Petabencana.id in Flood Disaster Management: An Innovation in Collaborative Governance-based Early Warning System in Indonesia

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Abstract

The flood disaster has become one of the most damaging hydro-meteorological disasters which recorded a loss of Rp30 trillion in Indonesia. The flood disaster early warning system is one of the most important parts of the disaster management process which can reduce the possibility of losses that can occur. The mandate of the existing regulation emphasizes that in the disaster early warning system it needs to involve various parties from public and nonpublic actors collaboratively. The manifestation of the mandate is Petabencana.id which was initiated by the Yayasan Peta Bencana and involved elements of government, universities, mass media, donor agencies, nonprofit organizations, and the community. This study analyzed the collaborative process of public and nonpublic actors through collaborative governance frameworks. This study included descriptive qualitative research with post-positivist paradigm and uses in-depth interview methods and directed content approach. Based on the findings, it is illustrated that the process of collaboration has been formed between the public and nonpublic actors. In terms of collaboration process, there is lack of transparency in Petabencana.id management especially in finance issue. The findings also revealed that the socialization process of Petabencana.id in community and educational entities still in effective and the roles of government role can be enforced. However, there is lack of role from the private sector which can contribute to make Petabencana.id better. This study still has limitation include the amount of informant of various elements from university, mass media, and community, in this study just use directed content approach to describe the perspectives of them in terms of collaboration process.

Keywords: *Collaborative Governance, Early Warning System, Petabencana.id.*

INTRODUCTION

Floods are hydrometeorological disasters the occurrence of which increasingly become more frequent over the last few years. Tingsanchali (2012) considers flooding as one of the most detrimental disasters in the world, while Islam et al. (2016) categorizes flood disasters to be among the most influential things on human life. The Asian region is at the top of the list of victims of natural disasters. Indonesia ranked second in terms of death toll that are caused by hydro meteorological disasters that include floods, landslides, tropical cyclones, and drought that are in part attributable to higher frequency of extreme weather events in the Asia-Pacific region, inflicting losses that amounted to USD 22.5 (Ulum, 2013). Based on BNPB (2016) statistics, Indonesia has 315 districts / cities in Indonesia as pone to disasters to varying degrees. Almost all regions in Indonesia face vulnerability to flooding disasters ranging from medium to high that are in. In terms of population, 63.7 Indonesians live in areas that are prone to between moderate and high flood hazards (BNPB, 2016). The same study also revealed that the estimate of the average loss and damage attributable to flooding is in the order of IDR 30 trillion. To that end, flooding disasters, which have become more frequent, have become increasingly detrimental to society, by inflicting huge losses in both material, live lost, livelihoods disrupted through displacement, destruction, and damage to both community and personal property (BNPB, 2012). Society pays lower material and human cost if preventive and proactive mechanisms are in place that provides advance warning about an impending disaster. This research assesses the function and activities of Petabencana.id, which is multi-stakeholder framework that involves state and non-state actors that provides and disseminates information about flood disasters specifically the adoption and deployment of an flood disaster early warning system (EWS that is based on a collaborative governance framework in DKI Jakarta. Specifically, the research identified factors that have contributed to the progress, obstacles encountered and weak areas that need improvement to enhance Petabencana.id platform performance as a reliable reference of information on flood disasters. The novelty in this study lies in the adoption of collaborative governance arrangement in EWS management that involves various state and non-state actors.

Collaborative governance itself is defined as a process and structure of decision making and management policies that involve actors at the boundaries of public, government and community, private, and civil institutions to achieve public interests which a single stakeholder can hardly achieve a single stakeholder (Emerson & Nabatchi, 2015). Collaborative governance framework, which involves various or stakeholders, enhances the involvement of state and nonstate actors in public policy (Kusumasari, 2012; Muham-

mad, 2017;(Saptawan & Yustian, 2019; Daswati et al., 2019), and have positive impact on disaster management process , specifically, during disaster early warning system, phase. The argument, is in line with findings that by involving nonpublic actors in the early warning system, Petabencana.id has instituted a major change that has become an element of its institutional framework. This is due to the fact that collaboration is not only limited to involving and engaging both state and non-state actors in the process of reporting disaster events but also in in conducting research, dissemination of information, and funding disaster related events in Petabencana.id (Widyanarko, 2018).

