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Asset identification: Addressing the climate change in public asset management process

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ABSTRACT

Climate change is becoming increasingly apparent that is largely caused by human activities such as asset management processes, from planning to disposal, of property and infrastructure. One essential component of asset management process is asset identification. The aims of the study are to identify the information needed in asset identification and inventory as one of public asset management process in addressing the climate change issue; and to examine its deliverability in developing countries' local governments.

In order to achieve its aims, this study employs a case study in Indonesia. This study only discusses one medium size provincial government in Indonesia. The information is gathered through interviews of the local government representatives in South Sulawesi Province, Indonesia and analyse documents provided by interview participants.

The study found that for local governments, improving the system in managing their assets is one of emerging biggest challenge. Having the right information in the right place and at the right time are critical factors in response to this challenge. Therefore, asset identification as the frontline step in public asset management system is holding an important and critical role. Furthermore, an asset identification system should be developed to support the mainstream of adaptation to climate change vulnerability and to help local government officers to be environmentally sensitive. Finally, findings from this study provide input for local governments asset manager of types of information that essential in asset identification/inventory system particularly in addressing the climate change.

Keywords: Asset management, local government, climate change.

1. Introduction

Climate change and sustainability in relation to build environments have becoming hotly debatable issues globally since the United Nations Framework Convention on Climate Change in 2007 brought the subject to the attention of governments (Qian & Chan, 2010). The recent meeting of the Commission for Sustainable Development (CSD 15) under UN Department of Economic and Social Affairs examined global climate change, along with energy, air and industrial development toward not only the built environments subject but also as a comprehensive cluster of issues (Anonymous, 2007). Similarly, on February 2, 2007, the United Nations sponsored Intergovernmental Panel on Climate Change (IPCC) released its fourth assessment report, concluding that climate change and its affects are clearly identifiable and that human activities are the main driver of this warming, asserting with near certainty environment (Peebles, 2007). Further development within the Clean Development Mechanism of land use, land-use change, and forestry activities, including the potential synergy with poverty reduction is a necessary and should be treated as the first priority, especially for those regions with high level of vulnerability and low capacity to mitigate and adapt to the impacts of climate change. This should include natural disaster prevention, response capacities and documents and information to support ongoing discussions on the development and workings of the climatic regime (Anonymous, 2007).

On the other hand, mitigations and adaptations to the climate change effects to the built environments should also acknowledge the need for better climate information to facilitate the adaptation and mitigation efforts (Klein et al., 2007). Therefore, it is important to develop and implement best practice guidelines for screening governments' assets in climate change sensitive sectors to determine how their performance could be affected by climate risks, as well as how those risks can be managed. Unfortunately, this mitigation and adaptation sometime fail to acknowledge and to include measures that address the underlying factors of vulnerability to climate change. These underlying factors are often structural issues characterising low development, such as high dependence on natural resources, resource degradation, inability to secure basic needs, lack of capacity and most importantly lack of information (Klein, et al., 2007).

Therefore, the aims of this study are to identify the information needed in government's assets screening process which also known as asset identification and inventory system in addressing the climate change issue; and to examine its deliverability into developing countries' local governments asset management system. By maintaining high quality and up to date data regarding the assets, public organisations can significantly improve their efficiency, effectivity and the quality of public services; and at the same time be climate sensitive.

This paper starts with discussion on the impact of real properties and infrastructures to the climate change, and the effect of climate change to the real property and infrastructure. After that the paper discusses methodology used in this study, followed by discussion on findings and closes with conclusions.

2. Literature Review

2.1 The impact of real properties and infrastructures to the climate change

The building industry uses a substantial amount of resources and, accordingly, has a significant impact to the environment. According to Qian and Chan (2010, p. 565), buildings in the USA are account for 39 per cent of the country's total energy use, 12 per cent of total water consumption, 68 per cent of total electricity consumption and 38 per cent of carbon dioxide emissions. In China, where industrialisation and urbanisation have been fast-paced, the building industry is number one in terms of energy consumption, accounting for 44.2 per cent of total consumption. More than 60 per cent of the energy consumed in buildings comes directly from fossil fuel combustion, and buildings are responsible for 17 per cent of China's total CO2 emissions. All those activities undeniably impacting the environment which leads to climate extreme and natural related disasters (Qian & Chan, 2010).

It is now well recognised that efficiency improvements in energy used by the building industry would make a major contribution to the friendliness of the assets toward the environment. This friendliness could reduce the vulnerability of the assets to the climate extreme and natural disasters (Qian & Chan, 2010). At the international level, energy efficiency is being promoted to mitigate climate change, decrease global warming and improve air quality. International cooperation and the attainment of knowledge through open and critical comparative studies will go a long way toward furthering these efforts.

