Mapping Island Information Ecosystems: Exploring the Role of the 'Bōsai Musen' Emergency and Disaster Broadcasting System in the Everyday Life of Amami Islands

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Abstract

Bōsai Musen (BM) is part of Japan's extensive disaster and emergency broadcasting system. This article, based on ethnographic research that sought to map the communicative ecology of the Amami Islands, focuses on the use of *Bōsai Musen* and its integration in the islands' information ecosystem in the form of convivial technology that reflects resiliency and agency. Many remote island communities still rely heavily on this system to get information not only about weather emergencies but also vital community related news. Most island communities have either a loudspeaker mounted on a tall pole in a central location, or a device installed in individual homes or a combination of both. The degree of access, frequency of use, amount and type of information and engagement with it, as well as their technology status (digital or analogue, single or multichannel, varies significantly depending on t the communicative ecology of an individual island or community. What has emerged from this research is a system that is well integrated into the everyday life of some Amami island communities and forms an integral part not only of their disaster and emergency information ecosystem but overall communicative ecology. The article also presents a more integrated approach to mapping island information ecosystems.

Note: this research is not concerned with the technical aspects of BM or its role in disaster prevention but its 'softer' role in the wider communicative ecology of the islands.

Key words: Amami islands, Bōsai Musen, Convivial Technology, Emergency Broadcasting Systems, Mapping Island Information Ecosystems, Remote Island Communicative Ecology

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Introduction

A loud male voice sprang into life from the ether while having dinner at our Kikaijima host's home. We had arrived very early that day with the overnight ferry from Kagoshima and looking forward to exploring the island's communicative ecology, but we did not expect it to manifest right in the middle of our island feast. At first, I assumed the voice was coming from outside, from one of those loudspeakers that mark most small island community public spaces. However, it became clear soon enough that it was coming from within the house, and it was loud! My mind went on tsunami alert, should I be alarmed? Nobody around the table seemed bothered enough to interrupt their eating and drinking. When I looked around to locate the source, our host, Toyokazu-san, pointed at the small white device on the kitchen wall with a red blinking light signalling it was alive (as if the loudness of it was not enough). This led to a long, and rather amusing at times, account of what, uninvited and loud, but seemingly important information the island inhabitants had to be aware off, including the following day's warning of water sprinklers being switched on and thus "please be mindful to close your car windows when you go through roads around the sugar cane fields." "And wait," our host said, "you will get a fresh update very early tomorrow morning. That will help you get up if you are still asleep"! "This surely must feel like an intrusion to your private life, imposed like that and with no choice of switching it off "mused aloud. I was assured they were used to it, part of their daily routine, "it marks the start and end of our day, least of all as it also acts as a village clock." This marked the start of our exploratory ethnographic fieldwork on Bōsai Musen*. It was typhoon season in the southwestern Japanese archipelago, and it could not be timelier for research on mapping information ecosystems, from typhoon warnings to water sprinklers being switched on! (author's ethnographic narrative)*

Shichōson bōsai gyōsei musen hōsō (市町村防災行政無線放送), local government disaster administration wireless broadcast), or *Bōsai Musen* (防災無線-disaster wireless) as it is mostly known, can be found in all Japanese islands. While emergency broadcasting has been its main function, local governments often use it to broadcast public and community-related announcements. This extensive disaster-warning network, part of a nationwide system that sends warnings to local governments in just a few seconds, is shifting to a digital phase linking to mobile phones and inserting messages into radio and TV broadcasts while automatically updating information on local governments' website. However, its original loudspeaker and home device elements remain the most reliable information dissemination point in disaster and emergency times (see Koichi, 2014, Hirokazu, 2013; Kusagaya and Khin 2021).

This article is based on ongoing ethnographic research[1] conducted in the Amami islands since 2017 which seeks to explore information ecosystems through communicative ecology mapping (Papoutsaki and Kuawaha 2018). The islands' distinctive identity within the southernwestern Japanese archipelago and micro-communicative ecology makeup provided a rich case study for this approach that we believe can make a contribution to

the study of small island information ecosystems across Japan and beyond (see Kato and Teraoka 2017, Kanayama 2008, 2011a, b). Studying communicative ecosystems that are part of existing island communities' structures helped us identify communicative practices that contribute to sustaining island resilience and agency.

Like in all ethnographic research, serendipity played an integral part of this research. Whilst *Bōsai Musen* (BM) was in our research horizon as part of mapping small island information flows linked to emergency broadcasting and weather patterns on these islands, it was not until its unique and alternative functions became evident to us after being hosted by locals in Kikaijima, one of the smaller islands in this group, that drew our attention to a distinctive aspect of this island's information ecosystem.[2] In this article we draw from our fieldwork on three islands, Kikaijima, Okinoerabujima and Tokunoshima with some references to Amami Ōshima's community radio and its links to Bosai Musen.

Background

Bōsai Musen: Japan's disaster and emergency broadcasting system

Bōsai is a Japanese word used to express various efforts to mitigate disaster risk (*bō* 防 protection, *sai* 災 risk), while *Musen* (無線) refers to wireless radio. Operating at municipal and village levels, *Bōsai Musen*, also commonly referred to as *goji no chaimu* (５時のチャイム the 5pm bell), Japan's local government disaster administration wireless broadcast system, can be found in all Japanese islands (Inagaki 2017, Gomi 2014, Aizawa 2009, Goto and Mitsuo 2009).



Figure 1 (left): Bōsai Musen's predecessor (source: https://commons.wikimedia.org/wiki/File:HinomiYagura_06g4599sx.jpg)
Figure 2 (center): Bōsai Musen loud speaker, Kikaijima 2017 (source: author)
Figure 3 (right): Bōsai Musen home radio device, Kikaijima 2017 (indoor receivers) (source: author)

Born out of necessity, this system has been developed to provide support in a country that frequently experiences natural disasters (*saigai* 災害), such as earthquake (*jishin* 地震), typhoon (*taifū* 台風), heavy rain/floods (*kōzui* 洪水), tsunamis and landslides (*gake kuzure* 崖崩れ). The disaster prevention radio system has been built for the national government and the municipal authorities to collect disaster prevention information and ensure effective means of communication are in place at the time of disaster that reach all affected population. The system is operated by the Japan Meteorological Agency (JMA) and broadcasts messages in both Japanese and English. The messages are sent out via radio,

television, and mobile phones. The system has expanded to include a wide range of features, such as warnings about impending disasters, evacuation orders, and safety tips. When a disaster is imminent, *Bōsai Musen* will broadcast an alert that includes the following information: the type of disaster, its location and severity, what action people should take (including evacuation and safety tips), and any other relevant information (Ministry of Internal Affairs and Communication 2017).

