(Viewpoints: a brief draft for discussion, personal opinion)

Japan's resilience to tsunamis and the lessons for Japan and the world: an early observation[1]

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1. Introduction

What makes the Great Tohoku earthquake 2011 historical is not only because of its tsunami-genic earthquake at 9.0 magnitude that led to a series of disasters including the loss of lives and economic assets but also the nuclear accidents which make post disaster response by the government become huge challenge, complex and difficult.

The total disaster mortality is temporarily confirmed to be 28,550 dead or missing (10,901 confirmed deaths and 17,649 missing - OCHA Situation Report No. 14). The tsunami hotspots are in the Ewate, Miyagi and Fukushima (Figure 1) and Iribaki prefectures. In total, 54 out of 174 cities in the aforementioned cities have been affected by the tsunami (Parashar et. al. 2011) but it has propagated other risks that had been traveled globally. The tsunami traveled further east and killed some people in Papua (Indonesian and Papua New Guinea Its tremor went to shake stock markets. Its nuclear risk and uncertainty have become a haunted existence, either amplified/ attenuated by the media.

Figure 1. Tsunami Hotspots Japan 11 March 2011

Source: OCHA Situation Report No. 12 on Japan Earthquake & Tsunami

This paper exclusively analyzes Japan's resilience to tsunamis by assuming that there was no nuclear accident. It asks the questions: What makes Japan's present losses in tsunami triggered by the Great Tohoku earthquake is enormous in Japan's disaster history? Is it because that it had been planning and waiting for different scale of tsunamis, informed by existing tsunami risk assessment and scientific

[1] Some part of this article has been published by the Jakarta post entitled "Get ready for major disasters" http://www.thejakartapost.com/news/2011/03/31/get-ready-major-disasters.html.

measurement – as some might believe? Is there any social-economic factor that serves as an "iron-law" behind the high disaster mortality rate (confirmed death and missing almost 30,000)? What is the conventional theoretical model that can help explaining the disasters that provide better argument for future disasters?

2. The reality of Japan's tsunami risk reduction policy

There was 'only' less than 15% of the Japan's coastal municipalities have produced tsunami hazard maps according to the study in 2006 by Suganuma from Science and Technology Foresight Center, Japan. One of the most surprising findings is that the evacuation behavior of Kesennuma Municipality during the 2003 Miyagi-ken-oki Earthquake, only 8% (of 3000 respondents) were willing to evacuate; 85% did not want to evacuate in which (41% never intended to evacuate); While the rest were joining the emergency response.

Government of Japan (2009) reported that 493 municipalities throughout Japan have so far published and distributed their hazard maps (varies from scale 1/2,500 to 1/25,000) in either print or other means as of July 2007. This report does not explicitly referrer to tsunami risks maps but the hazard maps in general.

Japan has developed coastal hazard countermeasures with clear objectives to protect its population from the risk of tsunamis, cyclones and the other routine coastal hazards. These countermeasures are meant to protect its present population exposed to cyclones (estimated at 22.6 million people) and tsunamis (4.5 millions people) (Global Assessment Report, UNISDR 2009). It has 34.500 km coastline of which at least 15.900 km need special protection measures (Koike 1996). As of 1992, a total of 9.400 km artificial structures had been built, thus a significant increase from 7.885 km in 1974. It has built 2829 km dykes in 1974 and later made it 2927 km in 1992. In 1974, the total built breakwater was 885 km and in 1992, it reached a total of 7083 km. This is part of the implementation of Disaster Countermeasures Basic Act 1961. Dolan and Chisholm (2011) reported from Sendai by quoting statements from Prof. Imamura, a leading expert in tsunami modeling, that Japan needs more infrastructure spending that "could have lessened the impact" of the disasters but "the government has become too reliant on low-cost measures such as handing out warning maps."

Government of Japan (2009) noted that "All of Japan's national territory is covered by early warning systems for storms, torrential rains, heavy snow, sediment disasters, tsunamis, tidal waves, high surf, inundation and floods, the Ministry of Land, Infrastructure and Transport, the Japan Meteorological Agency and local government bodies being the main institutions involved. The organizations use 24-hour systems to carefully monitor various natural phenomena and weather conditions" (Government of Japan 2009:8).

