assess ICT use and effectiveness with other actors including smallholder farmers and agricultural researchers. Different contexts could help to capture full insights into extension workers' ICT use for extension services.

Conclusions and implications

Mobile (smart) phones, internet-connected computers, magazines/newspapers and TVs were commonly used and considered effective ICT tools by Vietnamese extension workers. The Vietnamese Government, at local, regional and national levels should promote the use of mobile (smart) phones, internet-connected computers, magazines/newspapers and TVs by agricultural extension workers for communicating new technologies, knowledge and information with stakeholders. Agricultural extension programmes that aim to use ICT tools for delivering extension services to farmers should consider mobile (smart) phones, internet-connected computers, magazines/newspapers and TVs as the main means to interact with agricultural producers.

Characteristics of extension workers were related to their use of mobile phones, internet-connected computers and their effectiveness. Any agricultural extension development strategy that aims to facilitate the Vietnamese extension worker's use of mobile phones, internet-connected computers and newspaper/magazines for extension services should consider these extension workers' socio-economic characteristics including age, gender, education levels, types of extension systems and participation in ICT training programs.

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