The development and deployment of an early warning system (EWS) that provides information on community response and preparation for the disaster is one of the ways that can mitigate the negative impact of disasters on society. The response systems not only limited to equipping humans with the ability to respond as quickly as possible but also integral to the use of Information and Communication Technology (ICT) in the form of the infrastructure, knowledge, and technical facilities that are relevant to community needs (Onafeso & Samuel, 2012). The development of EWS can be influenced and informed by the use and adoption of sophisticated ICT to provide real time disaster information about the location and level of destruction and damage from disaster that is generated by reports on the ground

as well as via by satellite observation (Buzna et al., 2007; (Asplund, Nadjm-Tehrani, & Sigholm, 2009). Timeliness of information in early warning becomes one of the most important considerations give the need to minimize the losses flood disaster inflict and cause (Ginting & Putuhena, 2014).

Effective communication and information are important component of good EWS. Petabencana.id is one of the EWS that have been implemented in four cities in Indonesia. Since its development, Petabencana.id has received various awards from both local and foreign sources. Petabencana.id was the initiative of the Jakarta Regional Disaster Management Agency (BPBD) and other parties (Petabencana.id, 2018a; Menpan.go.id, 2019). The uniqueness of this innovation lies in the community involvement in reporting of disaster events in real time based on crowds online through the Petabencana.id website as well as social media including Twitter. The reports will be validated by the government, which minimizes the impact by reducing the time between the occurrence of a disaster vent and intervention (Petabencana.id, 2018a; OECD, 2017; Widyanarko, 2018). EWS can also be categorized as a form of e-government, which involves the use of ICTs to improve the effectiveness and efficiency of the delivery of government services (Chaushi, Chaushi, & Ismaili, 2016).

Online engagement has become increasingly possible thanks to the rapid devel-

opment of platforms coupled with open data initiatives and big data that have enhanced and connectedness among community members as well as between on community and other communities (Kornberger, Meyer, & Höllerer, 2017). Indeed, as Koffi Annan (1999) noted in BNPB (2012) policies relating to the disaster system are not only the monopoly of either the government or international institutions, but also are equally important for all stakeholders both state and non-state alike. To that end, the Indonesian Government seeks to transform the disaster system by adopting the Hyogo Framework for Action which entails incorporating EWS that keeps abreast of current development through the involvement of government agencies, the private sector, local communities, Non-Governmental Organizations (NGOs), and international institutions (UNEP, 2012; UNDP, 2018; Meechaiya et al., 2019).

METHODS

The study was based on mixed methods (Morris *et al*, 2009). Primary and secondary data were used. Secondary data in this study, which were obtained through directed content analysis, complemented primary data. Consequently, data collection techniques included in depth interview and directed content analysis. The use of directed content analysis was based on the ability of the technique to validate or extend the conceptually and theoretical framework (Hsieh & Shannon, 2005), of the phenomenon being studied, which in this case was collaborative

governance (Ansell & Gash, 2008). Informants included Yayasan Peta Bencana Researchers (Hotniida Sinambela as Research Operations Coordinator, Adhitya Yusuf as Research Associate, and Anarita Widyaningrum as Geospatial Data Coordinator). The foci of directed content analysis included to obtaining perspectives of the government, private sector, mass media, University and research institutions, and local community.

FINDINGS AND DISCUSSION

Public service is defined as the provision of goods and services that society needs in accordance with established regulations public service and procedures (Salomo & Rahayu, 2015; Nurmandi & Khozin, 2019). This research used the concept of public sector innovation to highlight Petabencana.id as one of the public sector innovations in Indonesia. Mulgan & Albury (2013) defines public innovation as "the design and implementation of new processes, services and provisions that result in significant improvements to the efficiency, effectiveness or quality of public services." Public sector innovations are associated with enhanced capacity to harness interactions between the government and the community (Bekkers, Edelenbos, & Steijn, 2014). This is because, interactions between state and non-state actors, including members of community, support and sustain the continuous innovation process that in turn sustains improvements in public service delivery perfor-

mance (Jannah, 2017).

Wirtz & Daiser (2015) and Warf (2017) in (Rahayu & Juwono, 2018) categorize five patterns of interaction in the conduct and implementation of E-government, inter alia, government to citizen (G2C), government to business (G2B), government to government (G2G), government to employees (G2E), and government to other institutions. The increase in demand for community services has led to using ICTs development

of more effective, efficient and transparent ICT supported and based public services (Nurmandi, Khozin, & Salahudin, 2018). E-government, which is defined as the use of ICT in conducting government affairs , has been associated with an increase in the accessibility of services to the community, public services effectiveness, and responsibility & accountability of the government (public goods and service providers) to service users (Spirakis, Spiraki, & Nikolopoulos, 2010). The concept of public service concept is used in this research to explain both the Petabencana.id business process and output, which are intertwined with the context of collaborative governance that emphasizes the involvement of various actors in public policy.

