The *Journal of International Agricultural and Extension Education (JIAEE)* is the official refereed publication of the Association for International Agricultural and Extension Education (AIAEE). The purpose of the *JIAEE* is to enhance the research and knowledge base of agricultural and extension education from an international perspective. Acceptance rates for the past five volumes are: Volume 23 = 12%. Volume 24 = 18%. Volume 25 = 9%. Volume 26 = 26%. Volume 27 = 18%.

Articles intended for publication should focus on international agricultural education and/or international extension education. Articles should relate to current or emerging issues, cite appropriate literature, and develop implications for international agricultural and extension education. *Manuscripts, or portions of manuscripts, must not have been published or be under consideration for publication by another journal.*

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Two different types of articles are solicited for the *JIAEE: Feature Articles and Research Notes*.

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A Feature Article should focus on philosophy, current or emerging issues, and the methodology and practical application of specific research and appropriate technologies, which have implications for developed and developing countries. Conceptual/Theoretical and Methodological manuscripts are also encouraged as submission for feature articles. If applicable, a feature article should report the findings from a fully investigated study. Feature articles are *no longer than 20 double-spaced pages, excluding references.*

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A Research Note is a concise but complete description of a limited investigation that will not be included in a later manuscript. It serves one of the following purposes: (1) presents initial proof-of-concept results on new ideas or program evaluations, timely issues, or innovative approaches; (2) reports replications or extensions of previously published research that does not merit another full-length manuscript yet provides results that contribute to a greater understanding of the phenomena under study. Research Notes are *no longer than 10 double-spaced pages, excluding references.*
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From the Executive Editor

Hello from beautiful Lexington, Kentucky! While you may still be mulling over the great articles published in Special Issue #1, we are very excited to share with you Special Issue #2! For this special issue, we wanted to focus on something that is impacting all of us around the world – the COVID-19 pandemic.

We broadened this focus just slightly to include other aspects of disruptive change – pandemics, climate issues and other global crises. Once we sent out the call, what we found was astounding. We learned that many of you are doing research on this topic; as a result, we ended up with an overwhelming answer to our call – so many great submissions, in fact, that we decided to split the accepted submissions into two special issues. Thus, we published JIAEE 2021 Special Issue #1 in January and are following up with Special Issue #2 in March.
Exclusive to Special Issue #2 are two research notes and four feature research articles that address disruptive change in unique ways, in order to call into question how we currently address change, and to push the boundaries of how we should tackle challenging issues in the future. More specifically:

We begin with a Research Note that introduces a new public value instrument and discusses how it was utilized to determine the impact of extension programming during shelter-in-place orders during COVID-19. Our second research note harkens back to an earlier time in United States history, when victory gardens were all the rage. A contemporary application, the *Victory2020 Garden Community Program* was designed by Florida Extension faculty in response to COVID-19 – to provide online programming that encouraged learning about home food production through gardening.

The Research Feature articles focus on a variety of challenges associated with disruptive change. We begin with an article focused on assessing the capacity of Caribbean extension and advisory service providers. Researchers found that governments played an important role in ensuring local food security during a global pandemic, and Extension officers utilized ICTs to provide some programming, while still facing a number of barriers when carrying out their Extension duties. In our next article, researchers focused on crisis communication, and explored the differences in how rural and urban Extension faculty communicated during and after a natural disaster. Interestingly, urban audiences chose more personal mediums when communicating personally about the hurricane, while rural participants preferred to use social media outlets.

Shifting strategies during a pandemic was the focus of our next article, more specifically looking at the Start Them Early Program (STEP). The STEP program – whose goal is to reinforce pathways to careers in agriculture for secondary students in DR Congo, Kenya and Nigeria – had to rethink its approach and embrace information and communication technologies (ICTs) due to school closures to keep the program moving forward.

Again, we end this special issue with a research article focused on a different disaster – Tropical Storm Karen. More specifically, researchers investigated the disaster preparedness and response strategies of agricultural extension professionals in Trinidad during Tropical Storm Karen. Utilizing a posttraumatic growth inventory to determine impact on individuals of traumatic events, research results suggested that females may be more adaptive to traumatic events and receptive to perceiving positive benefits resulting from these events. Overall, this information could be utilized when working with individuals recovering from natural disasters.

Please take the time to read and enjoy these interesting articles, and maybe stretch your thought processes a bit. It has been a pleasure to read the variety of perspectives and resolutions each of you have come up with in response to disruptive change. And finally, as usual, continue doing the great work you do within the field.

Warm Regards,

**Kristina D. Hains**

Kristina D. Hains  
Past Editor, *JIAEE*

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Abstract
Communicating the value of Extension programming to stakeholders remains a challenge for many Extension professionals. Program evaluation is a tool that can help communicate the value of Extension; however, many evaluation methods fail to articulate a story of aggregated impact. A public value instrument was recently developed to help communicate the impact of Extension. Communicating Extension’s impact has become more critical, yet more difficult, to do during the COVID-19 pandemic. This research note shares the results of a program evaluation using the Extension public value instrument to determine the impact of Georgia Cooperative Extension’s programs during the shelter-in-place orders due to COVID-19. Respondents (n = 572) indicated high levels of self-reported knowledge gain, wellness, intent to change behavior, and perceived economic value. The results demonstrated respondents’ overall satisfaction and valuation of Family and Consumer Sciences programs during COVID-19. The Extension public value instrument enabled evaluation data collection for Extension professionals to communicate the value of their program impact despite major disruptions to traditional program formats.

Keywords: evaluation; impact; crisis; COVID-19
Introduction

Evaluation is a critical asset to meeting the global grand challenges facing agriculture for feeding the world (Murphrey et al., 2018). Evaluation is also a powerful tool for communicating the value of Extension programming to stakeholders (Stup, 2003); yet Extension professionals often struggle to measure and demonstrate the impact of their work (Warner & Christenson, 1984). While Extension organizations strive to build institutional evaluation capacity (Arnold, 2002; Diaz et al., 2019; Franz & Townson, 2008), communicating how Extension efforts help improve the lives of citizens, increase business efficiency, and create stronger communities remains a challenge (Lamm et al., 2020). Proving the public value of Extension programs is essential to maintaining funding (Lamm et al., 2013). However, impact has remained difficult to measure due to the variety of topics covered by Extension programming, though recent work has begun to develop Extension’s capacity to aggregate program impact to communicate and better articulate the public value of Extension services (Lamm et al., 2020; Lamm & Lamm, 2018).

Extension professionals around the world strive to create relevant, community-focused programming attuned to local needs, and Extension programs are often viewed as a trusted source of information for local communities (Settle et al., 2017; Tidwell et al., 2019). In February of 2020, community needs changed rapidly due to the spread of the novel coronavirus disease (COVID-19) and the emergence of a global pandemic (Narine & Meier, 2020). COVID-19 is a highly infectious disease transmitted between people through droplets from sneezes and coughs (Heymann & Shindo, 2020). Organizations and institutions implemented measures to reduce the spread of the disease, including encouraging remote work and online program delivery (Narine & Meier, 2020). To respond to clientele needs during the COVID-19 pandemic, Extension professionals had to quickly adjust their program delivery methods to remain relevant. Extension’s response to the evolving pandemic was dependent upon its ability to be nimble in program development during the crisis and its capacity to adapt programs to client needs.

Evaluation is an essential element of effective Extension program design and implementation (Patton, 1987; Tidwell et al., 2019). The COVID-19 pandemic presented new complications for conducting evaluation work while mitigating the risk of infection, which impacted methodological considerations for data collection (UN Women, 2020; World Food Program, 2020). The pandemic required evaluators to think pragmatically and creatively about adaptations to the evaluation process, changing client needs, and future considerations. COVID-19 impacts occurred on a global scale, but the local implications and context in which programmatic developments occurred impacted evaluations the most during the pandemic (Patton, 2020). Evaluation adaptations occurred simultaneously with changing program dimensions, such as switching to online delivery (Narine & Meier, 2020). Due to changing Extension program delivery, the need to investigate how Extension program impact can be captured during a time of rapidly changing program contexts emerged.

Extension professionals, through a commitment to maintaining programmatic relevance, have sought opportunities to develop evaluation methods which allow community members and participants to provide honest and timely feedback (Tidwell et al., 2019). The issue of relevance is further compounded during times of crisis. Extension professionals’ ability to act during crises, such as the COVID-19 global
pandemic, requires a willingness to adapt to changing situations (Narine & Meier, 2020; Patton, 2020). Therefore, institutionalized evaluation processes that allow for the aggregated measurement of program impacts could enhance the resiliency of Extension evaluation efforts moving forward in the wake of COVID-19, but should be tested to determine their worth and value to the organization.

**Purpose & Objectives**

The purpose of this study was to assess the impact of University of Georgia Family and Consumer Science (FACS) programming during the COVID-19 pandemic. The following objectives guided this study:

(a) determine participants’ self-reported knowledge gain as a result of FACS programs during COVID-19;
(b) determine participants’ self-reported sense of wellness as a result of FACS programs during COVID-19;
(c) determine participants’ self-reported intent to change their behavior as a result of FACS programs during COVID-19; and
(d) determine the estimated economic value of FACS programming during COVID-19.

**Methods**

The Governor of Georgia, Brian Kemp declared a public health state of emergency on March 14th, 2020 due to COVID-19 (Exec. Order No. 03.14.20.01, 2020) and issued a shelter in place order for the state of Georgia on April 3rd, 2020 to mitigate its spread (Exec. Order No. 04.02.20.01, 2020). During the shelter in place orders, gatherings at any business, organization, or establishment were restricted to 10 or fewer persons and people were required to maintain six feet of distance between themselves and another person. Due to these orders, the Board of Regents for the University System of Georgia issued an immediate closure of all university and college campuses, required employees to telework, and converted classroom instruction and university programming to online delivery. Thus, Georgia Cooperative Extension was unable to conduct face-to-face programming. Very quickly, traditional in person programming was changed to online delivery, with most Georgia FACS programs conducted via Zoom (Zoom Video Communications, Inc., 2020; Dobbins et al., 2020). Within this program area, participants learned about topics including nutrition and health, human development and family life, food safety, food preservation, child development, housing, and financial management.

The Extension public value instrument (Lamm et al., 2020) was used to collect data from Extension program participants at the conclusion of each Zoom-offered program. The instrument was developed as a way to “measure aggregated knowledge gain, intent to change behavior (short-term outcomes leading to medium-term outcomes) and self-reported economic value (long-term outcome) of extension programs” (Lamm et al., 2020, p. 9). Development of the instrument was aimed at linking program change outcomes to social, economic, and environmental effects in order to tell an aggregated impact story for Extension programming.

The instrument measured four self-reported constructs: knowledge gain, intent to change behavior, sense of wellness, and perceived economic value (Lamm et al., 2020). Aggregated knowledge gain was measured through a two-part Likert-type question. The question asked about knowledge regarding information presented before and after the program. Respondents identified their perceived knowledge level on a five-point Likert-type scale ranging
from one - no knowledge to five – extremely knowledgeable. Intent to change behavior was measured using an ordinal scale ranging from definitely will not use this information to definitely will use this information. To measure level of wellness, a five-point semantic differential scale requested respondents indicate how they felt between five sets of opposing adjectives or statements (better-worse, more healthy-less healthy, more stable-less stable, less stress-more stress, and more in control-less in control). Self-reported economic value was captured by asking respondents to indicate the amount of money they believed they would save or gain from the type of information learned in the next month. Respondents could select from $0, $1-9, $10-49, $50-99, $100-149, $150-199, and $200 or more. If respondents selected $200 or more, they were asked to specify the amount in an open-ended question (Lamm et al., 2020).

The Extension public value instrument helped capture data for the research objectives, despite certain limitations. One limitation to the instrument is the reliance on self-reported data. However, self-reported measures have been found to provide key insight into program value and can help communicate program impact (Gonyea, 2005).

Data Collection & Analysis

The sample used in this study were participants of University of Georgia FACS programming delivered via Zoom between March and May of 2020, when the state was under shelter in place orders due to COVID-19. Participants were invited to complete a Qualtrics survey at the end of each respective program. Data were analyzed descriptively and inferentially using SPSS 26 (Field, 2013).

Respondents’ self-reported knowledge gain mean scores before and after the program were compared, using a paired \( t \) test \( (p < .05) \), to determine if a significant knowledge change occurred as a result of the program. Data for self-reported wellness were recoded to ensure higher numbers represented the positive indicators of wellness and the lower numbers represented the negative indicators \( (1 \text{ – low sense of wellness}; 5 \text{ – high sense of wellness}) \). An aggregate wellness score was calculated based on the average of the five items. Internal structure validity of the construct was analyzed through Cronbach’s alpha, \( \alpha = .92 \), indicating the aggregated scales were internally consistent and construct dimensions were closely related. In accordance with recommendations from Lamm et al. (2020), intent to change behavior data were analyzed descriptively using frequency counts and percentage of respondents who selected each category.

To analyze self-reported economic value, data were analyzed descriptively. First, data were recoded as the median value for each answer range (e.g. $10 - $49 was recoded into $29.50) and open-ended responses were recorded as reported. A total sum value was calculated to determine the value of the program for respondents over the next month (Lamm et al., 2020). The number was multiplied by the difference between total number of survey respondents and the number of question respondents to extrapolate the self-reported economic value to all respondents. A total sum value was then calculated to determine the self-reported economic value of extension programs for all survey respondents.

Results

A total of 572 participants completed the instrument. FACS Extension program participants were taught a myriad of topics during these programs including canning, soy, childcare injury prevention and control, food safety, green cleaning, reducing the
risk of a heart attack, weight management, and exercise. Results were categorized by research objective.

**Self-Reported Knowledge Gain**

When asked to rate their knowledge level before and after the program, 68.1% of respondents reported they were very or extremely knowledgeable after the program compared to 11.3% prior to the program (Table 1). A dependent t-test was used to assess self-reported knowledge gain before and after program participation. On average, participants reported statistically significant changes in knowledge attributed to FACS programs, \( t(531) = -36.56, \ p < .001 \). This represented a large-sized effect, \( r = .85 \).

**Table 1**

<table>
<thead>
<tr>
<th>Level of Knowledge</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( f )</td>
<td>( % )</td>
</tr>
<tr>
<td>Extremely Knowledgeable</td>
<td>10</td>
<td>1.7</td>
</tr>
<tr>
<td>Very Knowledgeable</td>
<td>55</td>
<td>9.6</td>
</tr>
<tr>
<td>Fairly Knowledgeable</td>
<td>154</td>
<td>26.9</td>
</tr>
<tr>
<td>Some Knowledge</td>
<td>232</td>
<td>40.6</td>
</tr>
<tr>
<td>No Knowledge</td>
<td>91</td>
<td>15.9</td>
</tr>
<tr>
<td>Total</td>
<td>542</td>
<td></td>
</tr>
</tbody>
</table>

**Intent to Change Behavior**

When asked about their intent to use the information provided in their respective program, 79.5% of participants indicated they would definitely use the information (\( n = 455 \)), and 13.3% indicated they would probably use the information (\( n = 76 \)). Only 0.4% of participants indicated they would probably not (\( n = 1 \)) or definitely not (\( n = 1 \)) use the information provided, while 1.7% of respondents had not decided whether they would use the information (\( n = 10 \)).

**Sense of Wellness**

Respondents indicated a high sense of aggregated wellness (\( M = 4.30, \ SD = .72 \)) as a result of the program. This indicated respondents felt less stress, more stable, healthier, and more in control of their choices as a result of the FACS Extension program.

**Self-Reported Economic Value**

Respondents associated the information received from their respective program with a $24,353.50 value over the subsequent month. By dividing this value by the number of respondents, the average self-reported economic value of the online programming received was $48.61 over the next month. These self-reported economic values ranged from $0 to $1000 per person. Assuming the responses obtained are representative of a typical month, they can
be extrapolated to an economic value of $27,804.81 for all online FACS Extension program participants over one month, and $333,657.72 over one year (see Table 2 below).

Table 2

<table>
<thead>
<tr>
<th>Respondents’ Perceived Economic Value</th>
<th>Amount expected to be saved/gained over subsequent month</th>
<th>Financial benefit expected to be derived by participants over the next year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregated Total</td>
<td>$27,804.81\textsuperscript{a}</td>
<td>$333,657.72\textsuperscript{b}</td>
</tr>
</tbody>
</table>

Note: \textsuperscript{a}Calculated by multiplying the amount expected to be saved/gained over the subsequent month by the difference between the total number of respondents ($N = 572$) and the number of respondents for this question ($n = 501$). \textsuperscript{b}Calculated by multiplying the amount expected to be saved/gained over the subsequent month by twelve.

Conclusions, Implications, & Recommendations

Similar to extensionists across the world, Georgia Cooperative Extension was unable to conduct face-to-face programming during government shelter in place orders resulting from the COVID-19 pandemic. FACS agents improvised and conducted programs online via Zoom (Narine & Meier, 2020). While uncertain of the impact of online programming, Georgia Extension professionals found their educational programs still provided needed information and resources to their clientele. Overall, respondents self-reported high levels of knowledge gain, intent to change behavior, and perceived economic value. The Extension public value instrument (Lamm et al., 2020) allowed for data collection and the measurement of aggregated knowledge gain, intent to change behavior, wellness, and self-reported economic value of Extension FACS programming during COVID-19. Without the instrument, collecting program impact data would have been very challenging due to social distance restrictions and program delivery changes which occurred in response to the pandemic. While agents can utilize other methods to assess impact, the Extension public value instrument increased efficiency and removed barriers to evaluation during this time. Despite its limitations, including the use of self-reported data, the Extension public value instrument (Lamm et al., 2020) provided a way to measure aggregated knowledge gain, intent to change behavior (short-term outcomes leading to medium-term outcomes) and self-reported economic value (long-term outcome) during a crisis.

Moving forward, Extension professionals and administrators around the world should consider using the results of our study to create professional development plans to further improve Extension professionals’ capacity to respond and adapt not only Extension programming, but evaluation during times of crisis. Other Extension organizations could utilize the instrument, both online and in paper format,
to quickly build Extension professional capacity to measure the impact of their programs. Considering changes in social structure which affect evaluation efforts, as with COVID-19, bolstering the resiliency of evaluation designs with such instruments will ensure continuity in the face of future disruptions, regardless of region, country, or continent. Adaptability is key to evaluation during times of crisis (Patton, 2020), and the Extension public value instrument allows for increased evaluation resiliency. Additionally, demonstrating the value of Extension programming to funders is critical for Extension organizations around the world (Franz et al., 2014). This instrument helps capture the aggregated impacts of Extension programs in an easily adaptable form.

