

When information becomes action: drivers of individuals' trust in broadcast versus peer-to-peer information in disaster response

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Information and communications technology (ICT), primarily mobile telephones and social media, is increasingly important in crisis and disaster response in developing countries. This fact raises an important question: in an information environment that includes traditional media such as radio and television, who are the people that trust information from ICT enough to act on it during a disaster? Drawing on a case study of and original survey data from the island nation of the Independent State of Samoa, this paper yields insights into who uses new technologies, particularly mobile telephones, to make decisions at the local level during crises such as natural disasters, as well as the socio-political factors that motivate their behaviour. The results add to the growing pool of knowledge on utilisation of ICT and new technologies in developing countries for disaster response, and provide practical information on the social and political factors that lead people to trust different information sources and media.

Keywords: disaster response, information and communications technology (ICT), natural disasters, politics, Samoa

Introduction

Increased global access to information and communications technology (ICT) is creating new opportunities for communities affected by crises and disasters to manage local responses and to reach out to governmental and international actors (Bott and Young, 2012). This paper draws on original survey data from and a case study analysis of the Independent State of Samoa¹ (hereafter Samoa), consisting of two main islands, Savai'i and Upolu, and four smaller islands in the Polynesian region of the Pacific Ocean, to address two questions: (i) while people with ready access to ICT, particularly mobile telephones, could use it to gather actionable information during a disaster, do they?; and (ii) who are the people most likely to trust ICT-derived information enough to take action, and what role do political and social contexts play in their decision? The case study and the survey data indicate that the majority of people still rely on traditional media such as radio and television, and the minority who depend on ICT do so since they prefer to gather information from familial and social networks. In some cases, furthermore, they lack trust in the central government.

While there are compelling examples of ICT being used by international and governmental organisations to manage crises and disaster recovery, less is known about whether *individuals* use such tools to make decisions during political or social emergencies. Since there is relatively little individual- and household-level evidence of which people use ICT to make choices about how to act during a crisis, this paper adds empirical evidence that reveals which information sources and media people generally trust enough to act on, and who is likely to act on information gathered using ICT, particularly mobile telephones.

The argument is framed using the literature on digital technology in disaster response and management to motivate an analysis of how and why people would use ICT during disaster response. Case study and original survey data from Samoa are then employed to explore how different factors among individual respondents affect information and ICT use. The data in combination with the case study yields new insights into peoples' adoption and trust in information from ICT, as well as the economic and socio-political factors that help to shape people's application of ICT.

The results of the case study and the survey data indicate that most respondents still rely heavily on traditional channels and official information sources during crises, such as broadcast media and government information, which is significantly different to many of the narratives concerning technology and humanitarian response from a decade or so ago. The findings indicate that levels of trust in central government to provide aid can be indicative of who will turn to ICT to gather information during and after a natural disaster.

ICT in crisis and disaster response: popular perceptions and empirical evidence

As access to computer hardware and mobile telephones has increased in developing countries since the late 1990s, a popular narrative has emerged regarding the idea that people can harness these technologies now to engage in economic, political, and social processes. Indeed, there are some truths in this account. Humanitarian organisations are increasingly integrating new technology into their fieldwork, and non-governmental organisations (NGOs) are increasingly using mobile telephones and social media to intervene at the local level to prevent disaster-driven crises from escalating into violence (Crawford and Finn, 2015). This narrative is not just prospective; agencies including the United Nations Refugee Agency (UNHCR), the United States Agency for International Development (USAID), and the World Food Programme (WFP) have invested significant resources in setting up innovation and ICT laboratories and hubs.² Consequently, a deeper understanding of who uses ICT in disaster-affected developing countries can have practical and theoretical value, especially since there is still a wide gap between access to mobile telephones versus mobile internet.

This section reviews the disaster response literature, focusing on ICT use in crisis response and management. While the literature on ICT in disaster response and

political participation draws predominantly on country-level event data, there is a mounting body of research on the micro-level aspects of ICT use in developing contexts. Next, the section provides definitions of technology, and specifically how the paper clusters *media* (such as mobile telephones and radio) and *sources* (such as government, reporters, and friends) of information. These clusters were the basis of the survey instrument, and are used to frame the empirical analysis. The case study that follows looks expressly at who employs ICT during disaster response, to understand better how the socio-political context affects ICT use at the individual level.

Changing access to technology, changing processes of social organisation?

Research on the use of ICT in crisis-affected settings has evolved significantly since the early 2000s. An active community of innovators has focused on using ICT to solve problems pertaining to disaster response and early warning by drawing on the concept of community resilience, arguing that increasing the capacity of communities to communicate among themselves would allow them to manage crises instead of relying solely on international actors (Meier, 2006, 2008). This type of analysis emerged at a time when the policymaking community was coming to grips with problems associated with country- and regional-level early warning programmes (Schmeidl and Jenkins, 1998; Austin, 2004; Wulf and Debiel, 2009). The confluence of problems with traditional early warning, the rapid increase in access to ICT in developing countries, and examples of ICT being used in disaster response in developing countries, such as after the earthquake in Haiti in 2010 (Norheim-Hagtun and Meier, 2010; Zook et al., 2010; Morrow et al., 2011), created a compelling narrative about the power of ICT to support local response capacity during crises.

