

## **Training, Trust, and Technology: A Mixed-Methods Study of Latin American Extension Workers' Experiences during COVID-19**

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### **Abstract**

*The COVID-19 pandemic has drastically affected people's lives around the world, including agricultural extension workers. To date, few studies have been conducted to understand the adaptation of extension services in Latin American countries during the pandemic. This mixed-methods study explored Latin-American extension professionals' preparation to implement knowledge-sharing activities and sought to understand extension professionals' responsiveness to COVID-19. The results revealed significant differences in extension responsiveness, between field extension workers and in-office extension workers. Delving into this difference revealed that field extension professionals perceived lower responsiveness because they were not able to continue their pre-pandemic, face-to-face activities in the field with farmers; on the other hand, office extension workers were able to complete and respond to their annual program objectives by increasing institutional partnerships by virtual means. Resilience was found in the two phases of this study. Extension professionals were viewed by farmers as a reliable resource for addressing COVID-19 challenges. Extension professionals began using new communications technologies to train farmers, even though they were not trained in these technologies themselves. It will be important to begin formally incorporating the use of new technology, and alternative communication strategies with communities during crises, as part of preparation for field technicians.*

**Keywords:** extension, Latin America, COVID-19, resilience, mixed-methods

## Introduction

The COVID-19 pandemic has drastically affected people's lives around the world (Wu et al., 2020). In addition to the loss of human life and the psychological impact on people, the global economy has also been affected, including agriculture and agricultural extension (Li et al., 2020; Nicola et al., 2020; Sampson et al., 2020). Latin America provides an interesting context for exploring the dynamics of agricultural extension during the COVID-19 pandemic, mainly because of the unique blend of public and private providers of extension services and because extension serves many smallholder farmers with agriculture as their only source of income (Luque Zuñiga et al., 2021). Latin American smallholder farmers rely on extension services to understand and mitigate common agricultural crises and extension is perceived as a reliable source of information (Alemany & Sevilla-Guzmán, 2006). In addition, the agricultural industry in most Latin American countries represents a significant economic source, in which smallholder farmers play an important productive role (World Bank, 2018).

Latin American rurality faces common issues such as inappropriate agricultural practices (Lacki, 2006), producers' low educational levels, passivity, lack of participation, and commercialization issues (Ferrer et al., 2006; Gaitán & Pachón, 2010; Henz, 2010). Currently, extension professionals are focused on increasing agricultural productivity, but at the same time, they must be resilient to change and adapt their interventions to address the concomitant socio-economic issues facing farmers (Food and Agriculture Organization [FAO], 2012).

Several studies have been conducted to understand how extension services in developed countries have addressed COVID-19 challenges (Hartmann, 2021; Jones et al., 2021; Narine & Meier, 2020). These studies indicate that resilience and adaptation are two main skills needed by extension professionals in their approach to addressing farmer's needs during COVID-19 (Dobbins et al., 2021; Jones et al., 2021; Rodriguez, 2021). To date, no studies have been conducted to understand the adaptation of extension services in Latin American countries during the pandemic. With the complexity of the pandemic and its implications globally, it is essential to explore and understand the adaptive response of extension services in the Latin American region during COVID-19.

## Conceptual Framework

Resilience Theory (RT) was used to frame this study (Van Breda, 2018). According to Luthar et al. (2000, p.1), resilience in social science is defined as “a dynamic process encompassing positive adaptation within the context of significant adversity.” Resilience Theory aims to understand how people overcome adversities under a mediating process, finishing with a better-than-expected outcome (Van Breda, 2018). This theoretical framework has been proposed mainly to study how adversity affects people in harmful ways (Fletcher & Sarkar, 2013; Southwick et al., 2014). Thus, it has been used to explain people's reactions during COVID-19 pandemic (O'Rourke et al., 2021; Kalaitzaki & Rovithis, 2021; Shaygan et al., 2021).