In recent years, numerous measures on climate change have been implemented by governments at the institutional level, including national inventories, the establishment of designated national authorities, diversification and decentralisation of actors to involve governments and local groups, and information-sharing discussions. There has also been considerable interaction with the private sector. Some countries have already prepared a number of national communications, pursuant to the UNFCCC, and some have introduced an obligation for industries to report their green house gas emissions when applying for environmental operating licenses (Anonymous, 2006; Clive, 2010).

However, one of the most serious limitations of the effort mentioned above are the lack of capacities, with which to evaluate vulnerability and adaptation, to generate reliable results and incorporate them into the national development planning processes. This limitation stems mainly from inadequate data collection and monitoring, limited access to existing databases and the lack of capacity to analyse, adjust and improve quality assurance in some data sets (Anonymous, 2007, pp. 34-39).

Conversely, continuity of public services deliverability is a key objective of any public organisations, which can only be maintain by the recognition of the importance of the data held to the ongoing success of the organisations (Warren, 2010). A key issue for public asset managers, particularly at the strategic level of asset identification and assessment, is lack of information about the condition of assets. Manual inspection is costly and time consuming, and coverage of the asset positions is incomplete. Much effort has recently been put into developing new instruments to improve the understanding of the asset conditions (Glendinning, Hall, & Manning, 2009, p. 116). However, tools such as these are only useful at a top managerial level,

once a problem has been identified. For major improvements to be made at a practical level, many complex and complete volumes of data need to be captured at a much faster pace across entire assets.

2.2 The effect of climate change to the real property and infrastructure

The incidence of natural disasters in recent decades has increased in both number and the extent of damage. In each year of the past decade an average of 258 million people have suffered from disasters, this is up from 74 million a year in the 1970s (Christian Aid, 2006, p. 7 cited in Warren (2010)). In 2008 the number of reported natural disasters were 326 worldwide, with some 235,736 people reported killed. This is the second highest number in a decade, the highest being as a result of the 2004 tsunami (Rodriguez et al., 2008, p. 326 cited in Warren (2010). The total cost of natural disasters in 2008 was US$ 181 billion. This compares to the costs of hurricane Katrina in 2005, which are estimated at US$140 billion. Damage from Hurricane Ike, which hit the USA in 2008 cost US$31.5 billion. In total, nine of the 15 natural disasters with damage costs of US$ 1 billion or greater occurred in North America, a further two occurred in Europe; three of the remainder occurred in China (Warren, 2010). Figures from insurers reveal a drop in the extent of natural disaster related losses to the lowest in three years for 2009 but by March 2010 they are already predicting a five-fold increase on the previous year with the Chilean earthquake in February expected to cost in excess of $8 billion (Benfield, 2009 cited in Warren (2010)).

In the past decade some 88,671 people died in Europe as a result of 953 disasters which affected more than 29 million people and cost losses of 269 US$ billion (Warren, 2010). The economic costs of natural disasters within developed countries are more acutely felt due to the higher densities of population and the economic intensity with which the land is used. It therefore follows that in these highly developed areas there is an enhanced need for buildings to be prepared for the adverse effects of natural disasters and key among these are many of the public sector buildings that will support the immediate disaster response and underpin the post disaster economic recovery of the region (Philippa, James, & Hadi, 2006; Qi, Ma, Zhang, & Li, 2008).

The effects of the predicted climate change will vary from region to region depend on the locality of the area. The most vulnerable area will be those located in coastal areas and within flood plains (Warren, 2010, p. 505). Storms, floods and heatwaves are major threats to Europe. In the US, severe weather events leading to flooding, extreme heats, which resulting in increase deaths due to the effects of heat, and significant energy demands to supply air conditioning systems are the major threats. Whereas in Australia, floods, storms, heatwaves, droughts and bushfires are the major impacts of climate change which need property and infrastructure adaptations.

Particularly in Australia, according to Emergency Management Australia (2010), from 2007 to 2009, the most severe financial impact from disasters (both natural and non-natural disasters) was in 2007 and the impact is majority from the natural disasters such as floods, bushfires and heatwaves. Detail data about the disasters in Australia can be seen from the tables below adopted from Emergency Management Australia Disasters Database (Emergency Management Australia, 2010).