The country has been well informed regarding the level of tsunami and earthquake preparedness as its Cabinet Office has conducted regular Disaster Preparedness Survey during 1991, 1995, 1997, 1999 and 2002 (Kesennuma 2006). What is probably missing is the connection between scientific findings and the uptake of the findings to inform disaster reduction policy. In fact it does not mean there is no uptake but the uptake is probably not optimal.

Disaster mortality, engineering measures and false sense of security

There are two distinct views explaining how to deal with the risks of tsunami. The first is represented by Imamura's view (see Dolan and Chisholm 2011) that the country needs more engineering measures. Even though this argument is half correct, it indeed is half wrong too as it is actually a "knowledge trap" built on the ignorance of the social and human behavior. What we have seen from the visual media concerning situation in Kesennuma is that the municipality has been severely damaged by the tsunami. One of the municipalities where tsunami countermeasures had been built is Rikuzentakata. It has built seawalls as high as 6-8 meters. The actual figures from Koike (1996) have been certainly increased by the government in the 21 decade. Tsunami countermeasures have been constructed for decades in some cities such as seawalls and tetrapods (massive concrete cross / four-legged). One of the municipalities that protected is Rikuzentakata. The seawalls are as high as 6-8 meters.

Tsuyoshi Kinno (74) from Rikuzentakata said that "Because we build the seawall, we are convinced that we will be perfectly safe." (The Economist 03/20-2011). At first glance, the readers may simply agree with the notion that Rikuzentakata is > 75%destroyed because the tsunami heights (run-up) occurred higher than 12 meters.[2] Perhaps, the existing seawall constructions may have already carried out their protection services during the last few years. The argument is certainly true, but at the same time it misleads the public because it underestimates the second option which is often called soft-measures such as community awareness and tsunami hazard maps, evacuation maps and including disaster drills. These cannot be underestimated because unhealthy reliance on engineering construction can lead to mass casualties, especially when the designed structures is set at optimum level and the occurrence happen at higher level. The myth is that engineering and high tech approach is more important than the approaches of non-technical (social, psychological, educational, etc.). Projects worth trillions of dollars with sophisticated infrastructure is more attractive to policy makers than the rather invisible options such as institutional and communities' strengthening and community awareness.

Engineering measures such as seawalls and flood dykes can reduce regular risks such as annual cyclones and floods but not always able to protect the people from the extremes. Engineering and technology are not the only "best" solutions (See Mauch 2009) because they may create false sense of security because the people at risk may delegate their responsibility of self-protection totally to the seawalls built by the states. When the people no longer experience "on the job training" to face the actual frequent floods, their coping capacity reduced. When the hazards with higher return periods occurred and their expectation does not match with reality, the community can be found totally unprepared, becoming more passive, refusing to evacuate and this eventually lead to more losses of life and asset. Whether or not this is the case of Japan today, it required more research.

3. Discussions

In my view, there is no first best solution in tsunami risk reduction in Japan and elsewhere. This is rather a hypothesis and not a bold statement as it requires further research. I hypothesize that policy makers only have a series of second best solutions, ranging from non-engineering to engineering and technological based solutions. This should include a great deal of "disastro-leadership" that can answer all the challenges and can provide a healthy balance of possible investment in all second best solutions as well as a creative government structures that can serve to meet disaster reduction goals pre during and after disasters.

Some brief arguments regarding the relative success of the Japanese disaster preparedness can still be mentioned: First, Japan might have prepared for tsunamis of smaller scales. Second, the coastal towns and cities are often contained dense population (regardless the demographic structures) which gives higher level of exposure to disaster risks. Further research on the correlation between disaster mortality rate and demographic structure in Japan is obviously a necessary project. Third, the Japanese catastrophic scale today is not simply because the disaster prevention/mitigation fails but there are limits to prevention and mitigation especially when the exposure to risk is neither reduced nor considered.

