

REPORT ON PROGRESS IN WATER RESOURCES MANAGEMENT (WET REGION – INDONESIA)

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Abstract

The journey of the water resources development in Indonesia during the last decade is generally inspired by the multi-dimensional crisis which knocked the country since 1998. From then on, water-related sectors began to reform their organization structures, two major features become the important issues for further water resources development, i.e.; the autonomy era and economics paradigm. The Government Law No. 25 Year 1999 about Local Government (being amended by Government Law No. 25 Year 2002) and the Government Law No.7 Year 2004 about Water Resources are two main legal aspects that should be taken into account in the water resources development in the country. This paper reviews the progress of the water resources development in Indonesia during the last decade and promotes the idea on the future water resources management as part of the sustainable development of the country. The review includes the history of the water-related infrastructure development in the country, their post construction management (operation and maintenance), and their impacts on the community welfare. It was obvious that during 1999-2004, the presence of the two main legal aspects was not yet indicated the convergence of the idea in attaining better water resources management. One possible reason was that the autonomy system is really new system that the country has never been experienced before. The second possible reason was that the miss-interpretation (maybe due different aspiration and perception) on the understanding of economics paradigm, which in some extent against the social paradigm. The identification of national strategy being addressed in 2005-2009 is presented, problems and impacts are discussed, and ideas for further development of the 2009-2014 national strategy are promoted. The concluding remarks highlight the thoughts on necessary action to support the sustainable development through the proper management of the water resources.

1. Introduction

The idea of the implementation of integrated water resources management has been initiated since the early 1990's, where the Board of National Development and Planning (*Badan Perencanaan Pembangunan Nasional* = BAPPENAS) held the International Seminar on the Integrated Water Resources Development and Management for Sustainable Usage in Cisarua, West Java, 29 October - 1 November 1992. The Ministry of Public Works conducted the National Symposium on Water Resources Management at Cilegon, West Java on 19-20 July 1993. Along the year 1997, similar seminars were then conducted by BAPPENAS and Ministry of Public Works, participated by representatives from Non Government Organizations (NGO's), universities, and water-related sectors such Ministry of Agriculture, Ministry of Forest, etc. The above events inspired further direction of the water resources development in the country, at which the three main aspects (water conservation, water usage, and control of destructive power water) of the water resources issues began to be considered more intensively. The monetary crisis in 1997-1998 has forced the government to obtain some loan from World Bank as 'Quick Disburse' to assist the negative balance of the national expenditure. This loan was then termed as Structural Adjustment Loan (SAL), which should have been utilized to carry out the structural changes (institution, legal aspects, and management of some sectors). The aforesaid loan for the water resources sector was then named as Water Resources Sector Adjustment Loan = WATSAL. In 1998, the Head of BAPPENAS then established the Task Force of the Water Resources Sector Strategy Reform, comprises representatives from some water resources – related sectors, i.e. Office of State Ministry of National Planning and Development, Ministry of Public Works, Ministry of Home Affairs, Ministry of Industry and Commerce, Ministry of Forest, Ministry of Agriculture, Board of Regional Environment Impact Assessment, and Indonesian Science Board (LIPI).

The main reformation agenda of the WATSAL was then published as Letter of Sector Policy Reform (Policy Matrix) from the Indonesian Government to World Bank in April 1999, with the main agenda (further called as Water Resources Sector Adjustment Program = WATSAP) was to replace the Government Law No.11 Year 1974 about the irrigation and its corresponding law products. The Loan Agreement was then signed on 28 May 1999 for the amount of USD 300,000,000 to be returned within 15 years period. Based on the reformation agenda, this loan was planned to

be utilized in three stages, i.e. USD 50,000,000; 100,000,000; and 150,000,000 for May 1999, December 1999 and March 2000 respectively.