The theory describes resilience in a three-step process: 1) adversity, 2) mediating processes, and 3) better-than-expected outcome. According to Riley & Masten (2005), adversity refers to experiences that have the potential to produce undesirable outcomes by disrupting formal functioning. The mediating process (resilience processes or protective process) is centered on the “process of adjusting well to significant adversity” (Theron, 2016, p.636). Better-than-expected outcome refers to a ‘good’ outcome within the range of outcomes across the population under study (Luthar, et al., 2000; Rutter, 2012; Ungar et al., 2013).

This theoretical framework can be applied to extension professionals in the following way: adversity is found in restrictions due to COVID-19 and lack of facilities to implement training with farmers (in-person training restrictions, mobilization restrictions, curfews, markets closed, lack of information and communications technology (ICT) knowledge tools, lack of money to purchase cellphone services). The mediating process is the alternatives extension professionals have available to them in order to address the issue (Zoom, social media, individual visits, radio, phone calls). A better-than-expected outcome varies depending on the situation. For extension professionals, the selected outcomes were to keep in contact with farmers and fulfill their previously determined activities or to have resilient extension professionals who may produce long-lasting changes through the delivery methods and tools used during activities.

### **Purpose and Objectives**

The purpose of this mixed-methods sequential explanatory study was to identify and assess Latin-American Extension professionals' response to the COVID-19 pandemic.

#### **Quantitative Objectives**

(1) Analyze the Latin-American extension professionals' preparation to implement knowledge-sharing activities during COVID-19. (2) Examine outreach activity modifications used by extension professionals in response to COVID-19. (3) Evaluate the perceived literacy level and resources available to extension professionals regarding COVID-19 (4) Analyze extension professionals' responsiveness to COVID-19 and compare those working in the field and those working in an office.

#### **Qualitative Objectives**

(1) Understand the ability to implement and select knowledge-sharing activities during COVID-19. (2) Understand the strategies implemented by extension professionals in response to COVID-19. (3) Explore the resources used by extension professionals to prevent or reduce COVID-19 transmission. (4) Understand extension professionals' self-assessment of their responses to COVID-19.

#### **Mixed-Methods Objective**

(1) Merge the qualitative and quantitative data findings to provide a deeper explanation of Latin American extension professionals' response to COVID-19.

## **Methods**

### **Study Design**

For this mixed-method study, researchers collected, analyzed, and integrated the quantitative and qualitative data to comprehend how Latin American extension professionals worked on the accomplishment of their tasks during the COVID-19 pandemic (Creswell & Creswell, 2018; Tashakkori & Teddlie, 2010). The reason for using mixed methods is that neither quantitative nor qualitative methodology is sufficient by themselves to capture the trends and details of the complexity of COVID-19 phenomenon (Creswell & Clark, 2017).

A sequential explanatory mixed-method design was implemented as a two-phased project (Creswell & Creswell, 2018). For this study, the quantitative data helped identify the level of responsiveness and the COVID-19 prevention activities that extension professionals implemented in their programs. The qualitative data helps to deepen the COVID-19 pandemic issues found in the quantitative portion. The connection between the quantitative and qualitative section came from the 17 participants that were part of the quantitative section and decided to share their perspective in the qualitative phase.

A post-positivist perspective was used for the quantitative phase of the study (Creswell & Clark, 2017). Researchers evaluated and measured the adaptive actions taken by extension professionals during the COVID-19 pandemic. For the qualitative phase, a constructivist worldview was used to understand the meaning of the phenomenon based on participants' perspectives. Therefore, researchers aimed to understand the COVID-19 phenomena through the extension professionals' lens (Creswell & Creswell, 2018).

### **Target Population**

The target population in this study were people working in extension services across Latin America (field technicians, program coordinators, program directors, thematic area specialists, extension professors, and monitoring and evaluation specialists) who were implementing extension-based training activities with smallholder farmers or community members before and during the COVID-19 pandemic. The study was considered exempt by the IRB2020-642 at Texas Tech University. As part of the IRB, the anonymity of the participants in the first phase was protected by not collecting any personally identifying information. For the second phase, pseudonyms were used in place of participants' names.

