Building Resilience in Small Island Developing States: Social Media during the 2017 Atlantic Hurricane Season

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ABSTRACT

There are growing concerns that future Atlantic hurricane seasons will be severe and unpredictable due to underlying factors such as climate change. The 2017 season may offer a range of lessons, especially to small island developing states (SIDS), who are looking to build community resilience and heighten community engagement to cope with disaster. While many SIDS utilise a range of media and technology for these purposes, there has been a recent uptake in the use of social media, which may have further potential to support their goals. This paper scopes the use and users of social media in the case of Antigua and Barbuda during the 2017 Atlantic hurricane season. Through a series of qualitative interviews it explains the role that social media currently has, and concludes with suggestions for its improvement in future seasons that are contextualized over the disaster lifecycle phases.

Keywords

Social Media, Hurricanes, Resiliency, Community Engagement, SIDS.

INTRODUCTION

In the past decade, social media are being relied upon for a number of issues during natural disasters. This has become more prominent due to a rise in the number of global hazards (Huang et al., 2010). As a result of various underlying issues, such as climate change, these are becoming more severe and frequent than previously expected (Kappes et al., 2012). Many of these issues can be linked to the intensification and unpredictability of the Atlantic hurricane season, for example fluctuations of the El Niño phenomenon and variations in the state of the tropical Atlantic (Lim et al., 2018). In particular, small island developing states (SIDS) in the Caribbean have experienced record-breaking seasons in recent years: the 2017 season being the most destructive to date (Shultz et al., 2018). During the 2017 season ten hurricanes formed, six of which were categorised as being major (i.e. a hurricane that reaches sustained surface winds of at least 50 m/s, labelled as category 3-5 on the Saffir-Simpson scale). The named hurricanes Irma, Harvey and Maria were infamous not only in their collective damages and mortalities (exceeding $US477.5 billion and 400 deaths at a current estimate by the UNISDR), but also because of their quick succession which affected disaster response and recovery efforts in a range of countries.

The use of social media and wider Information Communication Technologies (ICT) has proved to be valuable in many disaster literature case studies (see for example Reuter & Kaufhold's history of significant disaster studies, 2017). They offer a range of benefits for individuals: most notably they are free to access with an internet

connection, require little authentication to use, and can be used in a real-time setting (Luna & Pennock, 2018). Especially in SIDS, the increased uptake of social media has been a significant development. This has come as a result of investing and improving communications infrastructures with the aim to build better connections within communities, as well as wider connections to surrounding SIDS (Thompson, 2015). This is particularly important for SIDS in the Caribbean as the islands feature compressed spatial scales, meaning that local level is often no different from national level (Krüger et al., 2015). Furthermore, the uptake of social media in such areas has naturally led to the expansion of resilience and preparedness information online (Demchak et al., 2010). The potential for social media as a tool to facilitate hurricane resilience, as well as encourage and enable community engagement throughout all phases of the disaster lifecycle, is therefore a priority for SIDS (Pelling & Uitto, 2001; Shultz, 2018).

The use of social media for disaster management still however faces barriers. These are often complex and multi-faceted, and may depend on a range of underlying factors such as political landscapes, socio-economic development, population demographics and structural design of social media platforms themselves (Olteanu et al., 2015). Expressly, given the annual reoccurrence of the hurricane season, the functions that social media may offer resilience and community engagement need to be continually reassessed given the evolution of digital technologies (Battistoli et al., 2018; Chacowry et al., 2018; Shultz et al., 2016). This is paramount to the continued development of SIDS, as well as ensuring that risk from the hurricane season is managed effectively – an important consideration given the unpredictable nature of future seasons (Zolnikov, 2018). This paper seeks to explore the role of social media in SIDS during the 2017 Atlantic hurricane season, focusing on its current roles for community engagement and resilience building. It employs a mixed methods approach that uses data from multiple online sources, which includes Twitter, blogs, news/TV media and radio content. It additionally draws qualitative interview data from the Recovery of Caribbean Community from Hurricanes project (RECCOH) funded by the HEIF Research Collaboration Stimulus Fund (2017). Using these, the paper scopes the role that social media had in resilience and community engagement in Antigua and Barbuda as a case study example of a Caribbean SIDS, as these islands experienced some of the highest damages during the 2017 season.