Since the 1950s, legislation has been enacted to ensure disaster prevention information reaches residents in affected areas in a timely manner starting with the 1950 "Radio Law in Disaster Times" that ensured emergency communication (article 74) and appropriate infrastructure (article 74 paragraph 2) were in place. It was followed by the 1961 "Basic Act on Disaster Control Measures" enacted to carry out comprehensive and systematic disaster prevention measures based on the experience of the severe damage caused by the Isewan Typhoon in 1959. A major revision to this Act was made in 1995 after the experience of the Great Hanshin-Awaji Earthquake (Ministry of Internal Affairs and Communication 2017). After the 1964 and 1968 Earthquakes in Niigata and Tokachi-oki, the national government started the infrastructure provision of "fire disaster prevention radio," which connects the Fire Department and prefectures, and "disaster prevention administrative radio," which connects prefectures and municipality the past, wide-area radio was permitted as fixed service and local government radio was permitted as mobile service, but the unified service of the two started in 1978 as "Municipal disaster prevention administrative radio (fixed and mobile)". The provision of the "Local Disaster Prevention Radio" (MCA) infrastructure started in 1988, which ensured network contact between the municipality and daily-life-services-related institutions. Infrastructure provision of local satellite communication networks started in 1990. (Ministry of Internal Affairs and Communication 2017a). The system is currently shifting to a digital phase linking to mobile phones and inserting messages into radio and TV broadcasts while automatically updating information on the local government's website. J-Alert, the current satellite-based early warning system launched in 2007, can inform local authorities in as less as one second, and it takes another four seconds for the alert to be relayed to the masses (Patowary 2020).

As of 2021, out of all municipalities (1,741), fixed municipal disaster prevention administrative radio was provided to 1,318 municipalities (75.7%). In Kagoshima prefecture, which Amami islands are part of, 41 of 43 municipalities (95.3%) have installed fixed municipal disaster prevention administrative radio, one of the higher penetration rates (Ministry of Internal Affairs and Communication 2017b).

Table 1: Improvement rate of municipality disaster prevention administrative radio (Bosai Gyosei Musen) Source: Ministry of Internal Affairs and Communication 2023

Year	Total number of municipalities with Bōsai Musen	Total number of municipalities (improvement rate)
1984	1,015	3, 276 (31.0%)
1990	1,574	3, 264 (48.2%)
2000	2,121	3, 250 (65.3%)
2005	1,376	1, 844 (74.6%)
2015	1,363	1, 741 (78.3%)
2021	1,318	1, 741 (75.7%)

A typical municipal disaster preparedness information package would provide step-by-step information that places the disaster prevention administrative radio (*Bōsai Gyosei Musen* 防災行政無線) right at the start, under information seeking. A second step would recommend listening to *Bōsai Musen* for where to run for safety announcements and the designated emergency evacuation sites. Several information options are given for these two first steps with *Bōsai Musen* often recommended to be kept in the house, giving residents the option to rent the device at the City Hall (for free or at subsided price) and/or listen to the loudspeakers in their neighbourhood.[3]

The following figure illustrate the nationwide automated early warning system linking to the municipal disaster administration level that is responsible for transmitting through *Bōsai Musen* evacuation information.[4]

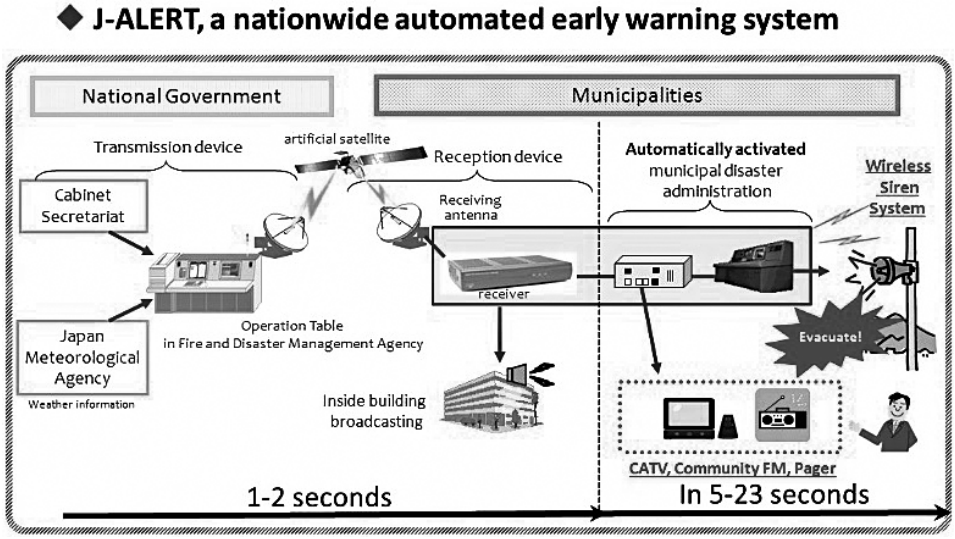

Figure 4: (source: Koichi Katagiri 2014, http://slideplayer.com/slide/5734229/)

Bōsai Musen in the everyday life of Japanese communities

Although many municipalities have switched to more advanced digital systems that allow two-way communication through mobile phones and devices installed in homes, the cornerstone of the *Bōsai Musen* network is the enduring and ubiquitous loudspeaker. Looking like air-raid sirens, these loudspeakers make their presence noticeable visually and audibly and at such regularity that they have become an integral part of island communities' audio scape.

Although different areas chose a different time for their daily tests, it is commonly referred to as "the 5 p.m. bell" (*goji no chaimu* 5時のチャイム), with noon also used in some locations. Some municipalities have two test broadcasts a day, usually around noon and early evening time, with seasonal adjustments. The regularity of these broadcasts is such that it shapes the daily routines of community members, including, for instance, acting as a reminder to children to return home from the playground (i.e. "Let's go back home chime" お家へ帰りましょう チャイム or "Children watch/tracking broadcast" 子ども見

守り放送) (Parker 2015; see also Patowary, 2020; Richarz, 2019; Gordenker 2013). It could be said that BM acts as the modern-day Drum Tower, a continuation of the "taiko-drumming" timekeeper and announcing function of older days (*tokiuchi-taiko* 時打太鼓).

It is not unusual to hear loudspeakers playing out different types of music for about two minutes while testing the system or before announcements, contributing thus a colourful and uniquely developed local character that makes it instantly recognizable for what it is. Some examples, for instance, include children's nursery rhymes (i.e. 夕焼けこやけ *Yuyake Koyake* "Red sunset sky", 帰ろ帰ろ *Kaero kaero to* "Go home, go home", 赤とんぼ *Akatonnbo* "Red dragonfly") or foreign music (i.e. "Moon River" *Breakfast at Tiffany*, and "Edelweiss" *The Sound of Music*) (see Patowary 2020 and Parker 2015 for audio examples of these music broadcasts).