### **Quantitative Phase**

#### ***Data Collection***

Data was gathered using snowball sampling from Latin-American extension professionals who met with the inclusion criteria (N = 80). The instrument developed by Narine & Meier (2020) was adapted to the Latin American context, translated to Spanish, and validated with an expert panel of native Spanish speakers. The instrument is comprised of three sections: (a) individual capacity, how extension professionals perceive their ability to meet residents' needs, (b) actions, the outreach activities used to respond to COVID-19, and (c) knowledge, professionals' perceived knowledge, and access to new information. Extension professionals were asked to complete an online questionnaire using Qualtrics to rate their capacity to implement outreach factors (1 = terrible, to 5 = excellent) and rate the changes made to their activities after the onset of the pandemic (1 = yes, 2 sometimes, 3 = no). They were also asked to rate their knowledge on implementing actions related directly to COVID-19 (1 = yes, 2 = no).

#### ***Data Analysis***

The quantitative data were analyzed using the Statistical Package for Social Science (SPSS) version 26. Surveys with more than 10% of missing values (10 surveys) were deleted from the data analysis (Raaijmakers, 1999). Missing values were between 2 and 8%; therefore, multiple imputation was used to replace the missing data (Enders, 2017).

To address objectives 1, 2, and 3, data were analyzed using descriptive statistics and percentages. Objective 4 was achieved using descriptive statistics, and a Mann-Whitney test was run to analyze the differences in perceived response to COVID-19 between Program Directors (office workers) and Field Technicians (field workers). This variable was created by averaging the four responsiveness declarations. The reliability of this construct was .84, which is considered good (Rubin & Babbie, 2009).

### **Qualitative Phase**

#### ***Research Design***

Across the lens of a phenomenological case study, researchers aim to explain the essence of extension professionals' experiences by providing a rich understanding of the participants' perspective (Ary et al., 2010; Creswell & Clark, 2017). This requires the extension experiences to be described precisely, thus, one-on-one interviews were conducted (Collingridge & Gantt, 2008; Kvåle & Bondevik, 2008).

### **Data Collection**

The content of the interview protocol was based on the quantitative result from the first phase of the study (Creswell & Creswell, 2018). Semi-structured in-depth virtual interviews were conducted between September 2020 and January 2021. Sixteen open-ended questions were used to explore extension responsiveness to COVID-19 (“capacity to implement factors of outreach capacity”, “actions taken by in response to COVID-19”, “perceived prevention and COVID-19 knowledge”, and “perceived response”). The interview protocols and questions were previously pilot tested with three Latin-American extension professionals. As a result, additional probing questions were added to improve comprehension of the questions.

### **Data Analysis**

Each interview was audio-recorded and lasted between 25 and 60 minutes. The audio-recording was transcribed verbatim by two Spanish speakers, and the interviewers’ reflexive notes were discussed between the members of the team. The data collection continued until data saturation. Once transcription was completed, two researchers coded and analyzed the data by hand, using inductive analysis that allowed themes to emerge from the data (Saldaña, 2016). The steps in the qualitative analysis included: (1) preliminary exploration of the data by reading the transcripts and writing memos; (2) coding the data by segmenting and labeling the text; (3) validating the coding through an inter-coder agreement check; (4) using codes to create themes by clustering similar codes; and (5) connecting and interrelating themes.

The investigators recorded inquiries, comments, personal feelings, and reflections of the interview and completed memos after the interview to enhance the transparency of any bias through reflexivity (Lincoln & Guba, 1985, Saldaña, 2016). The trustworthiness of the findings was accomplished by triangulation, member checking, inter-coder agreement, and by using the information generated during the quantitative data (Creswell & Creswell, 2018).