Modern coastal cities can hardly reduce its exposure to natural hazards such as tsunami to zero. Therefore the only option available is to creatively develop a voluntary exposure policy (e.g. to *ex-ante* plan where the areas and which infrastructure are allowed to be *tsunamized*). Fourth, there is an important message unseen by the uninformed public: the avoided losses resulted from the seismic risk management policy and its earthquake warning system is of huge benefit and the vast majority of the buildings had safely stood against the earthquakes. This means that the investment in disaster mitigation pays off as the Japanese earthquake early warning gave enough time for many households to switch off the gas lines to avoid more fire. This does not mean that there is no fire but policy makers should expect a manageable fire. Recently in Japan, there were 325 recorded fire events as of 19th March (Parashar et. al. 2011).

[2] Please see detail reports on tsunami inundation and run up (m) in Parashar et. al. 2011, available at: www.iedm.ges.kyoto-u.ac.jp/report/2011/IEDM%202%20Week%20Report%20Japan%20EQT.pdf. Last accessed 29 March 2011.

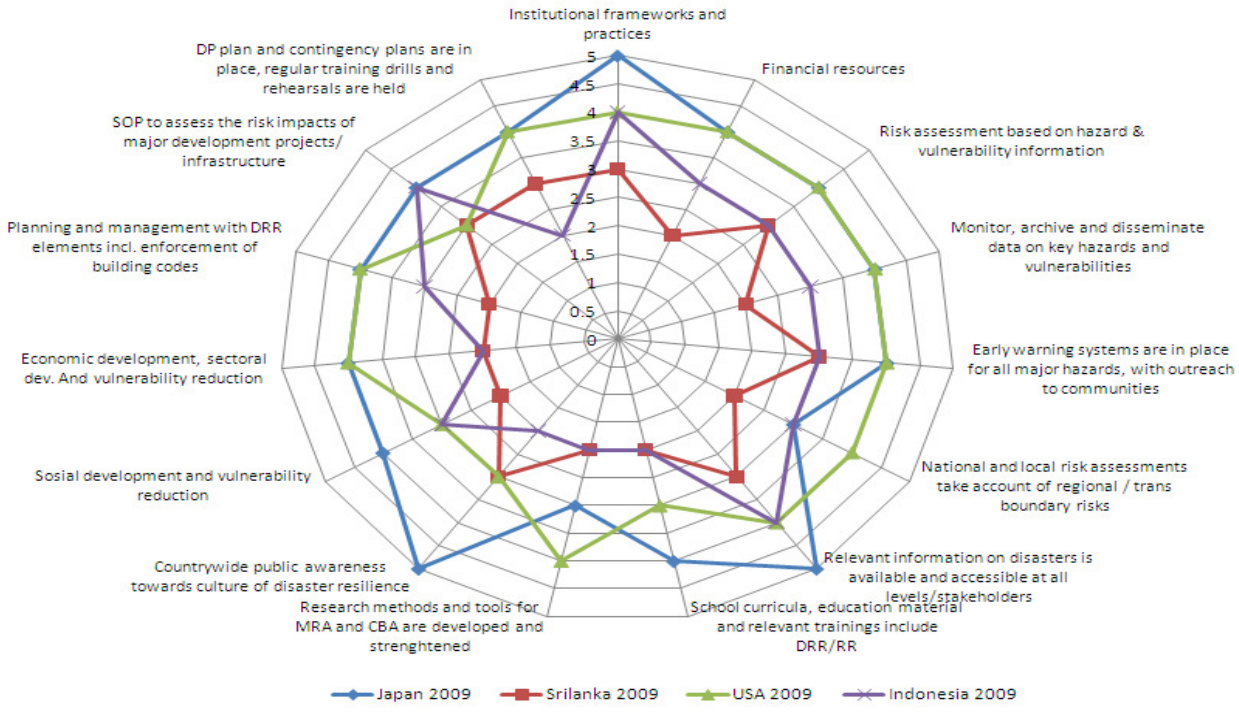
The future effect for disaster reduction in Japan can be improved significantly because the informed policy maker may take the best lessons from the events for a consistent and more sustainable reform in disaster reduction policy. It does not mean things will be easier. But we can expect for a more solid knowledge based reconstruction and disaster reduction policy and stronger policy enforcement to be demonstrated by Japan in the future. This includes ensuring the future approval of nuclear facilities in earthquake and tsunami prone regions needs serious thinking.