The multi-dimensional crisis in the country in 1999 had delayed the implementation agenda, and finally the Coordinator Minister of Economy appointed the Minister of Ministry of Settlement and Regional Development (currently Ministry of Public Works) to be the coordinator of WATSAL agenda implementation. The implementation strategy was then made involving representatives from related institutions including universities and NGO's. The government then issued Presidential Decree No. 123 Year 2001 about the establishment of Coordination Team of Water Resources Management, a non-structural body that was responsible directly to president. This coordination team has the task to assist president in formulating the national strategy of water resources and their water resources related legal products.

The main water resources reformation agenda persist in the form of the launch of the Government Law No. 7 Year 2004 about Water Resources with currently having eleven related legal products as the derivatives of the aforesaid government law.

1.1 National Water Resources Management as Revealed by Dam Development

There have already more than 235 large dams been built in Indonesia, with the classification as follows:

- 100 dams with height of more than 15 m and storage capacity of more than 100,000 m³.
- 135 dams with height of less than 15 m and storage capacity of more than 500,000 m³.

Among of 235 large dams, 40 (17.02%) have very low performance, 29 (12.34%) have medium performance, 50 (21.28%) have good/fair performance, and remaining 98 (4.22%) are not yet identified.

Almost all of dams were built to fulfil the demand for irrigation and electricity (BAPPENAS, 2003). However, the development so far covers only 10% of the total demand for irrigation. The growth of the demand for irrigation water increases rapidly in accordance with the growth of population (and their food consumption). Unfortunately, such rapid population growth needs availability of land for settlement, shifting in land use is therefore unavoidable. Figure 1 shows the growth of irrigation area in variation with time. The national rice production was approximately 51.10 million ton, harvested from 11.57 million Ha in 1996 or average production of 4.456

ton/ha. In 2002 this illustration became 51.49 million ton of rice harvested from 11.52 million ha or average product of 4.459 ton/Ha. It was also reported that the rice field area in Java Island is about 40% of the total area of the rice field within the country (Loebis, J., et al., 1987; Mardjono, S. and Sutadi, G., 1987). The rice field area in Java Island decreases 6.5% during 1999-2003, while the availability of land in mostly every island outside Java increases slowly.

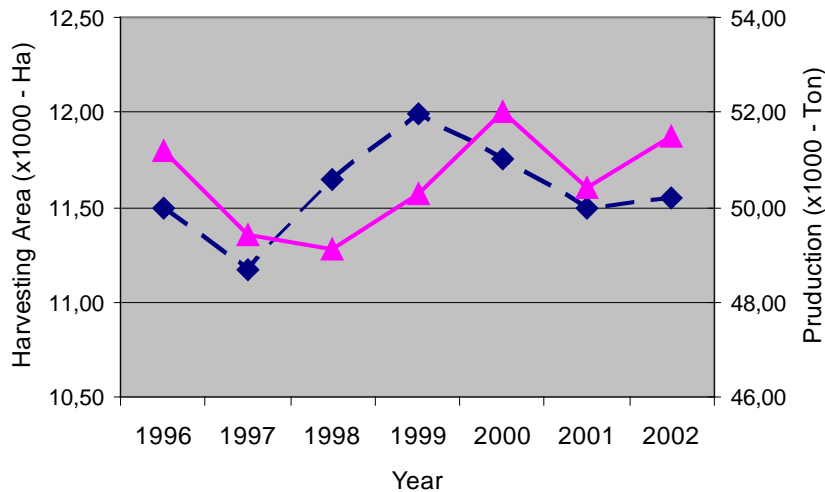


Figure 1 Harvesting Area and National Product of Rice (BAPPENAS, 2003)

They are several on going water resources development programs in 2008, those are described as the followings:

- a) Continuation of eight dam development, i.e. Gonggang, Kedung Brubus, Lodan, Jatigede, Bajulmati, Keuliling, Benel, and Kelara Karraloe;
- b) Optimization of the reservoir and other storage function management;
- c) Optimization of the raw water infrastructure development including groundwater development to fulfil the DMI demand;
- d) Operation and Maintenance of Irrigation Network including the groundwater irrigation network and swamp irrigation network;
- e) Construction of flood infrastructures at the strategic locations (Jakarta and its surrounding), as well as its flood forecasting and warning system;
- f) Construction of infrastructures for coast protection on some vulnerable locations;
- g) Establishment of eleven legal aspects as the derivatives of the Government Law No.7 Year 2004 about Water Resources;
- h) Establishment of 55 group water coordination board at the district/city levels

