Gotong Royong in the Digital Age

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Abstract:
Jakarta faces floods every single year and every few years, the city is confronted with a rampant flood. Despite large-scale infrastructural works, floods will not be eliminated overnight. Jakartans will have to face the risk of floods now and in future. In such case, a robust and accurate flood warning and information system can be very valuable.

Current flood information warning does not always reach the entire population nor does it spread a message upon which people can take the right action. While technically, it should be feasible to implement a flood information system that 1) shares all information that is valuable for government and community to reduce flood risk 2) disseminates flood information in comprehensive messages and 3) can even be used to increase awareness for both government and community.

Indonesia has a long tradition of Gotong Royong. According to Wikipedia, Gotong Royong is the cooperation among many people to attain a shared goal. Perhaps, by sharing data, sharing sense of urgency and sharing information on resources and actions digitally, Jakarta can even lead Gotong Royong to the digital age and in doing so, support the thousands of decisions taken every year, when the floods of Jakarta are threatening its inhabitants again.

Keywords: *Floods, data-sharing, early warning, disaster risk reduction information, decision-making,*

1. INTRODUCTION

Jakarta faces floods every single year and every few years, the city is confronted with a rampant flood. The most recent severe floods took place in 1996, 2002 and 2007. On those occasions, more than half of the city was inundated. Increasing population pressure and further land subsidence are amongst the reasons which cause the city to face a vast increase of flood risk (Brinkman & Hartman, 2009). Also, Jakarta is one of those metropolises in the deltas of the world that will be severely affected by climate change. Jakarta is considered the most vulnerable city in the South East Asia Region (EEPSEA, 2009). Without adequate action, floods in Jakarta are expected to become even more frequent and extreme. New technologies in Flood Control could help Jakarta to release this burden.

The Government of Jakarta has been undertaking a number of big infrastructural works to reduce the occurrence and /or impact of floods, amongst them construction of an eastern floodway (completed in 2010), large-scale dredging works (planned start in 2011) and improved management of the coastal zone (under review in a Jakarta Coastal Defense Strategy). Despite these large-scale infrastructural works, floods will not be eliminated overnight, if ever. Jakarta citizens will have to face the risk of floods now and in future. Most people in the frequently flooded areas consider the floods as a routine event, and, with nowhere else to go, adapt their lifestyles to 'live with the floods'. However, the fact that they are already used to these floods, does not make them prepared for just any flood. Communities perceive floods as normal, disturbing, unmanageable and in some cases disastrous, depending on its characteristics (ITC, 2008). This can be illustrated with the result of a small inventory in Kampung Melayu, in which 87 inhabitants were asked about their perception on floods, see Table 1.

Table 1: Community's perception on flood intensity (Marchiavelli, 2008)

Water depth (cm)	Duration (days)			
	< 1 day	1 – 3 days	3 – 7 days	> 7 days
10 – 50	Normal	Normal	Disturbing but still manageable	Disturbing but still manageable
51 - 100	Normal	Disturbing but still manageable	Disturbing but still manageable	Unmanageable
101 – 200	Disturbing but still manageable	Disturbing but still manageable	Unmanageable	Unmanageable
201 – 300	Unmanageable	Disastrous		
> 300	Disastrous			

Globally, the decline in injuries, loss of livelihoods and deaths from disasters over the past 30 years is, in part, due to the establishment and improvement of early warning systems (International Federation of Red Cross and Red Crescent Societies, 2009). Today, a wide range of possibilities exists to take measures to mitigate the impact of flooding, including improved IT possibilities, better and cheaper satellite information, wide availability of smartphones in all societies, and web 2.0 applications. This paper discusses how there is a gap between what is technically possible and what is actual, on-the-ground. It is a plea to all actors in flood management to join forces in a modern form of *gotong royong*, and together counter the negative consequences of flooding.

2. LIVING WITH FLOODS

Almost every time a heavy downpour occurs in Jakarta, the inhabitants of the lower parts of the city face floods. Though these floods might not always be high or take very long, a number of residential areas is flooded ankle to knee deep up to several times a month, disrupting social and economic activities, transporting garbage and mud into the streets and houses, and increasing health risks such as diarrhoea, skin diseases and dengue.