The need to test them regularly (one or two a day) has given the opportunity to many municipal authorities to use them as a public announcement system, reporting local news or upcoming events. The degree of use depends on the locality, with some getting overzealous in their use, such as in an Ishikawa Prefecture community where a 7 am "Good morning!" broadcast irritates its sleeping residents; to the point of provoking complaints and in some instances even lawsuits (although unsuccessful). Similar to our findings in Kikaijima during our fieldwork, it is not unusual for municipalities to broadcast reminders, multiple times throughout the day, about the residents' social responsibilities, such as disposing of garbage properly, signing up for health examinations, speaking kindly to children, for drivers to exercise extra caution during and after sunset and, in smaller communities, announcing births and deaths (Patowary 2020, Richarz 2019).

The frequent use of BM, both through the loudspeakers and the home devices, for other than emergency-related broadcasts has caused many to question its necessity, with some arguing that the more frequently it is used the more they run the risk of "tuning off" which can have real implications in times of actual emergency. After the 2011 disaster, some citizens reported shrugging off the warnings broadcasted through BS, attributing it partly to a sense of familiarity. See for instance the Official Noise Pollution site (騒音公害公式サイト, 防災無線スピーカーの騒音問題について) for noise problems related to disaster prevention radio speakers broadcasting at 85dB at a distance of 50 meters (comparable to the noise of a freight train passing by at 15 meters) (Richarz 2019). However, there are those who believe in the importance of having this system in place and are willing to put up with the noise pollution it causes.

Conceptual framework: island information ecosystems and remote islands communicative ecologies (RICE)

Literature shows systemic and resource exclusion usually overlaps and is reinforced by remoteness (see Heeks and Kanashiro 2009). As many small island communities are often remote from centres of formal knowledge, political power, and economic activity, this could have a substantial impact on their information ecosystems. While mapping remote island communicative ecologies (RICE), the question of what makes a place remote came

up: is remoteness that which is geographically distant from the centre of administrative, political and economic activities or is it a construct of connectivity? In Gohain (2019)'s research, remoteness denotes multiple aspects, not just geographical isolation but also lack of material infrastructure and transport, and improper communication. Mapping a remote island's communicative ecology can demonstrate who has access to different information and communication channels and how factors such as geography, distance and cost shape communication practices and the island's micro-communicative ecology (see Lennie and Tacchi 2013).

Based on the Island Communicative Ecology (ICE) concept that first emerged from the research this article draws on (see Papoutsaki and Kuwahara 2018), Remote Islands Communicative ecology (RICE) in this particular context contains various communicative/information networks, flows, systems, forms, activities, resources, as well as interconnections and issues distinctive to these remote island communities (adapted from Tacchi 2006). It also refers to a context of remoteness in which occurring communication processes involve island inhabitants engaging with others in their local and extended island social networks, both face-to-face and using a mix of media and communication technologies. Similarly to the ICE concept, RICE also contains expressions of island identity, the topics and language/dialect of communication and the ways in which things are communicated. It is also described as a milieu of island agents who are connected in several ways by various exchanges of mediated and unmediated forms of communication (adapted from Tacchi et al. 2003).

In this research, the communicative ecology of remote and peripheral island communities is considered to be created through a storytelling network process in which inhabitants of these communities, island organizations/authorities and various means of communication work with each other to construct an island reality where they engage with shared concerns.[5]

In this research, the communicative practices of remote island communities, unlike their mainland urban and centre counterparts, are seen as part of a more fluid interconnected network system of individual and collective agents, reflecting reciprocal relationships that are necessary for living in these communities and also containing several elements of what makes them resilient. These elements include a localized information landscape and dynamics of production, movement, access, use and impact based on island information needs, social trust and catalysts. We perceive resilience, in this context, as a culturally mediated response to some of the challenges remote Japanese islands often face, including an aging population and depopulation, heavy weather patterns, infrastructure, and services (Papoutsaki and Kuwahara 2018).

Furthermore, the information ecosystems approach has provided a useful model for mapping RICE. Developed by Internews (2015) as a tool to understand how information contributes to a more connected and resilient community, it identifies several elements that can assist in contextualizing the RICE model (see figure 2).

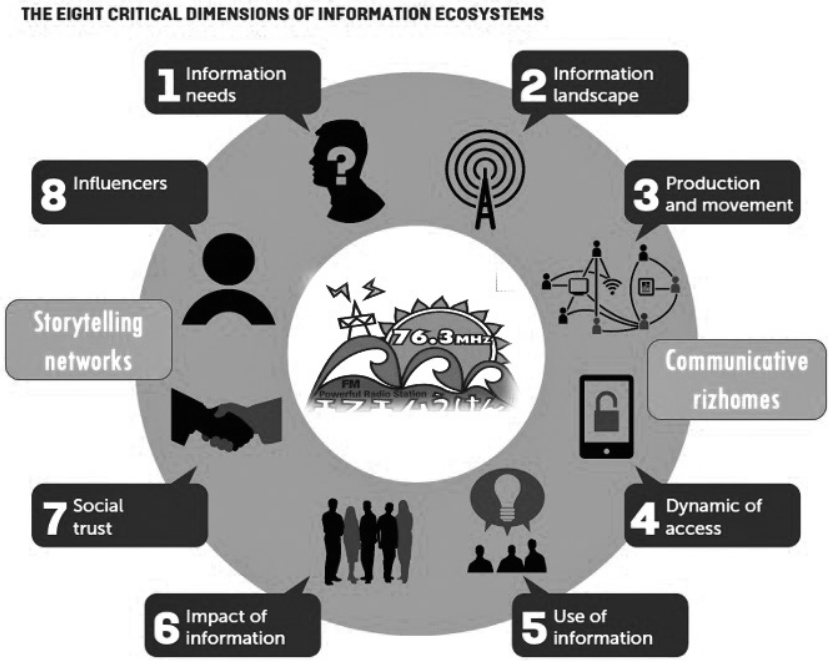

Figure 5: Key Elements of the Information ecosystems model (Internews 2015) modified by authors.

In the process of contextualizing this model to our research, we identified some additional elements, like island storytelling networks agents and enablers and communicative rhizomes. In addition to these elements, we also borrowed Hearn' and Foth (2007, p.1) three communicative ecology layers in the mapping process which include a technological layer consisting of the devices and connecting media that enable communication and interaction, an important component of emergency broadcasting systems; a social layer consisting of island inhabitants and social modes of organizing, an essential element of remote island community organization; and a discursive layer containing the content of communication - the ideas of themes that constitute the known social universe that the island communicative ecology operates in.