Table 1. Emergency Management Australia Disasters Database for 2009

Start Date	Title	Category	Zone	Region	Dead	Injured	Affected	Homeless	Total Est. Cost	Total Cost By Date
▼2009					637	97	40,000	0		$48,000,000
08/11/2009	Kokoda Plane crash	Transport	Offshore	Outside Territorial Waters	13	0	0	0	$0M	
07/17/2009	Jakarta Hotel Bombings	Criminal Act	Offshore	Outside Territorial Waters	9	53	0	0	$0M	
05/20/2009	Floods - South East Queensland	Flood	Queensland	Multiple Regions	1	0	40,000	0	$48M	
05/01/2009	Australia-wide Influenza (H1N1) pandemic	Epidemic	Australia Wide	All States	131	0	0	0	$0M	
04/19/2009	Severe floods: Lord Howe Island, NSW	Flood	Offshore	Lord Howe & Norfolk Islands	0	0	0	0	$0M	
04/16/2009	Ashmore Reef Boat Explosion	Transport	Offshore	Territorial Waters	5	44	0	0	$0M	
03/13/2009	Oil Spill Queensland Coast	Environmental	Queensland	Brisbane	0	0	0	0	$0M	
02/07/2009	Victorian Bushfires	Bushfire	Victoria	Multiple Regions	173				$0M	
01/27/2009	South Eastern Australia - Heatwave	Environmental	Australia Wide	VIC-SA	304	0	0	0	$0M	
01/03/2009	Monsoonal flooding: north-west Queensland	Flood	Queensland	Multiple Regions	1	0	0	0	$0M	

Source: adopted from Emergency Management Australia Disasters Database (2010)

Table 2. Emergency Management Australia Disasters Database for 2008

Start Date	Title	Category	Zone	Region	Dead	Injured	Affected	Homeless	Total Est. Cost	Total Cost By Date
▶2009					637	97	40,000	0		$48,000,000
▼2008					6	9	0	0		$473,000,000
11/16/2008	Severe storms & flooding SE QLD	Flood	Queensland	Brisbane	1	0	0	0	$0M	
06/03/2008	Gas explosion: Varanus Island, WA	Chemical	Western Australia	Dampier	0	0	0	0	$0M	
04/02/2008	Windstorms: Southern States	Severe Storm	Australia Wide	Multiple Regions	3	0	0	0	$12M	
03/26/2008	Bushfire: Perth, WA	Bushfire	Western Australia	Perth	0	0	0	0	$0M	
03/13/2008	Bushfire: Willunga, SA	Bushfire	South Australia	Adelaide	0	9	0	0	$0M	
02/15/2008	Flash flooding: Mackay, QLD	Flash Floods	Queensland	Mackay	1	0	0	0	$342M	
02/01/2008	Monsoonal Flooding: Eastern Queensland	Flood	Queensland	Multiple Regions	1	0	0	0	$104M	
01/04/2008	Flooding: North Coast NSW	Flood	NSW	Lismore (NSW)	0	0	0	0	$15M	
01/04/2008	Tropical Cyclone Helen: NT	Cyclone	Northern Territory	Darwin	0	0	0	0	$0M	
01/03/2008	Bushfires: Perth, WA	Bushfire	Western Australia	Perth	0	0	0	0	$0M	
01/01/2008	Widespread flooding: Queensland	Flood	Queensland	Multiple Regions	0	0	0	0	$0M	

Source: adopted from Emergency Management Australia Disasters Database (2010)