Collaborative governance is regarded as an arrangement of one or more public institutions that directly involve non-public stakeholders in the process of making decisions that are collective and formal, oriented towards shared consensus, and deliberative ,

that have the aim of making or implementing public policies or managing public programs or public assets (Ansell & Gash, 2008; Rahmaningtyas & Rahayu, 2019). Collaboration between government actors and non-state actors is be more effective in achieving than the government going it alone (Ihsanudin & Rahayu, 2019). Moreover, collaborative governance framework can be used in analyzing the existing collaborative process (Abubakar, Prasojo, & Jannah, 2017). One of the models that posit interaction among various stakeholders in delivering services is Ansell and Gash (2008) model. Ansell & Gash (2008) model of depicts the relationship between public institutions and non-governmental actors within a framework that comprises four main variables, including starting conditions, institutional design, facilitative leadership, and collaborative process.

Petabencana.id has been described as an innovative solution (OECD, 2017; global-unnovationexchange.org, 2019); as well as an institutional arrangement and framework that has contributed to improvement in the design and implementation of processes and services, which in turn has higher quality of services (Mulgan & Albury,2003).The Complications and complexities in public policies are important factors that trigger innovations in the public sector (OECD, 2014). This is especially true for true and relevant for the context of Petabencana.id. The emergence of Petabencana.id as triggered by floods in Jakarta in 2013, attributable specif-

ically to the existence of an information gap between the government and the community. The information notification process lacked promptness with the frequency of updates being once in 6 hours.

The innovative process, which has occurred since the establishment of Petabencana.id is gauged from enhanced involvement of the public in providing real time reports through sharing data on Twitter, Qlue, detik.com, Pasangmata.com, Petabencana.id website, which the government agency, The Emergency Operation Center (EOC), of the National disaster Mitigation/reduction board (BNPB) processes validates and subsequently shares media partners (such as CNN Indonesia and The Jakarta Post), local government platforms such as Qlue or via updates on the Petabencana.id website (OECD, 2017; Petabencana.id, 2018b ; BNPB, 2019). The involvement of the community in the collection and dissemination of disaster event information and various platforms or media partners increases public access to information that in turn creates conditions where anyone can receive relevant information in real time on the location and trajectory of flooding points mapping, which in turn reduces the risk of higher losses from flood disasters (Barnett et al, 2018). The innovation uses a non-paid platform, which was created by CogniCity that was later developed further by the MIT Urban Risk Lab by developing the existing features, including the crowdsourcing facility. Meanwhile,

BNPB, through EOC, is tasked with to verifying and sharing data received from various sources to mass media, community, and other stakeholders.

A public innovation is considered beneficial if it contributes to society improvement by mitigating the occurrence or reducing the adverse impact of recurring problems. The establishment of Petabencana.id strengthened and improved relations between the government and the community, by allowing community members to participate actively in collecting and sending reports about their environment by taking selfies themed "selfies save lives" activity Bekkers, Edelenbos, & Steijn (2014). Moreover, the activity while simple and seems self-indulgent, manifests the contribution of community members to the wellbeing of other members of the community as well as communities to which activity participants are not members (OECD, 2017). Petabencana.id was the first innovation that involved the community in the flood disaster early warning process, which achievement was possible thanks to the interaction of the community and government through online platforms that facilitate the emergence of an efficient, timely and effective disaster events (Widyanarko, 2018). Online community engagement is effective because of the large number of Indonesians who have access to internet. Referring to More than 130 million Indonesians use social media (We Are Social, 2018), making the space an opportunity for high community interaction engagement

and participation in various issues that affect the community. Such space is also an opportune medium to foster and harness interaction of the community with a process that contributes to the improvement and enhancement of community-government relations.