The Communication Infrastructure (CI) theory also offered us a valuable framework of analysis through three clearly identified levels of storytelling agents (micro, meso and macro) depending on who is the primary storyteller and their community-based audience. While mass media tell stories at a macro level that focus on the nation and beyond with a national or regional audience in mind, the meso level provides more complexity that can be of more relevance to RICE. At this level, community media and organizations can act as key agents in defined geographical areas and specific populations (Kim et al. 2006). The storyteller agents at the meso level work closely with those at the micro level, which may include community members in their networks of family, friends, and neighbours. The focus on meso and micro-level storytellers fits well within the RICE approach as they address communities like those one encounters in remote communities closely defined by specific geographic features and small-scale social groups where socio-cultural interactions are

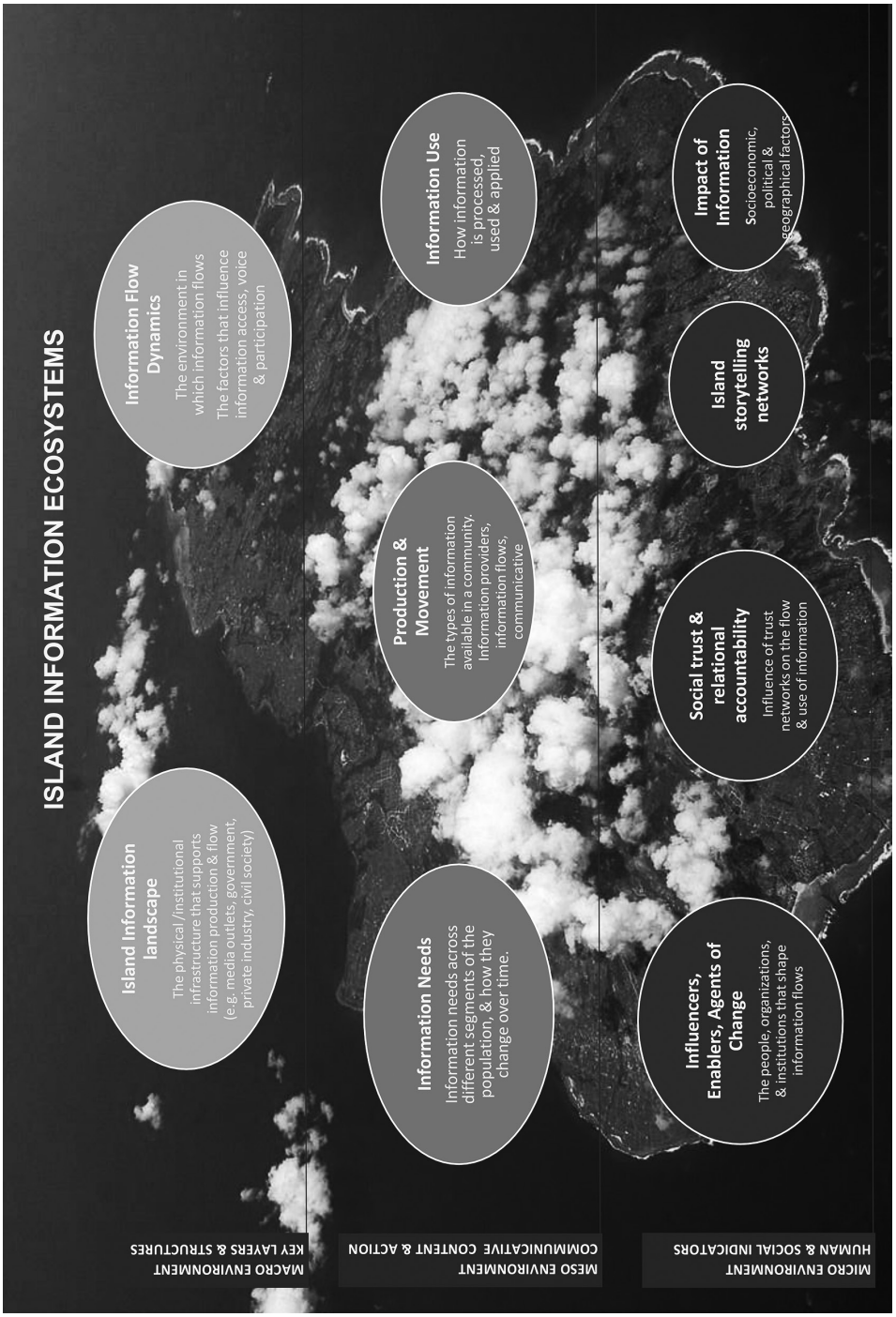

Figure 6: Island information ecosystem mapping guide (source: authors, adapted from Internews 2015)

closely intertwined. When mapping RICE, one needs to take into consideration community-focused media as they act at both meso and micro levels, intermeshing collective and individual storytelling agents with overlapping and multifunctioning networks (see Papoutsaki and Kuwahara 2018; Konishi and Papoutsaki 2020). While *Bosai Musen* does not fit in the conventional media category, we would argue that it has become part of a mediated system of communication.

Remote island communities are distinct communities, defined by a strong collective identity and close, reciprocal relationships that define their communicative sociality, a concept that refers to the language/dialects, identity and kinship relationships that bind them together (adapted from Hartley and Potts 2014). Along with language and identity, story (communication) enables the collective making of these community groups. In the Amami islands, kinship continues to contribute to community cohesion (Nakatani 2013). This is particularly pertinent to smaller and remote island communities and plays a key role in shaping their communicative ecologies.

Lastly, we will argue that Bōsai Musen serves as a tool for conviviality, a concept introduced by Illich (1973) who imagined a world where people had an open relationship with the material world surrounding them, including the technologies they used. Conviviality in this context, is about being actively engaged in island information and communication flows and networks. Convivial tools are those which give 'each person who uses them the greatest opportunity to enrich the environment with the fruits of his or her vision' (1973, p. 21).[6] Conviviality is related to empowerment, creativity, and sociability and convivial technology is designed to be used creatively by networks of people for shared projects (Goodyear 2011). We will be arguing that *Bōsai Musen* is an example of the convivial use of technology for shared sense-making that extends beyond its original purpose, especially in the smaller remote island communities where social cohesion is higher.

Bōsai Musen in the Amami Islands' Information Ecosystem

The Amami archipelago's prominent typhoon weather patterns frequently cut off communities for several days and BM is often the only source of reliable information. Although emergency broadcasting remains its core function, island municipal administrations use it also make localized public announcements. The research findings indicate that the *Bōsai Musen* system is integrated in the communities of the smaller Amami islands information ecosystems, especially in Kikaijima, the smaller of the islands in this study, where it has been shaped to serve its own unique information needs, outside emergency and disaster times. This additional function in the island CE merits more attention which illustrates well our argument, that small islands' unique micro-communicative ecologies shape and ascribe unique meaning to technology and information flows and uses. While BS does not fit in the conventional media category, we would argue that it has become part of a mediated system of communication.