Much research on disaster response has concentrated on how to integrate ICT and new technologies into institutional processes. Sagun, Bouchlagem, and Anumba (2009) describe the role of ICT in the flow of information during disaster response, explaining how information moves between local and national administrative levels, and demonstrate how ICT facilitates the flow of information during different types of disaster scenarios. The practicalities of institutional use of ICT in disaster response and management are also important, with Patricelli et al. (2009) exploring technical remedies to fill transmission gaps in ICT infrastructure following a disaster and Reddick (2011) highlighting the budgetary challenges relating to information technology (IT) and ICT upkeep and information management. Moreover, Houston et al. (2014) set out the specific ways in which agencies at different levels, from the local to the national, can incorporate social media in their disaster management information-gathering strategies. They note that social media is particularly useful for linking individuals to services, and in identifying and reconnecting families in disaster-hit regions.

The modern conception of ICT in crisis and disaster response tends to centre on social media and mobile technologies, including mobile telephones and tablet computers. SMS (short message service) texts and Twitter are two channels that are of

core interest to the disaster response community. SMS has particular advantages in that it links networks of people who ostensibly know each other personally, although disaster response agencies have used platforms that aggregate SMS text messages for large-scale outreach (see, for example, Meier, 2010). Twitter is a microblogging social media platform that networks people by interest. Although there are concerns about the verifiability and accuracy of information that flows through Twitter during disasters (Mersham, 2010), Mills et al. (2009), Kaigo (2012), and Spence et al. (2015) explain how such platforms can create backchannels for information-sharing across local networks that can be useful to first responders. In the context of this paper, these examples must be treated with a degree of caution, since they focus on developed countries. Nonetheless, modern ICT has demonstrated value in linking local social networks and providing alternative communication channels during natural disasters and periods of social duress (see, for example, Bilali, Vollhardt, and Rarick, 2016).

While these studies provide some generalisable empirical analyses of ICT and collective action in disaster- and conflict-affected settings, they do not speak to *who* the specific people are that act on digital information in such environments. Romo-Murphy, James, and Adams (2011) provide a model to show why this is important, having revealed in their survey research in Banda Aceh, Indonesia, how people gather information through different social networks, and the importance of radio in these communication processes. After a natural disaster or during a crisis, maintaining stability in the short term requires significant amounts of information-sharing at the inter-community and community-government level. It is important not only to understand these general patterns of information-sharing, but also to recognise which people use different information sources and media, and how the socio-political context in which they live affects their information-gathering decisions.

Defining technology and information-sharing

It is important to differentiate between the types of ICT, and how they are integrated in terms of information production and flow. This study utilises a heuristic developed by Martin-Shields (2016), similar to the one used by Warren (2015), which divides information media into *vertically* and *horizontally* integrated systems. Broadcast *media*, such as radio and television, would be *vertical* since the information is single-source, broadcasts down, and diffuses out. *Horizontal* media include cellular telephones, crowdsourcing platforms, and social media; these tools permit peer-to-peer information production and sharing. *Sources*, the institutions and people from which/whom information comes, can be vertical and horizontal too. Governments, news reporters, and political elites would be vertically integrated, whereas friends, family, and local leaders would be horizontally integrated. Sources always determine the integration where there is a mixture. For instance, in a situation where a vertical source uses a horizontal medium, such as a government social media feed, this would be a vertically integrated information stream since the source (government) is vertical. Figure 1 shows sources and media broken down by horizontal or vertical integration.

Figure 1. Heuristic of sources and media grouped by direction

SOURCE		MEDIA	
Vertical	Horizontal	Vertical	Horizontal
<ul style="list-style-type: none"> • Government • Reporters • Elites 	<ul style="list-style-type: none"> • Family • Friends • Local leaders 	<ul style="list-style-type: none"> • Radio • Television • Newspaper 	<ul style="list-style-type: none"> • Social media • Mobile telephone • Internet chat

Source: author.

The categorisation of sources and media as being vertical and horizontal guided the design of the survey that was administered in Samoa. The survey instrument and the definition of trust are covered in more detail later, but suffice to say at this point, people were asked about use and trust in relation to information gathered via the different sources and media listed in Figure 1 after a recent natural disaster. The objective was to differentiate between sources and media to identify whether there were social or political factors that influenced peoples' information-gathering and trust preferences.

Empirical strategy

The empirical strategy aims to address two gaps in the wider discussion about ICT in crisis and disaster management. First, do people generally use horizontally integrated communication media, the survey's proxy for ICT, to gather information and to take action during an emergency? Second, what are the political and socio-economic correlates for those respondents who are likely to draw on horizontally integrated information to make decisions? The following text sets out the expectations of the empirical approach, explains the case selection, survey strategy, and the results, and discusses why people may use ICT in crisis and disaster response.

Broadly speaking, with regard to how ICT fits into crisis and disaster management processes, more is known about macro- and institutional-level patterns than about subnational and individual-level patterns. National and cross-national empirical evidence indicates that ICT generally is not distributed in a way that, a priori, leads to it being used for something like disaster response (Weidmann et al., 2016), and there is little data on whether or not individuals trust information procured using ICT when they can access such technologies. To address this fact, the empirical approach of this study focuses on the contexts and the demographics of the individual technology user, to understand better how people acquire information during crises and which people are more likely to use horizontally integrated information to respond to them. The results presented relate to Samoa and the Pacific region, but the intention is to make the research approach as replicable as possible so that comparative work can be done in other parts of the world in the future.

A mixed-methods approach of case study and survey data analysis is employed here. Samoa serves as the case, with a discussion of the structure of the society and

the politics, and how these variables could influence information-sharing and organisation after a natural disaster. Survey data collected in Samoa is then used to analyse empirically the theoretical expectations raised in the case study. The case study and the empirical results are linked to practical issues concerning the use of ICT in disaster response in the discussion section below.