References


Planting Seeds of Victory: Creating Shared Meaning while Gardening amidst a Pandemic

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Abstract
The Victory2020 Garden Community Program was established by faculty members within the University of Florida (UF), Institute of Food and Agricultural Sciences (IFAS) in Marion and Columbia County Extension offices. In response to COVID-19, the purpose of the program was to provide online-mediated programs that could be completed at the desired pace of the participants, while promoting a self-reliant, science-based approach to learning about home food production through gardening. Due to food insecurity rates in both Marion (14.4%) and Columbia (15.2%) counties ranking above the statewide average in Florida, an immediate need to provide educational resources on becoming self-sufficient in growing one’s own food became increasingly important due to nationwide supply-chain shortages (Feeding America, 2020). 2,548 participants representing 43 states and six countries were provided access to eight learning modules hosted by Canvas, an online tool through UF. Participants were provided a package of free seeds, including corn, squash, cucumber, and cowpea to plant their Victory2020 Garden. A purposeful online community was established by extension agents in Marion and Columbia counties to facilitate quality discussion and growth, culminating in over 225,000 total impressions. The findings of the program revealed that 88% of gardening households began eating more fruits and vegetables while 73% are embracing new food safety techniques in both the garden and kitchen. Primary investigators and co-pi's recommend an implementation of a program timeline to benefit the participants through diverse, online learning options. Continued programming addressing mental health, nutrition, and gardening is recommended across extension programs nationally.

Keywords: Extension education; pandemic; Victory Garden; holistic wellness; social connection
Introduction

On January 30th, 2020 the World Health Organization declared a Public Health Emergency of International Concern, the WHO's highest level of alarm, due to the outbreak of the novel coronavirus, known as SARS-CoV-2, in Wuhan, China (World Health Organization, 2020a). Ten days earlier, the first confirmed case of the novel coronavirus was reported in the United States in a 35-year-old male who had returned from visiting Wuhan, China (Holshue et al., 2020). The World Health Organization declared the COVID-19 outbreak as a pandemic, a worldwide spread of a new disease, on March 11, 2020 (World Health Organization, 2010; World Health Organization, 2020b). Shortly after, the United States declared a public health emergency by suspending entry to certain foreign nationals and issuing Federal quarantines for individuals evacuating from specific nations (Trump, 2020). Individual states quickly started declaring states of emergency and taking precautions to keep residents safe as did Florida on April 3rd, 2020 when the state entered into a safer at home order until April 30th, 2020 allowing only essential employees to report to work (Executive Order 20-91, 2020). However, this was not the first time our world has faced a pandemic (Qiu et al., 2016).

Social distancing is one of the most important strategies for decreasing spread of the virus (Venkatesh & Edirappuli, 2020). However, connection is a human instinct and when people are forced to distance themselves from each other, feelings of loneliness can occur (Baumeister & Leary, 1995). Additionally, social isolation can produce stress which can lead to detrimental consequences on cardiovascular, immune, and mental health (Haslam et al., 2018; Hawkley & Cacioppo, 2010). Social scientists in China found a higher rate of depression, anxiety, and a combination of the two during the COVID-19 outbreak (Gao et al., 2020), which aligned with public health concerns amidst previous public health emergencies or crises such as Earthquakes (Xie et al., 2014), Ebola (Ji et al., 2017), and SARS (Mak et al., 2009) implying governments need to pay more attention to the holistic health of individuals during emergencies.

Furthermore, the Cooperative Extension System addresses needs and provides solutions to current issues facing citizens at a local level by acting as liaisons of information between research and the public (Borron et al., 2019; Holt et al., 2019). This purpose coincides with authors such as (Davis et al., 2018) who suggest that the ethos of extension is to provide relevant solutions to current and ongoing situations or phenomenon's (Cartwright et al., 2002). Historically, extension agents are on the front line of current events around the world and strive to serve the public as communication liaisons delivering science-based information to improve the lives of the public (Holt et al., 2019). Strauss & Howe (1997) express that during times of nationwide crisis, such as the Great Depression or World War II, the scope of what Cooperative Extension’s outreach to local communities consisted of was defined.

During World War I, the United States was burdened with feeding soldiers fighting overseas and the National War Garden Commission was organized encouraging Americans to do their part for the war by planting, harvesting, and storing their own vegetables (Pack, 1919). Clubs organized by the Extension Service involved more than 15,000 children and were responsible that “gardens sprang up everywhere as if by magic – in the backyards, by the railroad tracks, in the cotton patches and in the new ground”
By 1918, 1,500,000 children responded to the call of President Woodrow Wilson that gardening should become an integral part of schooling and joined the U.S. School Garden Army (Francis, 1919). Extension Agents were needed to teach gardening and between 1917 and 1918, the number of agents in the U.S. went from 2,200 to 6,000 with the USDA requesting their time be spent instructing gardens (Hayden-Smith, 2006; Francis, 1919).

In situations of crisis, extension agents that typically operate in programmatic silos, are called to find the greatest solutions that exist between the silos of their individual programs (Cartwright et al., 2002). In early 2020, when Extension Agents in Florida saw the same sort of needs: people beginning to homestead and families and individuals in isolation at their homes, they decided to serve the population through something that had previously worked in our nation while “providing rapid response in regard to disasters and emergencies” (USDA-NIFA, 2018, para. 6). Food will win the war was a phrase commonly spoken amidst the first World War in 1914 and the Spanish Flu in 1918, in an effort to help the public understand the role food played in either winning a war or fighting a pandemic (Schaub, 1914; Richard, 1918). As an effort to help with food insecurities and holistic wellbeing during the COVID-19 Pandemic, extension Agents developed the Victory2020 Garden Community to endure the pandemic.

**Conceptual Framework**

The use of social constructivism as the theoretical framework allowed for an environment of co-creation of meaning and understanding to be established. The Victory2020 Garden Community was guided by social constructivism in order to best determine the various factors that shaped participants views of gardening amidst a global pandemic (Kim, 2001). In order to transcend social and cultural influence, co-creation of meaning was examined through diverse learning platforms hosted by UF and IFAS.

Furthermore, social constructivism supports the understanding of competencies and related social behaviors that are created through experiences and interactions in an online setting (Fevre et al., 1999). As Stetsenko and Ariecitch (1997) note, “taking an active stance in co-constructing,” leads to methods of guided formation that through discourse, can provide a developed self and more enhanced views of the world. Therefore, examining the social structures and virtual, cultural systems that are constructed as a result of being placed in new situations across different time periods needed examination in connection to how new knowledge is constructed (Linell, 1998). Understanding how behaviors of our participants in virtual programming lead to new forms of knowledge and the empowerment of beneficiaries were necessary features in the success of the program.

Through inserting qualitative themes within our purpose and objectives, we were able to pursue what Carl Moustakas refers to as the “thing as a whole.” By using social constructivism as the guiding framework, the ability to describe, perceive, and imagine were common thread’s in observing the experience of participants involved in the Victory2020 Garden Community (Moustakas, 1994). Therefore, observing forms of shared meaning, acknowledging the self-perceived value of the program from each participant were essential to the basis of the program design and evaluation.
Purpose & Objectives
With the onset of COVID-19 both in the United States and worldwide, it was evident that families desired to utilize home gardens to become more self-reliant, like Victory Garden efforts seen during World War II. The difference being many individuals had little to no gardening experience. Extension plays an active role in community education; the onset of a pandemic created an environment where garden knowledge would be utilized immediately. The research objectives for the Victory2020 Garden program were to:
(a) increase participants knowledge of gardening and home food production techniques;
(b) build social connections and cultivate an online community; and
(c) improve participants well-being in their daily lives.

Methods
A working group of twelve University of Florida extension agents was formed to deliver education and online experiences for the Victory2020 Garden Community. As the COVID-19 pandemic restricted traditional program delivery, the program was executed in two phases.

Phase 1: Pre-Assessment and Access to Online Learning Tools
Phase one consisted of the creation of a pre-assessment using a Qualtrics survey to establish an understanding of the gardening and food production competencies of the Victory2020 Garden Community participants. Questions were aligned to capture demographic data while being open ended and qualitative in nature. In an effort to remain unbiased and open to all interested in participating, the working group of extension agents did not place any constraints or limitations on the selection of or number of participants. The study is limited in the collection of data from the pre-assessment that was a preliminary requirement for participants to complete. However, from the pre-assessment, we observed that 1,624 participants had never seriously gardened prior to signing up for the online program. Using the newfound knowledge to guide our efforts, phase one additionally provided participants with access to an eight module, tech-mediated learning platform hosted by Canvas, an educational classroom that uses informal and formal learning at the participants’ respective pace. Lastly, 2,548 participants were sent free vegetable seeds to plant their Victory2020 Garden. The vegetable seeds mailed to each registered participant included corn, cowpeas, cucumber and squash and were sent directly to participants home after registration in the program.

Phase 2: Social Media and Tech-Mediated Learning
The second phase sought to capture the public perception and shared meaning being created through an online community of over 1,400 registered Victory2020 Garden participants via access to a private Facebook group. Zoom webinars and YouTube videos were produced and shared within the Facebook group to compliment the informal learning for participants. Social media supports the capturing of unfiltered information in an unprompted manner, allowing responses to posts, shared items, and helpful resources to reveal the varying levels of self-perceived value the Victory2020 Garden Community provided (Connolly et al., 2016). Phase two included a Qualtrics survey that was assessed retrospectively to evaluate knowledge gain, community connection, and well-being of the participants. A five-point Likert scale ranging from strongly agree to strongly disagree was used to accurately inform knowledge gain and behavior change that
aligns with the efforts made in programmatic design, further establishing validity and comparable reliability (Gay et al., 2015). Furthermore, the use of a mixed methods post-assessment enabled the team of researchers to review significance in areas of feedback from the participants. The program design also included the use of evaluating open ended questions to collect qualitative comments from respondents, while comparing the quantity of produce grown. The team of twelve extension agents participated as nonparticipants or observers, watching and recording points of data from a distance (Creswell & Poth, 2016). Findings were analyzed by qualitatively coding responses from participants and categorizing our findings into themes (Creswell & Poth, 2016). Generating themes enabled the researchers to assess qualitative input while relying on standard deviation of quantitative questions to formulate the results below.

Results
Victory2020 Garden survey respondents (n=285) reported an increase of gardening knowledge (88%), they reported their household eating more fruits and vegetables (73%) and are using food safety techniques in the garden and kitchen (82%). For 1,624 participants, this was their first ‘serious experience’ with gardening and growing food at home. The seeds provided to participants helped them establish the confidence to start their home gardens. The 22 online educational Zoom webinars, eight Canvas modules and private Facebook group provided participants with the knowledge to get their garden started. As one respondent noted, “This program gave me the confidence to try starting a garden and growing food.” While some gardens struggled to produce, others reported harvesting pounds of vegetables. Over 40 vegetable and fruit crops were recorded as grown to harvest on our survey with a total of more than 3,000 pounds of food grown from respondents. Participants also indicated they shared the knowledge with an average of 34 people, which included their family, neighbors, and social media sites. The total reach of people impacted by the program is estimated at 225,000. This includes the number of people per household and number of people they shared the information with. With 98% of participants indicating an interest in gardening in the future, the impacts of the Victory2020 Garden Community will be long-lasting.

Results showed the Victory2020 Garden Community private Facebook group was the most frequently used online platform to make new connections and expand existing social networks. Study participants also emphasized how much they enjoyed connection with the Facebook group. One respondent noted, “I loved hearing the experiences of other gardeners. I have truly felt like I have a new community.” The Facebook group reached over 50,000 in a six-month period and had over 4,000 engagements monthly. Participants shared photos, gardening advice, and sent each other seeds with the oversight of extension agents ensuring the correct information was given. According to the study participants, they had positive impacts on social, emotional and overall well-being. Participants reported their mental health improved (76%), their physical activity level improved (80%), saved money on fresh fruits and vegetables (57%), and reduced their stress level during COVID (79%).
Conclusions

With this international intergenerational program, extension agent efforts reached over 225,000 individuals and families to create community and experiences that covered a range of subjects including gardening, well-being, food safety, history, and careers. Using non-traditional educational methods allowed participants a chance to learn from each other and have a space they felt comfortable asking questions. There are even more undocumented results such as spontaneous seed shares with other Facebook page members and increased awareness of the science-based resources and expertise of the University of Florida extension program. This cross-programmatic collaboration allowed agents to provide a holistic program that enhanced participants physical, mental and social well-being. Participants utilized the Victory2020 Garden Community to find a sense of belonging during the isolation of the pandemic, learn home food production and keep some peace of mind.

Recommendations

Lack of definitive controls for COVID-19 implies that the current state of crisis and specialized protocols will continue beyond the foreseeable future. Due to financial instability in the world, this type of program can help meet the needs of those with food insecurities. Advance implementation timeline for a more proactive program that benefits the participants by possibly increasing yields and agents by allowing diversification of program administration. Furthermore, increased evaluation parameters to establish a mixed-methods approach enhancing the rigor and credibility of the program is needed for international and domestic audiences (Lamm & Lamm, 2018).

Continued programming addressing mental health, financial health, nutrition, and gardening is recommended across extension nationally.

Implications

As the world experiences an ongoing battle to fight global food insecurity, there is an overwhelming need for programs, such as the Victory2020 Garden Community to assist food banks, farmers, and extension efforts across the world in equipping and informing the general public on topics ranging from food education, food safety, and becoming self-sufficient in growing one’s own food during times of crises (Carroll et al., 2020). Many projections show that anywhere from 90-150 million households will fall into poverty due to COVID-19 related restrictions, with many of those households spending over 70% of their income on food related costs (Laborde et al., 2020). To further address the issue of food insecurity, specific actions need to be taken to prevent and prepare for times of crisis at the local level by investing in the time and resources made available for municipalities in order to communicate with the public on the importance of food education (Paslakis et al., 2020). Further proving the efficacy of community-based programming, such as the feedback received from participants in the Victory2020 Garden Community who reported an overall level of reduced stress, increased consumption of vegetables, gained knowledge and experience growing food leading to greater food security, reported better health (sense of wellness), and potential for life-long benefits of a healthy life (Van Den Berg & Custers, 2010).

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Confronting a Global Pandemic: Responses from Caribbean Extension Service Providers

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Abstract
Agricultural Extension is an essential service, and this was even more so highlighted in this global pandemic which has significantly affected the agricultural sector. This rapid research sought to assess the capacity of Caribbean extension and advisory service providers. Seventy extension service providers from 11 Caribbean countries responded to an open-ended questionnaire administered via the Survey Monkey platform. The findings indicated that governments played an important role in providing opportunities such as distribution of seedlings to encourage producers, and promoted backyard gardening and other programmes to ensure continuity of country’s food security. Extension officers faced a number of barriers in the execution of their duties. Some of the barriers included technological barriers, limited resources, and limited mobility as a result of the necessary restrictions and in some cases psychological barriers such as the fear of contracting the disease in the execution of their duties. Officers however utilized strategies such as increased use of ICTs to train farmers and link them to market opportunities. In an attempt to increase the use of ICTs a number of challenges were highlighted. Challenges such as limited ICT resources for officers, poor connectivity in some remote areas, aged farmers literacy levels in the use of ICTs as well as access. This rapid research recommends policy development towards the increased use of e-extension with consultation among key stakeholders. This can be done on a regional basis, and eventually scaled up in an effort to further strengthen extension and advisory services globally.

Keywords: agricultural extension; Caribbean region; Extension and Advisory Services (EAS); ICTs; knowledge management
Introduction

The impact of COVID-19 was felt and continues to be felt worldwide. This global pandemic is significantly affecting every sector including agriculture. Traditionally, agriculture has contributed significantly to the economies of Caribbean countries. Plantation crops such as sugar, cocoa and bananas were exported, and contributed largely to the countries’ Gross Domestic Products (GDP). To date even with diversification within the sector away from the traditional plantation crops, agriculture still makes significant contributions to GDPs ranging from 7 to 17 percent (FAO, 2019).

Additionally, a high proportion of employment in these countries come from the agricultural sector, as much as 50 percent in Haiti and ranging between 10-25 percent in the other islands (FAO, 2019). Prior to the COVID-19 pandemic, the agricultural sector in the Caribbean was already marred with a number of challenges. The extension divisions of the different countries were not without their share of those challenges, some of which include limited resources such as transportation to reach their clients, adequate financial capital and materials to successfully execute duties, a lack of specific extension policies and limited trained staff to be readily available to farmers.

The role of agricultural extension in agricultural development is important. Extension’s role is fundamental in building the capacities of farmers and helping them to maintain good agricultural practices. Extension units, despite the challenges they experience in the execution of their duties, employ a number of strategies to meet the demands of producers and other clients. In the Caribbean 80% of the strategies employed, include face-to-face interaction. Some of these strategies include farmer field schools, demonstration plots, training through workshops and seminars and training and visit (Even & Nyathi, 2020).

In an effort to contain the pandemic, countries across the world, including the Caribbean employed a number of strategies including “lock down” of normal operations except in cases of essential services to contain the spread of the disease. Initially some Caribbean countries example Grenada did not recognize farming as an essential service hence; farmers were confronted with a number of challenges such as accessing their farms as many farmers live away from their farmlands. Other challenges comprise limited access to input supplies, as input supply shops were closed during these periods of lock down. Thankfully, this was rectified, and farming was placed on the list as an essential service given its role in meeting the food demand and the effects of lockdown on inter-regional trade that affected the importation of food.