The degree of access, frequency of use, budget allocation, areas covered, channel choice, amount and type of information and engagement with it, as well as their technology

status (digital or analog, single or multi-channel), varies significantly depending on the individual island or island community information ecosystem. All island communities have a loudspeaker mounted on a tall pole in a central location and in some cases a device is also installed in individual homes at municipal cost or a combination of both.

At the time of our research (2017 and 2019), outdoor loudspeakers were installed at all the twelve municipalities by each municipal office, while individual receivers were installed by the municipal office at all households in nine municipalities (Tatsugo town, Yamato village, Kikai-cho, the three municipal towns of Tokunoshima, and the two municipal towns of Okinoerabujima and Yoron-cho). In Amami City and Setouchi Town, the individual receiver was partly installed in the district head's and fire chief's houses, the households of disaster hazard areas, and of areas where the loudspeaker is hard to hear). In Uken village (Amami Ōshima), instead of a separate BM device, FM radios with a BS function have been given to all households by the village hall, playing a dual role.[7]

Some of the emerging themes from this research, that have implications for access, voice and participation (key factors in islands agency), included the following: the enduring nature of the community loudspeaker system; the coexistence of old (loudspeaker) and new technology (digital modes); convergence (i.e. Uken FM doubling as a BM system); cost and noise pollution (challenges); a top-down but equal access to the information system; an important part of the island's information content production and dynamics; meeting highly localised information needs; contribution to the island's information landscape and flows and more specifically to the island storytelling networks; and different island contexts shaping different uses.

There is also evidence that the use of BM and its integration in the islands' information ecosystem have contributed to their resilience, especially in areas where depopulation and aging population are prevalent. Many island communities rely heavily on this system to get important information for a variety of community-related news most of which are practical in nature and help forge a community spirit (i.e., searching for a lost elderly person, funeral announcements and reading groups in smaller communities in Kikaijima). Our observations point at a system that is overall well integrated into the everyday life of smaller island communities and forms an important part of their information ecosystem and overall communicative ecology.

In those urban areas considered safe in terms of natural disasters and no loudspeaker is installed, residents are often left out of vital information that is normally disseminated by the Town Hall through BS. Although this information comes in municipal newsletters, often the loudspeaker acts as a reminder and is thus more effective: i.e., preventative injections against rabies.

Kikaijima's integrated Bōsai Musen system

Kikaijima is 69 km off the northeast shore of Amami Ōshima and occupies 57 square kilometres, 40 percent of which is farmland.[8] An "Agricultural Island", Kikaijima's subtropical climate has made it suitable for sugarcane cultivation.[9] Depopulation, aging and a low childbirth rate are very noticeable in almost all villages with a population having

dwindled to 6,633 people (as of March 2022), compared to over 20 thousand in pre-war times. About 44 percent of the population is concentrated in the southwest part of the island in three districts. The island is connected to Kagoshima and Amami by air and sea with two ferries in service every day, which take about eleven hours and two-and-a half hours respectively. NHK (Japan National Broadcasting Company) TV and commercial broadcasting are available. Regional internet started in 2006 and an online broadcasting of the town assembly started in 2017.[10]

Before BM was introduced in Kikaijima in 1988, a cable radio system was used for disaster prevention in each community. Its digital upgrade, completed in 2015, covers all 3,600 households. The cost of each device was 50,000 yen per household with a total cost of 200 million yen (interview with Shigeru Kanae, Manager of General Affairs Division, Kikai Town Hall, 7/11/2017). It is important to note that there is a Self-Defence Force Communication Station (*"Elephant Cage"*) in Kikaijima that might partly explain this expensive BM upgrade.

Two or three employees of the General Affairs Division are usually in charge of BM who prerecord information around 5 pm every day and air it at 6.30 pm and 6:30 am the following morning. The content changes every day, but it mostly involves that day's events. On special occasions such as in typhoon season, the information on disaster prevention is

Figure 7: Kikaijima BM loudspeaker 2017 (source: authors)

aired live and at any time. If the power supply is cut off, a battery backup is used (Akio Akizuki, Maeganeku Community head of Onotsu village, 7/11/2017). A chime sound is used before and after each announcement on BM.

Our Kikaijima observations indicate that the use of the BM system has developed distinctive characteristics that make it stand out as one of the island's key mediated communication systems (Papoutsaki and Kuwahara 2018). This is evident in its many functions, ranging from the standard use as a village clock (chiming at 12 pm, 3 pm and 5 pm) and channel for public announcements with fixed broadcasting time (early morning and evening) by the Town Hall (i.e. recruitment calls for Town Hall, district meetings, election announcements), Village Chief and Police (i.e. elderly people missing) to regular and periodic services reminders system for the Agricultural Association/Cooperative (i.e. land registration of sugar cane harvest and production per farmer), Council of Social Welfare, and Health-related services (i.e. reminder for rabies injections); as a school/ community voice (i.e. invitation to or reminder for the annual cultural school festivities; as a chime/call at 5.30 pm during school time and 6 pm during summer to remind children to return home from the playground; reminders to drivers to be careful with students on the streets at the start of the school year).

Highly localized information is evident for instance during the dry season when BM reminds the island inhabitants when driving through sugar cane fields to close their car windows to avoid getting wet from the water sprinkle system. And on the rare occasion that the island makes it to the national news or other regional media, an announcement early in the day shares with excitement the news: "we've made it to the national news, don't miss tonight's TV program!"

Death announcements, aired at the request of the deceased family, are another important local information function. Although *Bōsai Musen* is mostly used for providing public information, private information, such as funerals, is also aired at the request of the deceased's family. In such small island communities, a funeral is considered a public matter. Even if there is no request from the deceased's family, the community head will still air the funeral information as a matter of public concern. Information, thus, on who has died and how, when and where and the time of the funeral service will be broadcasted as a community matter, even if there is no request from the deceased's family.

Figure 8 and **9** (left and center): Kikaijima Municipal BM technology 2017 (source: authors)
Figure 10: Akio Akizuki, Maeganeku Community Head, Onotsu village, operating BM system from his home 2017 (source: authors)

The Kikaijima Town Hall asks each community head to manage *Bōsai Musen* for their community, including housing the broadcasting equipment in their private residence. Announcements are made from the community head's house and transmitted through centrally located loudspeakers fixed on a pole (each carrying four speakers facing all directions; image 4). Depending on the size of the community, more speakers are added. In some communities, broadcasting equipment is housed at the community center, so that there is no need to relocate the equipment every time the community head changes.

In Onotsu village, the Maeganeku community head mentioned that when he is not available or on leave, his wife fulfils the role. If both are unavailable, a neighbour or relative is asked to step in the role. In that case, he demonstrates to them how to use the broadcast equipment beforehand. This rarely happens and he always has enough time to prepare because the Town Hall provides information a week in advance. The Head of the Community we talked to had already served three terms (6 years), as no one else expressed an interest in the role.