## **Findings**

### **Phase 1: Quantitative Results**

Descriptive analysis revealed that participants came from 13 different Latin-American countries (Mexico, Guatemala, Belize, El Salvador, Honduras, Costa Rica, Panama, Colombia, Ecuador, Peru, Dominican Republic, Brazil, and Chile). Participants included field technicians (31.4%,  $n = 22$ ), program coordinators (27.1%,  $n = 19$ ), program directors (15.7%,  $n = 11$ ), thematic area specialists (14.3%,  $n = 10$ ), extension professors (7.1%,  $n = 5$ ), and monitoring and evaluation specialists (4.3%,  $n = 3$ ). Most of the participants were men (71.4%,  $n = 50$ ), but some women also participated (28.6%,  $n = 20$ ).

### **Objective 1: Analyze the preparedness of Latin-American Extension professionals to implement knowledge-sharing activities during the COVID-19 pandemic.**

For objective one, extension professionals were asked about the skills and strategies they developed during COVID-19. The highest-ranked response was “partner with other organizations to coordinate efforts” ( $M = 4.21$ ,  $SD = 0.86$ ), while the lowest-ranked response was “providing information to community media” ( $M = 3.50$ ,  $SD = 0.97$ ). Table 1 shows the professionals’ capacity to implement outreach activities.

**Table 1**  
Professionals' Percentage of Capacity to Implement Outreach Activities

Task	Percentage (n = 70)						Mean
	T	P	A	G	E	N/A	
<i>Online Education</i>							3.90
Conduct effective online classes	1.4	8.6	18.6	40.0	30.0	1.4	3.93
Convert traditional face-to-face classes to online	0.0	8.6	24.3	41.4	25.7	0.0	3.84
Creating new online classes	0.0	10.0	17.1	42.9	30.0	0.0	3.93
<i>Engaging Residents</i>							3.90
Reach out residents to provide updates (Facebook, WhatsApp, or other methods)	0.0	7.1	18.6	41.4	32.9	0.0	4.00
Translate educational content to another language	2.9	10.0	24.3	28.6	24.3	10.0	3.91
Provide online learning activities for youth	1.4	10.0	25.7	37.1	22.9	2.9	3.79
<i>External Partnerships</i>							3.96
Partner with other governmental organizations to coordinate efforts	1.4	1.4	12.9	45.7	35.7	2.9	4.21
Partner with nongovernmental emergency response organizations	0.0	2.9	5.7	20.0	48.6	22.9	3.97
Reach out to local leaders about how your team can support or address farmers' needs	1.4	1.4	18.6	35.7	42.9	0.0	4.17
Provide information to community media (radio, newspaper)	1.4	12.9	34.3	40.0	8.6	2.9	3.50

*Note.* T = Terrible, P = Poor, A = Average, G = Good, E = Excellent, N/A = Not Applicable

***Objective 2: Examine the modification in the outreach activities used by Extension professionals in response to COVID-19.***

The purpose of objective 2 was to provide a before-and-after comparison of the actions that extension professionals implemented. The net change in actions represents the responsiveness of extension professionals to the initial pandemic outbreak. Results showed that the greatest change for extension professionals was “learning to work from home throughout the pandemic.” Over 80% of participants transitioned to working from home due to the pandemic. Before the pandemic, there were only 18.6%. This represents a 330% increase in working from home. The lowest percentage net change (13%) was “reach out to local leaders about how your team can support or address farmers' needs.” Before the pandemic, 57.1% of the Extension professionals were doing this task, while during the COVID-19 pandemic, 64.3% addressed it. Table 2 shows the Extension professionals' net change by action.