The case of Samoa: strong social networks facing natural disasters

Samoa is a Polynesian country with approximately 190,000 inhabitants, and a land mass of some 2,850 square kilometres. Cyclones pose the main threat, with the island group confronting annual storms; a secondary threat is tsunamis, since the bulk of the population lives along the coast. Cyclones are not the only hazard that can cause an emergency or disaster in Samoa: according to Meldau (2013), earthquakes, inland flooding, large-scale fires in the capital (Apia), and volcanic eruptions all pose potential systemic risks to the country (Government of Samoa, 2013). Cyclones have presented the most consistent threat to safety and security in Samoa and the wider Pacific Islands region. While there are multiple annual tropical depressions and Category 1 or 2 cyclones, there have been a number of storms over the past 30 years that have caused severe damage and led to significant economic losses. In a country with such a high-risk profile, it is important to understand the ways in which political and social networks are interwoven from the family level through to villages, and up to the national level, since this can affect which sources and media of information people rely on during a disaster.

In the modern era, there is a unicameral parliamentary system that operates in parallel with a traditional governance system called the *Matai* system. The latter is a title system in which each family bestows a unique title on a family member or selected important individual signifying family leadership (Hills, 1993). The family's *Matai* titleholder represents the family in village and local government, as well as in inter-village governance. In the *Matai* system, the family can choose to bestow the title on any person they select; this could be a biological family member, although it is not uncommon for a popular or respected non-family member or even a non-Samoan to be given a title (Hills, 1993). Titles can also be taken away if the titleholder does not meet the duties expected of them; this has ramifications not only for the family and village, but also at the government level, since one must be a *Matai* to run for and hold a seat in parliament.

These socio-political dynamics are important to any grounded analysis of vertical and horizontal information-sharing in Samoa in response to a natural disaster. Samoa is a particularly interesting case for researching ICT-based horizontal networks of information-sharing because of the central importance of the family unit in governance. *Matai* titles are based within the family unit, and, as noted, are requisite for someone to engage in local and national politics. This means that family units represent a large web of village political structures, and therefore information shared horizontally across family units using ICT could prove valuable and trustworthy. Alternatively, there is no history of strife between the citizenry and government

that could shake trust, so information gathered through vertical channels could also be considered trustworthy. As governance structures at the local and national level are grounded in the family-unit *Matai* system, and people can gather information from both horizontal and vertical sources and media, Samoa is an interesting context for studying what drives variation in information-gathering preferences.

John S. Odell's (2001) typography of cases is employed for the case analysis. He describes theory-building cases as either being 'theory-confirming' or 'theory-infirming'. Theory-confirming cases take a country where a phenomena is unlikely to manifest and test whether the phenomena does indeed manifest; if a phenomena manifests in a place where it is unexpected, then it is also likely to manifest in places where it is expected. Theory-infirming does the opposite: it starts with a case where a phenomena is likely to manifest, and if the phenomena does not manifest then the assumption is that it is unlikely to manifest in places where it is not expected.

In this analysis, Samoa is a 'theory-confirming' case, where a preference for horizontally integrated information is *not expected*; if it is observed, it means that one is likely to see it elsewhere. The kind of policy and market factors that attract media coverage and push international organisations to be experimental with their in-country programming are not extant in Samoa. Thus, the average citizen is less likely to have heard about ICT being used for governance, and by extension, he/she is less likely to view his/her mobile telephone or social media platform as a tool for managing or taking action in response to a disaster. While Samoa has a diverse telecommunications sector, with full mobile coverage and countrywide access to the internet, there have been no significant pushes to develop an innovation community along the lines of Kenya's iHub,³ or a constellation of NGOs with a mandate to use horizontally integrated technologies to manage natural disaster or governance challenges.

Furthermore, there are no political or sociological reasons that, a priori, would lead people not to trust the central government. Hence, there would be no pressure to seek information from horizontal sources and media. These factors tell us not to expect Samoans to use horizontal technologies for disaster response. Based on these assumptions, if people in Samoa do demonstrate a preference for trusting and acting on horizontally integrated information after a disaster, then it is possible that people in other countries will do so too.

Hypotheses

The first set of hypotheses responds to the overall question: do people prefer to make decisions using horizontally or vertically integrated sources and media? Theoretically, Samoans could opt to gather information from family and local governance networks, which would be horizontally integrated. The family network systems in Samoa underpin the entire political system; the Samoan political system is essentially a network of the *Matai* titles (Holmes, 1980; Hills, 1993; Tcherkezoff, 1998). Since most of the function of governance emanates from local-level *Matai* committees, it may be more efficient for Samoans to tap into their local familial networks to manage the post-

disaster setting before the government gets involved. Alternatively, the second hypothesis could be true if Samoans are willing to wait for the government to share information on the disaster response process. There is no history of political violence or ethnic cleavages in Samoa, and the government has proven reliable since independence from New Zealand on 1 January 1962, so its broadcasting services may be sufficient for most people as an information source during a crisis.

- H_1 : preferring family- or village-level information, Samoans trust horizontal information over broadcast media because their family and social networks are interwoven with village and district governance.
- H_2 : people trust vertically integrated broadcast media because they trust the government, making traditional information-gathering most efficient.

Hypotheses 1 and 2 are tested using basic descriptive comparisons of the preference of respondents for vertical or horizontal information sources and media. They are duelling hypotheses since we do not know respondents' general preferences for information trust and taking action.

- H_3 : people who trust/act on horizontal sources and media will have a preference for information from local *Matai*/familial networks, or lack trust in central government information.

Hypothesis 3 is explored using multivariate analysis, specifically penalised likelihood analysis, a variant of logistic regression designed to manage rare event bias in small samples.

Controls: age, gender, and income

As the study wanted to know who within the sample is likely to act on horizontally integrated information, and if there is a political or social influence on this decision, data were captured on other possible reasons why people may turn to ICT for information during a crisis.