Once a week, on Friday, the Town Hall posts information to each community head's house, including not only broadcast announcements but also public brochures (i.e., Kikai Town newsletter), which are to be delivered to each household by the community head. For instance, in the Maeganeku's 70 households (with a population of about 120, one third of which is elderly women living alone), the community head delivers the material to each of the 12 groups head who in turn delivers the material to each household of the community.

Usually, the community people are out in the fields during the day and at home in the morning and evening, which is the time BM broadcasts announcements. Each community head receives announcement requests from the Town Hall two days earlier who announces the information three times, that is, in the evening of the day he receives it, the next morning and evening, and in the morning of the following day. Aside J-Alerts broadcasts from the town hall are not always aired, left to the Head's judgment to decide.

The Community head is also asked by the Council of Social Welfare of the Town Hall to broadcast a light exercise program (*Rajio Taiso* ラジオ体操 Radio Calisthenics) for the elderly people, often aired 3 times a day. The head of the community also announces when x-ray services are available by the Health and Welfare Division of the Town Hall. If there are important local announcements, such as community events, community heads are expected to make their own decisions about which ones to broadcast. An example shared with us is the following: "Today, the Honen festival starts at 2 pm and the preparation starts in the morning. Members of Young Men's Association, please gather at the community center at 10 am".

Most broadcasting requests come from the Agricultural Association and schools. School broadcasts are primarily about culture and sports festivals, announcing dates, meeting times, and calling for participation. It is important to note here that Kikaijima's agricultural economy relies heavily on sugar cane production. For instance, the "Please order seed potatoes" announcement, made by the Maeganeku community head of Onotsu village, comes from the Agricultural Cooperative, which provides potato seeds to each farmer. The BM system is also used to call farmers to come to the Community Hall to

provide information on their sugar cane production (i.e., how many tons of sugar cane each farmer is going to sell to the sugar mill). This is then matched with each community head's information on the sugar cane fields each farmer is recorded to have.

Bōsai Musen in Tokunoshima town

Tokunoshima is located in the centre of the Amami archipelago, and it is the second-largest island with a population of 21,803 people (2020 National Census). The island is registered as a World Natural Heritage Site with Amami Ōshima, Yanbaru Forest of Okinawa and Iriomote-jima (Tokunoshima Town Hall). As it has the largest arable land area in the Amami Islands, its main industry is agriculture (sugarcane, potato, ginger, fruits). There are four daily flights to Kagoshima and two to Amami Ōshima and two ferries operate daily to Kagoshima and Okinawa from two ferry ports.[11]

Tokunoshima has three Municipal Towns, each of which has a different *Bōsai Musen* receiver. While the same information is broadcasted by the Town Office at the same time, each sub-district can also broadcast its own information. BM seemed to be functioning well during our fieldwork with district heads reporting to using the system frequently. Our informant, Tsutomu Hirota, the District Head of Kametsu Kita-ku of Tokunoshima town, mentioned that BM receivers were distributed for free to every household (Dec 9, 2017, Kametsu Kita-ku Community Hall).

According to Hirota, Amagi town and Isen town spent 1 billion yen each to introduce an optical fibber cable TV system into each town, which has all the functions of *Bōsai Musen*. In Tokunoshima Town, only Kametsu district introduced optical fibre at the cost of 500 million yen. In Tokunoshima Town, administrative information from the town office is broadcasted by *Bōsai Musen* from 7:15 to 7:30 every morning and also from 19:15 to 19:30 every evening. However, there is no music or time signals. The announcement from a district head through *Bōsai Musen* includes information on the town office, district meetings, health check-ups, school children's activities, preventive injection against rabies and events such as seniors' club sport events. For example, Hirota had recently announced to his sub-district people a call to attend a community meeting and at another time to not park cars on the road because school children would be running during a school sport event.

In the Minami sub-district, a traditional dance called *Hama Odori* is practiced twice a month, so the district head calls the community people by BM to gather for the practice on that day. BM receivers were always switched on in this sub-district at the time of our fieldwork. When we visited a local house at Isen town, we noticed a BM receiver. According to our host, the BM receiver was installed in every household by Isen Town Office. The receiver had four channels: ch.1 was the administrative channel of Isen-cho, ch.2 was devoted to *Shimauta* of each village in Isen-cho, ch.3 was devoted to the *Shimauta* of Tokunoshima, ch. 4 was devoted to J-pop. The Town Office cuts into the ordinary programs anytime they need to announce something urgent to the residents.

In Isen town, the music and town office announcements are automatically recorded while residents are out, allowing them to play them back after returning home. In Tokunoshima Town, residents do not have this function, so they rely on their neighbours or

call the district head about the day's broadcast. They could also listen to the district head's announcement from a loudspeaker. If they find BM loud or noisy, they can lower the volume if they have a baby sleeping. We heard some complaints about noise pollution, including references to elderly people often shutting down the receiver by unplugging it. The information on typhoons and other warnings are broadcasted from the town office. As a BM receiver has a battery backup, information is still broadcasted even when electricity is cut off because of the typhoon. Initially, the town office provided receivers to each household free of charge by using subsidies from the government. But once the subsidy finished, people had to buy themselves and no budget was allocated for this at the time of our fieldwork.

Residents of a new residential area in Tokunoshima town cannot get information from *Bōsai Musen* because they are not provided receivers from the town office. The town office turned down a request for BM receivers because of a lack of budget. There were no loudspeakers either in the new residential area. But because this area is located on a hill with residents living in five-story apartment buildings, they are considered comparatively safer against natural disasters. However, they are not only missing disaster information but also other information, related to health and public events. This problem is special to Tokunoshima town, which has seen a population increase because of its central location that attracts residents from other parts of the island. Residents in the new residential area that has no BM receive town hall information newsletters, sent to a district head, who then distributes them to group leaders.

The islands natural habitat contours their communicative ecology and information ecosystems, as the *Bōsai Musen* unmistakably demonstrates. The interconnectedness of human and nature ecologies is evident in the islands where weather patterns are integral to their life. The typhoon season comes with strong winds, and heavy rainfall, causing landslides and stopping transportation that cut off the islands for several days at a time, including the disruption of newspaper delivery (Papoutsaki and Kuwahara 2018). A good example of how important BM is for island information flows in Tokunoshima, where depending on the weather, the ferry will choose between two ports to berth. It takes about 40 minutes from one port to another by taxi, so, you may miss the ferry. In the past, this information was announced by *Bōsai Musen*, but this service is no longer available much to the islanders' consternation.