According to the Food and Agricultural Organization (FAO), the spread of the COVID-19 virus has deepened the vulnerability of producers as well as other workers in the agricultural sector. The lock down did not only affect producers but also affected the work of extension officers, limiting movements in the execution of their duties. The work of extension became even more vital in reaching producers as they were now confronted with added issues such as health regulations because of the pandemic. Implementation of advisory services in the wake of the pandemic in an environment where it was predominantly through face-to-face interaction and already marred with other debilitating factors will have many challenges. Extension officers have to adapt to adhering to the safety measures implemented by government such as “lock down,” while at the same time develop and utilize the best strategies to continue meeting the needs of producers (Even & Nyathi, 2020).
Purpose & Objectives

The purpose of this study was to assess the capacity of Caribbean extension and advisory service providers in response to the COVID-19 pandemic of 2020. The research sought to identify the current extension strategies utilized to assist farmers during the pandemic, to describe the barriers extension officers encountered in the execution of their duties and to make recommendations that would facilitate the delivery of extension services in light of the COVID-19 pandemic in the region.

Methods

This study was conducted with extension and advisory service (EAS) providers throughout the Caribbean during the months of April through June 2020, during the first wave of the COVID-19 pandemic. A total of seventy EAS providers inclusive of extension field officers, extension field supervisors, extension field managers, researchers and food safety personnel, with varying levels of expertise participated in this study.

A questionnaire consisting of 10 open-ended questions was administered to the sample population. The questions sought to gather responses pertaining to: (i) the current strategies being undertaken by extension in the respective Caribbean country to assist farmers in light of the COVID-19 pandemic, (ii) perceptions as to whether or not these strategies would be successful, (iii) barriers hindering or challenging the delivery of extension services within Caribbean countries during this time and (iv) perspectives from EAS providers as to the challenges they currently face in terms of delivering extension and advisory services to farmers at this time. The development of the questionnaire followed the tailored design method (Dillman et al., 2014) and was administered via the internet-based Survey Monkey program. It took approximately 7 minutes for participants to complete the questionnaire.

To identify the current extension strategies to assist farmers during this time of the COVID-19 pandemic, participants were asked to describe the strategies extension within their respective countries are undertaking and to indicate whether or not they perceive these strategies to be successful. In order to describe the barriers extension staff are facing this time which may hinder the effective delivery of services, participants were asked to describe any barrier they perceived as a hindrance. After being asked to indicate the barriers they may face, participants were also asked to recommend suitable strategies that could facilitate the delivery of extension services during this time.

Data Analysis

This study was guided by interpretative research. Interpretative research according to Kaplan and Maxwell (1994) focuses on human sense making without predefined dependent and independent variables. The focus on human sense making for this research centered on the unfolding COVID-19 pandemic and the responses of the extension and advisory service providers.

A qualitative analysis technique was utilized to analyze the responses to the open-ended questions. This included organizing and summarizing participant responses, developing categories/ codes, and sorting information to develop themes. In-vivo coding was used to code the collected data, following steps prescribed by Saldaña (2011). In-vivo coding, according to Saldaña (2013) allows the researcher to code using the direct language of participants as codes rather than researcher-generated words or phrases. The developed themes were compared across the responses from each participating country, in order to identify
similarities, variations and outstanding comments among the participants. In reporting the findings, participant quotes were included with the relevant themes as evidentiary support. Trustworthiness and credibility of the data was established through peer review of the participants’ responses and In-vivo coding.

**Findings**

**Demographic Profile of Participants**

A demographic profile (see Table 1) shows that the majority of participants were male (55.71%) extension field officers (65.71%), from the Caribbean country of Jamaica (32.86%) with more than fifteen years of service (30%).

<table>
<thead>
<tr>
<th>Table 1</th>
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### Demographic Profile of Participants

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<td>Research Technician</td>
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<td>St. Lucia</td>
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<td>St. Vincent and the Grenadines</td>
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Identifying Current Extension Strategies to Assist Farmers during COVID-19

One of the questions sought to identify the extension strategies in place to assist farmers at this time. Four specific themes were revealed by participants. Participants identified (i) continued service delivery via the use of ICTs, (ii) providing incentives to encourage local production, (iii) providing timely information and (iv) linking farmers to markets (marketing support) as the current extension strategies to assist farmers during COVID-19.

**Theme 1: Encouraging the Use of ICTs**

The COVID-19 pandemic highlighted the usefulness of ICTs, especially in its role in agricultural extension service delivery. Given that ICTs (Information and Communication Technologies) encompasses telecommunication technologies and devices such as radios, televisions, computers, mobile phones, videos and WhatsApp, the encouraged use of these technologies to complement the traditional face-to-face extension service delivery during this time was embraced. This ensured the facilitation of continued extension service delivery throughout the Caribbean. Participants highlighted the use of mobile phones, WhatsApp and various social media platforms as the preferred ICTs tools. Although respondents indicated a few challenges relating to accessing and delivering real time EAS, the use of ICTs ensures that there is continuation of service delivery.

One participant from Jamaica indicated that “strategies such as farmers training via WhatsApp with intention to eliminate physical farmer training, provide advice to farmers via phone calls and WhatsApp, mobile markets with different communities” are being conducted. The officer further stated that “these strategies help eliminate close contact and promote social distance while still improving farmer livelihood.”

Additionally, participants from Guyana highlighted the use of mobile phones as a main ICT tool of choice for the continuation of their service delivery. This was highlighted by them stating that “farmers are contacted via telephone and in some cases the use of WhatsApp messenger to exchange photographic documents” and making the statement that “extension activities are conducted via the use of mobile services”. This participant however felt that the success of this would be limited as “many farmers are aged and tend not to be technology savvy.”

In St. Vincent and the Grenadines, social media is being used to collect and provide information to their farmers “although face to face training activities have ceased, we are making use of social media to collect and provide information to our farmers.”

**Theme 2: Providing Incentives Geared towards Encouraging Local Production**

Participants indicated that measures are being taken to encourage activities geared towards increasing home/backyard gardening activities at various local levels. The provision of technical support and advice, the distribution of planting material and implementation of various government policies were discussed.
In Antigua and Barbuda, participants indicated that they “are providing training, technical support, and also distributing seeds and seedlings to both farmers and backyard gardeners.” This is being done “in an effort to boost local levels of production.”

Encouraging homeowners to engage in backyard gardening activities was also highlighted in Dominica, where persons have been encouraged to grow their own food which can “reduce the need for persons to go shopping for vegetables” thereby limiting the volume of persons being out at any given time. From the Haitian perspective, strategies have been planned on paper but not yet implemented. These strategies are “based on promoting the production of short cycle crops such as sweet potato, corn, okra and other vegetables” which would “allow for food to be made available to Haitians thereby minimizing shortages in the food supplies if well implemented.”

“Boosting local production via farmer aid programs to ensure some measure of Food Security” was shared as the strategy of the Prime Minister of Barbados. In order to achieve this, the extension officer indicated that “extension has been included among the Essential Service here in Barbados to ensure that our Farming Community has all the Technical Support that they will need to ensure high levels of production.”

Theme 3: Providing Timely and Useful Information

The dissemination of timely and useful information forms part of an immediate response strategy. The provision of credible information relating to farming advice and by extension the virus is a requirement, especially during this period. Extension officers in St. Vincent and the Grenadines indicated that they are “using farm visits to provide technical advice and support while adhering to social distancing protocols.” Similarly, in Trinidad and Tobago “teaching and knowledge sharing” is being done while “following health guidelines and protocols.” The Jamaican extension service providers shared that “farmers are still being guided with technical advice to produce the best quality for our plate, and if we have to conduct on-farm visits, it is done with minimal workers present.” Another participant from Jamaica also stated that “keeping close contact with the farmers helps us to help the government track the availability of food supplies, and also to ensure that all is well with the farmer.”

Theme 4: Linking Farmers to Markets (Marketing Support)

Sharing technical advice is important in terms of facilitating agricultural production. However, this should be complemented by activities that would link farmers to suitable markets. Marketing support featured as another strategy being utilized especially in Jamaica, as participants identified that markets which were once easily accessed and available are no longer easily reached as before. Participants indicated that they are currently “assisting with marketing of produce that were under contracts to hotels which may have been closed due to the pandemic.” This strategy helps farmers market their excess agricultural produce, whilst at the same time allowing them to be able to sustain their livelihood. Another participant also shared that assisting with linking farmers to markets can “prevent farmers from going into a state of depression when their produce cannot be marketed.” Providing assistance to aid in finding markets also “alleviates the loss of produce in ground which can cause the farmer to enter into great financial problems” and also
facilitates “improved distribution of fresh agricultural produce.”

Describing the Barriers Extension Staff are Facing during this Time – Hindering Service Delivery

Unprecedented changes as a result of COVID-19 has thrust extension and advisory service providers to adapt their regular outreach to the new normal of physical distancing and noncontact communication. The use of ICTs is favored to achieve these new normal approaches, however there are some noted challenges which possibly are hindering the efficient delivery of extension and advisory services. These challenges according to the participants are (i) technological barriers, (ii) limited resources, (iii) lack of mobility, (iv) governmental restrictions and social distancing protocols and (v) physiological barriers.

Theme 1: Technological Barriers

Some of the technological barriers highlighted included the difficulties experienced by farmers in using the technology. The difficulties experienced are farmers not being up to date with the use of the technology, “some farmers aren’t technologically savvy and some do not use or have a phone so they can’t be reached and if they are it takes time.” Additionally, some have difficulties transferring what they see in the field through the technology. One participant from Jamaica expressed that “some of them are not able to fully describe what they are seeing and as a result it is difficult for the officer to know exactly what the issue is and as a result they are not able to confidently make the best recommendation due to limited information.” This in itself poses a challenge when officers are unable to adequately assist the farmer.

According to the participants other barriers relating to the use of the technology include limited access and availability experienced by both farmers and officers. “Farmers not having access to the technology to be in the know,” and in some instances “farmers in remote and rural areas mostly don’t have internet connection.” While officers have to contend with these difficulties experienced by farmers, they too expressed that there are inadequacies in the “proper technology available for extension staff to carry out service delivery.”

Theme 2: Limited Resources

The extension and advisory service providers highlighted several concerns regarding the availability of resources needed to conduct service delivery at this time. These barriers, some of which were experienced prior to the pandemic, persisted during this time as officers attempted to execute their duties in more difficult circumstances. They expressed issues such as “staff shortage” and not being provided with the necessary tools by the ministry. According to some of the participants “we have to use our own resources, internet, computer, phone...we are basically running agriculture with our hands tied.” Another important resource that some officers indicated were limited in some cases was the necessary protective gears for protection in instances where face-to-face interaction was necessary. “Adequate and necessary gears and hygienic necessities for the field staff to operate are scare” expressed a participant. Another indicated “the ministry is too top down; extension is not institutionalized (Haiti); lack of resources (human and funds)” made operating in this time very challenging.
Theme 3: Limited Mobility

Some officers expressed that the “lock down” implemented by governments also proved to be a major barrier. In Grenada for example, it was highlighted that “due to the curfew situation and public transportation not in operation” officers were “unable to reach designated areas.” Many of the officers depend on public transportation and given the limited staffing reaching as many farmers became even more difficult. One officer stated “there are not enough officers to execute programmes. Some are not mobile and public transport is not fully operational.” Participants indicated that it was obvious that farmers needed more support however the inadequacy in mobility made it difficult. This was compounded by the lack proper communication tools for some officers.

Theme 4: Governmental Restrictions & Social Distancing Protocols

The restricted measures and the social distancing protocols implemented by many governments across the region also impacted several businesses and their normal operations. This further affected extension service delivery. The participants indicated that governmental restrictions impacted their daily routines inclusive of their ability to deliver an extension service. “With the 24-hour curfew in place at this time officers may be discouraged to venture too far” a participant expressed. Given the low extension officer to farmer ratio in most of the Caribbean countries (Pemberton, 2005), officers conducted a significant portion of their work in group meetings and trainings. The necessary social distancing protocols affected the abilities of officers to account for work done. “right now our parish is on lock down due to the number of COVID-19 cases, and also due to the social distancing requirements it is hard to get the farmers to sign the contact sheets to say you visited,” or got work down.

Theme 5: Physiological

A barrier not to be overlooked, is the psychological difficulties associated with having to conduct duties with limited protective wear in an environment where a highly contagious disease existed. One officer indicated “my main barrier is the fear of contracting the COVID-19. Hence, farmers are not feeling the strong and usual support from their officers.” Extension and advisory service providers may be considered as being part of the essential services and their fears of contracting this virus in addition to the other challenges they face hinders them delivering effective advisory services at this time. With the limited availability of Personal Protective Equipment (PPE), officers are uncomfortable interacting with farmers. Some indicated that given the aging population of farmers in the region, they are even more vulnerable to contracting the disease, an indication of the risk for both farmers and officers.

Recommended Strategies for Facilitating Delivery of Extension Services in Light of the COVID-19 Pandemic in the Region

Extensive adoption of digital technologies in extension and advisory services within the Caribbean region has been long overdue. The present pandemic has highlighted the need for the immediate adoption of various digital technologies as an effective regional response. The unprecedented impacts of COVID-19 has made EAS more challenging and in some cases more demanding. Accessing real-time EAS is a challenge, limited mobility, access to markets and social distancing protocols pose serious challenges to the livelihoods of Caribbean small farmers. The use of digital technologies are favored strategies,
particularly in being able to overcome the identified challenges. 

The recommended increased “use of ICTs for communications and information” coupled with “explaining how to work the technology” should be considered for both extension service providers and farmers. 

The existence of appropriate infrastructure, adequate mobile network coverage, prices of devices and costs of data plans also has to be factored in with the recommendations. One participant indicated that “although we know the benefits of utilizing ICTs, and also knowing how costly it can be, it would be nice if service providers within the Caribbean can provide a mobile plan or packages at subsidized or cheaper rates that would allow farmers and extension officers to access the internet or various social platforms.” Another participant echoed this by suggesting that mobile companies make certain websites free in an effort to facilitate access. These recommendations would therefore ensure that services can be accessible and affordable.

Conclusions, Recommendations & Implications

Prior to the COVID-19 pandemic, extension services in the region were already contending with a number of challenges. The pandemic brought with it additional challenges; however, evidence suggests extension officers continue to make efforts to transfer information to producers. Officers attempted to make use of ICT platforms to continue their work despite challenges experienced because of regulatory policies put on by governments to curb the spread of the virus. They also encouraged farmers to utilize the platforms as much as possible. Officers applied platforms such as WhatsApp through group chats and through one and one communication. These platforms were also utilized for training. Notably however the use of ICTs was not all smooth sailing as a number of farmers in the region are older with lower literacy levels and experienced problems keeping up with the modern technologies and at times being unable to communicate their on-farm challenges.

Additionally, in some remote areas of some countries there were connectivity problems making it difficult for them to access information. While officers recommended that the current situation has highlighted the need for a revolution in the adoption of e-extension, they emphasized the current difficulties as the resources available to them in making full use of technological platforms were limited. COVID-19 has highlighted the importance for e-extension but it has also highlighted the current challenges both farmers and officers have in fully utilizing these platforms that have the ability to transform the flow of information among the stakeholders.

While the evidence suggested that officers made use of e-platforms, the COVID-19 pandemic has highlighted that much more needs to be done in the region. It has also drawn attention to the fact that the region is behind in being able to fully embrace e-extension. Efforts must be made to assist farmers who are struggling with the platforms and to equip officers with the necessary tools to fully utilize these platforms. This can be realized through collaborative work among key stakeholders to ensure that connectivity is available to key rural communities. The network providers must be on board with efforts. It is imperative that continuation of some of the existing strategies must continue as it will take some time given the challenges experienced by both farmers and officers. In that regard, there should be a regional effort in securing the necessary PPE for officers to use when interacting with clients, since
extension is listed as an essential service. COVID-19 has certainly reemphasized the importance of digital advisory services and the opportunity must be embraced by all stakeholders. Intervention at the policy level is necessary going forward. This is an opportunity to address the absence of extension policies in the region and capitalize on these unprecedented circumstances to make digital advisory services a regional effort. Making digital advisory services a regional effort coupled with a regional extension policy aids in the creation of a community of practice with like-minded extension professionals to foster the continued exchange of ideas. This exchange of ideas would aid in continuing to improve regional extension and advisory service delivery. The created community of practice can also be beneficial to the rest of the world in that it would contribute to the pool of knowledge and advice pertaining to extension service delivery. As such, this is an opportune time for extension units across the region to invest in knowledge management from a regional perspective.

References


Communicating through Calamity: Rural and Urban Extension Professionals’ Communication during and after a Hurricane

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Abstract
The purpose of this study was to determine the role urban and rural community status plays in the communication of University of Florida Cooperative Extension faculty and staff during and after a disaster by identifying the extent to which technology was utilized, the communication messages conveyed, and organizational communication versus personal communication. The crisis used for understanding these efforts was Hurricane Irma in 2017. An online survey methodology was used to collect data from Extension personnel across Florida. Results indicate there are differences between how rural and urban Extension faculty and staff communicate during and after a hurricane. The internet was used to a great extent as a communication channel by both rural and urban Extension professionals, but how they used the internet differed. Urban audiences chose more personal mediums when communicating personally about the hurricane, while rural participants used more social media when communicating on personal channels. Implications for this study are an increased need for templates and communication training for Extension personnel. Future research should focus on understanding crisis communication during times of power loss and examine the different roles played by Extension in rural and urban counties.

Keywords: crisis communication; disasters; hurricanes; rural; urban; organizational communication
Introduction
Historically, Florida has been impacted by hurricanes more than any other state (Griggs, 2017). Including Hurricane Irma in 2017 and Hurricane Michael in 2018, Florida has had a direct hit by 118 hurricanes in recorded history. Hurricane Irma made landfall twice on September 10, 2017. First landfall in the Florida Keys as a category 4 hurricane and second landfall in Marco Island as a category 3. It was a huge storm at 650 miles making it the second most powerful storm in both velocity and duration. Hurricane winds covered 80 miles and tropical storm winds covered 400 miles. Of Florida’s 67 counties, 54 had evacuation orders and 49 were declared a disaster by the Federal Emergency Management Agency (FEMA). The sheer size and destruction from Hurricane Irma were unlike any other.

The current study is a replication of a study conducted in 2007 after the 2004 and 2005 storms (Telg et al., 2007). The study was conducted again in January 2018, four months following Hurricane Irma. Both studies were interested in learning the steps Extension agents took in preparing for, mitigating, and recovering from the hurricanes. For the purpose of this paper, the focus was on communication efforts and how these may have differed in rural versus urban areas. Of the 49 counties that were declared a disaster after Hurricane Irma, eight of these were rural counties.