The direction of strategy, focus, and priority of the water resources development at current national policy is as follows;

- a) Construction of raw water intake and conveyance facilities at 144 m³/s;
- b) Construction of raw water storage of 1,600,000 m³ capacity;
- c) Construction and maintenance of raw water intake infrastructures at 70 locations;
- d) Construction and maintenance of raw water storage at 20 locations;
- e) Operation and maintenance of other raw water infrastructures at 25 locations;
- f) Construction of ground water irrigation network at 16,954 ha;
- g) Rehabilitation of ground water irrigation network at 900 ha;
- h) Operation and maintenance of ground water irrigation network at 1,078 ha;
- i) Rehabilitation of flood control infrastructures at 62 locations;
- j) Operation and maintenance of flood control infrastructures along 1,500 km;
- k) Operation and maintenance of flood protection infrastructures along 120 km

At this time, the amount of electrical energy obtained from the dam development is only 3.4% of total energy required by national demand. The other water-related infrastructures development in the country persist in the form of the development of river basins, dams, diversion structures, swamps, lakes, rivers, etc. In fact, the water-related infrastructures development of the country has been initiated since the Dutch colonial, which is majority aimed at providing water for agriculture purposes, and minority for electrical/energy consumption for the industries. Such infrastructures development includes the development of for small scale irrigation scheme (less than 500 ha irrigation command) as well as the development of mini-hydro power (less than 200 kW capacities).

The water resources development in the country is managed under the coordination of the Directorate General of Water Resources, Ministry of Public Works. Other ministries involved are Ministry of Agriculture, Ministry of Forest, State Ministry of National Development and Planning, Ministry of Energy and Mineral Resources. The involvement of above ministries becomes more intensive after the launch of the most recent government regulation, i.e. the Government Law No. 7 Year 2004 about Water Resources. Initially, the presence of the above law had been causing some conflicts, among of those of the suspect on the fairness in utilizing the water for social and economic purposes. Only the rich side is supposed to have

better access in water, whereas the pour remains difficult to have appropriate access. Until this time, after four years of the launch of the government law and about eleven water resources-related law products, better water resources management arises.

There are several numbers of water resources-related organizations and among many of the water-related organizations, the *Komite Nasional Indonesia untuk Bendungan Besar (KNI-BB)* or Indonesian National Committee on Large Dams (INACOLD) is a non-profit organization which has a link or connection with International Commission on Large Dams (ICOLD), office in Paris, France. In 1950, the United State of Indonesian Republics registered INACOLD as a member of ICOLD. Therefore, the 1950 is then become the embryo of the *KNI-BB* or INACOLD, at which in 1967 the executive commission was established. The platform of the organization and its organization structure including its tasks and functions was accordingly introduced on 3 April 1972. As it is known, the ICOLD itself was established in 1928 with the main mission is to encourage the member countries to keep on improving dam development including its design, construction, and management (operation and maintenance). The activity of ICOLD and its member countries includes participation on the annual meeting, technical committee meeting, and triennial congress, to exchange experience in the large dam development in the member countries. The background of the establishment of the organization and the meeting agenda is basically inspired by the similar demand on obtaining information regarding the dam safety. Initially, at the first time establishment, the members of ICOLD are 26 country members, but now has become 82 country members and more then 7000 individual members. The INACOLD has a vision of increasing community welfare by improving the effectiveness and efficiency of water resources management through the establishment of development and management of large dams. The mission of INACOLD includes;

- a) To improve the quality of design, construction, maintenance, and management of large dams,
- b) To increase the expertise, role/responsibility of the Indonesian large dam engineers,
- c) To take part in increasing the country community welfare by controlling the water resources utilization through large dam development.