Figure 1: Flood respons in Bintaro Pessangrahan, August 2010

Jakarta's floods are non-discriminative: during the rainy season neither the poor nor the rich neighbourhoods escape to be submerged once in a while. The difference is however in the coping capacity of its inhabitants. Jakarta's poorest are for a number of reasons more heavily impacted by the floods than their neighbours of higher income groups: their houses are more often of low quality and situated in the more vulnerable locations such as riversides, their economic activities are often out in the street (street vendors), and their financial reserves insufficient to deal with damage and losses. The impact of floods does not only limit to the time of the flood itself – before the flood comes, people are busy moving their belongings to safer places, and after the floods houses and streets need to be cleaned from garbage and mud. The time needed for this is subsequently not available for economic activities.

Urban livelihoods and environmental risks – Findings from field research in Kel. Kedaung Kaliangke and Kel. Bidara Cina, Indonesia (M. Spies, 2011)
In Kedaung Kaliangke about 88 percent of the households had their house flooded in 2010 – 33% only once (in August), 41%two times (in August and October), and 12% three to five times already. In Bidara Cina, 52% of the interviewed households had their house flooded in 2010 – but most of them with a frequency far higher than in Kedaung Kaliangke. While some households were not flooded at all, others had their house flooded more than 20 times, especially those located close to the river. The average height of the highest flood households had experienced in 2010 was about 40 cm in Kedaung Kaliangke, with a minimum of 10 and a maximum of 100 cm. In Bidara Cina, the average height of the highest flood was more than double as high – about 90

The impact of floods cannot be denied and is impacting the economic development of the city as a whole, and of already marginalized groups in particular. Nevertheless, most people in the frequently flooded areas consider the floods as a routine event, and, with nowhere else to go, adapted their lifestyles to 'live with the floods'. As showed in Table 1, floods only become 'unmanageable' when the first floor of the house is totally submerged, or a flood of one meter or more stays on for 3-7 days or more. Less extreme conditions are being dealt with as a nuisance rather than a disaster. Typical ways of reacting to flood warnings are moving up valuable and vulnerable belongings (on top of bed, cabinet, or to second floor), wrap important documents in plastic, and block the door against mud and garbage. When people can't practise their livelihood due to submerged streets, they have no other choice than to rely on their savings.

During the floods of 2007 the early warning system did not reach the whole population. For critical information on when the floodwater was expected to rise, residents relied on mobile phone or short-wave radio communication with people stationed at the floodgates 2007 (JFM1: Public Communications Campaign, November 2007). In a survey held by Jakarta Flood Management, most of the respondents revealed that they had not received information about the effects of flooding before the floods of February 2007 (JFM1: Public Communications Campaign, November 2007). Secondly, those who received a warning, the message did not provide details on how high the flood will be or how long it will stay (PMI). In the 2007 flood, most of the households in Kampung Melayu lost their belongings (incl TV and radio) in the second floor. They just didn't expect the flood to reach so high (Marchiavelli, 2008). This means that people rely on their traditional knowledge and experience to predict beforehand whether the flood is going to become normal, disturbing, manageable, unmanageable or maybe even disastrous, and decide on appropriate action based on this.

> I remember the last big flood in 2007. It was about 10 p.m. and suddenly the water level rose up to our chests. We all rushed out, trying to save ourselves.
>
> *(Sarini, North Jakarta)*

3. FLOOD EARLY WARNING

3.1. Current flood warning system in Jakarta

Currently in place in Jakarta are telemetric systems with water level and precipitation monitoring by PU DKI[1], BMKG[2] and BBWSCC[3]. The telemetric systems are not linked to eachother. The monitored water levels are sent to various layers in city administration and RW (Rukun Warga – village) through fax, phone and SMS, triggering government and non-government to get prepared. Twelve specific

[1] Provincial Public Works department of Jakarta
[2] Indonesia's Meteorological and Geophysical Office
[3] Water Resources Management Office for the Ciliwung-Cisadane River Basin

water levels are used for official alertness level (siaga) and authority delegation. To manage the floods in Jakarta, central and regional government control five main water gates, 30 smaller weirs, 450 flood control pumps at 55 pump stations, and have sandbags to their disposal to be placed along the river floodplains and several areas of micro drainage. In the preparation for community aid and evacuation, the government works closely together with the three large NGOs'/humanitarian organizations being PMI, WAHLI and Mercy corps. Together they discuss and coordinate on what facilities and how many staff/volunteers need to be deployed.