SOCIAL MEDIA FOR BUILDING RESILIENCE

The concept of resilience can be traced back to disaster management literature during the 1980s. Resilience to disaster may now be defined in a number of ways. Individual resilience is the ability one has to "bounce back" after a disturbance (Houston et al., 2015). Community resilience however, while following the same premise, can be more complex. This is often defined by how well structures and networks may return to normal life after disruption (Demchak, 2010). Houston et al. (2015) go on to explain that community resilience encompasses more than resilient individuals alone, and should instead be viewed as a network of adaptive capacities and activities that is not static end-state. There are four key considerations for community capacity argued by Norris et al. (2008): information and communication, community competence, social capital and economic development. Pfefferbaum et al. (2013) stipulate that community resilience includes four additional considerations: connection and caring, resources, transformative potential and disaster management. Furthermore, the National Research Council (NRC) contend that community resilience needs to incorporate social subsystems (such as economics and civil society) and sectors also (such as business, healthcare, media and religious organisations) (Houston, 2015).

The considerations for building community capacity have been supported in the past decade by the use of social media and other similar technologies (Alexander, 2013; Huang, 2010; White, 2014). These have enabled a range of beneficial features that are well-documented in wider disaster literature. Dufty (2012) posits that social media have already illustrated their value in emergency management, and are steadily becoming more apparent in the specific fields of resilience and community development in recent years also. This, in part, is due to the fact that social media can easily form "communities of practice" (Wenger et al., 2002) or "relational communities" (Paton & Johnston, 2017). Within these networks, individuals are connected by similar concerns and seek out information, as well as further ways of learning from their experiences (Wenger, 2002). Further insight into social media's beneficial attributes has been scoped in other notable case studies. The degree to which social media constitutes a resilient information conduit was tested during the case study of the Australian wildfires in 2013, and found that the speed of online communication influences the level of resilience a network has (Dufty, 2012). This was also highlighted in (St. Denis et al., 2014) study of the Colorado floods. Comparing the resilience of two communities who experienced wildfires in Canada revealed that social capital and underlying factors create a complex dynamic for social media networks that have the power to shape the resilience and engagement a community has (Cox & Perry, 2011). Finally, studies such as (Baharmand et al., 2016) emphasize the importance of tailoring community resilience using the case study of Nepal after the earthquake in 2015.

Case studies in smaller countries and SIDS have found that the use of social media for building resilience and

community engagement differs from larger geographical areas for a number of reasons. SIDS are more vulnerable to disasters due to their small size, remoteness, environmental factors, limited resources, politics and insular demographics (Pelling, 2001). A study in Barbados highlighted that efforts to improve community resilience must be mainstreamed into governmental policy in order to be more effective, and that an emphasis needs to be placed on international efforts that reduce the effect of economic and environmental pressures stemming from changes in climate change and tourism (Pelling, 2012). Similarly, studies in the Cayman Islands revealed that institutional networks and resiliency had a larger role to play in wider community resilience than previously expected, and should seek methods of supporting networks both within their hierarchies as well as nationally (Tompkins, 2005). Furthermore, a case study in San Juan encourages SIDS to incorporate and develop other channels of communication that can be used to build resilience in the pre-disaster phase of the Atlantic hurricane season, as well as a range of other functions in the during and post-disaster phases: this is vital to islands where phone networks suffer damages from hurricanes (Bui, 2018).