Table 3. Emergency Management Australia Disasters Database for 2007

Start Date	Title	Category	Zone	Region	Dead	Injured	Affected	Homeless	Total Est. Cost	Total Cost By Date
2009					637	97	40,000	0		$48,000,000
2008					6	9	0	0		$473,000,000
2007					70	110	0	0		$1,713,000,000
12/28/2007	Bushfire: Boorabbin National Park, WA	Bushfire	Western Australia	Kalgoorlie	3	0	0	0	$0M	
12/27/2007	Flooding: South East Queensland	Flood	Queensland	Multiple Regions	0	0	0	0	$0M	
12/21/2007	Severe storms: Central NSW	Severe Storm	NSW	Multiple Regions	0	0	0	0	$0M	
12/09/2007	Severe Hailstorm: Sydney, NSW	Hail	NSW	Sydney	0	0	0	0	$201M	
12/08/2007	Wallerawang, NSW: Factory explosion	Industrial	NSW	Sydney	0	0	0	0	$0M	
12/06/2007	Bushfire: Kangaroo Island, SA	Bushfire	South Australia	Adelaide	1	0	0	0	$0M	
12/06/2007	Melbourne, VIC: Building fire	Urban Fire	Victoria	Melbourne	0	6	0	0	$0M	
11/17/2007	Cape Liptrap, VIC: Light plane crash	Transport	Victoria	Wilson's Promontory	4	0	0	0	$0M	
11/10/2007	Light plane crash: Elliott, NT	Transport	Northern Territory	Newcastle Waters	3	0	0	0	$0M	
11/03/2007	Storms and floods: Gippsland, VIC	Flood	Victoria	Multiple Regions	1	0	0	0	$0M	
10/26/2007	Tornado: Dunoon, NSW	Tornado	NSW	Lismore (NSW)	0	0	0	0	$0M	
10/09/2007	Hailstorm: Lismore, NSW	Hail	NSW	Lismore (NSW)	0	0	0	0	$57M	
10/07/2007	Storms: South Queensland	Severe Storm	Queensland	Multiple Regions	0	0	0	0	$0M	
09/22/2007	Myer store fire: Tasmania	Urban Fire	Tasmania	Hobart	0	0	0	0	$50M	
09/01/2007	Marine accident: Moreton Bay, QLD	Transport	Queensland	Brisbane	4	10	0	0	$0M	
08/23/2007	Sunshine coast, QLD: Floods	Flood	Queensland	Brisbane	0	0	0	0	$0M	
08/22/2007	Equine Influenza outbreak: NSW, QLD	Epidemic	Australia Wide	QLD-NSW	0	0	0	0	$0M	
06/27/2007	Flooding: Gippsland, Victoria	Flood	Victoria	Multiple Regions	1	0	0	0	$15M	
06/11/2007	Flooding: Northern and Western Queensland	Flood	Queensland	Multiple Regions	0	0	0	0	$0M	
06/07/2007	NSW east coast storm and flood event	Severe Storm	NSW	Multiple Regions	10	0	0	0	$1350M	
06/05/2007	Train disaster: Kerang, VIC	Transport	Victoria	Swan Hill (Vic)	11	14	0	0	$0M	
03/28/2007	Ferry accident: Sydney NSW	Transport	NSW	Sydney	4	8	0	0	$0M	
03/23/2007	Tunnel fire: Melbourne, VIC	Transport	Victoria	Melbourne	3	2	0	0	$0M	
03/13/2007	Southwest Queensland storms	Severe Storm	Queensland	Cunnamulla (QLD)	0	0	0	0	$0M	
03/10/2007	Train crash: near Forbes, NSW	Transport	NSW	Dubbo	1	2	0	0	$10M	
03/08/2007	Tropical Cyclone George	Cyclone	Western Australia	Port Hedland	3	28	0	0	$8M	
03/07/2007	Plane crash: Indonesia	Transport	Offshore	Outside Territorial Waters	21	39	0	0	$0M	

Source: adopted from Emergency Management Australia Disasters Database (2010)

If the governments are going to cope with climate change, it is necessary for the governments to develop sufficient technical adaptation capabilities and to have the human and financial resources to act on mitigating against actual and potential climate vulnerability (Warren, 2010). The extent of adaptation needed to existing government buildings and infrastructure will vary depending on location. The effect of climate change will be felt in a number of areas that relate to the way the assets are used to support government services delivery (Schreurs, 2008; Sugiyama & Takeuchi, 2008).

The change in frequency of extreme heat days for example, particularly in the cities, will lead to a number of air conditioning systems problems that struggle to maintain satisfactory indoor air quality conditions, leading to staff and public services user dissatisfaction in side the buildings which associated drop in productivity. The high demand on electricity supply network is likely to lead to interruptions in the continuity of public services delivery and an increase in public services production costs (Warren, 2010). All these conditions are similarly took place in infrastructure assets, where floods, over heats may cause roads and bridges failure to operate.

Organisational resilience can be achieved through risk assessment and the preparation of risk minimisation and mitigation approaches. This risk management approach is often termed disaster recovery planning, crisis management, business impact assessment or, more commonly, business continuity management. It must be recognised within the context of natural disasters and climate change that the potential risk is quite uncertain in terms of both frequency and the extent of damage and that in order to address the risk mitigation and monitoring strategies need to be researched and developed (Warren, 2010). Such exertions can only be achieved if information related to the climate change and natural disaster and its effects to the assets is properly collected, stored and maintained.

2.3 Identification of assets

After discussing causalities between assets and the climate change, the next discussion is practices in asset information system in daily practices. The primary purpose of an asset identification/inventory system and its accompanying components (programs, tasks, or activities) is to help asset managers to (Davis, 2007):

- Know exactly what assets they manage (i.e., those who are responsible for operating, monitoring, and/or maintaining the assets),
- Know precisely where the assets are located,
- Know the condition of the assets at any given time,
- Understand the design criteria of the assets and how they are properly operated and under what conditions,
- Develop an asset care (maintenance) program that ensures that each asset performs reliably when it is needed, and
- Perform all of these activities to optimise the costs of operating the assets and extend their useful life to what was intended for by the initial design and installation (if not beyond).