**Table 2**  
Main Actions Taken by Extension in Response to COVID-19

Action	Yes-before	Yes-During	% Net Change
Learn to work from home	18.6	80	330
Conducting virtual training instead of face-to-face training	14.3	61.4	329
Creation of new workshops using virtual platforms	14.3	57.1	299
Learn to conduct virtual workshops	24.3	61.4	153
Reach out to farmers to provide technical assistance (Facebook, WhatsApp, and texts)	34.3	74.3	117
Provide information to community media	22.9	44.3	93
Provide virtual learning activities for youth	35.7	51.4	44
Partner with other organizations to coordinate efforts	51.4	65.7	28
Translate educational content to another language	32.9	41.4	26
Partner with non-governmental organizations working to resolve emergencies	38.6	45.7	18
Reach out to local leaders about how your team can support or address farmers' needs	57.1	64.3	13

***Objective 3: Evaluate the perceived literacy level and resources available to extension professionals regarding COVID-19.***

Participants were asked if they had knowledge of COVID-19 prevention activities and addressed them as part of their programs. Overall, from the 70 participants, personal hygiene was the most addressed action ( $n = 64$ ), and with a high perceived knowledge ( $n = 68$ ). On the other hand, only 27 participants implemented telehealth, and 25 were planning to implement it, even though only 54.29% of them feel they have the knowledge needed. Table 3 shows the extension professionals' perceived knowledge and implementation.

**Table 3**  
Frequency Perceived Knowledge and Actions Implementation during COVID-19 ( N = 70)

Action	Perceived Knowledge [f, (%)]		Implementation [f, (%)]		
	Yes	No	Already Implementing	Plan to Implement	No plan to Implement
Personal hygiene	68 (97.14)	2 (2.86)	64 (91.43)	2 (2.86)	4 (5.71)
Handwashing	68 (97.14)	2 (2.86)	63 (90.00)	3 (4.29)	4 (5.71)
Self-quarantine	66 (94.29)	4 (5.71)	60 (85.71)	7(10.00)	3(4.29)
Self-distancing	66 (94.29)	4 (5.71)	58 (82.86)	7(10.00)	5 (7.14)
Remote work	59 (84.29)	11(15.71)	54 (77.14)	12(17.14)	4 (5.71)
Finding reliable information	63 (90.00)	7(10.00)	53 (75.71)	13(18.57)	4 (5.71)
Exploring for online learning opportunities	64 (91.43)	6 (8.57)	52 (74.29)	16(22.86)	2 (2.86)
Grocery shopping	59 (84.29)	11 (15.71)	51 (72.86)	12(17.14)	7(10.00)
Emergency preparedness	53 (75.71)	17 (24.29)	45 (64.29)	20(28.57)	5 (7.14)
Emergency Kits	49 (70.00)	21 (30.00)	37 (52.86)	26 (37.14)	7(10.00)
Financial management	44 (62.86)	26 (37.14)	34 (48.57)	35(50.00)	11 (15.71)
Telehealth	38 (54.29)	32 (45.71)	27 (38.57)	25(35.71)	18 (25.71)

**Objective 4: Analyze extension professionals' responsiveness to COVID-19 and compare those working in the field and those working in an office.**

Objective 4 sought to evaluate extension professionals' perceived response to COVID-19. Overall, participants ranked "Extension has the necessary experience to make the transition from traditional education to online education" as the highest response ( $M = 2.81$ ,  $SD = 1.27$ ), followed by "Extension is meeting the information needed during COVID-19" ( $M = 2.51$ ,  $SD = 1.16$ ), and "Extension responded quickly to COVID-19" ( $M = 2.49$ ,  $SD = 1.20$ ). The lowest response ranked was the "Extension is prepared to provide emergency educational resources on COVID-19" ( $M = 2.46$ ,  $SD = 1.20$ ). In the case of Program Directors and Field Technicians, both groups followed the same pattern, however, Field Technicians had a lower perception of the response to COVID-19 statements. Table 4 shows the extension professionals' perceived responses to COVID-19.