THE STUDY

Antigua and Barbuda: Rationale for Analysis

There is a growing need to understand the role that social media has in SIDS, particularly in the area of resilience and community engagement during disasters (Shultz, 2016). Predominantly the issue of climate change is a driver for this as the IPCC stated in 2001 that small low lying islands will be increasingly exposed to vulnerability from hazards caused by climate change. Furthermore, there is question as to the severity of future Atlantic hurricane seasons as the 2017 season was unpredictable and intense. One country that was particularly badly affected by the 2017 season was that of Antigua and Barbuda. Situated in the Atlantic Ocean where it meets the Caribbean Sea, Antigua and Barbuda are a part of the Lesser Antilles and are subject to the annual Atlantic hurricane season. Consequently, the country can be considered to have a fairly high level of resilience (Lam et al., 2015).

This case is valuable to study for a number of reasons. Firstly, sociological issues such as its small population size, mean that disaster response and recovery volunteers are drafted in from neighboring islands and countries. This means that community engagement is more complex, and must take into account the relationships between individuals from many different Caribbean islands (Thompson, 2015). While traditionally media such as phones have been used for this purpose (Cottle, 2014), the increased use of digital technologies and social media on the islands are now being relied upon more heavily due to ease of access, and the ability to share information in multiple formats (Mackay et al., 2018). Secondly, economic issues such as low development and self-sufficiency, mean that methods of community resilience and engagement are often through face-to-face interactions or free technologies. This means that the utilization of social media as a further channel for communication is an interesting and original phenomenon to study. Thirdly, the islands are subject to a shifting political landscape, which is an observed factor in the effectiveness of building resilience. This is especially prominent as the country's government is beginning to invest more in hurricane resilience and preparedness information hosted online, as well as setting up Facebook pages, groups and other resources for crisis communications (Friedman & Look, 2017). Finally, the isolated nature of the islands results in logistical issues during disasters, as well as representing a valuable study into the use of social media in SIDS specifically.

METHOD

Data collected in this paper was funded by the HEIF stimulus fund as part of a larger project entitled "The Recovery of Caribbean Communities from Hurricanes" (the RECCOH project). This is an interdisciplinary project (i.e. employing expertise from varying departments such as Public Policy, Oceanography, Social Sciences, and Data Science) based at the University of Southampton UK, which gathered qualitative interview data from a range of individuals who experienced the 2017 Atlantic hurricane season in Antigua and Barbuda.

Qualitative Interview Participants and Procedure

The RECCOH project has a partnership with the Antiguan High Commission, which were the first source of expertise for sourcing interview participants. Through consultations with relevant representatives who had local knowledge of Antigua and Barbuda, and of communities of interest, a shortlist of potential interview participants was created. Inclusion criteria dictated suitable interviewees must be over 18, were residents of Antigua and Barbuda, had experienced the 2017 Atlantic hurricane season, and had used social media during at least one stage of the disaster lifecycle. Exclusion criteria for participants was being under the age of 18, not being present during the season at all, or subject to any mental or physical illness that may cause anomalous

results. According to the World Bank Group (2018), 73% of the population of the country has access to the internet, with some 63% of citizens owning a mobile device. This provided an appropriately large pool from which to source interviewees.

Snowball sampling was then employed on the shortlist where individuals were asked one by one to take part: this was done via email or face-to-face which were deemed the most appropriate for small island communities in an isolated region (Marpsat & Razafindratsima, 2010). Snowball sampling was used as a means to ensure that the most relevant individuals were contacted, and that the researchers had control over the data saturation point (Baker & Edwards, 2012). The individuals approached were from a range of different backgrounds and vocations, which allowed for a broader picture of the hurricane season to be revealed. Interviewees were invited to participate in a qualitative interview, lasting between 30-60 minutes, by either word of mouth or email (if this information was publicly available). This ensured that high quality data was collected from the most relevant individuals who originated from a variety of backgrounds. It is important to note however that the data collected is not treated as a representative sample of the Antiguan and Barbudan total population. Interview questions included "In what ways did you personally use social media during the 2017 hurricane season?", "Did you create or disseminate any resiliency or preparedness information on any social media platforms during the season?", and "In what ways do you feel that hurricane resiliency can be improved by the use of digital technologies?".