Age is a popular differentiator between who uses and does not use ICT. Herring (2008) argues that the idea of youth as 'digital natives' is more of a popular idea than a theoretically grounded concept, asserting that more empirical research is required to understand fully how youth uses and experiences ICT in daily life. Overall, though, the data still indicate that youth is a major user of ICT, especially mobile telephones and social networking sites, and that this can be leveraged to engage young people in policy and development (Blanchard et al., 2008; Thackeray and Hunter, 2010).

The gender dimension of ICT access has been analysed critically in international development. A report by the United Nations Department of Economic and Social Affairs (2005) indicated that there was a distinct risk of a digital gender divide unless women enjoyed the same access to ICT as men. Best and Maier (2007) evaluate the use of internet cafes and computer access points, noting that in rural India, women

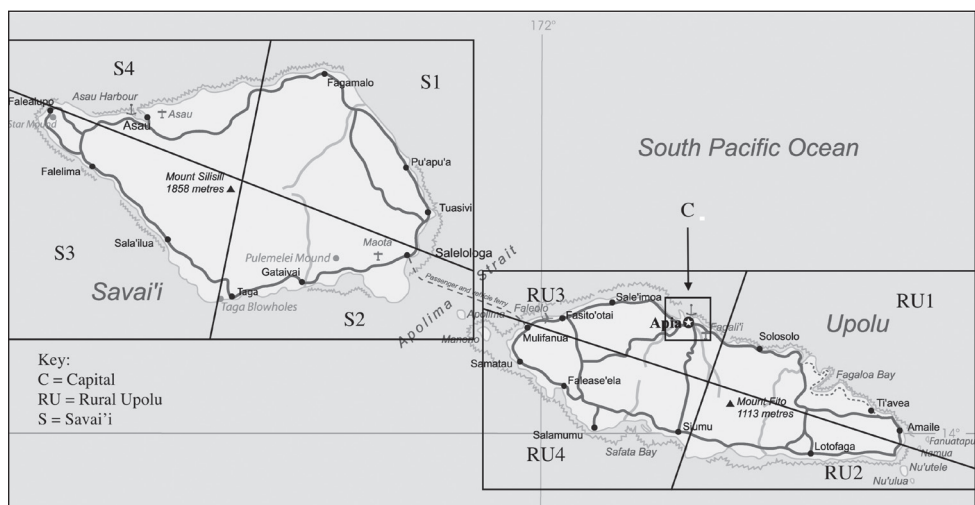
have unique patterns of computer use and internet access, particularly with respect to gender-based scheduling issues. While statistics on gender and ICT in development remain underdeveloped (Hafkin and Huyer, 2007), evidence from Muslim communities in India shows that when male and female students have access to computers and the internet, female students take greater advantage of the technology than do male students and benefit more from it (Khan and Ghadially, 2010).

The role of income and geography in whether people have access to and incorporate ICT in their daily lives is mixed. Tengtrakul and Peha (2011) found that income does not have an effect on whether people in rural Thailand decide to access the internet from home when they have computers and telephone lines already installed in the house. Selwyn (2004) and Fuchs (2008) contend that in general, there is a mixture of cultural, economic, and social forms of capital that denote how much access someone has to ICT. Adding to the complexity, Verdegem and Verhoest (2009) argue that the problem in many countries is less about who has access to ICT, and more about who are the non-users. Although there are intervening factors, the ability to afford access and to be located in a region that has the infrastructure to support connectivity are important. People with more money to spend are more likely to have access to a wider selection of information media. In Samoa, one gigabyte of mobile data can require expenditure of seven per cent of average monthly income.⁴

Sampling and survey data collection

The survey was administered nationwide, dividing the country's two islands into eight geographic regions, plus a special region for the urban capital area. Figure 2 shows the sampling geography.

Figure 2. Map of Samoan sampling regions



Source: Wikimedia Commons (https://commons.wikimedia.org/wiki/File:Samoa_map_800px.png) under licence (https://en.wikipedia.org/wiki/GNU_Free_Documentation_License); modifications by the author.

The total sample was composed of 400 respondents, of whom 150 came from the capital region, 150 from rural Upolu, and 100 from Savai'i. Notably, 31 surveys were excluded from the analysis owing to incomplete answers; the remaining 369 were included. The surveys were administered between 1 and 20 May 2014⁵ with the help of 10 enumerators from the National University of Samoa, under the management of members of the Faculty of Computer Science (as well as the author) and with the advice of the Samoa Bureau of Statistics. As the population is located on the coast, almost exclusively along two main ring roads, the randomisation strategy was to drive clockwise through each quadrant surveying all adults in alternating housing compounds until the target sample was reached. Follow-up surveys were performed on three Saturdays to gather male responses since many were out of the house during the week. Non-response was not a problem; indeed, when the team arrived in a village people often had to be turned away.⁶

The sample represents a cross section of the population; sample data are listed in Table 1. As with the general population, the sample is on the young side, and a larger number of females were sampled to capture data on gender differences in ICT use. Owing to the size of the urban respondent base, people with formal employment were oversampled; employment and economic activity in Samoa can assume forms that would not be confirmed as 'formal' in a Western setting. Tasks conducted around the household and plantation are considered as formal economic roles in a Samoan household structure; household income also is difficult to measure since many households receive cash from multiple sources outside of formal work. Mobile telephone ownership across the sample is high, as expected, but given the cost of data in Samoa, it is unsurprising how few respondents use internet-based social media tools.