Bōsai Musen in Okinoerabujima

Okinoerabujima is in the southwestern part of the Amami archipelago[12] and is closer to Okinawa geographically and culturally. It consists of two municipal towns (with a population of under 12 thousand people).[13] It takes 35 minutes from Amami Ōshima by plane. The primary industry is agriculture, flower cultivation, livestock, and brown sugar shochu, while caving tourism has been increasingly attracting attention.

Our fieldwork took us to the farming village of Amata (China-cho or China municipal town) whose population of 225 people, in 91 households, consisted mostly of elderly people (about 70 percent). Yasuhiko Maeda, Head of the village in his fifth year, mentioned that the community meeting takes place once every two months, and household heads (about 25

people) participate (interview, 25/6/2019). The *Bosai Musen* system was upgraded in 2014 with a combination of digital/analog version. The maintenance cost was 371.7 million yen, out of which the subsidy was about 220 million yen. The digital receiver was 100,000 yen per unit and 155 receivers were ordered, some of which were installed in public facilities. The BM receiver with analog radio was 15,000 yen per unit. Digital signals are used between the town hall, the Ooyama relay station and each retransmission station which converts the received digital signal to analog. Individual receivers receive digital signals from the Ooyama relay station. Bosai Radio receives the analog waves sent from each retransmission station. Since individual receivers are expensive, a combination type was adopted to reduce costs.

BM is used to make community broadcasts three times a day. Chime and community broadcast at 7:05 am. China-cho town hall broadcasts at 7:15 am. Use is reflected in the seasonal variations, for instance, Chiming is at 18:50 in summer, while in winter it comes earlier at 18:05. The Head brings the information requested by the town hall to the community twice a month and broadcast it through BM. The village head, and heads of the Women, Parents and Elderly Associations have the key to the community center that houses the BM system, and each one freely uses it to send information related to their activities when they deem necessary. Village-related broadcasts, for instance, carry information about the *Bon Dance festival*, *Keiro-kai* (meeting to show respect to the elders), Sports Day, welcome and farewell parties for elementary school teachers, and the New Year's parade of the fire department (consisting of three nearby villages). Information about funerals is broadcast only once at 12:20p m. Unlike Kikaijima, the Head of Amata village mentioned that he does not broadcast personal requests such as search calls for "lost cat, dog and missing elderly people even if requested because there is no end".

The Bosai Musen system in China Town used an analog system from 1984 to 2014 when a digital/analog combination type was installed. The maintenance cost was 371.7 million yen, out of which the subsidy was about 220 million yen from the National government. The digital receiver was 100,000 yen per unit and 155 receivers were ordered, some of which were installed in public facilities. The BM receiver with an analog radio was 15,000 yen per unit. Digital signals are used between the town hall and the Ooyama relay station and each retransmission station which then converts them to analog for local transmission. Individual receivers receive digital signals from the Ooyama relay station. Bosai Radio receives the analog waves sent from each retransmission station. Since individual receivers are expensive, a combination type was adopted to reduce costs; analog for home use and digital for community centers. There is a total of 31 receiving antennas and 31 loudspeakers in China-cho. Maintenance is once a year and is outsourced to Japan Radio, the Kagoshima branch office and a subcontractor in Amami Ōshima with field workers available in China Town (Shigeki Shiraishi and Kosuke Nishida, Chiefs of General Affairs Division, China Municipal Town Hall, 25/6/2019).

The scheduled (regular) broadcast is at 7:15 and 19:45. The broadcast time is around 5 minutes. It chimes the time at 7:00, 12:00, 15:00, 17:00, 17:30 (for children) and 21:00. There is loudspeaker interference near the border between the two towns which can be

noisy, but inhabitants seem to be used to it. Radio calisthenics is broadcast at 15:00. Each village has its own loudspeaker. Manufactures of Bosai Musen vary by village. Small villages have cable broadcasting. There are both the Town Hall's broadcast receiver and the community's broadcast equipment. Each village chief receives information from the Town Hall twice a month and sends it to each family's receiver. Village loudspeakers are found in all villages and are used for emergencies and time chiming.

The BM system at Wadomari Town was upgraded from analog to digital in 2012. Out of the total 28 transmission stations, five key digital stations transmit to 23 auxiliary stations which retransmit in analog to individual homes. The cost of building this new system was 400 million yen. Recordings are broadcast at regular intervals, twice a day, at 7:20 and 18:20 from Monday to Friday. A loudspeaker is installed in each village, while larger ones have two (Shogo Ooe, Chief of General Affairs, Ryu Kamibeppu, Assistant Manager of Planning Section and Eioki Mori, employee of Erabu Sun-sun TV, June 24, 2019).

Broadcast content includes administrative and health-related information (health checks, garbage collection etc.), with village chiefs responsible for the circulation in their communities. The town hall employs six people who are in charge for each day of the week, and who pre-record, and broadcast information approved by each department. The information flow in one way, from the Town Hall to communities, unlike the two-way village broadcasting system, taking in individual or community requests for circulation through the loudspeaker or BM home devices. The system is developed so that each village head can record and broadcast information by dialing the number from their mobile phone. The maintenance engineer from Comsys comes from mainland Japan once a year to service the system.

The Chief of General Affairs is in charge of typhoons and emergencies (Shogo Ooe June 24, 2019). He often makes phone calls to exchange information with his counterpart in charge of disaster prevention in China-cho Town hall. For instance, when we were there, it had heavily rained the day before, and Ooe mentioned he had exchanged information on whether to issue an alarm. He broadcasts information within 5 minutes and because residents complain if the same information repeats in the morning and evening, he tries to vary the content of his broadcasts in the morning and evening to avoid repetition. However, the information for the evening and the following morning is the same to ensure people have not missed important accouchements. He broadcasts to home receivers only administrative information while emergency broadcast is recorded automatically. If you miss it, there is a replay function on the home receiver. In China-cho this receiver is a Bosai radio, which is compatible with both music and disaster prevention radio and portable to the field. The loudspeakers in this community are used only for J-alerts. There are often complaints from people living close to loudspeakers. BM chimes the time at 7:00, noon, 15:00 and 17:30. The time signal at 17:30 tells children to go home. Radio calisthenics is broadcast at 15:00.

Wadomari town distributed 3300 new receivers free of charge to each household and business in 2017. Although portable, they do not have a radio program function. This receiver is mostly wall mounted in residents' homes who can also receive BM content automatically by e-mail if they choose so. While working in the fields, people are listening

to the radio program of Okinawa. China-cho has mountains, so wild boar damage is common. Because of the geographical (and cultural) proximity to Okinawa, islanders tend to get the weather forecast from Okinawan TV and radios as typhoons move from the south. This is a good example of shared inter-island communication ecosystems that need particular attention when designing emergency broadcasting systems.