The process of creating sustainable innovations should involve the role and in-

ships with social media and media in data sharing, and nearly 50 media in Indonesia and abroad (Petabencana.id, 2019; Harvard University Center for Geographic Analysis, 2017; BNPB, 2019). The role of every actor intertwined, interdependent on, and influenced, roles of other actors. This is because the data creation and sharing process and platform integration at the local government
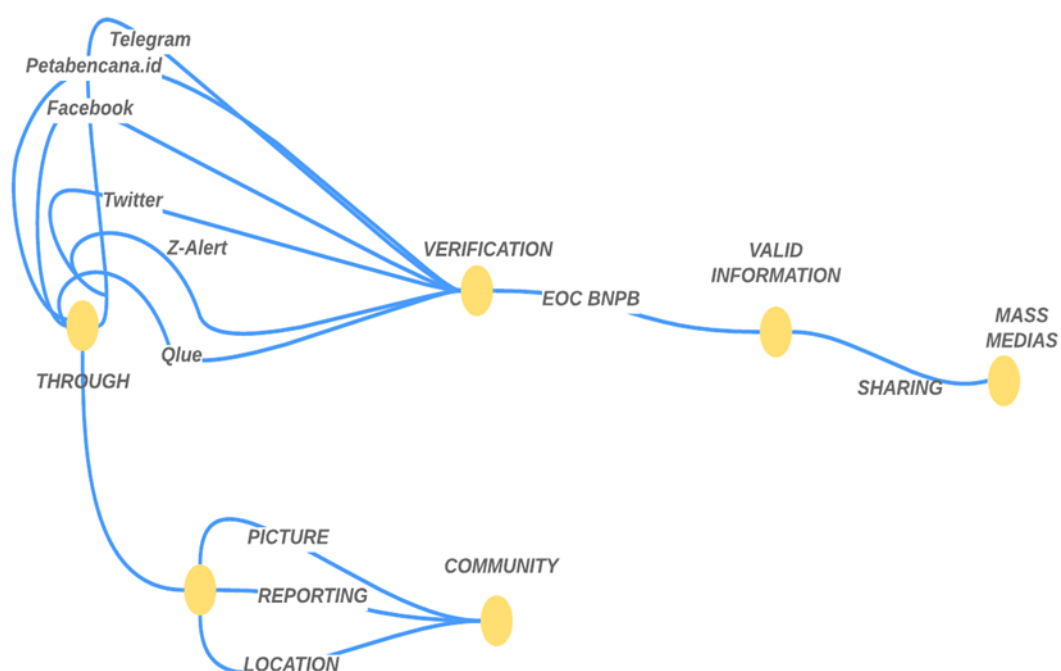
Figure 1 Community Involvement in Petabencana.id
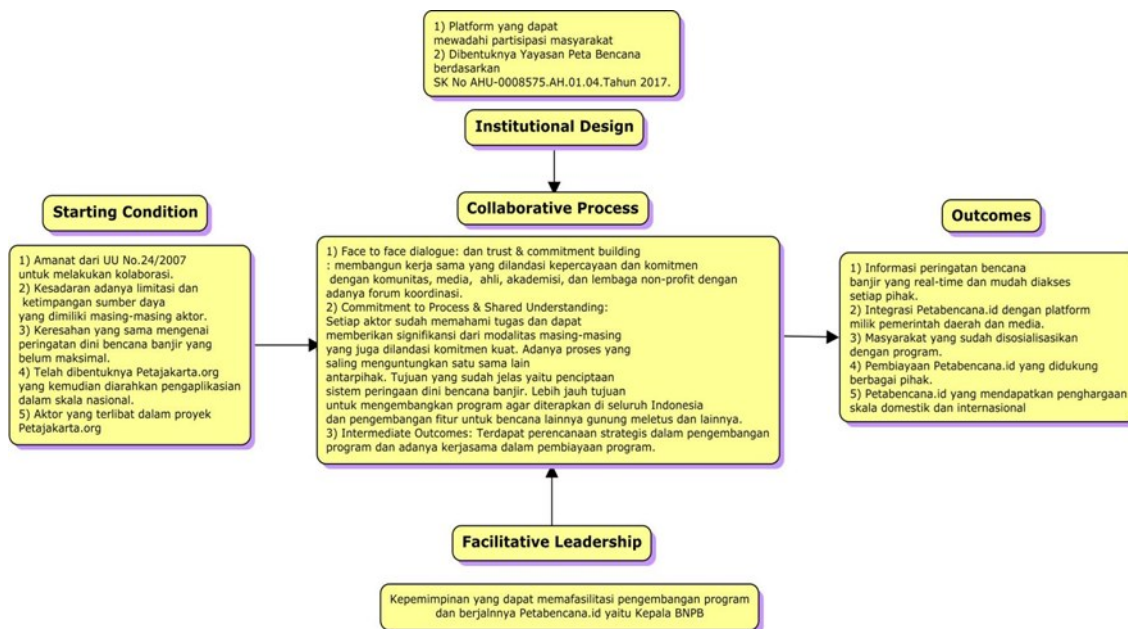Source: Petabencana.id, 2019

teraction of various stakeholders (Jannah, 2017). From the Petabencana.id has involved a variety of important parties including the government (BPBD Jakarta & BNPB), MIT Urban Risk Lab researchers (Tomas Holderness who became the lead developer of Petabencana.id), various universities, international donor agencies and domestic donor agencies, five local governments, partner-

level with Petabencana.id (OECD, 2017; Searle, 2017). MIT as the initiator of Petajakarta.org, which was the forerunner platform that preceded Petabencana.id, as also involved in establishing the collaboration that secured funding for the platform by pivoting the project and its benefits to potential donors.