Detail explanations regarding fundamental information and requirements that apply to each asset identification component are {Amekudzi & McNeil (2008) Cagle (2003),

Davis (2007), Dent (1997), Dow, et al. (2006), Ebeling & Bittner (2007), Eckhard (2006), Frank (2007), Lundqvist & von Borgstede, (2008) and Michele & Harriet, (2006)}:

Know exactly what assets an organisation has. This might sound simple, but knowing what assets an organisation has may not always be easy. Some organisations have inherited certain assets that were annexed or may have been previously installed by developers or homeowners associations. In addition, some assets may have been added by the organisation's own activities.

Without proper and complete documentation, asset records may not fully reflect changes to assets. This is why an organisation should have in place a comprehensive maintenance work order system that is a proper documentation all of the corresponding and procedures, roles and responsibilities, and feedback loops to ensure that every time anyone touches one of the assets, there is a complete and easily retrieved record of the event.

Know precisely where the assets are located. Again, this may sound simple, but how much time is still wasted digging out drawings, searching for documents, or tracking down the last person(s) who worked on an asset in order to locate it. Even worse, what used to be easily accessible may now is hidden under a new building, street, or sidewalk.

However, with today's geographic information and global positioning system technologies, this is becoming less of a problem. Part of an organisation's overall asset management system should include updating and modernising previous asset information and data with these same system and technologies. Designing the installation of future assets so they are easily accessible is also a critical part of a well-functioning asset inventory system.

Know the condition of the assets. Actually knowing the condition of each asset can present its own set of problems, especially when the asset is "hidden" (i.e., vaulted, underground, or remotely located). These situations dictate that an organisation have a system (process or procedure) in place requiring it to do whatever inspections, preventive maintenance, and/or predictive tasks whenever the opportunity presents itself (sometimes the opportunity must be created) and that all related and pertinent information is completely and accurately captured, documented, and stored for easy access and review at a future time.

Understand the design criteria of the assets. How are they to be operated and under what conditions? Increased customer demands, diversity, and modifications to equipment (not to mention environmental issues) may cause utilities to push assets far beyond their design capacity.

To avoid this situation, according to Davis (2007), an organisation need to know what their assets' design specifications are, document them, ensure that equipment is operating within those specifications, and maintain the equipment accordingly.

Develop an asset maintenance program that ensures each asset performs reliably (reliability) when it is needed (availability). Once we know what assets we have, where they are, and how to properly use or operate them, a basic maintenance

program must be integrated to ensure they are ready, available, and, once turned on, will operate at or near the design specification parameters until the assets are turned off (reliability) (Davis, 2007).

It is always better to operate in a proactive versus a reactive maintenance environment. Proactive means that through the use of regular inspections, effective preventive maintenance various predictive technologies, asset manager is finding problems before they occur and fixing them before an actual failure.

Acknowledge and perform all recommended activities to optimise operating costs and extend an asset's useful life. This is the strategy component that primarily falls under the responsibility of supervision and management. There are two basic requirements (Davis, 2007; Lundqvist & von Borgstede, 2008; Michele & Harriet, 2006):

- Establish proper key performance indicators for the asset-maintenance processes in order to monitor and determine its performance as per cent scheduled versus unscheduled work, per cent planned versus unplanned work, preventive maintenance compliance rates, average age of a backlogged work order, and average number of backlogged work orders.
- Collect the right kinds of data at the right times in a consistent format to enable asset owner/manager to make data based decisions versus those based on a best guess. In addition, know where and how maintenance budgets are being spent so there is enough information in tough detail to determine whether to repair, refurbish, or replace an asset and the consequences of that choice.

3. Methodology

A case study in South Sulawesi Province in Indonesia was used to achieve the research aims. The case study employed interviews, which are continued by examining documents retrieved from interviewees. The interviews were conducted to South Sulawesi Province asset managers and officers in the form of semi-structured mode followed by telephone interviews to clarify unclear and more detailed questions.

Indonesia is a unitary state with a central government and two levels of autonomous sub-national or local government and administration; that is; provincial level government and regency or city government. Currently there are 33 provinces and each province has several regency/city governments (Bureau of Statistics Indonesia, 2006).

South Sulawesi is chosen because it is the gate of eastern part of Indonesia (Bureau of Statistics Indonesia, 2006). It is located in the center of Indonesia and well known as the Indonesia Centre Point. It is often used as reference or example for other local governments in that region. Some key data about South Sulawesi Province can be seen at Table 4.

The Interviews were conducted in 2009 and 2010 in South Sulawesi Province Office. There are 5 participants selected from South Sulawesi Province officers based on their job responsibilities that related to public asset. Two participants from technical public

asset management officers, two participants from middle level manager and one participant from public asset management decision maker.