Disaster risk reduction goals are often not achieved because the community at risk and vulnerable communities become more vulnerable and alienated by technology that is also foreign to them. Countries like Indonesia can certainly be trapped in the myths of coastal protection per se as well, especially in areas such as coastal Padang city where the inhabitants feel protected by the construction of coastal protection infrastructures. Tsunami can certainly travel higher up in miles through the natural channels such as rivers and ruin anything it faces. Seawalls and breakwaters can be easily damaged by tsunami because there will always be uncertainty in the design and assumptions of engineering measures.

Physical infrastructure can create temporary security and create a false sense of security which makes communities more vulnerable and riskier, not empowered to prepare and use other instruments including indigenous knowledge. These may create dis-incentives for communities not to participate in evacuation drills. Passive community in Rikuzentakata, Japan in responding to the tsunami may be triggered by a false sense of security on the existing physical infrastructure. This gives a message that building tsunami preparedness is not about buying instruments or building coastal protection, but social problems in the broad sense that must be understood to ensure allocation of adequate resources.

There is no doubt that Japan has been as an 'ideal type' of seismic and tsunami resilience nation during the last decades not because it is a perfect 'guru' but because it has advanced its self among above other nations in regards to the science (and to significant extent including policy and practice at the local level) of the earthquakes and tsunamis risk management. Figure 2 shows the relative progress of Japan compared to other countries such as Indonesia, Sri Lanka and United States. Apparently, Japan has better regulation as it claims to have excellent institutional frameworks and public awareness as well as accessibility of disaster information to locals (5 in scale 1-5) compared to other nations. Its early warning system and building code enforcement are equally to United States and obviously above Indonesia and Srilanka.

Figure 2. Disaster Reduction Measures Comparison 2009.



Source: author (Self evaluation data from Government of Japan, Sri Lanka, USA and Indonesia 2009)

Given the possibility that the media may 'amplify' the scale of the events, the vast majority of the viewers may get wrong messages from the visual media (TV and internet) by believing that there is nothing human system can do to avoid the catastrophe before the events. The naturalness of the events may receive more attention than the social-economic factors that shape both pre events (the placement of people and infrastructures in the coastal areas) and the events (the hit of the tsunamis on the people and infrastructures. The catastrophe can actually be best explained by the existing theory of disaster risk studies, based on the fundamental laws that the catastrophe is not only due to the 9.0 SR magnitude earthquakes that triggered tsunamis but also because the way the people, the infrastructure and the wealth have been placed in the tsunami zones have in fact led to high vulnerability to disaster risks.

4. Final remarks

A colleague from Banda Aceh asked me via Facebook whether the present disasters can be good or bad for the future of disaster risk reduction? He insisted "What can I explain to the people of Aceh as a disaster mitigation advocate as I used Japan as a perfect model for tsunami readiness society?" What is the best answer to these questions?

I have almost no doubt about the future of Japan's disaster risk reduction despite of fact that the constraints are not easy to be dealt with. But I am very worried about the developing nations. Volatility in political will for disaster reduction is a global phenomenon today (Wisner et. al. 2011, Lassa 2010). Policy makers and politicians tend to play down the importance of investing in disaster reduction. Some often manipulate the religious texts to delays action in disaster reduction. Volatility in commitments to disaster reduction is not exclusively a developing world phenomenon. Present cuts in spending from the Department for International Development (DFID) to the United Nations International Strategy for Disaster Reduction[3] is an evidence for these volatility in DRR commitments that may have big step back in the global commitment to reduce disaster risks through Hyogo Framework for Action, the global blue print for disaster reduction. This is contrast to UK Prime Minister's statement that "We have had a terrible reminder of the destructive power of nature" which conveys an implicit meaning that natural hazard cannot be underestimated. Unnecessary delays in spending for risk reduction will eventually lead to bigger donor losses in the future. How many disasters are needed to make our policy makers become aware of their ignorance and inaction to reduce disaster risks?

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[3] Please see interviews from Thin Lei Win (Alertnet) with Margareta Wahlstrom (the U.N.'s special representative of the secretary-general for disaster risk reduction) Available at http://www.trust.org/alertnet/news/interview-uns-disaster-risk-reduction-chief-responds-to-britains-aid-cuts/. Last access 29 March 2010

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