Respondents were asked to answer the questions in light of their experience of Cyclone Evan in December 2012. In order to select a source or medium of information and then act on it, people have to trust that source or medium. Trust is a

Table 1. Sample metadata, N=369

Age	Regional distribution	Gender	Formally employed	Mobile telephone owner	Smartphone owner	Internet access	Uses IP-Chat	Uses Facebook	Uses Twitter
18–30: 60%	Capital: 40%	Female: 52%	68%	92%	31%	35%	25%	50%	13%
31–40: 19%	Rural Upolu: 33%	Male: 48%	–	–	–	–	–	–	–
41–50: 13%	Savai'i: 27%	–	–	–	–	–	–	–	–
51–60: 6%	–	–	–	–	–	–	–	–	–
61+: 2%	–	–	–	–	–	–	–	–	–

Source: author.

complex concept; the initial definition of trust at the start of data collection was simply whether or not people believed an information source or medium enough to take action on what they heard or saw. The way that trust in information manifested among respondents was more complex (see the results section below).

Results: descriptive statistics and penalised likelihood analyses

The survey contained a number of controlling questions, with three of them representing the dependent variables of interest.⁷ As noted, these questions were asked in the context of peoples' memory of the most recent disaster: Cyclone Evan. The first two questions in Table 2 were developed by requesting that people select the single most important source and medium of information from a range of choices (see Figure 1). These were the last two questions presented to the study participants. To create a binary variable the responses were recoded depending on whether the single most important medium and single most important source were horizontal (coded as '1') or vertical (coded as '0'). The third question, about acting on mobile telephone/SMS information, was multiple choice. The respondents were asked to select all of the information media that they would trust enough to act on during a disaster, such as laptop/tablet computers, mobile telephones, newspapers, radio, and television; I chose to focus on mobile telephones because 92 per cent of respondents owned one, and because increasingly they are a key tool in disaster response and wider development initiatives. The responses from the three questions in Table 2 were used to test the hypotheses listed in the previous section. The descriptive statistics in Table 2 allowed for an evaluation of the duelling hypotheses, H_1 and H_2 .

The descriptive statistics tell a stark story: when people must pick one category of information, either horizontal or vertical information, they prefer vertical information at much higher rates. Based on these results, H_1 is rejected and H_2 is accepted for this sample. The third question in Table 2 permits one to probe more deeply preferences for horizontal information. A large proportion of the sample was willing to trust information gathered via mobile telephones; what is important to note here is that participants could select mobile telephone as one of a number of options. Hence, mobile telephone information is important as part of a wider information-gathering strategy (see the discussion section below).

Table 2. Independent variable questions from the Samoa survey, 2014

Information preference	Yes	No
Do you find a horizontal medium most important?	14%	86%
Do you find a horizontal source most important?	16%	84%
Would you act on information from a mobile telephone/SMS?	48%	52%

Source: author.

These results are only generalisable to Samoa, but since the country is being treated as a confirming case, one can assume that in similar settings with similar access to technology, people would not prefer horizontal sources and media when responding to a crisis or natural disaster. This has important implications for the large-scale application of social media and other horizontally integrated information media in post-disaster environments, especially if the expectation is that people will turn to horizontal media to gather or to share actionable information. Rather than response organisations shifting towards using horizontal information systems more broadly, it is more important to focus on the attributes of the small minority who do utilise horizontal information streams. The majority of respondents will be content with radio and television, and at this point the analysis shifts the spotlight away from them. Instead, concern is with identifying the attributes of the minority who prefer horizontal information—do any of their geographical, political, or social characteristics serve as a signal to disaster responders to reach out to them via mobile telephone, for instance?

H_3 is assessed using a multivariate analysis technique called penalised likelihood analysis. It is a modification of logistic regression, and was developed by David Firth (1993) to adjust for bias in smaller sample sizes where the observation of an event is relatively rare. Examples of respondents preferring horizontal sources and media in the survey (rows one and two in Table 2) are indeed rare: approximately 1.5 out of every 10 respondents. This amounts to approximately 60 respondents across the sample; while it is not large enough to be generalisable to the whole population, penalised likelihood analysis helps one to understand the correlates that motivate this small group to prefer horizontal sources and media of information during a disaster.

To capture a wider swath of the sample, penalised likelihood analysis was also applied to the factors that correlate with trusting mobile telephone-based information enough to take action. This selection of respondents is shown in row three of Table 2, and is more evenly split across the sample. The ‘firthlogit’ programme in Stata (Coveney, 2015) was used to create the penalised likelihood models, which codes respondents who prefer horizontal sources or media or would act on information gathered via mobile telephone as ‘1’; respondents who expressed a preference for vertical information or who would not act on mobile telephone information are coded as ‘0’. All 369 complete responses are captured in these models.

H_3 assumes that people with an exclusive preference for horizontal communication, and a willingness to act on information from mobile telephones, will trust local customary governance systems and/or distrust central government. From a political perspective, these are individuals who would not trust vertical sources and media owing to economic, geographic, or political factors, and who could use horizontal information, therefore, to engage directly with one another. Each of the three dependent variables—preference for a horizontal medium, preference for a horizontal source, and willingness to act on information from a mobile telephone/SMS—is tested in four ways: first is a hardware model that includes information about telephone ownership and internet access; second is a software model that includes information on