Sampling increased the likelihood that individuals were a part of networks of interest who engaged with disaster preparedness and response. Members of the public were included to ensure that a commentary of the users of social media could be recorded to reflect how organisations and government were using digital technologies during the disaster. Finally, sampling allowed control over the data saturation point, and for interviewees to recommend other individuals who may be important for the project. It is important to note however that this data is not treated as a representative sample of the Antiguan and Barbadian total population. Interviewees included, but were not limited to, humanitarian aid workers and volunteers, governmental employees, civil servants, local business owners, governmental ministers, ex-politicians, religious representatives, and general members of the public. Interview questions were open ended, which allowed for individuals to convey their own personal experiences and emotions towards the hurricane season. Due to the large volume of rich data, interview results were processed initially by using keyword identification techniques to highlight popular areas of discussion (Ryan and Bernard, 2003). Once popular keywords had been identified, a cutting and sorting method was used to find thematic data tied to the keywords, and to sort responses by theme accordingly.

RESULTS

A total of more than 90 individuals took part in qualitative interviews. These originated from more than 20 different vocations, including general members of the public. During the interviews participants scoped out the way in which social media was used during the 2017 Atlantic hurricane season – specifically throughout the pre-disaster, during, and post-disaster phases. A focus was placed on the use of social media as a means of supporting community resiliency, as well as a tool for public engagement during crises itself. This was shaped by open-ended interview questions such as "did you create or share any information on social media which could be used for preparedness or resiliency efforts?" and "please describe any groups or networks that you are a part of which supported the sharing of information during the hurricane season". A summary of interviewees is shown in Table 1.

Interview results indicated that the role of social media itself in SIDS must first be understood before it can be analysed in the context of community resilience and engagement during the hurricane season. Antigua and Barbuda have in recent years been expanding the number of phone networks and quality of communications infrastructures as a result of the government placing more emphasis on communication. Therefore, in the past five years more individuals have access to the internet, and by extent social media - throughout the year as well as during the hurricane season. This is an important consideration for SIDS who must invest in pre-disaster functions such as preparedness, resilience and mitigation efforts in order to reduce risk in future seasons. While social media is evidently having a more prominent role for these purposes, there remain several issues that can be built upon to ensure that social media can be used more effectively as a tool for disaster management purposes.

Table 1. An overview of the interview participants interviewed regarding the 2017 Atlantic hurricane season, their vocation, and the number of participants for each of these.

Organisation	Brief Overview	No. interviewed
The Antigua and Barbuda Meteorological Centre	The National Meteorological Centre for the Country.	1
The National Solid Waste Management Authority	A service to provide residents with an integrated, cost effective solid waste management system that follows the guidelines of environmentally sound principles.	5
The University of the West Indies	The main university of the Caribbean islands with four landed campuses, and many open campuses.	8
Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs	A service for the application of modern and emerging practices designed to strengthen food security initiatives, efficient land use management and sustainable development of natural resources.	9
The Ministry of Education	A service to offer the highest quality education possible to children and young people, from pre-school to post graduate level.	4
ZDK Radio Station	A local radio station available to the residents of Antigua and Barbuda.	1
ABS Radio Station	A local radio station available to the residents of Antigua and Barbuda.	2
The Observer Radio Station	A local radio station available to the residents of Antigua and Barbuda.	2
The Barbuda Council	The Council runs the internal affairs of Barbuda. Members are elected by the registered voters of Barbuda, with the Parliamentary Representative (MP) and the Senator, who is nominated by the Council, as ex-officio members. The council administers and regulates agriculture, forestry, public health, public utilities and roads as exclusive powers, and raises and collects revenue to meet expenses incurred in the performance of its functions.	9
Red Cross Antigua	The Antiguan branch of the Red Cross which provides services in the areas of health, welfare, disaster relief, first aid and youth development.	1
The WAITT Institute	The institute endeavours to ensure ecologically, economically, and culturally sustainable use of ocean resources. The Institute partners with governments committed to developing and implementing comprehensive, science- based, community-driven solutions for sustainable ocean management.	5
The Community Development Project	A branch of the Ministry of Social Transformation of the government dedicated to supporting individuals and communities who are vulnerable in society.	4
The Antigua Lions Organisation	The Antigua Lions Club is a non-profit service organization helping people in Antigua & Barbuda and the surrounding communities.	1
Antigua Public Utilities Authority	The Antigua Public Utilities Authority is a tripartite government statutory agency set up under the Public Utilities Act No. 10 to ensure that consumers receive the best possible value in Telecommunications (including mobile & internet), Electricity and Water services.	3
Digicel Telecommunications	One of the major telephone and internet communication providers in Antigua and Barbuda.	5
Antigua and Barbuda Individual Politicians	A collection of individuals from various governmental departments.	6
Antigua and Barbuda ex-politicians	A collection of individuals who were once in office in the country, including the ex-prime minister.	3
The High Commission	The High Commission for Antigua and Barbuda affairs.	4
Local Business Owners	A range of individuals that own business across Antigua and Barbuda, ranging from Taxi drivers to shop owners.	12
Members of the Antiguan and Barbudan Public	A collective of individuals who experiences the 2017 Atlantic hurricane season in Antigua and Barbuda.	20