2. Water Resources Management (Supply, Demand, and its Related Disaster)

Based on the main government law related to water, it is defined that water is all water available on, beneath, and below the ground. This includes surface water, rain water, and groundwater, but beyond ice/glaciers. The above water resources may vary in time and space, depending upon the location and its hydrological condition. This is why that at one location may have excessive water (in some extent create objection in the form of flooding), whereas at the other location may experience lack of water (in some extent create objection in the form of drought). Theoretically, due to the ideal geographical condition of the country, the entire parts of Indonesia should have little different in water resources availability. However, the physiographical condition and the formation of islands are such that the different in water resources availability varies considerably among the locations.

In term of water supply and sanitation, the priority of utilizing the water is now being introduced through the Government Law No.7 Year 2004 About Water Resources, and its derivation of the law products. Article 24 of the law indicates that strategy in utilizing water is still prioritized on surface water. However, a review says that 70% of the national DMI water demand is still served through groundwater exploitation (Ministry of Mineral Resources and Energy, 2006). Although the global availability of groundwater is relatively big compare with that of surface water, expressed in the ratio within total fresh water as atmospheric water (0.035%), surface water (1%), ground water (23.97%), and ice/glacier (75%), availability at some local areas in the country shows significant scarcity. The aforesaid situation may be a reason that water availability over the space within the local area is not evenly distributed. In term of water demand, the uneven distribution of the human population within local area may also increase complexity of the water resources utilization. Furthermore, this may contribute the unbalance condition between the supply and demand water resources at certain local areas.

The strategy of the water resources infrastructure development in Indonesia has been initiated since the Dutch occupation through the *Algemeene Water Reglement* 1936, and then was continued by the government through five years development program. Until the end of 2002, the government has invested around USD 32,000,000,000 for water resources infrastructure development, with the distribution to various purposes as shown in Figure 2.

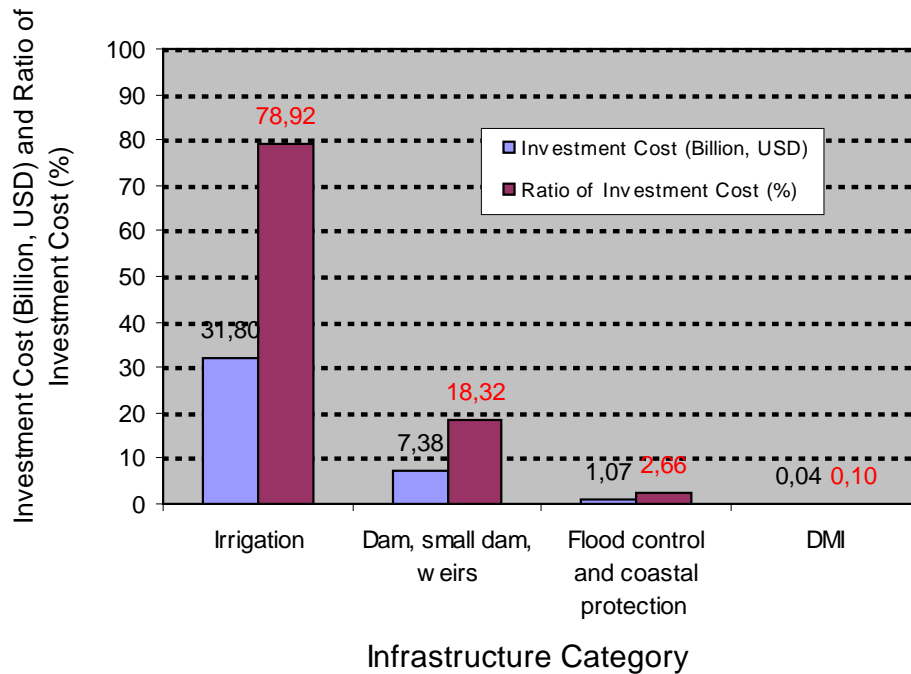


Figure 2 National Water Resources Infrastructure Development until 2002
(BAPPENAS, 2003)

It is apparent from Figure 1 that policy of the government to provide water for DMI demand is relatively too little (0.10%) compare with that of the irrigation (79.12%), dam and small dam and weirs (18.32%), as well as for flood control and coastal protection (2.06%). It can be imagine that the access of the rural community to water supply and sanitation obviously would be very poor.