Table 3. Multivariate test of preference for horizontal medium

Variable	Model			
	1. Hardware	2. Software	3. Trust in information	4. Full
Trust government to organise relief	0.703 (0.558)	0.709 (0.558)	0.601 (0.567)	0.596 (0.582)
Trust <i>Matai</i> to organise relief	-0.505 (0.395)	-0.546 (0.394)	-0.826 (0.421)	-0.879 (0.430)*
Formal employment	0.433 (0.395)	0.469 (0.380)	0.458 (0.391)	0.479 (0.399)
Region: rural Upolu	0.328 (0.377)	0.397 (0.377)	0.639 (0.407)	0.561 (0.413)
Region: rural Savai'i	0.076 (0.433)	0.420 (0.480)	0.063 (0.443)	0.479 (0.522)
Age	0.029 (0.013)*	0.030 (0.013)*	0.019 (0.013)	0.028 (0.014)
Gender	0.450 (0.013)	0.458 (0.309)	0.378 (0.323)	0.384 (0.325)
Own mobile telephone	0.313 (0.722)	–	–	-0.378 (0.788)
Own smartphone	-0.321 (0.372)	–	–	-0.144 (0.419)
Use telephone to access internet	0.716 (0.509)	–	–	0.677 (0.560)
No internet connection at home	0.129 (0.519)	–	–	0.232 (0.575)
Use IP-Chat (such as WhatsApp)	–	-0.362 (0.416)	–	-0.754 (0.469)
Use Facebook	–	0.827 (0.405)*	–	0.676 (0.495)
Use Twitter	–	-0.247 (0.527)	–	-0.130 (0.569)
Obtain news: mobile telephone/SMS	–	–	0.468 (0.414)	0.460 (0.422)
Obtain news: internet	–	–	0.088 (0.571)	0.059 (0.501)
Obtain news: radio	–	–	-0.698 (0.614)	-0.560 (0.623)
Trust information during a crisis: mobile telephone/SMS	–	–	1.372 (0.450)**	1.413 (0.448)**
Trust information during a crisis: internet	–	–	-0.006 (0.478)	-0.102 (0.506)
Trust information during a crisis: radio	–	–	1.034 (0.909)	1.062 (0.926)
Constant	-4.227 (1.116)***	-4.093 (0.927)***	-4.626 (1.149)***	-5.259 (1.434)***
N	369	369	369	369
Penalised log likelihood	-128.84	-128.52	-116.12	-107.59
Wald Chi-squared test	13.23	15.18	28.11	31.22
Probability greater than Chi-square	0.278	0.125	0.008	0.052

Notes: coefficients reported with standard errors: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: author.

Table 4. Multivariate test of preference for horizontal source

Variable	Model			
	5. Hardware	6. Software	7. Trust in information	8. Full
Trust government to organise relief	-1.135 (0.403)**	-1.310 (0.410)**	-1.137 (0.405)**	-1.201 (0.415)**
Trust <i>Matai</i> to organise relief	0.081 (0.410)	0.240 (0.407)	0.284 (0.416)	0.263 (0.431)
Formal employment	0.502 (0.386)	0.329 (0.361)	0.087 (0.360)	0.516 (0.389)
Region: rural Upolu	0.354 (0.367)	0.229 (0.350)	0.211 (0.355)	0.137 (0.382)
Region: rural Savai'i	-1.004 (0.484)*	-1.194 (0.497)*	-0.739 (0.463)	-1.103 (0.519)*
Age	-0.030 (0.367)	-0.025 (0.015)	-0.013 (0.014)	-0.024 (0.016)
Gender	0.153 (0.305)	0.118 (0.298)	-0.047 (0.303)	0.048 (0.320)
Own mobile telephone	0.608 (0.609)	–	–	0.522 (0.631)
Own smartphone	1.065 (0.401)**	–	–	1.242 (0.408)**
Use telephone to access the internet	-0.336 (0.545)	–	–	-0.159 (0.557)
No internet connection at home	1.350 (0.519)**	–	–	1.238 (0.571)*
Use IP-Chat (such as WhatsApp)	–	0.043 (0.392)	–	-0.205 (0.439)
Use Facebook	–	-0.671 (0.369)	–	-0.468 (0.485)
Use Twitter	–	-1.087 (0.618)	–	-1.096 (0.617)
Obtain news: mobile telephone/SMS	–	–	0.210 (0.374)	0.243 (0.397)
Obtain news: internet	–	–	-0.119 (0.450)	0.356 (0.487)
Obtain news: radio	–	–	-0.402 (0.472)	-0.485 (0.502)
Trust information during a crisis: mobile telephone/SMS	–	–	-0.198 (0.374)	-0.344 (0.403)
Trust information during a crisis: internet	–	–	-0.002 (0.449)	0.022 (0.494)
Trust information during a crisis: radio	–	–	-0.956 (0.526)	-1.052 (0.565)
Constant	-1.411 (0.993)	0.386 (0.806)	0.825 (0.831)	0.157 (1.122)
N	369	369	369	369
Penalised log likelihood	-126.96	-131.91	-129.5	-111.79
Wald Chi-squared test	29.11	22.54	24.26	39.51
Probability greater than Chi-square	0.002	0.012	0.028	0.005

Notes: coefficients reported with standard errors: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: author.

Table 5. Multivariate test of willingness to act on information received via mobile telephone