**Table 4**  
Extension professionals' perceived response to COVID-19

Response	Total (N = 70)		Pr D (n = 34)		Fi T (n = 36)	
	M	SD	M	SD	M	SD
Extension has the necessary experience to make the transition from traditional education to online education	2.81	1.27	3.06	1.179	2.58	1.33
Extension is meeting the information needed during COVID-19	2.51	1.16	2.76	1.15	2.28	1.13
Extension responded quickly to COVID-19	2.49	1.20	2.71	1.21	2.28	1.16
Extension is prepared to provide emergency educational resources on COVID-19	2.46	1.20	2.82	1.16	2.11	1.14

Note. Pr D = Program Directors, Fi T = Field Technician

A perceived extension responsiveness variable was created by averaging the previous statements. The averaged variable was used in to determine differences between Program Directors (office workers) ( $n = 34$ ) and Field Technician (field workers) ( $n = 36$ ). The alpha level was set at .05 *a priori*.

A Mann-Whitney U test was run to evaluate if there were differences between the two groups. Distributions of the perceived extension responsiveness scores for Program Directors and Field Technicians were similar, as assessed by visual inspection. The median in perceived extension responsiveness score was statistically significant, being higher in Program Directors ( $Mdn = 2.50$ ) than in Field Technicians ( $Mdn = 2.37$ ),  $U = 432$ ,  $z = -2.122$ ,  $p = .03$ .

### Phase 2: Qualitative Explanation

For the qualitative section, 17 participants from nine Latin-America countries (Mexico, Belize, Honduras, Guatemala, El Salvador, Panama, Colombia, Ecuador, and Peru) accepted to be part of a one-on-one interview to talk about the findings of the surveys.

#### **Objective 1: Understand the ability to implement and select knowledge-sharing activities during COVID-19.**

Researchers discussed some of the principal outreach activities during COVID-19 using open-ended questions. For objective one, three themes emerged: institutional solidarity, social media as an extension tool, and phone and radio.

**Institutional Solidarity.** Extension professionals agreed that they faced the same major challenges with COVID-19. When they were asked if they were partnering with other institutions, they mentioned that it had become a common practice. Instead of duplicating efforts, they were grateful to combine efforts through partnerships. Jaime, a Guatemalan program coordinator, mentioned the following about working with other institutions:

“We had to integrate with other organizations to facilitate the work, coordinate activities, and be able to assist producers. (...) In a community, there can be 4 or 5 institutions sometimes doing the same thing. Now we need to coordinate practices to fulfill needs, but now the integration with other organizations is more a friendship.”

**Social Media as an Extension Tool.** This theme emerged since participants from 7 out of 9 Latin-American countries explained that media platforms such as Facebook and WhatsApp were the only connection that Extension professionals had with producers. Raul, a Guatemalan

program director, mentioned that access to cellphones is very common in rural areas. He explained the following:

“In Guatemala, there are more cellphones and internet access than people. They do not have a laptop, but they have a cellphone, so they were connecting [Zoom]. (...) So, what we do is to record on Friday, and on Monday, we distribute. We put it on all our social networks.”

Hector, a Colombian extension director, agreed with Jaime’s idea. He mentioned the following: “We have found that most of the producers have a cellphone and are motivated to participate in the exchange networks that we have created by WhatsApp. It is a tool that we will continue using because it facilitates dissemination and coverage in rural areas.”

**Phone Calls and Radio.** In the first section, participants mentioned that sharing information using radio and newspaper was the least frequent of all the outreach activities they were using. In spite of this, extension technicians who worked in poor rural areas found it necessary to return to this “old-fashioned” technology as it was the only way to implement training. Juan, a field technician from Peru, explained that “In the case of training producers, I have trained them through telephone calls and radio. As you know in the communities, the only access to communication is radio.”

Anthony, a Honduran agricultural program coordinator, supported this thought; he has been using the radio for training. He mentioned: “Look, the closest option other than WhatsApp or texts is the radio, we use radio. Let’s say that it’s the oldest technology option that we know of and we know that everyone has access to FM/AM stations.”