Innovation and service share one com-

monality in the public service domain, which is the involvement of various stakeholders in the implementation process. Disaster, is a service , in which the community has interest, while an early warning system is mandated in Article 1, 44, & 45 of Law Number 24 / 2007 concerning Disaster Management , which is the legal framework that underpins BNPN establishment and operations as the lead agency in disaster management in Indonesia. In general, funds that are used to finance disasters are from various sources

suing program and institutional accountability and sustainability. On the contrary, Petabencana.id involves various stakeholders delivering services including government, Universities, mass media, and the community. The state provides the regulatory framework that supports effective and flawless disaster management. Such regulations include those that relate to sources of financing for disasters such as the central government (BNPB), international donor agencies, domestic donor agencies, and con-

Figure 2 the Modification of Ansell & Gash (2008) Collaborative Governance in Petabencana.id

Source: Researcher

including from the local and national government, international institutions, and domestic institutions. However, there is still limited transparency on sources and uses of funds, especially to local communities. This is despite the importance that transparency and accountability of budgeting plays in en-

tributions from the public and private sector and community contributions. By 2019, the total amount of funds accumulated had reached $ 874,000 or the equivalent of IDR 12,334,762,000 (Globalinnovationexchange, 2019). The conduct and operations of Petabencana.id is based on Law No. 24/

2007 concerning Disaster Management (the Disaster Management Act). The law mandates the creation of a collaborative process and developing and making an early warning system as an important part of the disaster management process. Besides, institution aspects are also an important component of public service. In general, Petabencana.id is under the coordination of BNPB and the Disaster Map Foundation. Meanwhile, some activities that include the development and management of information technology, reports receiving and verification,, information dissemination, program socialization and research are carried out with the collaboration of various government and nongovernment actors.

With respect to of the domain of e-government, Petabencana.id befits to be categorized as e-government because it uses ICT to provide real-time and more efficient disaster information. Moreover, the widely accessible platform enables Petabencana.id to foster easier interaction between the government and local communities, as well as other stakeholders. Based on the interaction pattern of the relationships among stakeholders can be characterized as G2C pattern (related to reporting patterns and the existence of information disseminated to the public), G2G (elation between Petabencana.id and Qlue / CRM), and government to other institutions (the process of sharing data and information dissemination process that involves Petabencana.id and mass media). The G2C pattern makes it possible for the public to obtain information and services they need quickly, cheaply, and easily at any time (Ahn & Bretschneider, 2011).

Petabencana.id provides early warning information on about flood disasters quickly, easily, and free of charge. Obtaining information only requires paying a visit to the Petabencana.id web page social collaborating media as well as social media (twitter). Nonetheless, the community only receives information about flood disasters through Petabencana.id. That said, community members can contribute information about flood disaster events and indications of impending floods online. This is among other ways achieved through government-to-government interaction that fosters the integration of Petabencana.id services with Qlue in Jakarta. The relationship and arrangement provide the community the opportunity to convey reports about flood events in their areas as well as access flood disaster information. Meanwhile, the Government to others relationship can be discerned from the process involving receiving and verifying reports, as well as disseminating information to various mass media and other disaster information pages.

"..We don't input the information of social media directly, it undergoes a filtering process based on keywords "banjir (flood)"...people tend to report later and they will be given a report card. They will verify the location, descrip-

tion, and photos. This verification or validation is aimed at ensuring that government provides reliable information to the community."(In-depth interview with Anarita Widyaningrum as Geospatial Data Coordinator, December 10th 2019).

Overall Petabencana.id collaborative governance framework involves more than 30 actors. A modified version of Ansell & Gash (2018) was considered the most suitable to analyze the collaborative governance.Four key variables influence the collaboration between public institutions and non-governmental actors within Petabencana.id framework. As regards the starting condition, some of the crucial factors deemed important include the mandate that La No. 24/2007 on Disaster Management as the basis of collaboration, raising awareness of various actors such as Universities and other research institutions of the need to support BNPB in developing the Petabencana.id system. The formation of Petajakarta.org, which is the forerunner of Petabencana.id platform, was possible thanks to the cooperation of BPBD DKI Jakarta and various parties, which therefore provided vital starting capital for developing Petabencana.id. This is because Petajakarta.org had well developed and clear definition of the role of actors in the collaborative governance framework, which meant that the establishment of Petabencana.id only required expansion and deepening the framework given the higher diversity of actors involved.