Social Media for Hurricane Resilience

Antigua and Barbuda have a high overall community resilience, primarily due to the fact that the Atlantic hurricane season is an annual phenomenon. This predates the incorporation of social media, where, due to the remote nature of SIDS, expertise was exchanged in face-to-face settings and handed down over many generations (Krüger, 2015; Shultz, 2018). The gradual addition of social media as an emerging channel for communications within Antigua and Barbuda has presented many new potential services and resources for disaster management. During the pre-disaster phase (where in this context the season begins in June) there are a range of media disseminated to the public on multiple channels. These provide step-by-step disaster preparedness information in case of a hurricane, and are generally considered a good way to support community resilience. Overall awareness of the hurricane season is similarly high, with organisations, departments and bodies who manage issues relating to hurricanes began their warnings in advance. Furthermore, there is a

growing concern present during all interviews which has stemmed from the unexpected severity of the 2017 season. It is evident that both individuals and communities alike now have an even more heightened awareness of future seasons due to the unpredictability of underlying factors such as climate change.

"We just don't know how severe the next hurricane season will be. We hear it will be worse, then we hear that it will be better. Having a bad season again is scary, but the not knowing is scary too." – Local hotel owner in St. Johns, Antigua.

During the 2017 season interviewees explained that particularly on the social media platform Facebook a range of groups, pages and communities were formed that sought to share the same preparedness information. In the during disaster phase the uses and users of social media shifted: instead, WhatsApp (as well as satellite phones) were more extensively used as opposed to Facebook due to phone networks being cut-off for several days after the landfall of hurricane Irma. Despite their value however, it was the local radio stations that remained at the center of community resilience. Interviewees explained that preparedness information as well as real-time updates created by organisations who were managing hurricane Irma (i.e. the MET office, the national office for disasters, humanitarian aid organisations) directly communicated via walkie-talkie, WhatsApp or phone calls to the radio stations. Radio stations in turn provided a 24 hour broadcast service to the Antigua and Barbuda public which relayed the information with the hope of supporting individual and household resilience. This is an important distinction separate from community resilience, as during the landfall of the major hurricanes citizens were confined to their own homes and were essentially isolated.

"We all listen to the radio once the storm has hit. You have no idea what's going on out there but you can hear the winds and the sounds. People ring in if the phones aren't down and share their own stories and its comforting you know – it's comforting to hear that you're not alone" – Local resident in Sweete village, Antigua.