Table 4: Key Numbers of South Sulawesi Province Conditions in 2009

Territory	(km^2)	46,116.45
Population	(habitants)	7,509,704
Density	(inhabits/km^2)	162.84
Regional GDP at Current Market Prices		69,271,924.57
Consumer Index Price		116.84
Inflation		0.29

Source: Bureau of Statistics Indonesia (2009)

From interviews, the study revealed that there are some documents need to be analysed to support the data retrieved from interviewees. The first documents are the laws and regulations related to public asset management; from the highest hierarchy i.e. at the Central Government Act and to the lowest hierarchy i.e. at the provincial level. Besides laws and regulations in the asset management area, local governments were producing other significant documents related to the asset management process. Those second documents are reports, notes, communication documents, asset census/inventory lists, and other relevant documents. All data collected was analysed qualitatively.

4. Result and discussion

4.1 South Sulawesi Province vulnerability to climate change impacts.

Indonesia is an archipelago country which means majority of its territory is surrounded by sea. Indonesia has around 17.508 islands (6.000 are inhabit) with total area of: 1,919,440 km² consist of 1,826,440 km² of land and 93,000 km² of water) (Hanis, Trigunarsyah, & Susilawati, 2010b; Irham, 2009; South Sulawesi Province Secretary, 2009). In 2030, it is predicted that Indonesia will lose around 2,000 islands due to an increase of sea level. Those islands have les than 20 cm height from the sea level. South Sulawesi province has 62,482.54 km² territory and around 85% of its territory is a coastal lowland. This geographical position exposing South Sulawesi as a high vulnerability to climate change related disasters.

In the interviews, participants were asked about the natural disasters that frequently hit South Sulawesi Province. According to the participants, those natural disasters incident are floods, severe droughts, tsunamis, earthquakes, volcanoes, landslides and forest fires. These answer then validated with official written records from the South Sulawesi Province office. We then asked the participants of possible grounds that cause the disasters. Response we received for this inquiry is that some of the disasters are strongly caused by illegal loggings, poor urban development planning and design, reclamation of coastal areas and improper waste management system. We then conclude that those natural disasters that are strongly related to human activities are

flooding, landslide, drought and forest fire. In Indonesia there are only two seasons i.e. rainy or wet season and dry season. On wet season, start from October to March, flooding and landslides are happening almost everywhere in South Sulawesi. On dry season, drought and forest fire take places in many region.

On the other hand, the impact of those natural disasters are significantly severe and affecting the quality of life of the community. According to interviewee, although there is no valid or exact data about financial loss, it is estimated that around Rp. 20-25 billion (equal to US $2,8 million) loss per year caused by the flooding, landslides, droughts and forest fires. This number is about 30% of total District Own-sources Revenue. Whereas total life/death lost resulted from those disasters are around 3.000 death from 2000 to 2009 (current population of South Sulawesi is 8,032,551 inhabit which means an increase of 522,847 inhabit compare to the 2009 population (Bureau of Statistics Indonesia, 2010)).

As a low coastal province, many of South Sulawesi province's assets are located on the coastal area or near the coastal. These assets are including long-live infrastructure owned either wholly by the government or partially in partnership with the private sectors, such as transport infrastructure, energy and water supply infrastructure, government's offices and some heritage buildings (e.g. Port Rotterdam). Those assets as the main backbone for public services delivery are potentially vulnerable to the impacts of climate change effects. Especially for the roads, where the CBD of South Sulawesi is located in the coastal area of Makassar city (the capital city of South Sulawesi Province), is heavily depending on the functionality of the roads. Unfortunately in many occasions, for example in September and early October 2010, the road was flooded due to the heavy rainy season and failed to function as what it is expected.

Meanwhile, energy consumption around the province is far beyond the capacity of power supply company. As result, since 2007, there was a rolling blackout until just recently ended on March 31st, 2010. The study found that in February 2010, current supply of state owned electrical company as the only power supply company in the country, is 480 Megawatt. Total costumers in South Sulawesi are 1,5 million connections with some 97.000 in a waiting list to be connected. According to the power supply company officials, at the peak hours, South Sulawesi needs 530 Megawatt of power. It means there is a 50 Megawatt shortage to fulfill electrical demand. That is why rolling blackout strategy was implemented. In April 2010, the state owned company make a subcontractor tender agreement to private sector to help the company fulfill the electrical power demand and filling the 50-megawatt gap.

All of those findings above are showing that the vulnerability of South Sulawesi Province to climate change related impacts and its energy consumptions, as an example, that effect the environmental changes.