***Objective 2: Understand the principal actions implemented by extension professionals in response to COVID-19.***

The purpose of this objective was to explain the extension professionals' actions that changed before and during COVID-19. For extension professionals, technology played an important role (Jones et al., 2021; Rodriguez, 2021). For this objective, the following themes emerged to further explain the quantitative section: Gaining through technology; and Extension and working from home.

**Gaining through technology.** Since the statement of conducting virtual training instead of in-person training had the second highest net change (329%) in the quantitative section, it was explored deeply in the qualitative phase. Participants described that before COVID-19, nobody was considering implementing online learning with rural producers. However, this changed since it was one of the tools that showed promise. Felipe, a Salvadorian field technician, explained the following:

“A learning outcome is that we got used to virtual meetings and training. A year ago, when somebody was talking about virtual training for farmers, nobody was going to invest a penny for that idea. Today we are already seeing that farmers are using this tool. So, I think that this will be an improvement for extension because a virtual training is cheaper than an in-person one.”

**Extension and Working from Home.** This theme emerged since field technicians perceived that working from home was something bad. They claimed that many of them had to change their work and their employment contracts due to working from home. They were conscious that this was a needed action; however, they argued that the role of extension is to work with producers in the field, not on a computer. Eliana, a Panamanian field technician, explained that even though many people perceived that working from home requires less work,

for her, the amount of work increased. She said the following: “Before the pandemic, I had less work, now I have more work. Now we must work weekends, overtime.”

Joseph, a field technician from Ecuador, supported Eliana's thoughts. He explained that working from home caused a reduction in their monthly payments to some extension professionals. He said: “The Ecuadorian salaries fell during the state of emergency. The reduction was to support people with limited resources.”

***Objective 3: Explore the principal COVID-19 prevention resources used by extension professionals.***

Participants were asked if they were implementing COVID-19 prevention training for farmers. In total, 16 participants were implementing them, and one field technician mentioned that it was not part of extension's responsibilities since it is a public safety issue and must be addressed by experts. Participants mentioned that COVID-19 prevention questions were frequently asked by the farmers because many times, the only reliable source of information for farmers were extension field technicians. For this section, the following themes emerged: Extension as a COVID-19 resilience tool and prevention actions.

**Extension as a COVID-19 resilience tool.** According to Resilience Theory, resilience is a process that mediates adversity, concluding with a better-than-expected outcome. This theme emerged since extension professionals considered that extension served as a mediating action to address COVID-19. Kristian, an Ecuadorian field technician, mentioned that due to the pandemic conditions, extension activities changed from their agricultural focus to a more general focus on helping farmers and their families. He mentioned the following:

“COVID-19 was one of the main issues that we faced because people were not fully informed of what was happening worldwide. It was necessary for the Public Extension Service and other institutions to go to the field to train on how to protect themselves and how to work without negative repercussions.”

Beyond the time invested in adapting their extension activities to COVID-19 conditions, extension professionals learned and trained farmers about COVID 19-related topics. Gina, a 30-years-old Guatemalan field technician, mentioned the following adaptations: “the preparation of various trainings served to establish COVID protection outcomes; for example, [the use of] bleach, aloe vera-based alcohol gel.”

**COVID-19 Prevention Protocols.** This theme emerged when COVID-19 prevention actions were incorporated as part of agricultural training. Extension professionals were not providing comprehensive training to address this topic, but some of them repurposed training funding to COVID-19 prevention tool kits. Luis, a Belizean program director, mentioned the following: “From the beginning of the pandemic, there were health protocols that we were implementing with our producers. So far, there have been no infection problems among producers, due to the measures that have been implemented.”

Technology during the COVID-19 pandemic was one of the main tools that allowed people to stay informed and continue work-related activities. Extension professionals received a better-than-expected response on the use of the technological platform and shared the COVID-19 prevention protocols using these sources. Jaime, a Guatemalan program director, explained: “We are giving a lot of information about handwashing, masks, the use of personal protective equipment. We put all the information on social networks and share them with the partners.”