The water recourses infrastructure development is generally interrelated with the development of other sectors such as agriculture, flood control, water power plant, etc. The country is now facing serious problem in making priority on the development of water resources infrastructures, since agriculture may contribute significant food security, flood control relates with security against disaster, and power plant as well as other sectors relate with the economic development of the country. As a developing country, Indonesian water resources development should pay attention on the holistic sustainable approach, i.e. socio-economic-environment consideration. Water resources infrastructure development for agriculture sector supports the development of infrastructure development to avail sufficient water for irrigation of paddy field, fresh water of fisheries, fresh water of veterinary, etc. Recently, many efforts to develop methods and techniques are made to increase the efficiency of water utilization for agriculture sector.

Indonesia with the total area of 1,919,440 km², consists of more than 13,000 islands, 54,716 km length of coastline, lies between approximately 7°N and 11°S latitude, and between the 95°E and 140°E longitude, has very potential disaster (Legono, D, 2005 (Dec); 2005 (Sept)). There was a catastrophic tsunami disaster in Aceh and North Sumatra in December 26, 2004, more than 125,000 people were reported died. The types of natural disasters which are considered common (by order) are flooding, earthquakes, volcanic eruptions, droughts and cyclones (Table 1). Figure 3 shows the distribution in space of potential flood disaster area in Indonesia.

Table 1 Type of disasters casualties between 1907 - 2004

Disaster	# of Events	Total killed	Avg.# Killed	Total Affected	Avg.# Affected
Cyclone	10	1,992	199	19,698	1,872
Drought	11	9,329	848	4,894,220	444,929
Earthquake	78	21,856	280	1,723,756	18,180
Flood	93	4,296	46	5,069,306	49,643
Volcano	43	17,945	417	981,853	22,351

* Center for Hazards and Risk Research at Columbia Univ.

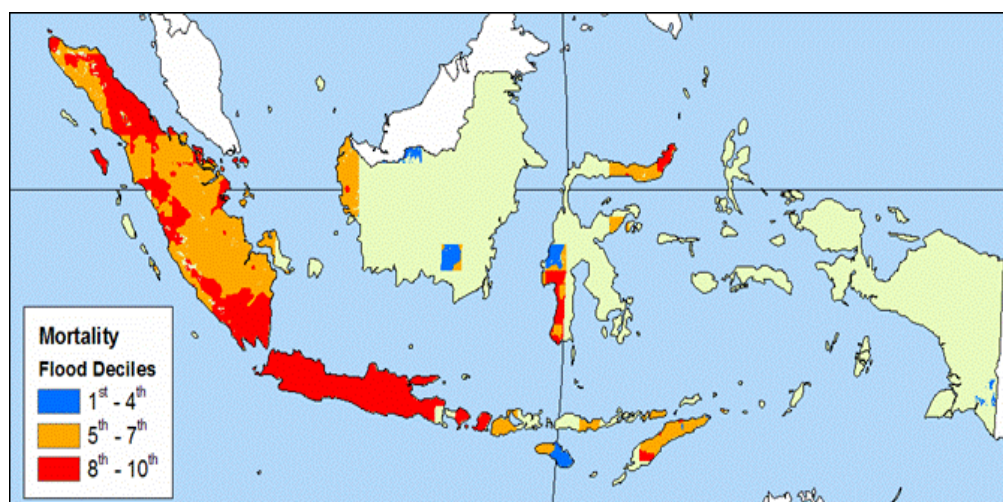


Figure 3 Location and degree of flood disaster

Water resources infrastructure development for flood control purpose has become more important role recently, due to the significant increase on the number of water-related disaster including reservoir sedimentation (Mahmood, 1987). The

total loss and damage of flooding of Jakarta (capital city) at early 2007 and Solo (Central Java Province) at end of 2007 of approximately USD 8,000,000 and 2,000,000, respectively, are examples to show the importance of water resources development for the flood control purpose during next decade. However, optimization technique should be adopted to meet the cost effectiveness and efficiency of the development. This is a very difficult task unless a sufficient and reliable data is available.