According to the Fourth National Climate Assessment (2018), new risks of intense extreme weather events will provide additional challenges to vulnerable communities: “[p]eople who are already vulnerable, including lower-income and other marginalized communities, have lower capacity to prepare for and cope with extreme weather and climate-related events and are expected to experience greater impacts. Prioritizing adaptation actions for the most vulnerable populations would contribute to a more equitable future within and across communities” (p. 555). Rural counties often encounter a longer response and recovery time after disasters due to a lack of resources and decreased capacity.

Communication during a crisis, or crisis communication, is crucial at all levels during a disaster. At a high level, federal and state governments are in constant communication with local government in impacted areas to address needs accordingly. At a local level, communication is essential for first responders and emergency managers to effectively manage a crisis. In addition, during response and recovery, communication with community members that have been impacted is crucial (Steelman et al., 2015). Given the complexity of disasters, the communication system through which information flows during a disaster can be conceived of as a set of relationships among many different senders, messages, and receivers (Fessenden-Raden et al., 1987; Renn, 1991).

Extension agents in the Cooperative State Research, Education, and Extension Service (CSREES) have a critical role to play within this communication system (Boteler, 2007). Extension often acts as a first responders and/or information first responder within a community in times of disaster, particularly in rural areas where other first responders may be part-time, volunteer, or shared between multiple areas. Because Extension has people already embedded in communities who are prepared and qualified to respond in times of disaster, Extension can be one of the first to arrive and provide aid, assistance, and information to community members (Telg et al., 2007). Extension has resources developed and in place to help communities prepare, mitigate, respond, and recover from a disaster and work closely with established networks and partners (Boteler, 2007). This communication system also includes other
partners within the Extension Disaster Education Network (EDEN), which is a nationwide network of Extension professionals that provide materials and a system for best management practices during disasters.

**Conceptual Framework**

The conceptual framework that informed this study was crisis communication with supplemental literature related to communication with rural audiences, Extension communication, and organizational communication. Because of the high level and sheer number of organizations involved in a disaster, coordination and communication can often hinder progress (Vanderford et al., 2007). In addition, disasters can create crisis situations for public and private organizations, forcing them to engage in their own crisis communication (Coombs, 2012). This communication, although rooted from the larger disaster, will be designed to meet the specific needs of the organization and the organization’s stakeholders. Crisis communication includes the critical internal collecting and processing information for the crisis team and the developing and dissemination of messages to audiences outside of the organizations (Coombs, 2012). Post-crisis communication provided during the response and recovery phase is often the most crucial through providing necessary information to those impacted. It is at this level that “crisis responses are highly visible to stakeholders and very important to the effectiveness of the crisis management efforts” (Coombs, 2012, p. 20).

Where people live can have an impact on how they communicate. When investigating differences in rural and urban social-media use Gilbert et al. (2008) saw rural users have fewer “friends” on social media than those in urban areas. They also found that rural social-media users were predominantly females who were more cautious than urban users when making decisions related to privacy settings on their accounts. In general, rural users were less trusting of new sources and information they saw on social media (Gilbert et al., 2008), which may indicate reaching rural users on social media from an organizational standpoint is more difficult than reaching their urban counterparts. Rural areas can struggle to keep up with online technology, which has been noted in studies looking at the ability for small, rural agricultural businesses to effectively compete in online marketing and strategy (Baker et al., 2018; Peterson et al., 2018; Stebner et al., 2017a; Stebner et al., 2017b). While it is recommended that Extension use new and social media to communicate with stakeholders about programming, available resources, and contentious issues (King et al., 2017; Rohling et al., 2016), during times of disaster there can be power loss and other challenges for communicating via technology.

Defining rural and urban communities can be done in multiple ways depending on the parameters of interest (Cromartie & Bucholtz, 2008) with the majority of definitions surrounding municipal and jurisdictional lines, population density, and economic influence (Isserman, 2005). However, definitions of rural versus urban can be misleading (Isserman, 2005), thus the USDA/ERS researchers classify conditions as nonmetropolitan (nonmetro) and metropolitan areas (nonmetro) looking at the presence of open countryside, rural towns with fewer than 2,500 people, and urban areas ranging from 2,500 to 49,999 people (Cromartie & Parker, 2013). Specifically, “the rural-urban commuting area (RUCA) codes classify U.S. census tracts using measures of population density,
urbanization, and daily commuting” (USDA/ERS, 2019, para. 1). The RUCA Codes contain two levels and are represented by whole numbers 1 through 10 and are based on the size and direction of the greatest flow of commuters two and from an area.

These 10 codes can be further segmented and grouped other ways to look at specific areas as needed (USDA/ERS, 2019). In Florida, the Economic Research Services categorizes RUCA codes of 4-10 as rural areas of the state and codes 1-3 as urban areas of the state (ERS, 2019). Rural communities tend to be disadvantaged in multiple ways with less access to technology (Malecki, 2003), food (Blanchard & Matthews, 2007), and physical and mental health services (Smith et al., 2008). When looking at how to serve these communities prior to and during a crisis, Extension has been a major player in addressing rural issues and helping communities become more resilient (Coutts et al., 2019).

Organizations and individuals share similar roles and purposes when communicating and engaging with others during a disaster. An organization’s focus in the various stages of a disaster involves communicating valuable and accurate information systematically to stakeholders (Seeger, 2006; Seeger & Ulmer, 2001). In addition to sharing information, individuals use various methods of communication to socially support others within their network or community (Shklovskii et al., 2008). If an individual is considered a stakeholder of the organization, such as an employee or volunteer with the organization, they may serve as a first information responder (Omilion-Hodges & McClain, 2016). These individuals, while not necessarily charged with communication responsibilities, have experience with the organization and also have potentially developed trust within the organizational and personal networks in which they are a member (Omilion-Hodges & McClain, 2016).

**Purpose & Research Objectives**

The purpose of this study was to understand the communication of Extension faculty and staff during and after a disaster and the role that urban and rural community status played in response. Specifically, researchers were interested in Extension’s communication and use of technology in relation to a hurricane. Hurricane Irma was used as a case study. The specific research questions used to understand how crisis communication during was used during a hurricane were:

- **RQ1**: How does crisis communication efforts of Extension faculty and staff differ based upon rural or urban locations?
- **RQ2**: How does the use of technology for crisis communications differ for Extension faculty and staff in rural and urban locations?
- **RQ3**: Do crisis communication messages developed by Extension faculty and staff differ based upon rural or urban location?

**Methods**

The data utilized in this paper were gathered using an online survey distributed by Qualtrics. The survey link was distributed to a list of 358 Florida Extension faculty and staff with valid email addresses as of October 2017. A modified version of Dillman et al. (2009) tailored design method was utilized to collect the responses. Potential respondents were given an initial invitation and three follow-up reminders. Of those 358 potential respondents, 129 usable responses were collected from the Extension faculty members for a 36% response rate. The survey instrument was based on a questionnaire developed in a previous study
(Telg et al., 2007). Although both versions of the survey were similar in content, modifications were made to include additional questions that could determine Extension's communication methods such as social media and internet-based communication platforms (Mike et al., 2019). This 15-minute survey was developed to determine the extent of communication efforts, the extent to which technology was utilized, the communication messages conveyed, and organizational communication versus personal communication.

To ensure validity, specific sections of the 2017 questionnaire were used for analysis in this study. The first section concerned the extent to which Extension faculty members made use of select communication methods to communicate to Extension clientele during the 2017 hurricane season. The internal reliability of this scale was $\alpha = .78$. The same items and response scale were used in the next section of the instrument to examine Extension faculty’s perceptions of the extent to which the communications were used by their Extension offices to communicate to clientele. The internal reliability of this scale was $\alpha = .79$. The instrument also examined Extension faculty members’ perceptions of the extent to which their Extension offices utilized select communication channels to convey information to the general public during the 2017 hurricane season. The internal reliability of this scale was $\alpha = .81$.

Urban and rural designations were based on the zip code of the Extension faculty and staff members. The zip codes were coded into the 10 rural-urban commuting area (RUCA) codes. Those RUCA codes were further divided based on the Economic Research Services categories of 4-10 as rural areas of the state and codes 1-3 as urban areas of the state (ERS, 2019). Statistics package for social sciences (SPSS version 26) was used to analyze the data using descriptive statistics (means, standard deviations, frequencies, and percentages). Advanced statistics were not able to be run because of the disproportionate size between rural and urban groups.

**Results**

**Crisis Communication Efforts Based Upon Rural or Urban Locations**

This research question sought to determine if communication efforts of Extension faculty and staff differ based on rural or urban location. The responses for this series of questions were asked using a four item Likert-type scale, where $1 = not at all; 2 = slight extent; 3 = moderate extent; and 4 = great extent$. Real limits were used for interpretation of the responses: $1.00$ to $1.49 = Not at all, 1.50$ to $2.49 = Slight extent, 2.50$ to $3.49 = Moderate extent, $3.50$ to $4.00 = Great extent$.

Extension faculty and staff members were asked to what extent they and their Extension offices used mass media channels to communicate during the 2017 hurricane season. Urban Extension faculty and staff members indicated usage was to a slight extent ($M = 1.95$) while rural extension faculty and staff members indicated they used mass media channels to a moderate extent ($M = 2.54$; see Table 1). Regarding the use of mass media communication by their Extension offices, urban Extension faculty and staff members indicated usage was to a slight extent ($M = 2.07$) and rural Extension faculty and staff members indicated usage was to a moderate extent ($M = 2.73$; see Table 1).
Table 1

**Extent to which Extension Faculty and Staff Members Used Mass Media Channels to Communicate during the 2017 Hurricane Season**

<table>
<thead>
<tr>
<th></th>
<th>Urban (n)</th>
<th>M</th>
<th>SD</th>
<th>Rural (n)</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass media channels used for communication during recent hurricanes</td>
<td>103</td>
<td>1.95</td>
<td>1.10</td>
<td>26</td>
<td>2.54</td>
<td>.99</td>
</tr>
<tr>
<td>Mass media channels used by Extension office during recent hurricanes</td>
<td>102</td>
<td>2.07</td>
<td>.94</td>
<td>26</td>
<td>2.73</td>
<td>.83</td>
</tr>
</tbody>
</table>

*Note: Real Limits: 1.00 to 1.49 = Not at all, 1.50 to 2.49 = Slight extent, 2.50 to 3.49 = Moderate extent, 3.50 to 4.00 = Great extent.*

Regarding communication sources and channels used by Extension offices to communicate with the general public, both urban and rural Extension faculty and staff members indicated their offices used the internet/web to the greatest extent ($M = 2.86; M = 3.21$). The communication sources and channels used to the least extent by both urban and rural Extension offices to communicate with the general public were, live TV interviews ($M = 1.24; M = 1.42$) and TV public service announcements ($M = 1.24; M = 1.35$). Urban Extension faculty and staff also reported their Extension offices used live radio to the least extent ($M = 1.39$). See Table 2.

Table 2

**Extent to which Extension Faculty and Extension Offices used Different Communication Channels to Communicate with the General Public during the 2017 Hurricane Season**

<table>
<thead>
<tr>
<th></th>
<th>Urban (n)</th>
<th>M</th>
<th>SD</th>
<th>Rural (n)</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet/Web</td>
<td>98</td>
<td>2.86</td>
<td>.95</td>
<td>24</td>
<td>3.21</td>
<td>.83</td>
</tr>
<tr>
<td>Flyers, print materials</td>
<td>98</td>
<td>2.09</td>
<td>.93</td>
<td>26</td>
<td>1.88</td>
<td>.82</td>
</tr>
<tr>
<td>Newspaper</td>
<td>96</td>
<td>1.70</td>
<td>.91</td>
<td>25</td>
<td>2.12</td>
<td>1.05</td>
</tr>
<tr>
<td>Radio public service announcements</td>
<td>95</td>
<td>1.54</td>
<td>.89</td>
<td>26</td>
<td>1.81</td>
<td>1.06</td>
</tr>
<tr>
<td>Live Radio</td>
<td>95</td>
<td>1.39</td>
<td>.79</td>
<td>26</td>
<td>1.77</td>
<td>1.14</td>
</tr>
<tr>
<td>TV public service announcements</td>
<td>95</td>
<td>1.24</td>
<td>.63</td>
<td>26</td>
<td>1.35</td>
<td>.85</td>
</tr>
<tr>
<td>Live TV interviews</td>
<td>95</td>
<td>1.24</td>
<td>.63</td>
<td>26</td>
<td>1.42</td>
<td>.99</td>
</tr>
</tbody>
</table>

*Note: Real Limits: 1.00 to 1.49 = Not at all, 1.50 to 2.49 = Slight extent, 2.50 to 3.49 = Moderate extent, 3.50 to 4.00 = Great extent.*

Regarding communication sources and channels used by Extension offices to communicate with the general public, both urban and rural Extension faculty and staff members indicated their most effective source/channel was the Internet (53%, 69%) Extension faculty and staff members were asked to what extent they used...
different instruments and personal communication methods to convey information to their Extension clientele group during the 2017 hurricane season. Urban Extension faculty and staff reported they used e-mail ($M = 2.84$), phone ($M = 2.76$), and face-to-face ($M = 2.67$) to the greatest extent. While rural Extension faculty and staff reported they used social media ($M = 3.21$), Facebook ($M = 3.17$), and face to face ($M = 3.04$) to the greatest extent. Both urban and rural Extension faculty and staff reported they used Twitter ($M = 1.32; M = 1.30$) and Instagram ($M = 1.16; M = 1.17$; See Table 3) to the least extent.

Table 3

| Extent to which Extension Faculty/Staff made use of Different Instruments/Personal Communication Methods to Convey Information to their Extension Clientele during the 2017 Hurricane Season |
|---|---|---|---|---|---|---|
| | Urban (n) | M | SD | Rural (n) | M | SD |
| Electronic mail (e-mail) | 90 | 2.84 | .105 | 24 | 2.58 | .93 |
| The phone | 95 | 2.76 | .105 | 24 | 2.67 | .92 |
| Face-to-face | 89 | 2.67 | .102 | 24 | 3.04 | 1.00 |
| Facebook | 92 | 2.42 | 1.20 | 24 | 3.17 | 1.09 |
| The internet | 89 | 2.42 | 1.09 | 24 | 2.63 | 1.10 |
| Social Media | 91 | 2.35 | 1.18 | 24 | 3.21 | 1.02 |
| On-site visits | 89 | 2.27 | 1.21 | 24 | 2.42 | 1.25 |
| Text messaging | 92 | 2.03 | 1.22 | 24 | 2.58 | 1.28 |
| Twitter | 88 | 1.32 | .80 | 23 | 1.30 | .77 |
| Instagram | 87 | 1.16 | .48 | 23 | 1.17 | .49 |

Note: Real Limits: 1.00 to 1.49 = Not at all, 1.50 to 2.49 = Slight extent, 2.50 to 3.49 = Moderate extent, 3.50 to 4.00 = Great extent.
Table 4

Extent to which Extension Faculty and Extension Offices made use of Different Communication Methods to Convey Information to their Extension Clientele during the 2017 Hurricane Season

<table>
<thead>
<tr>
<th></th>
<th>Urban (n)</th>
<th>M</th>
<th>SD</th>
<th>Rural (n)</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic mail (e-mail)</td>
<td>85</td>
<td>2.94</td>
<td>1.00</td>
<td>22</td>
<td>2.55</td>
<td>.91</td>
</tr>
<tr>
<td>The phone</td>
<td>86</td>
<td>2.84</td>
<td>.94</td>
<td>22</td>
<td>2.59</td>
<td>1.30</td>
</tr>
<tr>
<td>Face to face</td>
<td>84</td>
<td>2.76</td>
<td>.97</td>
<td>22</td>
<td>2.86</td>
<td>1.13</td>
</tr>
<tr>
<td>Facebook</td>
<td>86</td>
<td>2.59</td>
<td>1.08</td>
<td>22</td>
<td>3.27</td>
<td>.94</td>
</tr>
<tr>
<td>The internet</td>
<td>86</td>
<td>2.58</td>
<td>1.03</td>
<td>22</td>
<td>2.55</td>
<td>1.06</td>
</tr>
<tr>
<td>Social Media</td>
<td>86</td>
<td>2.57</td>
<td>1.04</td>
<td>22</td>
<td>3.14</td>
<td>1.04</td>
</tr>
<tr>
<td>On-site visits</td>
<td>86</td>
<td>2.41</td>
<td>1.06</td>
<td>22</td>
<td>2.73</td>
<td>1.20</td>
</tr>
<tr>
<td>Text messaging</td>
<td>84</td>
<td>1.95</td>
<td>1.05</td>
<td>22</td>
<td>2.32</td>
<td>1.13</td>
</tr>
<tr>
<td>Twitter</td>
<td>81</td>
<td>1.40</td>
<td>.82</td>
<td>22</td>
<td>1.32</td>
<td>.78</td>
</tr>
<tr>
<td>Instagram</td>
<td>79</td>
<td>1.15</td>
<td>.40</td>
<td>22</td>
<td>1.18</td>
<td>.50</td>
</tr>
</tbody>
</table>

Note: Real Limits: 1.00 to 1.49 = Not at all, 1.50 to 2.49 = Slight extent, 2.50 to 3.49 = Moderate extent, 3.50 to 4.00 = Great extent.

Extension faculty and staff members were asked to what extent they believed the general public and their extension clientele group were aware of their efforts during the 2017 hurricane season. Urban Extension faculty and staff members indicated the general public and their clientele were aware of their efforts to a slight extent ($M = 2.01$; $M = 2.49$). Rural Extension faculty and staff members indicated the general public were aware of their efforts to a slight extent ($M = 2.42$) while their clientele to a moderate extent ($M = 2.65$; See Table 5).