4.2 Current practice on asset identification

Based on the literature, a combination of improved data, multiple-scale modeling and better designed monitoring will provide a high-quality database of information stored on asset inventory system. The information stored would therefore no longer be historical, but would represent the current and future condition that support the decision-making process.

The discussions on the literature also point out important information that should be gathered in asset identification in order to address, adopt and mitigate the climate change consequences. Those are:

1) Information related to the assets owned by an organisation, such as asset name, asset identification code, asset ownership, ownership documentation, acquisition process, asset type, asset model, asset volume, asset serial number, asset specifications, purchase information, and if necessary asset pictures, etc.
2) Information related to the location of the assets, such as: coordinate, boundaries, slopes, asset movements', whether it is on the ground, underground, in the water, map visualisation, etc.
3) Information related to asset's condition, such as: physical conditions, economical conditions, functional conditions, etc.
4) Information related to asset's design.
5) Information related to asset's maintenance procedure and process, such as: past maintenance, current maintenance, and future maintenance schedules, parties involved in the process, costs maintenance related, etc.
6) Information related to asset's performance measurements, both quantitative and qualitative performances.

The information mentioned above is the standard information on current asset identification practice adopted by many organisations. In order to address the climate change issue, additional information is needed. Those are:

7) Information related to the impact of asset to the climate change, such as: energy consumption, water consumption, electricity consumption, carbon dioxide emission, greenhouse gas emission, pollution level, asset's components/materials, carbon capture, etc.
8) Information related to the effect of the climate change to the asset, such as: sea level, surroundings' temperature, past, current and predicted weather extreme occasions, floodwise, and any other natural disaster records, etc.

Our previous study (Hanis, Trigunarsyah, & Susilawati, 2010a) found that in some cases in Indonesia, local governments suffer difficulties in identifying which asset falls in whose jurisdiction, whether it is central government's or local government's jurisdiction or other local government's territory. This condition is mainly caused by a lack of coordination and proper asset documentation. There is no evidence of the assets ownership, whether it is transferred from central government or from other local government or acquired by compulsory acquisition or gift from other entities. If such important information concerning the asset ownership is not recorded properly, then it is not surprising to reveal that climate sensitive information in asset inventory system is not recorded and listed in the report.

From a detail analysis on South Sulawesi asset inventory documents, this study found that information collected and stored in the inventory sheet, is insufficient not only for addressing the climate change effects but also not sufficient to satisfy the regular practice. The information stored is (in particular order as the original sheet): name and type of the asset, code, condition, construction, floor measurement (m^2), location, documentation, land volume, ownership, land code, fund resource, acquisition prices, and notes (as shown on Table 5 below).

Table 5: South Sulawesi Asset Inventory Sheet for Buildings

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	KARTU INVETARIS BARANG (KIB)																
2	C. GEDUNG DAN BANGUNAN																
3	a. Bangunan Gedung (Milik APBD)																
4																	
5	3	SATUAN KERJA	: DINAS PENDIDIKAN														
6																	
7	No	Jenis Barang/ Nama Barang	Nomor		Kondisi Bang.	Kontruksi Bangunan		Luas Lantai (M2)	Alamat	Dokumen Gdng		Luas (M2)	Status Tanah	Nomor Kode Tanah	Asal - Usul	Harga	Ket
8																	
9			Kode Brg	Register		Bertingkat/ tdk	Beton tdk			Tgl/Thn	No.						
10																	
11																	
12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
13			-	-													
14	1	Tanah Bangunan Kantor	-	-	B	Bertingkat	Beton	-	Jl. P. Kemerdekaan Km. 10 Mks	-	-	9.000	Hak Pakai		APBD	4,000,000	
15	2	Tanah Bagunan Mesjid	-	-	B	Tidak	Beton	-	Jl. P. Kemerdekaan Km. 10 Mks	-	-					-	
16	3	Tanah Bagunan Pos Penjagaan	-	-	B	Tidak	Beton	-	Jl. P. Kemerdekaan Km. 10 Mks	-	-					-	
17	4	Tanah Bangunan Kantor	-	-	B	Bertingkat	Beton	-	Jl Jenderal Sudirman No. 23 Mks	-	-	12.027	Hak Pakai		APBD	5,000,000	
18	5	Tanah Bangunan Rumah Dinas	-	-	B	Tidak	Beton	-	Jl. Lanto Dg Pasewang No 1 Mks	-	-	1.411	Hak Pakai		APBD	1,500,000	
19	6	Tanah Bangunan Gedung	-	-	B	Tidak	Beton	-	Jl. Amannagappa Mks	-	-	1.599	Hak Pakai		APBD	1,000,000	
20	7	Tanah Bangunan Gedung	-	-	B	Tidak	Beton	-	Jl. Ir. Sutami	-	-	2.701	Hak Pakai		APBD	100,000	
21	8	Tanah Bangunan Gedung	-	-	B	Tidak	Beton	-	Jl. Inca Nurdin	-	-	2.071	Hak Pakai		APBD	1,000,000	
22	9	Tanah Bangunan Rumah Dinas	-	-	B	Tidak	Beton	-	Jl. Nuri No.27 Mks	-	-	382	Hak Pakai		APBD	200,000	
23	10	Tanah Bangunan Gedung			B	Tidak	Beton	-	Jl. Muh. Jufri	-	-	841	Hak Pakai		APBD	150,000	
24																	
25																	
26																	
27																12,950,000	
28																	