The geography of the islands impacted the management of the hurricane season, as although the residents are familiar with the topology and oceanography, there is a lack of official maps and data that would have been valuable to teams sent out for repairs (Lam, 2015). For example, the flatness of Barbuda meant that communications infrastructure was destroyed by hurricane Irma, having no physical resilience. Consequently, repairs and substitute technologies needed to be placed in areas that would be more sheltered from subsequent hurricanes in the season – however this was lacking, and so manual scouting of areas and local knowledge was relied upon instead. In the post-disaster phase of hurricane Irma, repairs were made to the damaged communications technologies and networks which allowed for social media use to gradually increase once again. The expected uses of social media during this phase scoped by previous studies such as (Gray et al., 2016; Houston et al., 2012), for example re-connecting with loved ones or sharing personal experiences, became the main role of social media. This was mainly categorised by citizen to citizen communications, summarised by a citizen who stated:

"As soon as the internet came back we were straight on Facebook, straight on WhatsApp, straight on the phones. I borrowed someone's phone to WhatsApp my family, and when mine was finally working again I lent it to others too. We were trying to find out what happened to everyone on Barbuda."

Alongside citizen-to-citizen crisis communications, interorganisational communication also become one of the biggest uses as bodies managing the disaster then began to communicate between themselves, rather than feeding all information directly to the radio stations. Local government employees from the Department of Social Transformation stated that "We began using WhatsApp and direct Facebook messages between governmental departments because it was a simpler solution." Government employees went on to explain that communications to the surrounding islands and other SIDS in the Caribbean was of paramount importance as well as interorganisational communications, considering the level of damages sustained. This is a function of social media unique to SIDS experiencing disaster, who are more isolated and resource-starved than most other communities in more accessible regions (Thompson, 2015).

"We had no contact with Barbuda for two days. We tried all communication we had access to but it wasn't until the prime minister actually flew over in a helicopter that we actually knew what the situation was" – National Office for Disasters (NODs), Antigua.

Social Media as a Tool for Community Engagement

The community engagement of Antigua and Barbuda was affected in a number of ways: the sociological, political, and economic spheres each shaped the flow of community engagement on social media. These in turn shaped how social media channels were used, and by whom, throughout the disaster lifecycle phases. For example, interviewees from the Department of Education noted that students, who had more of a reliance on digital technologies compared to the rest of their families, tended to rely on these channels for communication. This was further evidenced by interviews with the University of the West Indies who explained that due to this,

hurricane updates and campus closures were announced via social media as a priority method of communication to students. Sociological issues that shaped online community engagement were also apparent in the structure and nature of offline community networks. In Antigua and Barbuda community networks have close bonds, especially considering the small population of the islands. This means that a positive community attitude towards helping one's neighbors is fostered, and is subsequently transposed into crisis situations also. Interviewees explained that this community nature is the most prominent in the post-disaster phase where local representatives from communities communicate to wider networks in order to share knowledge, aid with emergency response, and communicate wider disaster management efforts.

"The whole community bonded together. We had people bringing food from all over – to the point where we had too much food to know what to do with it!" – The Department for Social Transformation, Antigua.

Political factors affected community engagement also. Tensions between the Antiguan and the Barbudan council reached a boiling point after the landfall of hurricane Irma on Barbuda. The damages to the island were so severe that the entire population had to be evacuated to Antigua, and is still in the midst of the recovery and rebuilding phase with just 400 citizens out of 1800 returned to living on the island as of June 2018. Many Barbudans feel victimized by the manner in which the Antiguan government have responded to the disaster: likewise, many Antiguans feel that their efforts to aid the island have been undermined by Barbudans. Nearly a year after hurricane Irma these political tensions are still present, with little chance of being solved in the near future. As a result of the shifting political landscape social media became a lens for community engagement where individuals shared personal opinions, questioned the political motives, and probed the socio-technical responsibilities of organisations and departments responding to the disaster. Social media provided a function that allowed communities to engage with other individuals in order to discuss these factors, but most importantly still enables this function in the present-day.

"I still use WhatsApp to stay in contact with friends and family who have moved back to our island. It allows us to stay in contact and still feel close while we are still going through the process of re-building our lives" – Barbudan citizen who was evacuated to Antigua during hurricane Irma.