Variable	Model			
	9. Hardware	10. Software	11. Trust in information	12. Full
Trust government to organise relief	0.353 (0.356)	0.400 (0.356)	0.579 (0.452)	0.569 (0.449)
Trust <i>Matai</i> to organise relief	0.761 (0.305)*	0.726 (0.304)*	0.295 (0.380)	0.301 (0.379)
Formal employment	0.086 (0.266)	0.086 (0.258)	0.112 (0.332)	0.102 (0.341)
Region: rural Upolu	-0.172 (0.275)	-0.098 (0.275)	0.196 (0.350)	0.237 (0.354)
Region: rural Savai'i	-0.255 (0.299)	0.010 (0.330)	-0.296 (0.369)	-0.234 (0.438)
Age	0.020 (0.010)*	0.025 (0.010)*	0.016 (0.013)	0.016 (0.014)
Gender	0.354 (0.216)	0.386 (0.215)	0.205 (0.274)	0.200 (0.272)
Own mobile telephone	0.725 (0.455)	–	–	-0.158 (0.571)
Own smartphone	0.149 (0.271)	–	–	0.014 (0.368)
Use telephone to access the internet	0.180 (0.349)	–	–	-0.269 (0.464)
No internet connection at home	-0.016 (0.345)	–	–	-0.211 (0.456)
Use IP-Chat (such as WhatsApp)	–	0.588 (0.296)	–	0.354 (0.394)
Use Facebook	–	0.294 (0.283)	–	-0.132 (0.422)
Use Twitter	–	-0.354 (0.351)	–	-0.254 (0.449)
Obtain news: mobile telephone/SMS	–	–	1.282 (0.309)***	1.275 (0.316)***
Obtain news: internet	–	–	-0.797 (0.438)	-0.817 (0.445)
Obtain news: radio	–	–	-0.913 (0.535)	-0.935 (0.534)
Trust information during a crisis: mobile telephone/SMS	–	–	2.355 (0.318)***	2.308 (0.317)***
Trust information during a crisis: internet	–	–	0.586 (0.418)	0.624 (0.429)
Trust information during a crisis: radio	–	–	0.276 (0.670)	0.275 (0.661)
Constant	-2.589 (0.728)***	-2.300 (0.625)***	-2.977 (0.908)**	-2.553 (1.058)*
N	369	369	369	369
Penalised log likelihood	-224.481	-225.083	-148.821	-141.964
Wald Chi-squared test	19.71	20.53	108.41	107.11
Probability greater than Chi-square	0.049	0.024	0	0

Notes: coefficients reported with standard errors: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: author.

social media use; third is a model on trust that focuses on news and information-gathering across multiple media; and fourth is a full model.

The tests in Table 3 concerning who is likely to prefer exclusively horizontal media produced some interesting results. When the focus is on just hardware and software, the significance of age (Models 1 and 2) and ownership of a Facebook account (Model 2) is surprising, since it shows that older people are more likely to trust horizontal media. It is unsurprising that people who trust crisis and disaster response information received via mobile telephone would significantly prefer horizontal information media. What is surprising in Model 4 is the significant negative relationship between respondents' trust in *Matai* committees to organise disaster relief, and a preference for information from horizontal media. Apropos of H_3 , the relationship between trust in customary local governance and the preference for horizontal media is significant, but in an unexpected way (see the discussion section below).

The influence of trust in central versus customary governance on the preference for horizontal *sources* of information during a disaster is in line with the expectations of H_3 . Table 4 shows that across all models, respondents who prefer horizontally integrated sources of information have significant distrust of the central government organising post-disaster relief. Trust in customary local governance is not significant, and across all models ownership of a smartphone, but no fixed internet connection at home, relates significantly to a preference for horizontal sources of information. This combination of factors—low trust in government, ownership of a smartphone, and a lack of wired internet—is unpacked in the discussion section using qualitative data from different regions of rural Upolu.

If one enquires for a specific medium who would act on information that came via their mobile telephone during a disaster, Models 9 and 10 indicate that people would indeed trust their local *Matai* at a significant level. However, when variables pertaining to news gathering and general trust in information across media are introduced in Models 11 and 12, the relationship vanishes, and is replaced by a highly significant relation with news gathering and trust in general information gathered by a mobile telephone. What is interesting is that while these two variables are highly significant, mobile telephone ownership is not. The following section evaluates these results in relation to the literature as well as the details of the Samoan case study.

Discussion

The results in Table 2 not only indicate that overall, people do not prefer horizontal sources and media for acquiring information during crisis response, but also paint a challenging picture for those who claim that ICT is altering significantly how local communities and individuals interact with each other and government entities in the wake of a disaster. Under the surface of wider claims about the effects of ICT

on disaster response, there are interesting social and political factors that can point to the people within a society who would turn to ICT to organise during a crisis. Trust is a key issue when people seek to procure information from horizontal media, and the way that trust (or a lack thereof) manifests itself can tell us important things about who will use ICT to organise at the local level at a time of disaster.

When talking about sources of information, the lack of trust in central government to provide relief is salient, since one would then seek alternate or corroborating information through different channels. In Samoa, the family unit is where people would start, drawing especially on family members overseas who could pass along news from foreign meteorological offices. The most reliable way to communicate with overseas family is via SMS and IP (internet protocol) messaging services such as WhatsApp; owning a smartphone makes this easier, although a basic telephone can still send text messages. What appears to be important in the process of making a decision about whether or not to favour horizontal sources of information is whether or not the respondent trusts the central government; when he/she does not, he/she will turn to the necessary technology for engaging with horizontal sources such as family and friends.

When the survey commenced, trust was defined as willingness to take action based on information. What the research team learned during the data collection phase was that trust in vertical information, especially government information, actually is based on whether the government has fulfilled previous promises to provide post-disaster relief and insurance. This open response information was captured in a final question on information and technology preferences in the Samoan version of the survey.⁸

During the surveys, this was highlighted in two regions on the island of Upolu. When the team was in rural Upolu 1 (see Figure 2), particularly the villages of Lauli'i and Solosolo on the northeast coast, people were frank about why they did not trust vertical sources and media, particularly the central government and broadcast media. None of the promised rebuilding supplies or insurance payments had been delivered and it was more than 18 months since Cyclone Evan had hit. From the standpoint of respondents, if the government could not meet its stated obligations, then it and its associated broadcast systems generally could not be trusted. They noted that they relied on family in New Zealand to send text messages with updates from overseas news sources to corroborate anything that they heard on Samoan broadcast media.