Source: adopted from south Sulawesi Asset Inventory database

Data availability required for asset identification creates challenge for local government to adopt current asset inventory practices. As of 2008-2009, only 50 per cent of all local authorities or divisions in South Sulawesi Provincial Government have their property records computerised. There is no reliable up-to date inventory data on property holdings of the government. It is found that inventory report is lack of strategic and meaningful data such as property utilisation, condition, historic significant, climate related data and other important information. This, in turn, causes poor decision making related to public asset management. Revenues and expenses are not tracked on a property-by-property basis, mainly because this information is not collected within governmental budgeting systems. The potential market value of real estate is also frequently unknown, even for highly marketable and legally permissible properties. Out of date historical values of the property always quoted in the report. Such conditions due to that current market values are not available or not recorded properly by government officials.

4.3 Deliverability of environmentally friendly asset identification system in South Sulawesi

This study found that the climate change in South Sulawesi Province local government have been given a considerable degree of interest particularly in high level officials. This indication can be seen from governor instruction to "bike to work", weekly bike gathering among the staff and the open access and funding for reafforest activity proposed by both environmental government and non-government organisations. However, this attention is not reflected to the whole and bigger development project. Current attention to the changing climate in the respective agencies' development programmes and projects, policies, is slightly low, which significantly impacts the current development progress in South Sulawesi. Consequently, South Sulawesi still underway the non-environmental sensitive development projects and programmes.

The lack of attention to climate change is also reflected in lower level staff attitudes towards the changing climate. Whilst there seemed that the high level officers in South Sulawesi local government have climate change sensitivity, attitudes at the lower level officials, particularly those who are directly responsible on asset identification, seem to be lack of awareness, capacity and capability to adapt and mitigate the climate change induced consequences.

Importantly, both high and low level local government officials' are willing to incorporate them self into any climate change related efforts. There is no reluctances or avoidances from the officials to support the successfulness of climate change adaptation and mitigation. It is also being recognised by the officials that regulation and policy should be develop to support the climate change sensitivity development programmes and projects in South Sulawesi.

Based on the literature and findings, this paper agree with Qian and Chan (2010) suggestion on how to improve and adopt climate change sensitivity effort in South Sulawesi province. There are several factors need to be improve or support to successfulness of climate change mitigation and adaptation. Those factors are:

1) Technical: improve availability, reliability and knowledge of efficient technologies related to climate change;

2) Institutional: provide technical input, financial support and proper programme design and monitoring expertise;
3) Financial: provide financial mechanism to support climate change mitigation and adaptation activities;
4) Managerial: develop appropriate programme management practices and staff training;
5) Pricing policy: supportive pricing of electricity and other energy commodities; and
6) Information diffusion: collect and maintain appropriate information of the assets not only regarding to climate change consequences but also a wider view of efficiency, effectivity and quality of public services.

5. Conclusion

The importance of a well-formulated risk management plan in the public asset management framework, which is widely communicated and subject to continuing evaluation, training and review is the basis of good business continuity and disaster planning. It is evident from the literature that the possibility of increased natural disasters as a consequence of global climate change will increasingly need to be considered by all organisations, particularly the governments. The level of both physical damage and economic loss associated with natural disasters cannot be ignored by any asset managers especially those public asset managers.

It is recognised that the data on possible damage costs is often not available or the damages costs are estimated subject to wide variances. However, attempted quantification and qualification supported by appropriately source information, is essential to rational decision-making and efficient use of resources. Therefore, sufficient asset identification system that addresses the climate change risk factor is urgently needed.

A proper asset identification system as the front line of asset data collection strategy in addressing the climate change effect should be developed. The current practice of asset identification is no longer satisfying the decision-making process requirements to address the climate change. In addition to current practice, information related to the impact of assets to the environment as well as information related to the effect of climate change to the asset should be collected and maintain in a proper way and incorporated in to the current asset identification system.

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