Finally, similar to many disaster case studies, the economics of the islands have had an effect on community engagement and resilience. Static economic resilience does not completely restore damaged capacity and subsequent full recovery of a community. The recovery process is dynamic and depends heavily on the nature and relationships of stakeholders and other economic influences, as well as on public policy. Certainly in the case of Antigua and Barbuda there has been a need for both adaptive and inherent resiliency, where the balance between these has yet to be struck. Inherent resiliency is built into the system (for example building up emergency supplies and import planning) which is the result of community engagement with other SIDS and suppliers. Adaptive resiliency is a result of improvising under extreme conditions, for example coping with a lack of resources after disaster. In the case of Antigua and Barbuda these have fed into one another. After the levelling of more than 80% of the buildings in Barbuda, timber and other building materials were a necessity for rebuilding. Through inherent capacity the government had access to a small stockpile of these, however more was needed. Adaptive capacity was then undermined by a lack of communication and community engagement with other SIDS in the Caribbean. This meant that other islands, similarly affected, had bought out all other building resources. This resulted in Antigua and Barbuda waiting for several months after the hurricane before they could begin to rebuild, having lacked the capital to import resources from further afield. It was also noted by employees of the National Office of Disaster Services (NODs) that improved interorganisational crisis communications may have been valuable in keeping up-to-date with the level of resources available – with some events suggesting that direct messaging on social media would have been a preferable method of communication if the networks had still been unavailable.

"By the time we began to scope what resources we needed to import we found that no one had any stocks left. We hadn't had much communication with the other places affected like Puerto Rico and Dominica because we were focusing on our own issues, and because of that lack of engagement we had to cope without those resources for longer than we would have hoped." – NODs, Antigua.

BUILDING RESILENCE: USING SOCIAL MEDIA AS A TOOL IN FUTURE SEASONS

The case of Antigua and Barbuda have highlighted several key areas where the use of social media could potentially be improved as a tool for building resilience and community engagement during the Atlantic hurricane season. These can be focused on each of the disaster lifecycle phases. Firstly, during the pre-disaster phase, developing a set of educational resources hosted across different websites and social media channels could be used to heighten community and individual resiliency. Secondly, in the during disaster phase, protocols for improving crisis communications could be introduced or invested in during normal times. Finally, in the post-disaster phase, methods of facilitating community engagement could result in supporting different types of

resilience.

Developing Social Media Resources for Hurricane Education

Education has been identified as a priority for the further development of community resilience in Antigua and Barbuda by a range of organisations, departments and institutions. These authorities have recognized that social media is increasingly becoming a part of every day life in the country, thus they have the opportunity to intervene and to improve the online content and information available – especially to the younger generations who are now being brought up with smart phones and other technological devices. In a range of interviews these authorities independently stated that the following actions would be beneficial in supporting hurricane resilience especially during the pre-disaster phase:

1. Compile a series of educational videos hosted on social media pages and groups (created by authorities and shared to relevant online networks), as well as organisational websites, that use a range of different types of visualizations (Becker et al., 2013). This is designed to maintain interest on a topic that has a high awareness in the community already.

2. Tailor these educational videos to specific age brackets of the population so that a demographics' background knowledge can be accounted for, i.e. younger generations should be more technologically interactive (Stewart et al., 2008).

3. Ensure that the core message for the educational videos remains the same despite what audience or age bracket it has been targeted at, avoiding issues such as misinformation and building trust in authorities management (Becker, 2013; Chandra et al., 2011, 2013).

4. Make sure that each of these resources has the ability to be downloaded or stored in an offline format in case of the collapse of networks in the future (Springgate et al., 2011).

5. Ensure that each authority that collaborates to manage the hurricane season hosts these resources on any online channel that they use uniformly (Springgate, 2011). This reduces the risk of making safety-critical decisions for the public as no matter where they seek information they are guaranteed the correct and relevant information (Chandra, 2011).