Table 5

Extent of Awareness by General Public and Extension Clientele of Extension Efforts during the 2017 Hurricane Season

<table>
<thead>
<tr>
<th></th>
<th>Urban (n)</th>
<th>M</th>
<th>SD</th>
<th>Rural (n)</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>General public awareness of Extension efforts during recent hurricanes</td>
<td>102</td>
<td>2.01</td>
<td>.71</td>
<td>26</td>
<td>2.42</td>
<td>.90</td>
</tr>
<tr>
<td>Extension clientele group awareness of Extension efforts during recent hurricane</td>
<td>102</td>
<td>2.49</td>
<td>.89</td>
<td>26</td>
<td>2.65</td>
<td>.94</td>
</tr>
</tbody>
</table>

Note: Real Limits: 1.00 to 1.49 = Not at all, 1.50 to 2.49 = Slight extent, 2.50 to 3.49 = Moderate extent, 3.50 to 4.00 = Great extent.
Extension faculty and staff were asked if their Extension offices have an internal plan to manage communication efforts in a crisis like hurricanes and other emergency situations. Approximately 80% of urban Extension faculty and staff indicated they have an internal plan to manage communication efforts in a crisis. Approximately 62% percent of rural Extension faculty and staff indicated they have an internal plan to manage communication efforts in a crisis.

Extension faculty and staff were asked if their Extension offices have an external plan to manage communication efforts in a crisis like hurricanes and other emergency situations. Approximately 56% of urban Extension faculty and staff indicated they have an external plan to manage communication efforts in a crisis while approximately 46% of rural Extension faculty and staff indicated they have an external plan to manage communication in a crisis.

Differences in Technology for Disaster Communications in Rural and Urban Locations

This research question sought to determine how the use of technology of Extension faculty and staff during and after a disaster differ based upon rural or urban location. Extension faculty and staff were asked what types of technology they personally used during the 2017 hurricane season. After checking all responses that applied, approximately the same percentage (85%) of urban and rural Extension faculty and staff reported a smart phone as a type of technology they personally used during the 2017 hurricane season. Approximately 57% of urban and 62% of rural Extension faculty and staff also indicated a laptop computer as a type of technology they personally used during the 2017 hurricane season (See Table 6).

Table 6

<table>
<thead>
<tr>
<th>Types of Technology Personally used by Extension Faculty and Staff during the 2017 Hurricane Season</th>
<th>Urban (n)</th>
<th>%</th>
<th>Rural (n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart phone</td>
<td>87</td>
<td>84.5</td>
<td>22</td>
<td>84.6</td>
</tr>
<tr>
<td>Laptop computer</td>
<td>59</td>
<td>57.3</td>
<td>16</td>
<td>61.5</td>
</tr>
<tr>
<td>Tablet</td>
<td>31</td>
<td>30.0</td>
<td>4</td>
<td>15.3</td>
</tr>
<tr>
<td>Desktop computer</td>
<td>30</td>
<td>29.1</td>
<td>5</td>
<td>19.2</td>
</tr>
<tr>
<td>Cell phone (with calling and texting only)</td>
<td>30</td>
<td>29.1</td>
<td>3</td>
<td>11.5</td>
</tr>
<tr>
<td>Wireless cellular hotspot</td>
<td>16</td>
<td>15.5</td>
<td>6</td>
<td>23.0</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>4.9</td>
<td>5</td>
<td>19.2</td>
</tr>
<tr>
<td>No answer</td>
<td>4</td>
<td>3.9</td>
<td>3</td>
<td>11.5</td>
</tr>
</tbody>
</table>
Extension faculty and staff were asked what types of special software or applications (apps) they personally used during the 2017 hurricane season. This question was asked in an open-ended response format and the responses were then coded into similar categories. Approximately 21% of urban Extension faculty and staff reported they used Facebook/Facebook messenger and 18% of them reported using GroupMe. Approximately 46% of rural Extension faculty and staff reported they used Facebook/Facebook messenger and 19% of them reported they used GroupMe (See Table 7).

### Table 7

**Types of Special Software or Applications (apps) Personally used by Extension Faculty and Staff during the 2017 Hurricane Season**

<table>
<thead>
<tr>
<th></th>
<th>Urban (n)</th>
<th>%</th>
<th>Rural (n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook/Facebook messenger</td>
<td>22</td>
<td>21.4</td>
<td>12</td>
<td>46.2</td>
</tr>
<tr>
<td>GroupMe</td>
<td>18</td>
<td>17.5</td>
<td>5</td>
<td>19.2</td>
</tr>
<tr>
<td>Weather Channel app</td>
<td>4</td>
<td>3.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>WhatsApp</td>
<td>3</td>
<td>2.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Zello</td>
<td>3</td>
<td>2.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Weather underground app “Storm”</td>
<td>1</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GasBuddy</td>
<td>1</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GIS</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>Text message</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>5.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No apps used</td>
<td>6</td>
<td>5.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Don’t know</td>
<td>2</td>
<td>1.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No answer</td>
<td>54</td>
<td>52.4</td>
<td>13</td>
<td>50.0</td>
</tr>
</tbody>
</table>

Extension faculty and staff were asked about whether they lost cellular service during and after the 2017 hurricane season. Approximately 29% of urban Extension faculty and staff reported they lost cellular service while approximately 27% of rural Extension faculty and staff said they lost cellular service during and after the 2017 hurricane season.

### Disaster Communication Message Differences Based Upon Rural or Urban Location

This research question sought to determine if communication messages before, during, and after a disaster of Extension faculty and staff differ based upon rural or urban location. This series of questions were asked in an open-ended response format and those responses were then coded into similar categories.
Extension faculty and staff were asked what messages they were trying to get across to the public during the 2017 hurricane season. Urban Extension faculty and staff reported that “hurricane preparedness” (37%), “recovery” (32%), and “availability of Extension services (17%) were the top messages they tried to get across to the public during the 2017 hurricane season. Rural Extension faculty and staff reported that “hurricane preparedness” (42%), “availability of Extension services” (23%), and “safety” (23%) were the top messages they tried to get across to the public during the 2017 hurricane season (see Table 8).

Table 8

Message(s) Extension Faculty/Staff were trying to get Across to the Public during the 2017 Hurricane Season

<table>
<thead>
<tr>
<th>Message(s)</th>
<th>Urban (n)</th>
<th>%</th>
<th>Rural (n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>General hurricane preparing home/agriculture</td>
<td>38</td>
<td>36.9</td>
<td>11</td>
<td>42.3</td>
</tr>
<tr>
<td>General/home/agricultural/natural resource recovery (after)</td>
<td>33</td>
<td>32.0</td>
<td>4</td>
<td>15.4</td>
</tr>
<tr>
<td>Extension services/resources/other resources/info</td>
<td>17</td>
<td>16.5</td>
<td>6</td>
<td>23.1</td>
</tr>
<tr>
<td>Food safety issues before/after the storm</td>
<td>14</td>
<td>13.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Safety/personal/family/friends</td>
<td>10</td>
<td>9.7</td>
<td>6</td>
<td>23.1</td>
</tr>
<tr>
<td>Information on shelter availability</td>
<td>6</td>
<td>5.8</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>Change in location/cancellation/altered schedules of programs</td>
<td>4</td>
<td>3.9</td>
<td>2</td>
<td>7.7</td>
</tr>
<tr>
<td>Updates during/after the storm</td>
<td>3</td>
<td>2.9</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>People/pet/animal evacuation</td>
<td>2</td>
<td>1.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>How to volunteer/volunteer needs after the storm</td>
<td>1</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Donations/coordination of donations</td>
<td>1</td>
<td>1.0</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>3</td>
<td>2.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Don’t know</td>
<td>1</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No answer</td>
<td>28</td>
<td>27.2</td>
<td>6</td>
<td>23.1</td>
</tr>
</tbody>
</table>

Extension faculty and staff were asked what messages they were trying to get across to their Extension clientele during the 2017 hurricane season. Urban Extension faculty and staff reported that “recovery” (26%), “availability of Extension services (24%), and “hurricane preparedness” (23%) were the top messages they tried to get across to the Extension clientele during the 2017 hurricane season. Rural Extension faculty and staff reported that “recovery” (31%), “hurricane preparedness” (31%), and “availability of Extension services” (27%) were the top messages they tried to get across to their Extension clientele during the 2017 hurricane season (see Table 9).
### Table 9

**Message(s) Extension Faculty/Staff were trying to get Across to their Extension Clientele after the 2017 Hurricane Season**

<table>
<thead>
<tr>
<th>Message(s)</th>
<th>Urban (n)</th>
<th>%</th>
<th>Rural (n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal and Agricultural recovery/response/damage (after)</td>
<td>27</td>
<td>26.2</td>
<td>8</td>
<td>30.8</td>
</tr>
<tr>
<td>Extension services/resources/other resources/info</td>
<td>25</td>
<td>24.3</td>
<td>7</td>
<td>26.9</td>
</tr>
<tr>
<td>Hurricane preparation of home/farm/agriculture (before)</td>
<td>24</td>
<td>23.3</td>
<td>8</td>
<td>30.8</td>
</tr>
<tr>
<td>General safety</td>
<td>10</td>
<td>9.7</td>
<td>3</td>
<td>11.5</td>
</tr>
<tr>
<td>Food safety issues before/after the storm</td>
<td>7</td>
<td>6.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Updates during/after the storm</td>
<td>5</td>
<td>4.9</td>
<td>2</td>
<td>7.7</td>
</tr>
<tr>
<td>Change in location/cancellation/alartered schedules</td>
<td>5</td>
<td>4.9</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>How to volunteer/volunteer needs after the storm</td>
<td>2</td>
<td>1.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Storm impacts on Agriculture quality</td>
<td>2</td>
<td>1.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Donations/coordination of donations</td>
<td>1</td>
<td>1.0</td>
<td>1</td>
<td>3.8</td>
</tr>
<tr>
<td>No answer</td>
<td>28</td>
<td>27.2</td>
<td>12</td>
<td>46.2</td>
</tr>
</tbody>
</table>

### Conclusions & Implications

Both rural and urban areas were actively communicating with their stakeholders with resources and technical and social support during, and after Hurricane Irma, which confirms previous work in crisis communication (Seeger, 2006; Seeger & Ulmer, 2001; Shklovski et al., 2008). Differences in how rural and urban areas communicated during the different stages of the crisis were seen in multiple ways. Rural areas used mass media to a moderate extent while urban areas only reported using mass media to a slight extent. This could be a function of the accessibility of mass media in rural areas versus urban. While there are fewer mass media outlets available in rural areas, Extension agents may have a regular local program on mass media and a connection with station directors that are more difficult to have in an urban area.

The internet was used a great extent by both rural and urban Extension personnel, who acted as first information responders on behalf of the Extension office (Omilion-Hodges & McClain, 2016). The internet was considered the most effective for that use by the largest number of people within this study. However, urban respondents were more likely to use the phone, email, and face-to-face communication when communicating personally during and after the storm while their rural counterparts were more likely to use social media and Facebook. This was also reflected in the types of apps used by participants with almost half of the rural participants using the Facebook app. The higher use of social media by rural participants could be because the people who the rural participants were connected to on social media were the same people who they know in their real life, whereas the urban respondents may have not had real
relationships with those on their social networks (Gilbert et al., 2008). Because of this, the urban respondents may have selected more personal forms of communication like phone and face-to-face when communicating personally about the storm.

The types of messages also differed depending on rural and urban areas. This may be an indication of the types of information stakeholders in these areas needed during time of crisis (Coombs, 2012). The top messages for both rural and urban during the storm were “General hurricane preparing home/agriculture”, which is on brand for Extension organizational communication, but other messages differed greatly with urban audiences sharing messages of technical aspects like already discussing what to do after the storm for “General/home/agricultural/natural resource recovery”, while the rural areas were sharing more personal messages like “Safety/personal/family/friends”, but also sharing more “Extension resources”. Interestingly, urban areas' 4th highest messages were “sharing about food safety issues”, and this did not appear in the rural messages. This too could be related to the nature of relationships in rural and urban areas (Gilbert et al., 2008), or it could be a function of other people who were or were not sharing this type of information in the specific areas. Less differences in messaging were seen after the storm however, food safety messages still only appeared in the urban communication.

Results of this study do not indicate that rural areas were excessively disadvantaged during Hurricane Irma, which contradicts other research on rural areas (Blanchard & Matthews, 2007; Malecki, 2003; Smith et al., 2008). In fact, in some ways the rural Extension personnel may have been able to have a greater impact in their communities than those in the urban areas. As indicated, this may be due to the established networks and bonds pre-established within rural areas. Of course, this study is only looking at the perspectives of Extension communication. As a whole, the rural areas may have less services and access to organizations beyond Extension. While in some responses to this survey rural areas appear to be better served, the urban areas are likely to have access to communication and services from more organizations, more emergency managers, and county-level staff outside of the Extension organization.

**Limitations**

Limitations of this study include looking only at the perspectives of Extension communication at one point in time following a devastating hurricane. A more comprehensive approach could include all Extension services and programs before, during, and after the hurricane. Validity would have increased by including communication efforts during several different hurricane seasons in succession. Other limitations include a small sample size and unbalanced responses from urban versus rural counties.

**Recommendations**

More research should be conducted to investigate the role of organizations other than Extension in rural and urban communities to understand the communication needs during disaster for rural and urban areas. It is possible Extension’s communication efforts are duplicated in some areas (urban) but are the only messages in other areas (rural). Future research could explore the differences in urban and rural use of mass media, personal/in-person choices, and use of social media during a crisis. Additional research should also look at the differences in
messaging in rural and urban crisis communication. With the low numbers in rural areas, future work may need to focus on qualitative methods.

Recommendations for practitioners include the development of a crisis communication plan. A template should be provided to begin the discussion and planning process. While in this study the effect of having a plan was not directly seen, previous work indicates its importance (Fessenden-Raden et al., 1987; Renn 1991). The top messages shared in this study were those readily available resources which Extension had ready to share prior to the hurricane. Extension faculty and staff should also work to identify and establish key networks and partners in the community in order to worker together to disseminate crucial information. Key individuals within Extension or the community should be identified to act as first information responders to share information on behalf of Extension.

While in this study, online communication channels were the most prominent, other tools should be developed and considered for long periods of power and cellular outages including grassroots efforts such as providing paper resources to community members. Practitioners should establish relationships and communication networks during ‘blue skies’ with other organizations in order to work together after disasters to provide information broadly across communities. Previously established networks could be why rural areas had successful communication efforts and access to mass media within this study.

References


An ICT Strategy Based upon E-Teaching and E-Learning in Response to the COVID-19 Crisis in Africa

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International Institute of Tropical Agriculture, Kenya, Africa

Abstract

The COVID-19 pandemic is a crisis that has gripped the world, causing governments and development agencies to search for critical measures to protect their people. The situation not only represents a significant health risk but has resulted in school closures that have disrupted agricultural education. This impedes the attainment of Africa’s larger food security and rural transformation agendas. Six months before the advent of the pandemic, the International Institute of Tropical Agriculture initiated a pilot project, Start Them Early Program (STEP) whose goal is to reinforce pathways to careers in agriculture within secondary schools in DR Congo, Kenya, and Nigeria. The project has now been forced to rethink its approach while embracing information and communication technologies due to the school closures. This paper describes the process involved in that operational pivot, particularly concerning the shift from electronic teaching by instructors towards distance electronic learning by students. Key issues addressed are the consolidation of digital applications, development of a mobile-based toolbox for use by young farmers, and constraints to device ownership. The means of addressing these concerns through working with instructors and their larger school systems are explained. Action points and resources that are recommended include the distribution of upgraded instructor workstations, a listing of relevant software applications, and the design of a mobile-based all-in-one toolkit for agriculture students and young farmers. The latter two developments have wider application in the reform of agricultural extension amongst the tech-savvy youth taking up agribusiness.

Keywords: agricultural transformation; COVID-19 response; digital agriculture; distance education; STEP program

Acknowledgments: This strategy was conducted as a component of the Start Them Early Program (STEP) International Institute of Tropical Agriculture (IITA), an activity originally envisaged by its Director-General, Dr. Nteranya Sanginga, and supported by grants obtained from the International Development Research Center (Canada) and the Technical Centre for Agricultural and Rural Cooperation (CTA). The STEP Kenya team consisting of Lorraine Mutinda, Maryfaith Simiyu, Felix Kiprono, and Phillip Kioko, and STEP ICT team consisting of Christophe Byake (DR Congo), and Bekee Barivure (Nigeria) prepared an earlier internal document that described available ICT applications featured in this report. Exchanges were conducted with Dr. Jemimah Njuki (IDRC), Dr. Mpoko Bokanga (IITA), and Adedayo Adefioye (STEP Coordinator) concerning a project “pivot” in the face of the COVID-19 pandemic. The authors thank all these persons and their departments and organizations for their respective contributions.
Introduction

COVID-19 is a growing pandemic with tangible effects on Africa’s educational and agricultural sectors (Africa Arguments, 2020). In addition to the adverse effects on health, it affects the livelihoods of poor rural farmers who heavily depend on agriculture, and investment strategies must be adjusted to their new realities (International Fund for Agricultural Development [IFAD], 2020). An important element of this adjustment is the role of Information and Communication Technology (ICT) services as teaching and learning tools available to youth, including students and young farmers in COVID-19 response, recovery, and more resilient aftermath (Ngwacho, 2020). ICT in agriculture, increasingly referred to as digital agriculture (Tsan et al., 2019), offers distinct advantages in securing essential farm operations, keeping food supply chains moving, and reaching vulnerable populations (Bashuna & Addom, 2020).

To counter the COVID-19 pandemic, many countries quickly instituted precautionary lockdown and social distancing at its onset, while maintaining domestic agricultural production and its supply chains as essential human activities (International Monetary Fund [IMF], 2021). Schools were closed indefinitely with little or no provision to continue instruction.

In Nigeria, the first case of COVID-19 was confirmed on February 27, 2020, sparking a series of responsive measures including the commissioning of a task force on March 9 by the President. Subsequently, the Federal government ordered the closure of schools on March 19 in a bid to prevent the spread of the virus. This saw 35.9 Million secondary and primary school students out of school indefinitely out of which 81% attend public schools. From April 2020, the country shifted to radio and television means to deliver lessons to learners with new networks being launched for this purpose. However, this was not free from challenges to a majority of students which included the inability for families to purchase and subscribe to satellite networks, non-existent connectivity, erratic electricity supply, and lack of access to computers and other sophisticated ICT devices that aid internet-based learning (Samuel, 2020).