The collaboration process is an important part of providing real time disaster information online through Petabencana.id, based on a face-to-face dialogue process and the creation of trust and commitment among actors involved in Petabencana.id framework. It must be noted though, that Petabencana.id as a collaborative governance framework, is driven by the need to achieve the objectives democratic governance, as well as enhance security, inclusiveness, and resilience of the city flood disaster service delivery system. Achieving that requires the existence of the capacity and capabilities to coordinate and share information between individuals and governments through the use of t democratic decision making supporting tools (Globalinnovationexchange.org, 2019). Based on the program plan, there is need to develop a long term plan that will forge collaboration as Petabencana.id program expands to other regions of Indonesia, Since 2018, Petabencana.id is expanding its operations to all regions in Indonesia where it is not only helping in the development an early warning system on flood disaster information but also other disasters including forest fires, volcanic eruptions, earthquakes, and extreme weather events (Globalinnovationexchange.org, 2019; BNPB, 2019). To that end, the development of a collaborative governance framework will be needed considering the need to coor-

dinate and manage activities of many actors that including local government agencies such as Meteorology, Climatology and Geophysics Agency (BMKG), and national government ministries such as the Ministry of Environment and Forestry (KLHK).

Besides, Petabencana.id is making adjustments in its operations, including tools it uses, to enhance community involvement. One of the adjustments related to increasing public access to Petabencana.id services in areas that lack strong mobile phone transmission capabilities and old generation mobile phones. Efforts to replicate Petabancana.id services in Bandung, Surabaya, and Semarang faced obstacles because of inability of the public to access services in part because of the mobile phones that on older operating systems than those in DKI Jakarta. Petabancana.id as a platform that is committed to providing public services to all sections of society regardless of class and region where they live, is bound by its mandate to ensure that early warning information about all disasters and extreme weather events is accessible to all, at all time. Other efforts to increase access of its services, relate to Petabencana.id plan to use a server that is located in Singapore (AWS); continuing the transitioning process from Petajakarta.org to Petabencana.id by strengthens the management information system to increase number of servers to eight (8), which should raise the number of people having access to its website to 10 million; scaling up the capacity by using the Elastic Beanstalk layer

that reduces the loading process time, strengthening the resilience of Petabencana.id page to disaster damage in emergency situations, double the stability and scale, dimensions of existing computer architecture (Widyanarko, 2018). Such important a role is Petabencana.id now playing in disaster reduction in Jakarta that it served as the main reference and guidance for DKI Jakarta provincial government in the evacuation of Jakarta residents impacted by the flooding disaster (Widyanarko, 2018). It is also supported by the existence of a high.

As regards to infrastructure, Petabencana.id is fairly good in optimizing the role of the community in the reporting process. Nonetheless, there are some shortcomings in the existing infrastructure. One of the limitations is the lack of feedback, consultation mechanism, and navigating system the community can use to interact with the Petabencana.id in real time. Features availability on the platform does not facilitate direct feedback for reports the community submits, nor does it have an emergency telephone number that the community can contact in case of a disaster emergency. Secondly due to the unavailability of a navigation system, Petabencana.id is unable to provide information about road accessibility that is affected and unaffected by flooding events for travelers. This is at a time when community is extremely dependent on online transportation services. Based on estimates from tirto.id (August 13, 2019), 21.7 million people used the service in 2019,

which is expected to reach 37.9 million in 2023.s. Thus, the availability of a navigation system should assist be beneficial to the community and the private sector who need information on roads that are accessible during flood disasters to reduce transportation cost and time to their destinations.

Another important issue that remains unresolved is the role of the private sector. Based on Petebancana.id sources, the contribution of the private sector has been limited to Twitter's involvement in providing donations to support the development of the platform, especially in tracking tweets that relate to flood disasters in Indonesia using hash tags.. The contribution of the private sector can be improved an enhanced in several ways, including the development of an effective navigation system by using Google Maps (Gibin, 2008). A good example of government and private sector collaboration in the development of the London-profiler. The Londonprofiler is a navigating system uses detailed spatial data and thematic search criteria, and a users' friendly interface fosters good understanding among stakeholders, which developed in collaboration between Google Maps and the London city government. as s. Collaboration between Petabencana.id and Google Maps should increase the accuracy of existing locations , facilitate better mapping of paths and routes community members can use during flood disasters, and help the private sector in giving directions to drivers to avoid the flood-affected routes during flood events. Second-

ly, Petabencana.id can benefit from collaboration with the private sector by drawing on the vast resources the latter have at their disposal. One of such resources the private sector has, closed-circuit televisions (CCTV), which if accessible have the potential to enrich information on indications and flood events. Petabencana.id can access local in CCTVs to confirm flood event reports submitted by the community in various regions Collaboration between government and the non-government sector through integrated CCTV collaboration in various urban centers such as Stockholm, New York, London, Singapore, Monaco, and Beijing.in has lent a lot of support to crisis and emergency management (Rahman, 2017). Thus, strengthening the collaboration between Petabencana.id and the private sector can quicken the response rate to disaster events, and better disaster management in general.