Other issues that should be considered are global warming and climate change during the last decade. Such issues in smaller level scale should be studied, even with very limited data. Whereas and at the same time, monitoring and evaluation of related physical phenomena should be carried out from now on. This monitoring and evaluation includes the water-related database development such as hydrology data, climatology data, land use data, and other socio-environment condition in variation with time. As we all know that the world wide concern about global warming and its impact on the fate of the planet has risen to unprecedented levels in the last few years. This explosion of information on global warming and climate change has made all of us much more aware of what is happening. But, the sheer magnitude of it can also be overwhelming. We often ask ourselves, in spite of all the media are we really certain about what we need to know and is there anything we as average citizens can do about it? Furthermore, how serious such issues happen at our localities? We might not be able to answer the above question now due lack of data; however, we have to avail the reliable answer in ten years from now by means of conducting monitoring and evaluation activities. At same time, necessary actions to encounter impacts from global warming and climate change should be carried out.

3. Access to drinking water and sanitation

Among approximately 250 million population of the country, more than 100 million people still have difficulties in accessing water for daily use. Some of them even make use of river as the water resources for their daily needs. Number of people having access on better water supply (clear water – not drinking water) and sanitation was reported at 47%, 55%, and 63.5% in 1990, 2000, and 2002 respectively [Salter, 1998; Whitten, 1997] . The terminology of drinking water has become improved significantly after the launch of the Government Law No. 7 Year 2004 about water resources. Previous terminology was limited to the effort of availing clear water which may be obtained from shallow well, spring water, and rain water.

Figure 4 shows the average condition of water and sanitation service at various provinces in Indonesia until 2004.

It is apparent from Figure 4 that the coverage of the service of the water supply and sanitation is 36.09%, whereas in fact, only 6.27 % in the village area. This means that the village people still have difficulty in getting the reliable water. They get water through the non-protected system such as flowing the water from the spring site utilizing plastic or PVC pipes, taking the water directly from shallow wells, or from spring site by means of using jerry can and then carrying it to home.