Kenya confirmed its first COVID-19 case on March 12, 2020, as relayed by the Ministry of Health (MoH) via a Presidential press release. The Government then announced abruptly the closure of schools as a preventive measure against the spread of the COVID-19 on 15 March 2020 affecting the lives of nearly 17 Million learners countrywide (Parsitau & Jepkemei, 2020). In May 2020, the Ministry of Education (MoE) declared public school classes, aligned with the school calendar, would be broadcast on multiple channels, such as radio, television, YouTube, and Kenya Education Cloud for a targeted 15 Million learners (MoE, 2020; Nzuki & Wanyama, 2020). However, this Basic Education COVID-19 Emergency Response Plan was marred and suffered several bottlenecks, including inaccessibility, insufficiency, low ICT literacy levels among students, parents, and teachers, and other social, health, economic and psychological factors brought about by the pandemic, and school closure. The MoE acknowledged that unequal access to learning portals would further create inequalities in access to education.

DR Congo announced its first COVID-19 case on March 10, 2020. By March 24, a state of emergency was declared restricting gatherings of more than 50 people and further closure of schools and universities. During this time, students were to continue education remotely where they struggled to access education through the internet and digital services; this has proved to be unequal for most students and their families (Ging, 2020).
Despite these government policies, it soon emerged that safety measures are not well understood and are weakly practiced. Public information campaigns were initiated, and enforcement intensified but the poorest in society are least able to comply with the stay-at-home requirements (IFAD, 2020; Ali et al., 2020). Chronically weak agricultural extension mechanisms are being further diminished by social disruption. Digital services are needed to fill the void, prompting the accelerated roll-out, promotion, and adoption of digital tools.

Farmer organizations and youth groups were less able to conduct conventional assembly activities and direct member services. Although their cooperative operations are an essential service, the inability to congregate has caused them to shift to safer, smaller groupings and digital information exchanges. The poorest small-scale farming households, however, are least able to cope with pandemic disruption and warrant special considerations in recognition of their services. COVID-19 is worryingly recorded in rural communities, where poverty, undernourishment, and lack of access to basic healthcare render the population highly vulnerable. Furthermore, rural women and girls are expected to increase their roles as household health and nutrition managers (Food and Agriculture Organization of the United Nations [FAO], 2011) and to responsibly supervise household pandemic recovery. At the same time, legions of economically marginalized youth engaged in daily income generation within informal economies (Alliance for a Green Revolution in Africa [AGRA], 2015) continue to resist compliance with public health measures, causing them to be seen as hazards to the population as a whole.

Continued operations of schools risked accelerated community contagion and are for the most part closed indefinitely, thus disrupting student progress (Ngwacho, 2020). Electronic teaching and learning have not met educational demands, particularly in poorer rural areas. This has not hampered the development and advancement of ICT learning tools and the attraction of developmental resources will hopefully lead to stronger educational systems in the pandemic aftermath. Mechanisms toward this end are described in this paper, which shows how a project devoted to agricultural education in three African countries; DR Congo, Kenya, and Nigeria is creating a new-normal for secondary schools through advances in electronic teaching and learning. This paper describes how ICT tools, teaching, and learning may be better offered at the secondary school level in response to the COVID-19 pandemic and its aftermath.

**Operational Framework**

Across the African continent, because of the COVID-19 pandemic, an estimated 297 million students have been affected by school closures. According to the United Nations Educational Science and Cultural Organization [UNESCO] (2020), the school closures worldwide had affected 1.29 Billion students in 186 countries (73.8%) of the world's student population. The United Nations International Children’s Emergency Fund [UNICEF] (2020) reported that a third of this population, 463 Million, globally were unable to access remote learning, a condition made by most governments as schools were closed.

Also affected was the Start Them Early Program (STEP), a pilot project intended to strengthen career pathways among secondary school students towards modernized agriculture that was initiated in September 2019 (Adefioye et al., 2019). It incorporates diverse Information and Communication Technology (ICT) strategies in support of client needs for electronic teaching (e-Teaching) by
instructors and school systems, and electronic learning (e-Learning) among students and other youth. It is understood that many youths view farming in a negative light (Mulei et al., 2020; Sumberg & Okali, 2013), and STEP seeks to change this perception.

The agribusiness opportunities most attractive to youth are recognized and reinforced within the International Institute of Tropical Agriculture [IITA] Youth in Agribusiness Movement (Owoeye et al., 2016; Woomer et al., 2015), the necessary entrepreneurship mechanisms described (Lawson-Hall & Leke, 2019), and the technologies required to realize these ambitions are being mobilized (Technologies for African Agricultural Transformation [TAAT] Clearinghouse, 2018). STEP acknowledges that youth are particularly attracted to and adept in the use of electronic devices whose potential remains under-exploited as tools for education (e.g. E-teaching and E-learning).

E-Teaching integrates with traditional learning in ways that increase its practical application while E-Learning is designed to advance longer-term capacities, focus on an individual learner, and contribute to the culture of lifelong learning (Meena et., al 2017; Ghirardini, 2011). The concept of E-Teaching and E-Learning has gained momentum in recent times because of school closures arising from the COVID-19 pandemic. In DR Congo, Kenya and Nigeria alone, there are over 66 million students affected by school closure (UNESCO, 2020), most without access to distance learning resources.

In the face of the pandemic, innovation has shifted from the periphery to the core of many education systems, and there is an opportunity to find creative methods that, if continued, will help young people get an education that will prepare them for changing times (Vegas & Emiliana, 2020). Karsenti et al. (2009) and Ghirardini (2011) show how students learn more and faster with ICT and online courses than in traditional classrooms. They affirm that ICT-assisted teaching and learning offers attractive, individualized options with many benefits, including flexibility, accessibility, enhanced communication and interaction, and a wider variety of teaching and learning modes.

**Methods**

This study was initiated in response to disruption resulting from school closure as a COVID-19 precautionary measure. The STEP project had started a few months earlier in a way that offered school-based activities to reinforce career pathways in several secondary schools (Mulei et al. 2020) and then found itself forced to adjust its approaches in absence of direct student interaction. Initially, the project had provided both computers, internet, projectors, and instructional software to participating schools to backstop electronic instruction but then found that those facilities could no longer be used and sought to understand the new pandemic situation in a more holistic manner. As a result, a qualitative research design was followed in this study. It is essentially a desk study conducted during the lockdown in Kenya between May and July 2020. At this point, we had, however, established communication with educators in several schools and ICT suppliers who then provided feedback to a series of queries addressing best steps forward under a very difficult situation. In addition, semi-structured interviews were used to collect information from these secondary schools and equipment, internet, and software suppliers. This in turn led to the design of the conceptual response diagram presented in Figure 1.
Efforts leading to the refinement of this model were systematic and span three countries i.e. DR Congo, Kenya, and Nigeria (Adefioye et al., 2019). First, the school system curricula were assembled to relate to agricultural instruction and rapport created with specific schools and instructors (Mulei et al., 2020).
The ICT facilities in those schools were then assessed and matched with the program’s capacities to make improvements which included the design and installation of instructors’ computer workstations described in Table 1. Support was also provided for modest computer learning laboratories open to teachers, students, and Table 1

Components and options of STEP instructor’s e-Training workstations in Kenya

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Cost (US$) and access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notebook Computer</td>
<td>Controlled by individual instructors, central to e-Teaching, lower-end models (&lt;4 GB RAM, &lt;500 GB hard drive) may operate too slowly, includes DVD and webcam, placed in lockbox when not in use.</td>
<td>$270 to $453 depending on capacities, purchased through competitive bids.</td>
</tr>
<tr>
<td>Projector</td>
<td>Projects computer screen to larger classroom, costs have decreased rapidly over time, a minimum 2000 lumens is recommended for lighted classrooms, placed in lockbox when not in use.</td>
<td>$281 to $356 depending on resolution and intensity, purchased through competitive bids.</td>
</tr>
<tr>
<td>Printer</td>
<td>Allows instructor to print instructional materials and tests, students to print assignments, and club members to produce information materials, refillable color cartridges preferred, smaller models placed in lockbox overnight.</td>
<td>$45 to $186 depending on type and coloring, purchased through competitive bids.</td>
</tr>
<tr>
<td>Software</td>
<td>Computers run on MS Windows, latest version of Microsoft Office, and antivirus package also purchased and installed by the project. STEP provides instructional materials, other specific applications described in Table 2.</td>
<td>$87 for MS Office for six-users (annually renewed) and four-user antivirus for $30. Total $117, purchased through competitive bids.</td>
</tr>
<tr>
<td>Metal lockbox</td>
<td>Considered essential for workstation security, available as single compartment padlocked or up to four drawers inbuilt locked, placed in secure location, keys retained by partnering instructor.</td>
<td>$86 for single compartment and $271 for four-drawer, purchased through competitive bids.</td>
</tr>
<tr>
<td>Uninterrupted Power Supply (UPS)</td>
<td>Permits e-Training during intermittent disruption of electricity, at least 650 VA required by projector, duration of backup depends on battery capacity.</td>
<td>$55 to $85 depending on capacity, purchased through competitive bids.</td>
</tr>
<tr>
<td>Miscellaneous supplies</td>
<td>Flash drive, printing paper, extension cables, laptop lock, external speakers (&gt;50 W), mouse, external keyboard, screen protector, other e-Training supplies needed by instructor.</td>
<td>About $140, purchased through competitive bids.</td>
</tr>
<tr>
<td>Total cost</td>
<td></td>
<td>$994 to $2008</td>
</tr>
</tbody>
</table>
agricultural club members. Upgrading included installing new or improving, where applicable the schools’ internet connectivity, computers, projectors, and audio systems. This approach also allowed for the construction of Tables 1, 2, and 3 relating to expanded ICT opportunities and their costs. This method was new and unplanned in that project pivots in response to a global pandemic of this nature had not been considered earlier in this (Adefioye et al. 2019) or most other projects (Banaszak et al. 2020; Chattopadhyay, 2020).

Results & Discussion
Offline E-Teaching is intended for the classroom and represents a better use of computer presentation tools, particularly digital projectors and display screens (Figure 1). It is a technological leap over classroom blackboards and chalk that is long overdue in Africa. STEP’s experience in upgrading offline instruction is that efforts must comply with existing curricular content and requirements and especially in a country like Kenya which had just rolled out a new Competency-Based Curriculum (CBC), in January 2019 to replace what used to be a Summative Evaluation Based Curriculum (Maluei, 2019). However, STEP’s target beneficiaries, secondary school-going youth, are still using the old curriculum, and as such there, is some considerable latitude for course revision and updating delivery modes in the three intervention countries overall.

Online E-Teaching involves linking to sources of information available over the internet and delivering educational material through others’ computers (see Figure 1). The mass of information available on all subjects available over the internet is staggering, but efforts to supplement current curricula through information sources beyond outdated student textbooks are compelling. Online E-Teaching may be delivered within schools or remotely through a range of household electronic devices, including less expensive laptops, smartphones, and tablets.

STEP’s support for E-Teaching is intended for instructors, their schools, and larger school systems (Figure 1). E-Teaching is subdivided into offline and online teaching, both requiring that ICT hardware and skills be available to its practitioners. The components of the STEP instructor computer workstation developed by STEP appear in Table 1. Students are particularly responsive to visual stimulus in the forms of photos, conceptual diagrams, and videos (Maal, 2004; Clarke et al., 2006; Valentinuzzi, 2015), and the use of electronic media such as television, radio, tape recorders, films, computers, projectors, telecommunication equipment, and the internet provides instructors many advantages (Classroom Teacher, 2008; Arora, 2015; Ezirim et al., n.d). However, it demands time for the development and upload of the material, and this requires the teachers to put in a little more effort than is needed in conventional teaching methods (Arora, 2015).
Table 2

**Selected ICT Applications that Assist in Agricultural Decision-Making in Kenya**

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
<th>Access and cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrobase</td>
<td>Provides agronomic information on pests, diseases and weeds, includes identification aids and country-based protection and treatment instructions, relates to livestock, horticulture, fruit, vegetable and field crop production.</td>
<td>Accessed through Google play store, costs through data usage.</td>
</tr>
<tr>
<td>Breeding Wheel</td>
<td>Allows users to access personalized data of dairy herd requirements including information on reproductive issues, service schedules, lactation periods, and calving.</td>
<td>Accessed through Google play store, costs through data usage.</td>
</tr>
<tr>
<td>Crop Farmers</td>
<td>Provides information about crop, fruit and vegetable growing. Details climate and soil requirements, harvesting, pests and diseases, their causes, symptoms, how they spread and preventive and control measures. Developed by Bivatec Ltd.</td>
<td>Accessed through Google play store, costs through data usage.</td>
</tr>
<tr>
<td>Dairy Live</td>
<td>Provides dairy producers interactive information on livestock events including pregnancy checks, vaccinations, semen inventories and breeding services through both computers and smartphones.</td>
<td>Accessible by downloading on Dairylive.com, onetime subscription cost of $459.</td>
</tr>
<tr>
<td>ICOW</td>
<td>Voice-based application provides information on animal breeding and feeding methods, users register animals free-of-charge and receive regular SMS updates, format available in different languages.</td>
<td>Accessible on USSD *285#, website at global.icow.co.ke, SMS is free.</td>
</tr>
<tr>
<td>Kilimo Salama</td>
<td>A climate-smart crop insurance scheme that enables producers to insure their agricultural input investments against adverse weather conditions and provides SMS messaging as seasonal insurance contracts are formalized.</td>
<td>Distributed through participating agrodealers and other participating retailers.</td>
</tr>
<tr>
<td>M-Farm</td>
<td>An e-commerce tool for Kenyan farmers using Safaricom; SMS from: 20255, and receive information on the retail price commodities, linked to buyers, allows purchase of farm inputs from manufacturers at discount.</td>
<td>Available through Safaricom via SMS for $0.01 for registration and $0.01 per usage.</td>
</tr>
<tr>
<td>M-Shamba</td>
<td>Regular SMS provides subscribers with information on production, harvesting, marketing, credit, weather and climate; customized to location, subscribers share information; accessible through smart and low-end phones.</td>
<td>The application is accessible through Safaricom, costs through mobile data usage.</td>
</tr>
<tr>
<td>MbeguChoice</td>
<td>Provides users with information on changing weather patterns, identifies drought-tolerant crop varieties recommending the top five varieties depending on location and altitude.</td>
<td>Download from mbeguchoice.com and Google app, costs through mobile data usage.</td>
</tr>
<tr>
<td>Mkulima Young</td>
<td>Connects young farmers and those aspiring with each other in a virtual space. This app provides an exclusive farmers marketplace where producers meet the buyers. An initiative by ACLECOPS.</td>
<td>Accessed through Google play store, costs through data usage.</td>
</tr>
<tr>
<td>Urban Farming</td>
<td>Provides information on vegetable production through interactive smart phone reminders, identifies common pests and disease, identifies “organic” options, and provides recipes.</td>
<td>Accessed through Google play store, costs through data usage.</td>
</tr>
<tr>
<td>Vet Africa</td>
<td>Provides diagnosis of livestock illness and identifies treatment options, intended for veterinarians, animal health professionals, agrodealers and producers, developed by Cojengo.</td>
<td>Accessed from cojengo.com, allows 15 entries before charges begin.</td>
</tr>
</tbody>
</table>
An intermediary approach to school-based, online E-Teaching is the establishment of WiFi systems that allow electronic devices to interact with one another, including a server containing large databases of educational material, without necessarily being connected to the worldwide web; however, this option restricts access to information and does not apply to more remote E-Learning. One important factor within schools that limits online E-Teaching capacities is the frequency and scheduling of online teaching sessions when the facilities are spread too thin across numerous instructors and classes.

E-Learning as advanced by STEP applies to secondary school students of participating schools and school systems. It is prompted by online E-Teaching materials as led by the instructor, in many cases via home computer systems and mobile electronic devices. As it is promoted by STEP, E-Learning is intended to both contribute to students’ learning experience and the growing culture of lifelong learning, particularly with agricultural production and agribusiness skills. For practical purposes, it is separated into online and offline E-Learning (see Figure 1).

Within the context of distance learning among secondary students in African public schools, a severe limitation exists in their access to the internet and adequate online computers and other suitable devices (Burns, 2020; Mukuni, 2019). Internet access requires payment, and the poorest households have to balance this cost with other more pressing demands. Another factor in rural areas includes how best to combine instructional schedules and home routines as stay-at-home youth are increasingly held responsible for household and farm chores (Lowe & Phiona, 2017; Vargas-Lundius & Suttie, 2014). A partial list of the 12 digital applications providing agricultural support available in Kenya and elsewhere appears in Table 2. In many cases, these applications have both offline and online features, where routine queries are handled through resident databases while the more complex features are uploaded and then responses downloaded, often seamlessly. Examples of this software include diagnostic services where plant and soil conditions (e.g. pests or disease and deficiency symptoms) are photographed, electronically diagnosed, and recommendations issued.

Similar applications assist in agribusiness planning, but when used to acquire market intelligence or conduct E-commerce, direct internet access is required unless interactions are based solely upon Short Message Service (SMS) or USSD codes (Unstructured Supplementary Service Data). But even offline applications must be loaded in the first place and periodically updated, and that requires connectivity.