One of the strong points of Petabencana.id collaborative governance framework is the involvement of local communities in platform activities (Widyanarko, 2018). Community members submitted 1,000 reports of flood events in Jakarta in 2017, which were subsequently uploaded to Petebanca.id website, which were accessed by more than 250,000 users (Widyanarko, 2018). The reports for 2017, which were 1,135 in total, comprised 876 Q-lue application, (223 reports from Twitter & Instagram, and 36 reports through Pasangmata. In addition, data analytics showed that the intensity of users of the Petabencana.id website has

increased and reached 252,449, while 373,591 people have had access to online services offered by the website and paid 312,794 visits on the website. Based on the above indicators, it is apparent that Petabencana.id has become the main source of valid, fast, and easily accessible information on flood disasters in DKI Jakarta. Other key characteristics of users and services Petabencana.id offers are discernible from a review by Widyanarko (2018) that notes that the majority of service users accessed website using mobile phones (83.79%), 14.69% used Personal computers, and 1.51 % used tablets. The content of the majority of reports submitted by the community mentioned specific locations (56.72%), while 33.83 % mentioned the depth of flood water (Widyanarko, 2018). It is also noteworthy that the number of users of Petabencana.id is already larger than that which accessed Petajakarta.org, and community awareness has increased as reflected by the search for and access to information on flood disasters.

There is evidence that points to enhanced community and stakeholder participation and use of Petabencana.id as a reliable source of real-time flood updates. Coverage of Jakarta floods in early 2020 by various mass media attests to that ((CNNIndonesia, 2020 02 January; The Jakarta Post, 2020 January 03; voaindonesia.com, 2020 January 31; tekno.kompas.co, 2020 11 February; goodnewsfromindonesia.com, 2020

February 12).. Mass media coverage of flood events and information about floods that is obtained from Petabencana.id serves as an important source of awareness for the community and other stakeholders about the benefit of Petabencana.id. Besides, Petabencana.id has made substantial progress in the way flood disaster information is displayed for users by using signs and coloring scale to represent the depth of floods. For instance based on the color scheme, red represents alert level one or *Siaga 1* for a a flood with height above 150 cm; orange alert level 2 or *Siaga* 2 for a flood height ranging from 71 cm to 150 cm; yellow represents alert level 3 or *Siaga* 3 for a flood with a height that ranges from 10 cm to 70 cm, and alert level 4 or *Siaga 4* which flood with low height that is symbolized by green color.. Thus, given the features and mechanisms Petabencana.id has in place, it has the ability and capacity to deliver a variety of information on flood disasters to various stakeholders using both offline and online tools (cnnindonesia.com, 2020 02 January; thejakartapost.com, 2020 03 January; tekno.kompas. co, 2020 11 February; goodnewsfromindonesia.com, 2020 12 February).

Moreover, members of local communities can serve as volunteers to socialize not only accessing and using Petabencana.id platform services, but also in raising public awareness about disaster mitigation efforts. Members of the community can also make donations to Petabencana.id via email, which

CONCLUSION

Petabencana.id is a public sector innovation tailored to improving the quality of disaster information delivery in real time, underpinned and implemented within a of collaborative governance framework that involves approximately 50 actors that are drawn from the government, Universities / intellectuals, international institutions, and local community .Petabencana.id has achieved a lot of progress in sensitizing and socializing the importance of flood disaster mitigation in the community, including the development and deployment an early warning system that has helped to mitigate and educed the adverse impact of floods in affected areas and communities in DKI Jakarta. However, Petabencana.id still faces some problems and obstacles. One of the most important is lack of transparency and accountability to the public, limited involvement of the private sector in Petabencana.id activities, socialization that is still not cover all the administrative areas of the city, noninvolvement of primary and secondary education in program socialization activities, To improve its importance and acceptance in the community, Petabencana.id has plans to increase the number of stakeholders who are involved in its activities at both the ministry, agency and local government level. Nonetheless, increasing the number of stakeholders involved in Petabencana.id activities implies that the collaborative governance framework will expand, making its complex to manage and administer. This is why BNPB leadership qualities will be needed to ensure that Petabencana.id activities and functions continue to smoothly, regardless of the increase in the number and variety of actors involved. What is equally important is that increasing the number of stakeholders in the collaborative governance framework will require changing the existing legal framework to accommodate expansion of its membership and collective joint funding of platform activities.