Ways to disseminate warnings include radio, television, telephone, mobile phone, handy talkie (HT), water level estimation board and speaker in mosque or even the conventional door-to-door. In recent years, we see that more and more people use high(er) technology tools to disseminate the flood information such as mobile phone (Machiavelli, 2008). Those who distribute and receive information include BMKG, PU DKI, BBWSCC, BNPB[4], BPBD[5] and various coorinating and operational units at municipal, kecamatan, kelurahan and community level.

3.2. IT and flood early warning systems around the world

A wide range of possibilities exists to take measures to mitigate the impact of flooding. Typically these are categorized as 'structural measures' (such as dams, drainage systems, dry proofing) or non-structural (such as forecasting, insurance, awareness). Deltares identified more than 185 different types of measures to reduce flood risk (Ven & Bons, 2011). An assessment of the robustness of realized flood management options (Ranger, Nicola and Garbett-Shiels, Su-Lin, 2011) in Guyana and Mozambique clearly concludes that the development of a Flood Early Warning System had a very positive cost-to-benefit ratio and are considered as a no-regret-option to reduce flood risk. Developments in Information Technology will make this cost-to-benefit ratio even better. Typically three types of flood early warnings can be distinguished:

- Manual flood warning systems, which are rather simple yet robust systems, often based on data collected in the field, and transferred to a central point.
- Simple automated flood warning systems, these systems are more automated in the sense that monitoring stations van deliver data automatically and in real time to a central point
- Sophisticated flood warning systems, these systems will include more data, including rainfall measurements and forecast, and hydrologic and hydraulic models to forecast future water levels.

The system currently in place in Jakarta can be categorized as a simple automated flood warning systems, often added with information from the field. Based on measured water levels upstream, a warning is given to downstream areas. It is expected that within the coming years, the system will be upgraded to a more sophisticated flood warning system. A good example of a sophisticated Flood Warning System operational in the South East Asian region is the Flood Early Warning System developed for the Lower Mekong Basin (Pengel et al, 2007). Due to improved IT, better and cheaper satellite information, wide availability of Smartphones in all societies, Web 2.0 applications, even more possibilities arise as demonstrated in the Dashboard BanjirOnline.

[4] National Board for Disaster Management

[5] Regional Disaster Management Agency (also known as SATKORLAK)

Dashboard BanjirOnline

The 'Dashboard Flood Management' combines multiple datasources and systems in an accessible, web-based flood information system. It provides users a (near)real-time overview of the current and forecasted water safety. One feature of the Dashboard is that sharing of information between agencies becomes easier because of its transparency and use of an service bus. Organisations can share their knowledge and data to be delivered to data users. Data users receive a comprehensive overview of all data available, through a personalized interface. This way, organisations can help eachother and the community with their most recent research and development. Dashboard flood management is being piloted in Jakarta, a first version of BanjirOnline can be consulted at www.dashboardbanjironline.com.

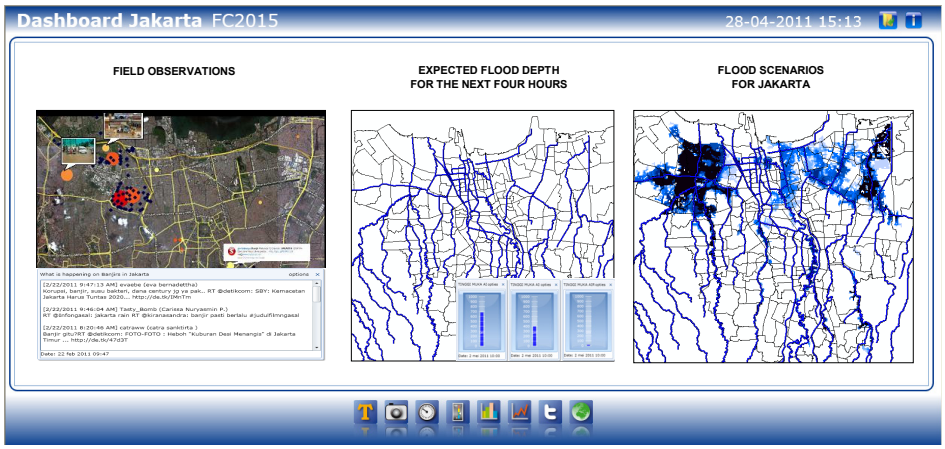

Figure 2: Screenshot of BanjirOnline

These new technologies and developments may well open the door to a further improvement flood forecasting, better dissemination of tailored flood forecasts, and improved advice on actions to be taken when a flood is imminent.