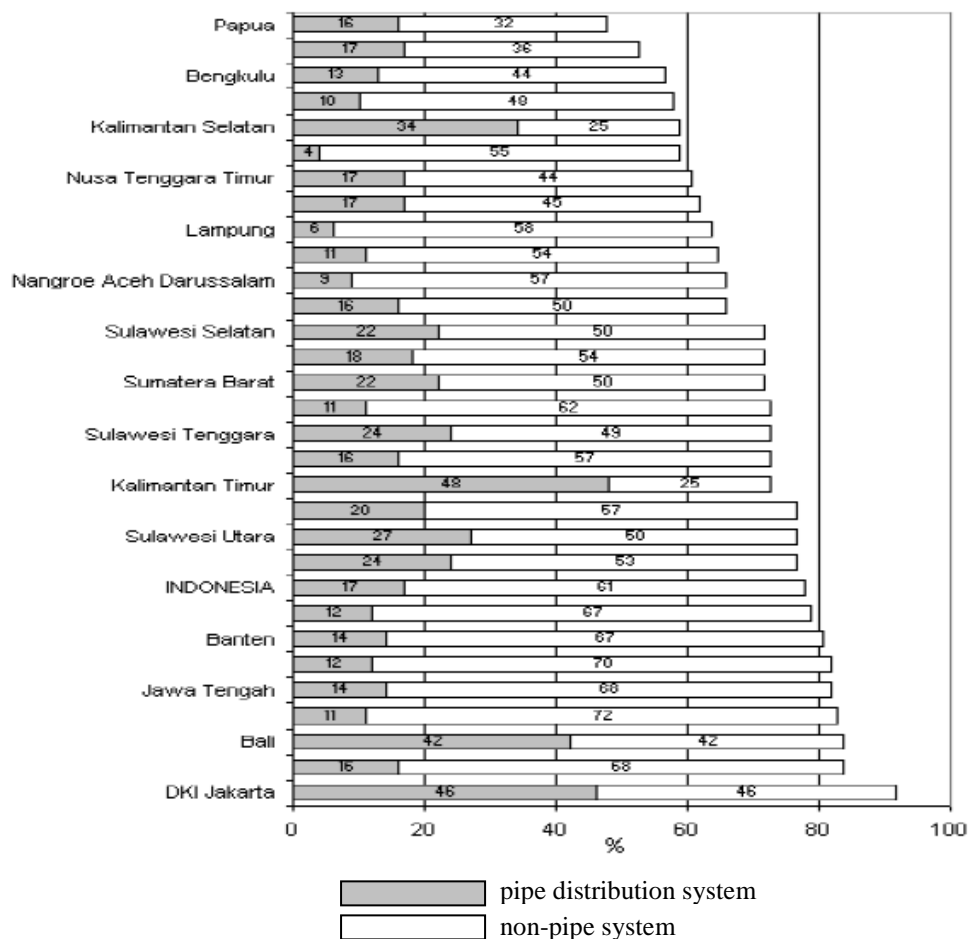


Figure 4 Water supply and sanitation condition in cities of various provinces

4. Conclusions and Recommendations

Followings are description of characteristics that should be taken into account for further development of water resources management in Indonesia;

- a) Water is a potential resource that every people have the same right to access it easily on the basis of fair management.

- b) Development policy of the national water resources should be addressed in such that the integrated and sustainable characteristic is met.
- c) The integrated development should be meant as development of water resources which apply a concept of one river-one plan–one management, involving various sectors and stakeholders, through participatory approach including its process of decision making.
- d) Sustainable water resources management should include economics aspect as the holistic understanding that paradigm of socials (including environment and culture) and economics should be carried out proportionally.
- e) The access for water for various purposes (such as irrigation, domestic, municipal, and industry) should be arranged in such that sustainability of water availability and water demand remains at good balance, taking into account the population growth and its distribution.
- f) In term of the water accessibility distribution in space, specific structural and non-structural method should be developed to avail water taking into account the local condition (such as man power, material, capacity, etc) of rural, sub-urban, and urban community,
- g) As water-related disaster becoming more intensive as resulted from global warming and climate change, more budgets should be allocated to mitigate the negative impacts due to disaster occurrences. However, a reliable approach to consider the value of any adopted action should be made available.

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6. References

- BAPPENAS, (2003) *The Formulation of Strategy of Development and Big Scale Infrastructures Financing*, 2003.
- Legono, D., (2005) *Important issues on sediment-related disaster management in Indonesia*, International Symposium on Fluvial and Coastal Disaster, Kyoto University, Japan, December 1-2.
- Legono, D., (2005) *Research on sedimentation issues and countermeasures in some reservoirs in Central Java and DIY*, Second Workshop on Countermeasures for Sedimentation in the Wonogiri Multipurpose Dam, Solo, Indonesia, September 8.
- Loebis, J., Soeharto, M., B., and Ilyas, M.A., (1987) *Review of the problem of reservoir sedimentation in Indonesia*, Workshop on Reservoir Sedimentation, Bandung, Indonesia, September 22-24.
- Mahmood, K., (1987) *Reservoir sedimentation: impact, extent, and mitigation*, World Bank Technical Paper Number 71, ISBN-0-8213-0952-8.
- Mardjono, S. and Sutadi, G., (1987) *Case study on planning and design of the Wonogiri Dam*, Workshop on Reservoir Sedimentation, Bandung, Indonesia, September 22-24.
- Salter, (1998) *Shifting paradigm in emergency management*, Australian Journal in Emergency Management.
- Whitten, A. J., (1997) *The ecology of Java and Bali*, Oxford University Press.