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Table 1 Stakeholders Mapping in Petabencana.id

Stakehold-ers	Definition		Modality	Contribution
Central gov-ernment	BNPB (Directive Interactive)	Implementing, Authorities, Policies, Budgets, Integration of existing Programs, and Coordination with the Gov-ernment.		Supporting the implementa-tion of the Petabencana.id program includes disseminat-ing information, verifying information through the EOC BNPB, funding the program, and conducting studies that can support platform develop-ment.
Local gov-ernment	DKI Jakarta Provincial Government (Jakarta Smart City) (Directive Interactive)	Implementing, Authorities, Policies, Integra-tion of existing Programs, and Coordination with the Gov-ernment.		Integration with Smartcity.jakarta.go.id plat-form and participate in dis-seminating information to inform the community about Petabencana.id.
	DKI Jakarta Provincial Government (Qlue & Citi-zen Respond Management (CRM) (Directive Interactive)			Integration with CRM & Qlue platforms
	DKI Jakarta Provincial Government (BPPD) (Directive Interactive)			The initial developer with the Yayasan Peta Bencana then there was a transition of high-er responsibilities, BNPB and funding when Petajakarta.org was being developed.
Data part-ners	Detik (Directive Interactive) Pasangma-ta.com (Directive Interactive) Zurich (Directive Interactive)	Integrated online platform with Petabencana.id		Sharing data, integrating Petabencana.id with existing features, and disseminating information so that people can participate and find out infor-mation
	Twitter & Data Grant (Directive Interactive)	Online platform integrated with Petabencana.id and sup-porting funds of Petabencana.id		Sharing data, integrating Petabencana.id with existing features, disseminating infor-mation so that the community can participate and find out information, and participant in funding the program.
Media part-ners	37 Media Partners from Indonesia and interna-tional media partners (The Street Jour-nal, BBC, Metro TV, etc.) (Indirectly interactive).	Platform that disseminates information about Petabencana.id		Dissemination of information so that people can participate and find out information.

Non-profit from Indonesia	**Yayasan Peta Bencana (Internal Environment)**	Petabencana.id developer and manager, coordination with all parties, and budget management.	Initiation of formation of the Petabencana.id platform, invitation various parties to collaborate, provided training to the community on the use of applications, provided opportunity for the involvement of volunteers to enhance community awareness of disaster mitigation, sharing data, opening community opportunities to donate by contacting via e-mail, and developing features Petabencana.id.
	Ciliwung Condet & Puncak Communities	Community members who can assist in the implementation of the Petabencana.id program.	Helping the socialization of Petabencana.id to community.
International non-profit organization	Wahana Visi Indonesia (Directive Interactive)	Donor and developer of Petabencana.id	Provide funding for operational needs, research, platform maintenance, and platform feature development.
	United States Agency of International Development (USAID) (Directive Interactive)		
	Australian Aid (Directive Interactive)		
	Disaster Management (DM) Innovation (Directive Interactive)		
University	Massachusetts Institute of Technology (Directive Interactive)	Ideas, innovations, platform development capabilities, and the development of studies or research.	One of the initial developers of the platform uses open source cognity technology and conducts research related to Petabencana.id and research related to disaster risk management.
	Harvard University (Directive Interactive)		
	Concordia University (Directive Interactive)		
	University of Wollongong (Directive Interactive)		
Research institution	Pacific Disaster Center (Directive Interactive)		Partner in the process of research and assessment related to disaster and the process of developing platform.
	Humanitarian Open Street Map Team (Directive Interactive)		
	Across The Cloud (Directive Interactive)		

Community (Directive Interactive)	Participation in terms of information based on crowdsourcing and information dissemination.	Leading line in ensuring the potential for flooding that will occur or that occur through social media reporting, the Petabencana.id platform with the Reporting Card feature, or by using the Qlue / CRM / Smart city Jakarta application. It also can make a financial contribution to the platform.
Twitter.inc	Donor and developer since Petajakarta.org	Widely known, Jakarta is the Twitter capital of the world with residents tweeting frequently on issues that relate to flooding. During the initial stages, Twitter contributed donations to Petabencana.id that were aimed at improving the effectiveness of the application to.