Bōsai Musen and FM Radio in Amami Ōshima

Along with Bōsai Musen, public funding has been made available to Cable TVs and FM stations for disaster and emergency broadcasting. Community radio, a relatively new development in Amami Ōshima, plays a significant role in the island's information ecosystem and is closely linked to BM (see Papoutsaki and Kuwahara 2018). At the time of our fieldwork, Amami FM, Uken FM, and Setouchi and Tatsougo FM had a BM function, especially Uken FM which was built to have a dual function right from the start (for more on community FM and island information ecosystems see Kato and Teraoka 2017:204-221; Papoutsaki and Kuwahara 2018; Masaaki 2018; Tomoko 2019; see also Inagaki 2012 for Community FM and disaster communication).

Uken FM stands out from these community radios in its dual function and key role in the community's information ecosystem. Established in 2010, it is run by the Uken administrative village office, which served 1700 people at the time of our fieldwork. The switch to an FM model was made when their old BM system needed to upgrade from analog to digital. Providing a radio to each household was more economical than individual BM receivers. The dual function means that residents can receive normal FM broadcasting which switches automatically to BM during natural disasters. The AM / FM radio cost was 3,000 yen each, but 850 out of 950 households received a radio device at the cost of 1,000 yen. For those people who lived in the fringe zone, the village office prepared a highly sensitive radio called "Bosai radio" that costs 9,000 yen each for 200 units fully subsidised. This radio is automatically switched on and can receive BM information at the time of emergency. The initial cost for establishing the broadcasting station was 30 million yen. The running cost is 3.5 million yen which includes the salary for one full-time staff, the royalty payment for the radio wave, copyright fees, maintenance, and inspection costs. However, the national government subsidizes 70 percent of the salary of two million yen, so the real expense for the village office is 2.1 million yen (Miyashita 2018:45-46). Uken FM is a good example of an integrated model that is fully embedded in the community's communicative ecology, and which acts as a collective storytelling agent at a micro level, also strengthening the function of BM in times of emergency and crisis as it is seen a trusted and agentic technology which merits further research.

Conclusions: exploring Bōsai Musen as convivial technology in the everyday life of Amami islands

Our research provides evidence of a well-integrated *Bōsai Musen system* in remote and smaller island communities' communicative ecology and information ecosystems, indicating

in its turn the importance of using an integrated mapping model that allowed us to identify how technology plays a significant part in the resilience and agency of small island communities. Because of its obvious use of technology for disaster prevention, its other functions in the information ecosystem of the islands have not been paid much attention to. We would argue that these additional functions can illustrate one key point, that small islands unique micro-communicative ecologies define, shape, and ascribe unique meaning and use not only of the information flows and uses but also the technology itself. As it was illustrated in Kikaijima (for Uken FM see Papoutsaki and Kuwahara 2018), the island agents (local authorities, community leaders and collectives), acting at meso and micro levels, have been able to translate Illich's vision of convivial technology that has contributed to adapting BM in an agentic way that enriches the island communicative ecology.

Information, and equal access to it, is a critical element in remote island community development as it enables informed voice, engagement and participation in small island communities. While BM appears to be a "top-down" information system, albeit at a very local level, acting like a "benevolent big island brother" beaming into neighbourhoods and dining rooms, when looked at closely there is evidence that it enables community agency and resilience as it sits in the centre of the island's information landscape, filling in an obvious gap by balancing out local information flows and dynamics and strengthening the impact of information as it is delivered by a local "agent" (at a micro level) that is seen as socially trustworthy (see Dale and Sparkes 2010).

Further, we cannot ignore the implications this locally adapted technology can have in times of crisis, like severe weather patterns. Trusted information sources and agents at the community level increase community resilience and agency when it comes to times of crisis. Resilience, as defined by the Resilience Alliance, is the "capacity of a system to absorb disturbance, undergo change, and still retain essentially the same function, structure, identity, and feedback" (www.resalliance.org/; see also Gunderson 2000). We know that communication is an essential element of resilience (Longstaff and Yang 2008), and that community agency requires being well-informed (Dale and Sparkes 2010). The role of communication in crisis time cannot be limited to the technical reliability of communication systems, assuming the messages sent are effective and that handing out brochures or broadcasting government-approved updates on the situation will be enough, as it is often the case. Information will not be successful if the people receiving it do not trust the message or the sender of the message (Griffin et al. 2004). In small island communities, this trust is the result of constant engagement build over time.

Notes

1. The original research started in 2017 as part of an International Research Fellowship at Kagoshima University's International Center for Island Studies that led to the collaboration of the authors. Since then, they have conducted extensive fieldwork in Amami Ōshima, Kikaijima, Okinoerabujima and Tokunoshima in 2019 and 2023 involving multiple formal and informal interviews with individuals, local authorities and island based organizations.

2. It is important to note here that one of the authors, Sueo Kuwahara, is an Amamian who grew up in Kikaijima and Amami Ōshima. This enabled us to enter an existing social network that afforded us rich ethnographic observations and engagement with locals at various levels of these island communities.
3. For an example of this information see the Sammu City's Safety and Security handout, 2023 https://www.city.sammu.lg.jp/data/doc/1636528134_doc_31_0.pdf.
4. Also see, Michiko Fukahori, Dec 2012. Disaster and ICT Systems in Japan. Ministry of Internal Affairs and Communications Japan: http://slideplayer.com/slide/1514176/
5. For the concept to Storytelling Networks see Kim, Jung, Ball-Rokeach 2006; for island storytelling networks see Papoutsaki and Kuwahara 2018, and 2021 and Konishi and Papoutsaki 2020.
6. For an example of island convivial technology see Konishi and Papoutsaki's work (2020) on Okinawa community radio used as a convivial technology
7. Kagoshima Prefecture: The situation of the instalment of Bōsai Musen in the Amami Islands (as of April 1st, 2015) https://www.pref.kagoshima.jp/aj01/bosai/bousaikeikaku/documents/51890_20180615115344-1.pdf
8. Kikai-cho Yakuba (Kikai Town Hall): http://www.town.kikai.lg.jp/tokei/machi/gaiyo/ichi.html ((March 30, 2023)
9. Kikai-cho Chosei Yoran (Kikai Town Statistical Survey Handbook) 2022: https://www.town.kikai.lg.jp/tokei/machi/gaiyo/documents/reiwa4tyouseiyourann3.pdf (March 30, 2023)
10. ibid.
11. Tokunoshima-cho Town Census Report 2017 https://www.tokunoshima-town.org/chose/koho/images/tyouseiyourann.html (March30, 2023)
12. http://www.pref.kagoshima.jp/ac07/pr/shima/gaiyo/erabu/okinoerabu_top.html (29/4/2023)
13. National Census 2020, https://www.machimura.maff.go.jp/machi/contents/46/533/details.html (29/4/2023) and https://www.machimura.maff.go.jp/machi/contents/46/534/details.html (29/4/2023)

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