A completely different story was heard in rural Upolu 2, especially in the villages of Lalomanu, Lepa, and Saleapaga on the southeast coast. Here, respondents' experience of disaster was most acute after a tsunami in 2009 destroyed villages and significant tourism infrastructure (BBC, 2009). Their opinion of and trust in central government was quite high; they noted how quickly relief supplies arrived, how funds were directed towards creating tsunami escape routes up the cliffs (World Bank, 2010), and how insurance claims were met. Respondents were happy with the response and reported having a high level of trust in government and broadcast information.

If people were going to turn to ICT to gather information, it seemed that it would be because of the inherent value that Samoans attached to family networks. Yet, the pathways to building trust in horizontal versus vertical sources and media ended up being more transactional than expected. Sjoberg, Mellon, and Peixoto (2017) have also identified the importance of transactions in building trust in their work on government responses to infrastructure issues. When governments are responsive to citizens' requests to fix roads, the likelihood that citizens will continue to reach out to the government to manage problems increases majorly.

Transactions matter, and when people feel that they cannot rely on the government to meet its responsibilities they will turn to other sources for information and support. These results also add a micro-level layer of knowledge to the macro-level analysis performed by Nils B. Weidmann et al. (2016), who state that the people who would need the alternative information streams offered by ICT frequently lack access to them. Access is not a problem in Samoa; what one sees is that, indeed, people who feel politically or economically excluded turn to ICTs to fill information gaps that they do not trust the government to fill.

Family structures help to explain two otherwise quirky results shown in Tables 3 and 5. First, people who prefer horizontal media do not trust *Matai* committees to organise disaster relief (see Table 3). The most probable explanation of this odd statement is that people may trust their family's *Matai*, but may not seek out information from the village *Matai* committee, essentially the village government. Second, ownership of a mobile telephone did not correlate significantly with being willing to act on information received via mobile telephone (see Table 5). What was important was whether someone gathered news via a mobile telephone, and trusted the information that was received by SMS. In many households, mobile telephones are communal; people will share information procured via SMS with others who do not themselves have telephones. What is important is the source; a family member based in New Zealand can share trusted news or information with an entire household in Samoa by sending a message to a household's telephone.

For someone working in a disaster response agency who wants to leverage ICT for disaster response, the results of this study provide a heuristic for thinking through who will be in the minority that probably prefers horizontally integrated information gathered using ICT. Humanitarian responders can focus on two questions:

- Which sources do people trust, and do transactional factors underpin this trust? In places where people have had bad transactional relationships with government, horizontal sources and media (ICT) could provide an effective alternative means of information-sharing.
- Which horizontal media do people then use to communicate with preferred information sources, such as family networks? In Samoa, the mobile telephone was the key tool; this will not always be the case, so responders need to be aware of which technologies people prefer to use.

Conclusion

The majority of respondents in Samoa preferred vertically integrated communications systems when it came to making decisions during a crisis. Even when given the option to select multiple information sources and media, people preferred vertically integrated broadcast systems by a wide margin (see also Chan Mow et al., 2017). This tells us that while ICT holds promise for empowering local action during disaster response, citizens still rely heavily on broadcast media and official channels for information. The case analysis and the survey data, though, help to highlight certain political and social factors that point to who would prefer horizontally integrated information. They show that when people do not trust the central government, they turn to horizontal information sources and media, such as family networks, to acquire the information needed to make decisions in a crisis.

The dynamic pertaining to trust in different levels of government and preferences for horizontally integrated information is something that would benefit immensely from further research. There are many politically-excluded communities and ethnic groups around the world that *do* have access to a wide range of communication technologies. Additional subnational- and household-level research on these peoples' technology preferences and information-gathering behaviour, along with data on their political experiences and representation, could help to illustrate the individuals and communities likely to prefer ICT when making decisions during a disaster.

There is also practical value in the results of this research. For organisations working in disaster and humanitarian response that want to leverage digital networks, the dispersion of familial and customary governance networks could be a key indicator of how important a horizontal medium is for information-sharing. Understanding the political and social factors that drive peoples' information-gathering behaviour can lead to better policy interventions, particularly when organisations are trying to use ICT in their work.

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Endnotes

- ¹ The Independent State of Samoa was formerly named Western Samoa until 4 July 1997, and is the independent chain of Samoan islands to the west of the International Date Line from the United States territory of American Samoa.
- ² See <http://www.unhcr.org/innovation/>, <https://www.usaid.gov/GlobalDevLab/about>, and <http://innovation.wfp.org/> (last accessed on 25 February 2019) for more information, respectively, on UNHCR's innovation service, USAID's global development laboratory, and WFP's innovation accelerator.

- ³ The iHub is an important technology incubator and organising body in Nairobi for social impact businesses and technology start-ups. For more information, see <https://ihub.co.ke/> (last accessed on 26 February 2019).
- ⁴ This is based on the gross national income per capita estimates of the World Bank (2016), using the average price per gigabyte of data of the two main mobile services providers in Samoa, Digicel and Bluesky. By way of comparison, a one gigabyte prepaid plan in Germany can require expenditure of as little as 0.3 per cent of average monthly income if someone uses a pre-paid service such as Congstar.
- ⁵ Original surveys (scans) are available from the author upon request.
- ⁶ Samoans are very sociable and enjoy discussing politics and local issues; if I were to carry out further surveys there, I would add time to organise focus groups to gather more qualitative data.
- ⁷ A full explanation of how the survey instrument was designed, the questions, and the structuring of data, and the analysis methods is available from the author on request.
- ⁸ Available from the author upon request.

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