3.3. Early Warning, Early Action

Early warning systems alone do not prevent hazards turning into disasters. Early action is essential. The development of a more people-centered approach is clearly essential to ensure that the warnings captured by satellites, computer modelling and other technologies reach at-risk communities and are then acted upon (International Federation of Red Cross and Red Crescent Societies, 2009). Getting people ready to act is what organizations such as Mercy Corps, WAHLI and the Indonesian Red Cross (Palang Merah Indonesia – PMI) do through their community capacity building and risk reduction programmes in Jakarta. The value of their programmes for the community could even be further increased if it would go hand in hand with timely and relevant information on upcoming floods. At the same time, their staff and volunteer networks could provide valuable inputs to early warning system developers to ensure the information submitted is understandable and tailored to the needs of local people.

Community based risk reduction
Since 2007 PMI has been supporting a number of flood prone communities in Jakarta to increase their resilience against disasters. This 'Integrated Community Based Risk Reduction' programme recognizes the role of local people being the 'first responders' to disasters that happen in their living area. Through its extensive network of local staff and volunteers, PMI endeavors to build local community capacity in a number of ways:
1) Increasing Awareness. This includes conducting a community assessment to identify the particular vulnerabilities and capacity of the community in relation to hazards; delivering risk reduction related messages to the community using different techniques including traditional community theater (*lenong*).
2) Building disaster response capacity. This includes (1) setting up community based action teams (community volunteers) and providing them with training and emergency response equipment; (2) Together with the community develop contingency plans; (3) Identification of evacuation route and transportation: (4) Conducting emergency drills in cooperation with local government.
3a) Strengthen resilience - Health: (1) Empower vulnerable communities to be able to conduct first aid in case of accidents or injuries and to respond to other common health problems; (2) Motivate health cadre to carry out various activities to support a healthy lifestyle, such as health promotion, keeping a clean environment and conduct waste management.
3b) Strengthen resilience - Livelihood: Increasing financial preparedness by giving training in household economics and home industry, providing opportunities to saving and/or take a loan through setting up community cooperatives.

PMI also has a network of command posts (Posko) for more systematic disaster preparedness and response. The posko at PMI national headquarters is staffed 24/7 by volunteers in 12-hour shifts, who gather, analyse and share disaster information. The posko has HF Radios (Codan and AICOM) for nationwide communication, VHF Radio (Motorola) to communicate in Jakarta, telephone and fax, 6 computers with 24 hours internet and cable TV. The national headquarter posko is connected to local poskos in Jakarta's branch offices and throughout the country.

4. CONCLUSIONS: Towards gotong royong

When consulting Wikipedia for gotong royong, we find:

> Gotong royong is a conception of sociality familiar to large parts of Indonesia and Malaysia. The phrase has been translated into English in many ways, most of which harken to the conception of reciprocity or mutual cooperation. For M. Nasroen, gotong royong forms one of the core tenets of Indonesian philosophy. Paul Michael Taylor and Lorraine V. Aragon state that "gotong royong [is] cooperation among many people to attain a shared goal".
>
> (Wikipedia, 2011)

The importance of gotong-royong in Indonesian life needs no futher explanation, rather the question is whether we can support gotong-royong even further by means of modern techniques. In chapter two we described how people in Jakarta live with the floods. When we compare living with floods to the technical possibilities and the current operation of the flood information system, we can conclude that there is much room for improvement. We observe three immediate opportunities:

- **Improve data and knowledge sharing**: Jakarta knowledge centres and agencies have valuable data to share. Presently, these organizations have limited access to each others' databases, while new techniques in data and knowledge sharing can increase completeness and accuracy of flood information.
- **Improve the added value of information by tailoring the information to individual users**: As described earlier, a water level at certain location and time is not enough for people to take appropriate action. With new techniques in dissemination, clear messages on action taking and resources deployment can be sent to increase effectiveness of measures.
- **Improved cooperation between early warning information providers and NGOs/ humanitarian organizations:** Flood information as such does not automatically lead to risk reduction. Following the concept of "Early Warning, Early Action", people who receive the

information should have the awareness, knowledge and means to act in accordance with the severity of the (predicted) flood. Therefore, information technology projects should run parallel to initiatives to support the community in being able to take the right actions (e.g. socialization, emergency drills, evacuation exercises).