***Objective 4: Analyze extension professionals' responsiveness to COVID-19 and compare those working in the field and those working in an office.***

Researchers asked extension professionals about their perception of the response that extension had on COVID-19 in their respective countries. The purpose of this question was to explore the statistical difference between field technicians and program coordinators. After analyzing the interviews and memos, researchers understood that extension responses varied depending on access to the internet, previous investment in technology, and their age. As a result, the following themes emerged for this question: Resilience and different perspectives.

**Resilience.** This theme emerged since most extension professionals expressed that technology must be part of extension activities. As part of the interviews and memos findings, it was found out a division in resilience perspective between young adults' participants, from 18 to 39 years (Erikson, 1966), and older generations, more than 39 years old. Younger extension professionals were more adaptable and resilient when confronting change, while older extension professionals had difficulties with technology. Extension professionals the importance of increasing resiliency to have more successful outcomes. Gina an older generation field technician mentioned the following:

“We all must update ourselves. I am a conventional extension professional. I am very much of the face-to-face treatment, but we must adapt to other things. People did not even know what COVID was; we were locked up for three months. I believe that in the end, we need to stay more informed, that we as technicians must be [comfortable both] in the field and behind a computer for the same purpose.”

Supporting Gina's thought, Joseph a young field technician mentioned that adapting to using electronic platforms is a way to give technical assistance to farmers. He mentioned the following: “We should seek to adapt to COVID-19 times. Adapt to the use of electronic platforms will as an alternative to provide technical assistance. Adapting to the use of field and technical training would be an option and be included as part of the work activities.”

**Different Perspectives.** This theme highlights the difference in perceptions between field technicians and program directors. Field technicians' perceptions emphasized their inability to work in the field and provide training to farmers. They felt they were giving an inadequate response to the farmers' needs. Gina mentioned that those who had limited access to technology were unable to limit the impact of COVID-19 in extension. She mentioned the following: “I think we were not prepared to address something like COVID. Much less at the extension level, where we work with people who do not have educational levels higher than primary school.”

On the other hand, program directors perceived that they had adapted by implementing innovative agricultural teaching ideas. Regarding the creation of online courses for rural farmers: “Since 2014, we have been implementing a virtual rural extension program. (...). When I worked with cacao producers, and we found a broad use of cellphones with internet, and a favorable perception about the use of short videos as complementary material for the face-to-face training program. Based on this antecedent, during quarantine times we said, ‘Since we have already tried it, let's do the same with other farmers.’”

### **Conclusions, Recommendations, and Implications**

Resilience was found in the two phases of this study. Extension professionals became a reliable tool for farmers by addressing COVID-19 challenges and using accessible technology to train farmers so they could continue producing. The second main component was the transformation process that extension professionals overcame, from being conventional

fieldworkers to adapting to COVID-19 conditions, using old and new technological innovations as tools to achieve their professional tasks.

Overall, extension professionals' perceptions vary significantly between those who are working in the field (Field Technicians) and those who are working in an office (Program Directors). The qualitative data revealed that field technicians felt that since they were not able to contact farmers in person provide a response in the field, they were not achieving their annual program objectives; while those working at an office were able to complete their annual program objectives easily by increasing institutional partnerships and completing the assigned trainings using online tools.

This mixed-methods study provides understanding of the importance of extension services in the Latin American region as a reliable source of information. During COVID-19, extension professionals have taken on the role of sharing up-to-date virus prevention information for rural farmers. Based on the importance of this communicative role, it is recommended to implement training with extension professionals on effective communication strategies to use with communities during crises, including conducting 'drills' for alternative approaches to outreach activities during a time of crisis.

Social media, such as Facebook and WhatsApp, have been considered a tool to reach out to residents to provide updates. In both phases of this study, extension professionals expressed that they were not trained in technology use. In light of the critical role extension professionals played in providing timely and trusted information through unfamiliar technology, it will be important to incorporate training on alternative communication platforms and technology as part of formal preparation for field technicians.

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