Strong overlap exists between STEP’s approaches for assisting youth along career paths in modern agriculture and the larger efforts directed to the digitalization of agricultural extension and marketing services (Tsan et al., 2019). Extension services in Africa have never been able to satisfy client demand (Rivera et al., 2005) and digitization is seen as the inevitable next development in agricultural information services. It is an opportunity that is especially the case fitting for youth who already possess skills in multiple device usage and are destined to become young commercial farmers and who already possess skills in multiple device usage (Beza et al., 2018; Edeoghon & Okoedo-Okojie, 2015).
### Table 3

**Structure and Components of the STEP Mobile Agricultural M-Learning Toolkit**

<table>
<thead>
<tr>
<th>Mobile component</th>
<th>Description</th>
<th>Cost (US$) and access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphone or Tablet</td>
<td>Many models available with at least 2Ghz RAM, 32GB storage, voice recognition included, Android version 9.0 upwards is recommended. Non-removable lithium batteries preferred.</td>
<td>$140 to $230 depending on model and capacity.</td>
</tr>
<tr>
<td>Protective case and cover</td>
<td>Provide good grip, is slim, fits perfectly on the device, gives good access to all buttons/connectors/speakers and adds enough protection against falls; especially at the corners of the device.</td>
<td>$35 in local stores.</td>
</tr>
<tr>
<td>Resident software</td>
<td>Inbuilt in device, upgrades and downloads possible, applications described in Table 2, linkage to e-Teaching platform required.</td>
<td>Varies among models.</td>
</tr>
<tr>
<td>Learning Management System/Platform (LMS)</td>
<td>Most modern LMSs are web-based. Allows one to create different types of users (hierarchy) and integrate course materials, articulate learning goals, align content and assessments, track studying progress, create customized test, allow different multiple question types, and answers, including essay ones. Can reach marginalized groups through special settings, streamline, feedback mechanism included.</td>
<td>Price depends on individual platforms/systems. STEP’s selection starts from $0.25 per subscriber. Subscribers require signing in, and internet connection.</td>
</tr>
<tr>
<td>Website</td>
<td>Publicly accessible, allows for interactivity between the site owner and site visitors/users. Includes features that can support distance learning programs and providing additional links to complementary sources of electronic information and the LMS.</td>
<td>Requires domain registration and hosting charges.</td>
</tr>
<tr>
<td>Voice recognition</td>
<td>Inbuilt in upper-end models or available in apps. Enables voice recognition in Google Voice, many voice-activated queries remain unrecognized because of a dissimilar accent of speaking.</td>
<td>Inbuilt in high end phones and integrated in some apps. Requires signing in/activation and internet connection.</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Enables accessibility to internet.</td>
<td>Based on monthly charges or pre-paid data subscription.</td>
</tr>
</tbody>
</table>
Having a handheld device that can serve as an all-in-one extension adviser and business organizer, offering both offline and online services is timely. The components of such a mobile “toolkit” assembled by STEP appear in Table 3. A powerful toolkit includes Artificial Intelligence Voice Recognition (AIVR) as illustrated in Table 2, where users ask questions and receive reliable audio responses and are linked to additional sources for detailed information.

The perennial problem of incorrect or contradictory information persists, and it is therefore important that device operators do not rely exclusively upon electronic information. They should instead use it to build a body of heuristic knowledge (Childs et al., 2013; Anderson & Freebody, 2012) that in turn allows them to serve as more reliable peers in the future. Another concern is that some sources of information are based upon restrictive ideology, overly politicized, or even result from mischievous or malevolent misinformation, and the abundance of information for the case of Online E-learning; so growing perspective is always required in interpreting and relaying electronic information and maintaining the focus of the main objective (Keshavarz, 2014; Meena et al., 2017).

The scope of the changes in ICT applications to agricultural instruction in Africa envisaged in Figure 1 is well beyond the scope of any one project, including STEP. STEP’s efforts are designed to better understand how best to undertake these changes, what options are available, and how to prioritize interventions that support youth pathways toward productive careers in modern farming and agribusiness. The approach also presents a model that weights key options among ICT applications, particularly E-Teaching vs. E-Learning and offline vs. online applications. E-Learning, through online applications, offers the greatest potential but is most difficult to achieve among low-income families.

The start of the COVID-19 pandemic prompted the abrupt closure of schools which disrupted classroom instruction, field practicals, and students’ young farmer clubs that STEP sought to strengthen in the partnering school systems. Pilot field demonstrations in modern agriculture that had been established were passed to caretakers rather than managed by students as first intended. The E-Teaching facilities provided to the schools were now no longer in use, and near-instantaneous demand was created for E-Learning for students that were confined to their homes.

Device ownership among students’ households immediately became an issue that was beyond the scope and ability of the project to rectify except in a superficial manner. Remote learning sessions on agriculture were encouraged, but the project was in no position to subsidize them as the public-school systems as a whole were incapable of offering such services. The project had however intended to examine the possibilities of handheld devices as agricultural learning tools, and so the development of mobile-based toolbox as described in Table 3 was accelerated, but these applications were only accessible by the minority of students who held smartphones or other compatible devices in the first place.

As the STEP website was being tested and improved, features that could support its role in distance learning programs were further developed. This entailed uploading the improved learning tools originally intended for use by the individual schools and providing additional links to complementary sources of electronic information and the Learning Management System (LMS). Several LMSs were tested and eliminated by accessibility; cost to the Project, and ease of use by students and
teachers; and functionality. STEP settled for Google Classroom, an interactive Edu-platform that has high student engagement, and automated classroom management tasks, including attendance. This brought together Online E-teaching with instructional support from instructors remotely, Online E-Learning for students already with access to gadgets, and Offline E-Learning. Only students residing in urban areas had better access to the Google Classroom owing to device ownership, connectivity, and parental and instructor support, and were also accessible for other forms of support, communication, and engagement via social media. In all the three intervention countries, Kenya had the largest number of students engaged in this way, with several in DR Congo, and barely any in Nigeria (data not presented).

Non-E-Learning is designed to serve the purpose of out-of-school learning (Figure 1). STEP designed a Home Agribusiness Challenge to improve students’ skill sets, enable them to assimilate learned content through the formal curriculum with actual experiences from home, move from conventional to space-optimized agriculture, creatively increase interest, feed homes, make some income, and bring about a gradual positive change of their perception of agriculture. STEP provided interested students with standardized packages modeled to their available home-spaces. These included seedlings of several crops and vegetables, manure, and fertilizer. No chemical-based products were included in the package for the students. Participating students receive communication via Short Messages Services (SMS) and WhatsApp from their Agriculture instructors to avail themselves to collect the inputs, all safety protocols against the spread of COVID-19 in place and observed. Good Agricultural Practices (GAPs) are communicated in the same channels and through social media.

STEP’s resolve is for E-Learning to contribute to students’ learning experience and the growing culture of lifelong learning, particularly about agricultural production and agribusiness skills. In effect, the STEP project that started six months earlier pivoted to adjust its efforts towards confronting the greatly altered COVID-19 learning environment but was in a weak position to offer scheduled electronic learning to students that lacked internet access.

**Recommendations**

The widespread attention to E-Learning that was accelerated by COVID-19 must coincide with efforts to promote device ownership and improved infrastructure for easier internet access. In addition, the importance of hands-on learning must not be overlooked and some form of home practice is encouraged. As a result, several parallel skills are reinforced including digital literacy, communication, time management, and practical analyses despite the closure of schools. The means to achieve this homeschooling balance should be further explored.

The restrictions to internet access by a large majority of the students should be overcome through the promotion of Offline E-Learning, particularly via applications loaded into handheld mobile devices that are periodically updated through WiFi access. The means to organize these updates within the context of lower-income African communities requires further attention.

An ongoing evaluation system should be incorporated to ensure improved, sustainable delivery of reliable applications, as well as offer access to monitor skills development of learners. In many cases, this involves improved computer literacy among instructors.
To tackle the hurdles faced by school closures, upgraded instructor workstations established within school computer laboratories should be redirected toward home-based E-Learning. This requires that a balanced assortment of software applications be adopted and mobile-based all-in-one toolkits for agriculture students and young farmers be designed and distributed. This approach offers benefits into and beyond the COVID-19 aftermath.

Conclusions

While the various digital applications offer exciting implications for agricultural modernization, they must be kept in perspective, both in terms of E-Teaching and E-Learning. E-training is intended to supplement practical understandings and experiential learning, not replace it. Students of agriculture should spend as much, if not more, time engaged in field practicals as in front of screens. While young farmers should be proud of their digital toolkits and the number and types of applications they contain, the device itself should be used in a way that supplements farm productivity and food systems transactions, not replace them. This “reality check” applies to the anticipated COVID-19 aftermath where a boost in agricultural modernization is needed. The focus must remain to digitize the next generation of farmers and agribusiness persons for productivity to secure Africa’s economic future with the recognition that digital tools complement production operations in terms of better farm planning, field diagnostics, and market intelligence, but does not replace them. These digital technologies then serve to enhance the quality and impact of agricultural teaching and learning for food security and rural development in Africa through effective interventions in their design and use.

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Disaster Management During Tropical Storm Karen: The Story of Trinidad Extension

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Abstract
The purpose of this study was to investigate the weather-related disaster preparedness and response strategies of agricultural extension professionals in Trinidad during Tropical Storm Karen (TSK). Trinidad faces perennial flooding, and Trinidad extension professionals have often been involved in the management of weather-related disasters. TSK was contextualized as a case study, and a qualitative approach was used to investigate the lived experiences of the extension professionals who directly assisted with managing the event. Semi-structured interview data were collected, along with concept maps and participant-rendered drawings. Each interview was compared with the participant’s concept map and drawing, while the constant comparative technique was used to evaluate the interview data among the participants to derive themes. Data were collected remotely using internet platforms due to the COVID-19 global pandemic. Findings indicated that disaster preparedness was strategized through field activities, including collecting data and providing disaster advice to clients. Disaster responsiveness was strategized through field actions, primarily through field evaluations for subsidy claims. In addition, related to disaster response, extension professionals faced various challenges in responding to TSK, most notably, the inability to access appropriate transportation. The findings of this study can guide the government of Trinidad and Tobago in bolstering the disaster management strategies of the country, as well as inform regional disaster management plans in other Caribbean countries.

Keywords: Tropical Storm Karen; disaster preparedness; Trinidad Extension; Caribbean
Introduction

On September 22, 2019, the Office of Disaster Preparedness and Management (ODPM) and the Ministry of National Security placed Trinidad and Tobago on a red alert after local weather was forecasted to worsen into Tropical Storm Karen (TSK) (Golembo et al., 2019; Moreno, 2019; Phillip, 2019). After landfall, TSK impacted many areas of North and Central Trinidad to the point of community evacuations in some areas (Phillip, 2019). Beyond the reports of damaged residential property, the agriculture industry in Trinidad faced damages to agricultural lands, crops, livestock, and the fisheries sector by way of sunken fishing vessels (Brackett, 2019; Caribbean Catastrophe Risk Insurance Facility, 2019; Connelly, 2019a, 2019b; Floodlist, 2019; Rampersad, 2019; Sambrano, 2019; Watson, 2019). One newspaper reported upwards of $24 million United States Dollars (estimated) in damages due to Tropical Storm Karen (Nicholas, 2019). For Trinidad’s landmass, this can be considered critical economic damage. MALF urged farmers to make claims at extension offices for agricultural losses due to TSK (De Souza, 2019).

TSK was not Trinidad’s only recent experience with disastrous flooding. Around mid-October in 2018, consistent heavy rains from Tropical Storm Bret gave way to the worst widespread flooding, landslides, damaged property, and agricultural loss that Trinidad experienced in over 50 years (CARICOM Today, 2018; Wilkinson, 2018). Over 3,500 homes and 120,000 individuals were affected by the flooding, with ripple effects to other economic sectors, like transportation and manufacturing (Achong, 2018; Dixon, 2018; Ragoobir, 2018). After the disaster of 2018, local, regional, and international agencies, including the Pacific Disaster Center (international) (PDC Global, 2019), the Caribbean Disaster Emergency Management Agency (regional) (Caribbean Disaster Emergency Management Agency, 2019), and the Organization of Disaster Preparedness and Management (ODPM) (local), assisted Trinidad with managing disasters.

The effects of Tropical Storm Bret in 2018 immediately triggered the development of new disaster management strategies by the government in Trinidad. Regional and international organizations were also involved in developing new disaster management plans after this event. Ramjattan et. al. (2018) highlighted the need to clarify the roles of extension professionals since extension activities in Trinidad are ambiguous at times. Additionally, there are projections that weather-related disasters will intensify for the country (Middelbeek et al., 2014), while annual disasters still occur. These factors suggest that the agricultural sector in Trinidad, affected by perennial flooding, requires competent disaster management. As such, researchers evaluated the disaster management strategies employed by extension professionals in Trinidad during TSK in 2019.

Literature Review

Trinidad & Extension

The Republic of Trinidad and Tobago consists of two islands in the Caribbean with a total land mass of 1,759 square miles. Based on the former plantation system of the 19th century, the agricultural sector in the country consists of small-scale farmers on parcels of land, less than five acres in size (Ganpat, 2013). Agriculture in the country historically contributed around 1% of total gross domestic product (GDP) to an oil-based economy (Seepersad & Douglas, 2002; Shik et al., 2018). Trinidad...
and Tobago has been considered a net food importer, making any agricultural production critical to surviving trade shocks or fluctuations in the global food market (Narine et al., 2019; Shik et al., 2018). Adverse weather conditions have historically impacted the agricultural sector on both islands (Roopnarine et al., 2018; Shik et al., 2018). The islands experience two weather seasons: a dry season from January to May, and a rainy season from June to December (McShine et al., 2019). Hurricane season exists from August to November (McShine et al., 2019). Additionally, close to 50% of Trinidad is affected by perennial flooding (Roberts, 2013; Roopnarine et al., 2018).

While one main government manages the economy of both islands, the agricultural sector is managed differently (Narine, 2018). Agricultural extension in Trinidad is managed by the Ministry of Agriculture, Land, and Fisheries (MALF) (Narine, 2018). Tobago agriculture is managed under the Tobago House of Assembly (THA), which manages agricultural extension differently (Ganpat, 2013; Narine, 2018; Parker, 2016; Ramdwar & Stoute, 2015). The regional administration units of MALF are responsible for frontline extension with farmers, which include farm visits (Narine, 2018; Seepersad & Ganpat, 2008).

Each of Trinidad’s eight counties has its own extension office which provides administrative services, accommodates farm visits, and arranges training for farmers, among other crop and livestock services (Narine, 2018; Parker, 2016; Seepersad & Ganpat, 2008). There were 90 frontline extension professionals who mainly used face-to-face methods of contact, each serving approximately 600 farmers (Ramdwar & Stoute, 2015; Ramjattan et al., 2017; Roberts et al., 2016; Strong et al., 2014). In terms of disaster management, extension professionals in Trinidad are expected to assist the government by assessing the financial damage to farms, necessary for farmers to claim reimbursement (“Barrackpore farmers report,” 2017).

**Disaster Management**

Disaster management can be described as “a set of rehearsed actions which will reduce the likelihood of a disaster occurring and further also reduce the extent of damage should a disaster occur” (Asamoah et al., 2018, p. 219). While several disaster management models and theories exist, Jaques (2007) posits that most models take a linear approach, or propose stepwise method of disaster management. However, the Jaques (2007) relational model of crisis management proposes that the phases of disaster management often overlap. The relational model contains four disaster management clusters (crisis preparedness, crisis prevention, crisis management, and post crisis management) in two distinct phases (pre-crisis management and crisis management). The crisis preparedness cluster considers planning processes, training, systems, and manuals. The crisis prevention cluster focuses on emergency response and early warnings among other elements. The crisis management cluster considers crisis recognition, system activation, and crisis management. Finally, post-crisis management focuses on evaluation of the crisis management process, post-crisis impacts, and recovery. The subsequent study was based on the principles of the Jaques (2007) relational model.

Part of the disaster management process for extension professionals in Trinidad was providing information to clients. Providing information to farmers on disaster risk mitigation was found to empower Caribbean farmers and improve
disaster management success (Shannon & Motha, 2015). Shannon and Motha (2015) also stated that extension organizations should work closely with agrometeorological agencies to translate information from these agencies to farmers and encourage relationships to promote disaster resilience. These findings also aligned closely with research by Hasan and Bart (2006) who concluded that technical advice is critical in disaster management in Bangladeshi agriculture. Researchers in South Africa highlighted that extension provided advice during disasters, and extension clients act on the advice provided to improve disaster outcomes (Kgakatsi & Rautenbach, 2014).

However, disaster management support for extension professionals is still a concern. Ramjattan et. al. (2018) stated that Trinidad extension professionals operate without clear directives. Regarding disaster preparedness, Ganpat et al. (2018) found that most extension officers in Dominica had no support for their physical needs in light of Tropical Storm Erica in 2015. Telg et al. (2008) found that among 328 extension faculty in Florida, 94% of respondents knew of the existence of a Florida extension disaster handbook, which contained plans and procedures to manage disasters. However, more than 60% of the respondents either never used the plan, or used it minimally, while approximately 69% of respondents never received training on using the handbook (Telg et al., 2008). Eighmy and Hall (2012) and Kerr et al. (2018) also echoed the importance of disaster planning in disaster management for extension.

Regarding disaster training, Ganpat et al. (2018) found that 67% of extension officers in their study were exposed to disaster management training. However, respondents indicated that they still needed hurricane disaster recovery training (Ganpat et al., 2018). Ricard et al. (2017) found that 79.4% of extension professionals in Connecticut needed disaster training. Ricard et al. (2017) also found that most respondents were unsure of disaster preparedness training availability. However, 88% of respondents in the study indicated that they either agreed or strongly agreed that there should be training available. Additionally, 81% of respondents would welcome disaster training for their job (Ricard et al., 2017). Telg et al. (2008) found over half the extension faculty and directors in the study needed training for personal stress, and personal needs during hurricane relief efforts in Florida. Eighmy and Hall (2012) reported that extension staff were trained on the use of new disaster resources, which involved family preparedness, community strengthening, and emergency planning.

In summary, Tropical Storm Karen damaged the agricultural sector in Trinidad in 2019, which lead to the mobilization of extension professionals to manage their clients’ needs during the disaster. This response came after a similar, but more destructive disaster in 2018. However, support for extension professionals in the country is still a concern. Researchers have identified various needs of extension workers during disasters across various regions, most of which highlighted the need for disaster management training. Given that extension professionals in Trinidad act in various capacities during the disaster management process, the current study covers the disaster preparedness and response strategies they employed during the TSK event for Trinidad extension professionals.

**Purpose & Research Questions**
The purpose of this study was to determine the Trinidad extension professionals’ disaster preparedness and disaster response strategies during Tropical
Storm Karen. Specific research questions were as follows:

- **RQ1:** How did Trinidad extension professionals strategize weather-related disaster preparedness concerning TSK?

- **RQ2:** How did Trinidad extension professionals strategize weather-related disaster response after TSK?