Indonesia has a long tradition of gotong royong, the cooperation among many people to attain a shared goal. Perhaps, by sharing data, sharing sense of urgency and sharing information on resources and actions digitally, Jakarta can even lead gotong royong to the digital age and in doing so, support the thousands of decisions taken every year, when the floods of Jakarta are threatening its inhabitants again.

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6. REFERENCES

Brinkman, J.J. and Hartman M (2009). *Jakarta Flood Hazard Mapping Framework.* Paper presented to international conference on Urban Flood Management, Paris.

Ven van de, F and Bons, K (2011). *Structural & non-structural response to urban flood vulnerability.* Worldbank Roundtable Urban Flood Risk Management.

Dutch Ministry of Infrastructure and the Environment, Stichting Ijkdijk (2009). *Macrostabiliteit IJkdijk: sensor- en meettechnologie*. Report number 2009-19 VIW, The Netherlands.

Ebel, M. (2010). *Advances in Flood Forecasting with (and without) Delft-FEWS*, Advances in Flood Forecasting and the Implication for Risk Management, International CHR Workshop Alkmaar

Hasanuddin Z. Abidin (2008). *Land subsidence Characteristics of the Jakarta Basin as estimated from levelling, GPS an InSAR and its Environmental Impacts.* Paper presented at mini-symposium: Flood Risk and adaptation in Jakarta, ITB.

Herminia A. Francisco, 2008. *Adaptation to Climate Change Needs and Opportunities in Southeast Asia. EEPSEA Special and Technical Paper sp200808s1, Economy and Environment Program for Southeast Asia. EEPSEA,* revised Aug 2008.

Marchiavelli, M. I. C. (2008). *Vulnerability assessment and coping mechanisms related to flood in urban areas: A community based case study in Kampung Melayu, Indonesia*. Gadjan Mada University and International Institute for Geo-Information Science and Earth Observation.

Pengel, B, Malone, T, Sopharith Tes, Phung Katry, Sambo Pich and Hartman, M. (2007). *Towards a new flood forecasting system for the lower mekong river basin*, Cambodia.

Public Works Agency, Government of DKI Jakarta Province (2009). *Flood Control in Jakarta*. Public Works Agency, Indonesia.

Ranger, Nicola and Garbett-Shiels, Su-Lin (2011). *How can decision-makers in developing countries incorporate uncertainty about future climate risks into existing planning and policymaking*. Policy paper of the Centre for Climate Change Economics and Policy Grantham Research Institute on Climate Change and the Environment.

Roelevink, A, Udo, J, Koshinchanov, G and Balabanova, S. (2010). *Flood forecasting system for the Maritsa and Tundzha Rivers*, BALWOIS 2010 conference, Macedonia.

Vermeer, B. (2010). *Climate management: it's a serious game.* Delta in times of climate change, issue 1, pages 54-55. The Netherlands.

Weerts, A. and Liu, Y (2010). *Advances in Data Assimilation for Operational Hydrologic Forecasting*. Paper presented to international workshop on Data Assimilation for Operational Hydrologic Forecasting and Water Resources Management, Delft.

International Federation of Red Cross and Red Crescent Societies, 2009. World Disaster Report 2009. Focus on early warning, early action

Westerhoff, R, Huizinga, J, Kleuskens, M, Burren, R, Casey, S. (2011). *Operational satellite Based Flood Mapping using the Delft-FEWS System*. The Netherlands.

Ogink, H. J. M., Muchni, M. (2008). *Jakarta Flood Early warning System – Telemetric System*. The Netherlands.

Internet sites: www.dinsos.jakarta.go.id