Social Media for Improving Crisis Communications

In light of the communications issues that were revealed during the 2017 season, the interviewees unanimously agreed that crisis communications within communities, between the islands of Antigua and Barbuda, and between the country and other SIDS needed improvement. This in turn may support both adaptive and inherent resilience, as well as fostering better areas for collaboration and information exchange in online communities during disasters. Interviewees explained that during the disaster phase in particular, the following actions would be beneficial for continuing to support resilience and community engagement during crises:

1. Developing a clear inter-agency communications plan and enforced protocol between the relevant organisations who respond to the events of the hurricane season (Kapucu, 2006). This should involve contingency methods of communications such as satellite phones or VHF radio systems in the case that networks collapse (Hagen et al., 2017).

2. Appointing a few select organisations to act as communicators to other SIDS and countries pre-event (Kapucu, 2006). These should employ teams dedicated to communication throughout the event to disseminate information (Palttala & Vos, 2012), and to stay informed about other areas of the Caribbean which are likely experiencing the same hazards.

3. Creating a "consolidation of lessons" methodology during each hurricane season. This compiles the most important and unexpected lessons learnt from organisations and the public, and should be shared interdepartmentally in order to be taken into account in future crisis communications to reduce risk (Jin et al., 2011).

Social Media to Facilitate Community Engagement

Finally, it has become apparent that communities are increasingly using online communication channels, alongside more traditional means such as radio, to facilitate engagement. With the increased use of online resources an importance needs to be placed on online spaces to support the resilience and community engagement already being fostered in real-life. Particularly in the post-disaster phase, there are a number of suggestions that interviewees put forward to achieve this:

1. Communities in real-life have representatives to liaise between the public and organisations during disasters (Becerra-Fernandez et al., 2008). This needs to be supported in the online channels as well as in the offline, for instance selecting a local community volunteer who tracks the proceedings of relevant social media channels who disseminate real-time hurricane updates.

2. The creation of online spaces specifically designed to act as public forums for the discussion of disaster-related topics, such as organisational responsibilities or voicing personal experiences (Simon et al., 2015). This allows channels dedicated to the dissemination of information to be kept clear of irrelevant engagement information.

3. Maintenance of suggested online forum spaces by governmental representatives who may then crowdsource ideas, voice concerns for the consideration of policy makers, and engage in two-way communications with the public to ensure that a sense of full community engagement is fostered (Soden & Palen, 2016).

CONCLUSIONS

The management of the Atlantic hurricane season is a challenge for many Caribbean SIDS. For Antigua and Barbuda in particular, there are a range of issues that affect the resiliency the population has to hurricanes as well as the community engagement during such crises. In recent years, social media have shown potential as an additional channel for a range of disaster related functions and services: Facebook groups and pages are offering preparedness information, WhatsApp has been relied upon for coordination and planning, and to an extent Twitter has been used for real-time weather updates. However, there remain barriers to the effective use of social media. Predominantly, the damages and collapse of phone networks and infrastructure undermined social media communications during hurricane Irma, subsequently shaping community resilience and engagement in the later stages of the disaster lifecycle. Similarly, political tensions, economic investment and relationships, and environmental data all represent issues with the potential to shape future hurricane seasons.

In response to these issues, social media can be utilised in several key areas to support future resiliency towards hurricanes, and to ensure continued and heightened community engagement. The creation of educational videos and resources, hosted online and across a range of channels, may support this in the pre-disaster phase. The development of communications protocols that take into account the variability of services may similarly achieve this in the during disaster phase. The creation and maintenance of online public spheres on social media may contribute to voicing and discussing concerns in the post-disaster phase and upholding community engagement. Ultimately, the lessons learnt from the 2017 season are important for the management of future seasons. The unpredictable and severe nature of the 2017 season has the potential to be replicated due to underlying issues such as climate change, which makes preparedness and resiliency efforts for SIDS a priority. Social media can be used in conjunction with existing disaster management plans to reduce the risk posed to SIDS, which may offer such communities better ways to mitigate, manage and respond to future Atlantic hurricane seasons.

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