**Methods**

Researchers used a qualitative approach for this study. Qualitative research allows researchers to extract data on participants’ lived experiences and the meanings associated with those experiences (Elkind, 1964; Englander, 2016; Merriam & Tisdell, 2015). Events (like weather-related disasters) that impact social norms have guided researchers to take an inductive approach to their studies, where themes or concepts were derived from evaluating data (Ary et al., 2010; Creswell & Plano-Clark, 2017; Thomas, 2006). Through the lens of a phenomenological case study, researchers intended to explain the essence of human experiences by providing a rich understanding of the experience from the perspective of research participants (Ary et al., 2010; Moran, 2000). A case study is a research method that emphasizes the details of a single event in context (Dooley, 2002). Contextualizing for case studies has been identified by several authors in research methodologies, where the parameters of the case study are defined (Ary et al., 2010; Baxter & Jack, 2008; Creswell & Plano-Clark, 2017; Gillham, 2000; Merriam & Tisdell, 2015; Yin, 2009, 2016).

Since the research subjects were in a different country during the travel-restricted COVID-19 pandemic, participants were invited to download the Zoom® software on an electronic device from which to conduct the interviews. Alternatively, an intermediary in Trinidad provided a device with internet, a camera, and software to participants for the interviews. The contingency provided all participants with access to the communication technologies for the research.

The data collection process started with semi-structured interviews conducted by the lead researcher, followed by requests for concept maps and participant drawings. A two-week gap occurred between the interviews and the concept maps and drawings. This interview-then-drawing method has been used by many researchers as a measure of participant reflection in the post-interview period (Ångström-Brännstrom & Norberg, 2014; Guillemin, 2004; Kearney & Hyle, 2004; Parrott, 2019). The concept maps and drawings were collected electronically.

**Sample Selection & Inclusion Criteria**

The sample population consisted of MALF extension professionals who worked through TSK and at least one prior weather-related disaster. The final sample included extension officers, an agricultural assistant, and extension directors who supervise extension officers. While frontline extension officers directly manage flood claims, extension directors provide directives on how to proceed with disaster management. Official Ministry permission to collect data from employees was requested before data collection began. The Ministry also issued a non-disclosure agreement to restrict the publication of sensitive information.

The lead researcher utilized a snowball sampling technique to recruit participants. The non-probability sampling technique helped researchers identify key informants, who provided rich data on the research questions (Ary et al., 2010). The lead researcher sent an initial email or text message to the potential participants, and reminder emails followed every five business days of non-response.
Semi-Structured Interviews

The researchers used semi-structured interviews to initiate the research. Interviews are one of the most widely used data collection strategies in social science (Ary et al., 2010; Dillman et al., 2014; Merriam & Tisdell, 2015; Plowright, 2011). Having guiding questions to encourage responses, while retaining the flexibility to probe further into the discussion, remains a major advantage of semi-structured interviews (Longhurst, 2003; Whiting, 2007). Additionally, participants may provide unguarded responses, which can lead to collecting valuable data (Ary et al., 2010; Merriam & Tisdell, 2015).

Two semi-structured interview guides, one for field professionals (extension officers and the agricultural assistant) and another for extension directors, were developed for this study. The two guides were alike, except when referring to the status of the extension professional. Experts in the field of qualitative research have discussed the benefits of having respondents exposed to a uniformed line of inquiry (Ary et al., 2010; Creswell & Plano-Clark, 2017; Dillman et al., 2014; Plowright, 2011). A panel of disaster management, research methods, communication, and extension experts from the [University] assisted with the development of the guide. Additionally, consultations with Trinidad extension professionals also assisted with finalizing the interview guide. These professionals were not included in the study sample.

While the interview guide encompassed six sections, sections two and three directly related to disaster preparedness and disaster response, respectively. The questions in these sections were based on the preparedness and response segments of the Jaques (2007) relational model. The questions on disaster preparedness considered disaster preparedness strategies, preparedness training, challenges in preparedness, and lessons learned from previous disasters, among others. For example, one question in this section read as follows: How did you, as an extension professional, prepare for Tropical Storm Karen? The questions on disaster response considered response strategies, challenges in disaster response, lessons learned, and responding to future weather-related disasters. For example, one question from this section read as follows: Based on your experience in responding to past weather-related disasters, how did you respond differently during Tropical Storm Karen?

Concept Maps

The lead researcher issued a request for participant-rendered concept maps as part of the data collection strategy. Concept maps can be defined as a schematic device outlining the interconnectedness between concepts within a given context (Butler-Kisber & Poldma, 2009; Daley & Milwaukee, 2004; Kinchin et al., 2010; Novak & Cañas, 2006). Concept mapping has been used in both qualitative and quantitative data collection (Atkinson et al., 2019). Additionally, qualitative researchers employed concept maps in qualitative research to supplement interviews since the 1970s (Butler-Kisber & Poldma, 2009; Wheeldon & Faubert, 2009). Visual modes of inquiry in qualitative approaches suggests that multiple realities and methods of understanding exists in the constructivist epistemology (Butler-Kisber & Poldma, 2009).

For this study, respondents were asked to draw a concept map to review what was covered in the interview. Each respondent was provided with an instruction sheet and examples of concept maps to frame their own map. The provided
examples were not associated with weather-related disaster management. Butler-Kisber and Poldma (2009) highlighted that concept maps can be constructed by hand or by using software. Therefore, two digitally rendered concept maps, and two hand-drawn concept maps were presented to the respondents as examples.

**Participant Drawings**

Participants also were asked to draw an extension professional assisting with managing TSK. Initial uses of drawings for collecting data was achieved by Goodenough (1962) in the Goodenough Draw-a-Man test (Caskey & Yeo, 2020; Williams et al., 2011). The test has since been rebranded for use in research with children and adults (Adamis et al., 2016; Atanu, Dogra, & Das, 2011; Bat Or & Ishai, 2019; Calvo, 2017; Del Greco et al., 2018; Guillemin, 2004; Klingemann & Klingemann, 2016; Moagi, 2014; Stewart & Brosh, 1997). Authors have used drawings as data collection tools in natural disaster research, including art therapy after natural disasters (Lee, 2018), impact of cyclones (Haring & Sorin, 2016), the depiction of Hurricane Katrina (Kelley-Romano & Westgate, 2007), earthquakes in Haiti (Brolles et al., 2017), and disaster trauma (Roysircar et al., 2019).

A benefit of using drawings in qualitative research is that it moves beyond verbal expression (Filhol et al., 2020; Moagi, 2014). Additionally, humans draw to grasp their physical and natural environment, while reflecting on life events (Calvo, 2017; Hsu, 2017; Kearney & Hyle, 2004). Each participant was given examples of drawings that were based in agriculture.

**Data Analysis**

The data collected during the interviews were transcribed for analysis. Using the constant comparative technique, each respondent’s transcript was compared to every other transcript in the data set. Data chunks were labelled with a code, then grouped by category, and then provided with a theme (see Table 1). In transcribing, start/stop sentences, filler words, and stutters/repeat terms were removed (Widodo, 2009). Verbatim transcriptions are common in qualitative research. However, denaturalized transcripts maintained the substance of the interview, while enhancing the efficiency of transcription and analysis (Halcomb & Davidson, 2006; Oliver et al., 2005). The participant-rendered concept maps and drawings were evaluated to identify visual representations of codes revealed from interviews specific to each participant. Numbers were appended to areas of interest on the illustrations and aligned to codes from the interview analysis at the bottom of each sketch. An example of the participant-rendered drawing analysis is provided in Figure 1.

**Table 1**

<table>
<thead>
<tr>
<th>Coding Sample for Disaster Preparedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data chunk (Sample Quote)</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>Even before (disaster occurs), from the time rain falls and we heard there is rainfall in a certain area, officers are required to go into what is called a reconnaissance to see if they have any flooding in a particular area</td>
</tr>
</tbody>
</table>
Data chunk (Sample Quote) | Code | Category | Theme
--- | --- | --- | ---
We have a crop registry in place that takes place before any natural disaster situations. That’s one of the ways we prepare | Data collection

So now fast forward to 2019, before the start of the rainy season, that’s when we tried to get information out to people about, you know, what to look out for and what to do.

Basically what we try to do is encourage proper drainage ensure that farmers try to make a difference. | Advising

Figure 1

**Participant-Rendered Drawing Analysis Sample**

![Participant-Rendered Drawing Analysis Sample](image)

RQ1 (preparedness)
- 8- preparedness planning (lack of information)
- 12- preparedness planning (no planning policy)

RQ2 (response)
- 2- field work
- 3- crops under water
- 6- lack of physical access

**Results**

Thirteen participants comprised the final sample: two extension directors, 10 extension officers, and one agricultural assistant. Pseudonyms were used to maintain respondent anonymity. Collectively, the sample consisted of six men and seven women from six extension locations in Trinidad. Their experience ranged from
under five years of experience to more than 20 years of experience in extension.

**Preparedness Strategies During TSK**

The theme that emerged from the data concerning RQ1 was that disaster preparedness was strategized through fieldwork during TSK. This involved collecting data on current farming activities to prepare for flood claims, and providing advice on preventative agriculture to mitigate against disaster damage. Most participants reflected this information in the concept maps. For example, Chris said, “Most of my farmers are in low-lying areas. So, I basically tell them what crops to plant and what not to plant at all because they normally do get flooded.” Chris also mentioned to manage livestock during the interview, and both the importance of managing livestock and land preparation were reflected in Chris’s concept map. In Chris’s concept map (see Figure 2), the *extension officer* was at the top of the diagram, with a direct connecting link to the *farmer*.

The diagram then forks into *Livestock Farmers* on the left, and *Crop Farmers* on the right. Under Livestock Farmers, Chris pointed to the advice he provided to farmers in preparation for TSK, such as referencing building structures and situating livestock to minimize losses. Similarly, the crop section of the concept map pointed to crop varieties that are resistant to floods, as well as land preparation techniques that can mitigate against disaster damage considering TSK.

**Figure 2**

*Chris’ Concept Map*
Data collection as a category in disaster preparedness was highlighted by the mention of a crop registry. As Samantha stated, “We have a crop registry in place that takes place before any natural disaster situations. That’s one of the ways we prepare.” Roy also mentioned the crop registry: “We would have started the crop registry maybe last year (2018) because in previous years we would have had difficulties in assessing what the farmers would have had planted when the crop is totally covered (in water) for a couple of days.”

In addition to crop registry data, extension professionals conducted reconnaissance work prior to TSK as a measure of observational data collection. As Crystal said, “Even before (disaster occurs), from the time rain falls and we heard there is rainfall in a certain area, officers are required to go into what is called a reconnaissance to see if they have any flooding in a particular area.”

Beyond data collection, extension professionals also provided advice on mitigating TSK to farmers. Ashley mentioned:

Before you would hear about farmers having flood damage, that kind of thing, but I think that one [2018 flooding disaster] was like a big whammy in the country. And then we realize how unprepared the Ministry was… So now fast forward to 2019, before the start of the rainy season, that’s when we tried to get information out to people about, you know, what to look out for and what to do.

Vince mentioned that, in most cases, providing advice is the best course of action: “Basically, the most we do is try to advise them.”

Participants’ responses indicated inconsistencies in disaster planning at extension offices. Most respondents highlighted the lack of a disaster management plan for Trinidad extension, while others suggested that some preparedness planning was available. Tracy, an extension director, stated “There was no plan in place. The Ministry is just now doing a disaster plan. So there is no set structure in place saying you have to do XYZ and having first responders.” Other participants made similar statements that no disaster management plan was currently available, but that a plan was in progress where several stakeholders were contributing.

Respondents understood the importance of a plan. Steve talked about the human condition in disaster planning: “Actually there are things that you forget, it’s obvious, we as humans forget. So, if we have a plan or schedule, we should have everything listed.” To this point, Bill said, “Having a plan puts everything in place.”

Several respondents pointed to the need for consistent disaster management training. Ashley also said consistent extension-wide training is not available:

Nobody is trained, none of the extension officers are trained in disaster preparedness as it pertains to the agriculture community, and how to respond to it, what they should or shouldn't be doing, that kind of thing. There is no formal training that was ever done.

Response Strategies After TSK

A theme that emerged from the data concerning RQ2 was disaster response after TSK was strategized through field activities. The category concerning field evaluations for subsidy claims by farmers was the most
common among the respondents. Overall, Crystal highlighted extension’s process in response to TSK:

Ideally, when a (disaster) takes place, the farmers have seven days within which to come in and make a claim. After that, the officers are assigned to different areas where they would go out and do the evaluation. And they have, depending on the quantity (of produce), a specific time to come in and bring in the calculations. In relation to the actual compensation, they (extension professionals) have the instructions of how to go about doing compensation and they know what to look for in the field, etc. So once that comes in, we have a procedure now to evaluate that administratively to get it checked and double-checked by a number of people.

This response was consistent across all respondents and was represented in the participant rendered drawings. For example, Bill said, “As the storm passed, we went out and did a flood assessment…. And we have taken information of floods and affected areas and try to quantify produce and livestock as loss, and feed that information back to the office.” Figure 3 showed an extension professional in the field, with a data collection tool, and crops partially under water.

Some respondents expressed concerns about the post-disaster data collection process. Tracy stated that the current system of data collection was “archaic” and “inefficient,” referring to the paper-based data collection process. Another theme that emerge from the analysis was that extension professionals faced various challenges in responding to TSK. The categories supporting this theme included the lack of resources and challenges in conducting field work. While collecting flood damage data, respondents noted resource deficiencies, like appropriate transportation and human resources, as major challenges in responding to TSK. For example, Bill stated:

Number one, the quantity of farmers that was affected for the number of officers that we have to do this assessment to start with is …. really, really difficult. And then, to get into some of the areas, I mean, not all the officers will have 4x4 vehicles, and even some 4x4 vehicles can’t even access some of the affected areas. So that was basically a specific challenge, on my side as an officer.
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Additionally, personal protective equipment (PPE), such as boots, coveralls,
umbrellas, and raincoats, for responding to TSK was also suggested to be lacking for most respondents. Samantha said, “(PPE is) something that comes with the job, but we were not able to get those facilities for the longest while.” Similarly, Fabian said, “Another thing is, a while now, our county didn't get any kind uniform package in terms of boots and safety stuff.” Financial resources were also highlighted as a resource constraint by a few participants.

**Discussion, Conclusions, & Recommendations**

The relational model proposed as presented by Jaques (2007) proposed that the different phases of disaster management may overlap. In this study, disaster preparedness strategies were implemented to improve the success of Trinidad extension’s response to TSK. Disaster preparedness has been highlighted as a critical aspect of disaster management (Henkel & Marvanova, 2019; McLean & Whang, 2019; Nyanga et al., 2018). The fieldwork conducted by extension professionals in the preparedness phase of TSK was conducted to improve the response efforts. Advice on flood-resistant crops, mitigative planting practices, crop management, and mitigative livestock practices was provided to Trinidadian extension clients prior to TSK. This is consistent with previous research by Shannon and Motha (2015), Hasan and Bart (2006), and Kgakatsi and Rautenbach (2014). The data collection performed in the preparedness phase also assisted with accuracy of the post disaster flood claims by farmers. Therefore, disaster preparedness in Trinidad extension was performed to improve the disaster outcome during TSK for farmers.

Concerning the inconsistencies in planning, access to a disaster plan was an element in disaster management stated to be important for disaster preparedness (Asamoah et al., 2018; Eighmy et al., 2012; Pitt & Treen, 2017). In this study, respondents said disaster plans and disaster planning were lacking. However, some participants mentioned receiving some training on disaster planning. Asamoah et al. (2018) suggested that when planning is inconsistent, the results of disaster management is difficult to predict. Further, implementing a poor plan can lead to reduced success (Pitt & Treen, 2017).

Eighmy and Hall (2012) stated that all educational materials and training were uploaded to an accessible website for extension professionals in North Dakota during a 2009 flood event. A similar solution may be applicable to Trinidad extension for future disasters as a starting point for country-wide disaster management resources. Beyond this, Ministry-wide disaster preparedness training should be implemented to increase the chance of disaster management success across all counties.

Regarding disaster response, all participants revealed that their response strategy involved field work through farm visits and damage estimates for flood relief disbursement. The literature concerning Extension professionals in disaster response point to field work in one form or another (Kerr et al., 2018; Telg et al., 2007, 2008). Data collection allows disaster response teams to make informed decisions with clients (Bonanno et al., 2010; Everhart et al., 2019; Merwaday et al., 2016). Additionally, data collection helped with accessing resources from stakeholders, like state or national funds (Chen et al., 2006; Downey et al., 2018; McLean & Whang, 2019). The lack of appropriate resources in disaster response impedes the success of disaster response efforts (Asamoah et al., 2018; Cummins & Wooden, 2014; Medford-Davis & Kapur, 2014; Norris et al., 2008; Tran et al., 2009). While most participants
mentioned resource constraints, the paper-based data collection method and lack of data collection technologies like unmanned aerial vehicles (UAVs) appeared to hinder response strategies during TSK. UAVs can maximize the data collection process, especially considering the potential for limited field access and time constraints for flood claims after disasters.

The concept maps and drawing data aligned with the data from the interviews. However, some participants provided more data than was originally presented in the interviews. This can be explained by the reflective period between the interviews and the drawing data. When research participants are allowed time to reflect, additional information may surface (Calvo, 2017). Additionally, drawings are alternative reflection tools, thereby soliciting ideas that are different from interview data, but adds to the overall data pool (Calvo, 2017; Caskey & Yeo, 2020; Del Greco et al., 2018; Guillemin, 2004; Hsu, 2014; Moagi, 2014).

Future research can be conducted on disaster management programming to determine the effect of new planning strategies at MALF, eliminating the inconsistency in disaster planning, preparedness, and training provided to Extension professionals involved in disaster management. Further, assessing the efficiency of current data collection strategies compared to digital data management can be assessed to determine the benefit to Trinidad extension during future disasters. Roberts et al. (2016) identified that extension systems across the Caribbean were similar. When weather-related disasters occur, they rarely affect only one country in the region. Therefore, the methodology can be adjusted and applied to other Caribbean countries to investigate disaster management as a region.

A consistent disaster management plan can bring clarity to those on the front lines of disaster response in Trinidad. The results of this study have been shared with the Ministry to improve disaster management resilience of extension professionals in Trinidad. This will also have a ripple effect for the agricultural sector, the food import bill, and government expenditure on agriculture. Finally, regional governments can use the results of this study to maximize disaster management activities in the future.

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