Integrated Lake Basin Management For
Save Indonesian Lake Movement
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Abstract

Many Indonesian lakes are deteriorating due to sedimentation, pollution, eutrophication, and water quality and water quantity depletion. On the other sides, Indonesian lakes are used mainly for hydro-power electricity, agriculture, fisheries, clean water source, culture, religion, and tourism. Regarding to those problems, it was pointed out 15 Indonesian Lakes Priority for 2010-2014. The smallest lake with huge problems: Rawapening Lake, was chosen as pilot project for Save Indonesian Lake Movement (In Indonesia called Gerakan Penyelamatan Danau = GERMADAN). Basically there is no difference between Integrated Lake Basin Management (ILBM) and GERMADAN. The approach technologies and knowledge information of ILBM was merger into the application of science and technology for lake remediation in GERMADAN. The pillar of institution, policies, and finance of ILBM was merger into good governance in GERMADAN, whereas participation in ILBM was develop into community empowerment in GERMADAN. This 3 pillars of GERMADAN was integrated and support each other. There were success storis in some Indonesian lakes, however, there was a rise problems in other lakes. The bottle neck of GERMADAN seems to be a governence, particularly on the policies and finance.

Keywords: GERMADAN; Rawapening; Integrated Lake Basin Management (ILBM)

1. Introduction

The Integrated Lake Basin Management (ILBM) is developed by ILEC (2007) as a guideline for lake managers and stakeholders to achieve sustainable management of lakes and their basins[1]. This conceptual framework consists of the lake biophysical features and management requirements of lake basin systems that are associated with the lentic water properties, and their dynamical changes, use and conservation of lake and basin resources. Moreover, this framework promotes the improvement of lake basin governance continuously by integrated 6 pillars of institutions, policies, participation, technology, information and finance. Institutions were required to manage the resources of the lake and its basin for all lake basin users. The policies have to be developed to govern people’s use of lake resources and human impacts on lakes. The involvement of key stakeholders in lake basin management as
well as community empowerment was the third pillar that will strengthen the ILBM. The use of technology, information from traditionally and scientific approach in some cases were the fourth and fifth pillar of ILBM. Last but not least was sustainable finance to support all the above activities. Those 6 pillars have to stand together to support ILBM[2] (Fig 1). There was cyclic process up and down on the development of ILBM. When one or two pillars were broken, the process repeated again and again until all 6 pillars were stand up.

There were 4 stages in the ILBM platform process with gradual synthesis of management reasons/purposes. Phase 1, called preparatory phase that required previous interventions. The vision had to be developed and shared to understand the needs and challenges of the vision, to assess the gap in ILBM pillars, and to prepare sharing and lesson learns. Phase 2, called initial phase, is getting started periods, put into account multiple management reasons/purposes. The lentic properties and ecosystem service framework was blind by balancing the service components, ecosystem service change over time, and ecosystem service and basin governance. Phase 3, called implementation phase, is trial and error period, that strengthened ILBM pillars gradually by accumulation knowledge and experience, sharing success stories and failures, autonomous efforts for evolving the cycle. Phase 4, called sustainability challenge period, synthesized of multiple management reasons/purposes. The cyclic process of ILBM platform consist of those 4 stages that repeated 1 – 8 cycles to reach the long term goal[3] (Fig 2).
The Austin Declaration which announced in 11th World Lake Conference held in Austin Texas 2011 recommended 9 points regarding the implementation of ILMB. First, the need of sustainable use of the lakes for enhancing human and ecosystem health due to the potential impacts of climate change and extreme water-related events such as drought and floods. Governments, NGOs, civil society, industry and agriculture strive for practical, participatory approaches for managing lakes, reservoirs, wetlands, rivers, groundwater, coastal and other water systems. Second, the linkages between flowing hydrological aspect and pooled freshwater systems have to be considered for effective water system management. Third, ecosystem maintenance, specifically on the regulation services were the essential for water management efforts. Fourth, the need of educate and inform all levels water users about their potential roles on the ecosystem health and sustainable development. Fifth, integrated water management might be undertaken through gradual, continuous and holistic improvement of basin governance by integrated institutional responsibilities, policy directions, stakeholder participation, scientific and traditional knowledge, technological possibilities and funding prospects and constraints. Sixth, management of freshwater systems consist of assessment, action, evaluation and revision over time. Seventh, the need of financial support, as well as appropriate technical and governance capacity for managing freshwater systems for sustainable use. Eight, the used of past experiences and lessons learned in a wide range of environmental and socioeconomic settings. Ninth, the need of collaboration between scientific and governance components of integrated water management. 

The ILBM platform development was based on the fundamental features of the lentic water systems, such as long residence time, complex response and integrated nature, coherence with 3 principles of sustainability for resource use and conservation, i.e ecosystem principle, change in resource value principle, and lentic and lotic watersheds. The development of lake brief and lake basin governance framework have to be explored to improve and enhance lake basin governance. ILEC have an important role in facilitating the development of lake brief, such as Guideline for Lake Brief Preparation (GLBP), Knowledge Base (LAKES), World Lake Database (WLDB), and Training Modules (TM). The ILEC’s guidelines for Lake Briefs related to the ILBM are consist of description of the
Lake, management of the lake and the basin, major impact stories of the lake, major lake basin governance issue, and key challenges to lake governance[4].

ILBM had been implemented in many countries Philippines, Malaysia, Nepal, India, Mexico, and Russia. How about in Indonesia? Indonesia has 895 lakes with the total area of 491,724 hectare (0.25% of Indonesian terrestrial), 52 reservoirs, waduk, and 22,158,000 hectare of wetlands[5]. The characteristics and type of Indonesian lakes were varies that required specific management. This paper was made to evaluate the ILBM in Indonesia.

2. Methods

The evaluation of ILBM in Indonesia had been conducted by getting involvement as a leader in the development of GERMADAN Rawapening by The Ministry of Environment. GERMADAN is Gerakan Penyelamatan Danau (Saving Indonesian Lake Movement), with the pilot project of Rawapening. The development of GERMADAN Rawapening had done in 2011, followed by Grand Design of Save Indonesian Lake Movement in 2012, followed the implementation of GERMADAN for other lakes with such modification adapting to the characteristic feature of the lake.

3. Results

The ILBM in Indonesia had started and announced on the first National Conference of Indonesian Lakes, in Bali 13th August 2009. The Minister of Environment, Home Affairs, Public Works, Agriculture, Energy and Mineral Resources, Research and Technology, Maritime and Fisheries Affairs, Culture and Tourism, and Forestry committed on Lake Sustainable Management, which then called Bali Agreement. This agreement consisted of 7 programs for 15 lakes priority: lake ecosystem management, the use of lake resource has to be based on deeply scientific and technological analysis and their impacts; the development of lake monitoring, evaluation and information systems; preparation of adaptation and mitigation steps the impact of environmental changes to the lakes; the development of capacity, regulation and coordination; improvement of community involvement; and sustainable funded. 15 National Lake Priority 2010 – 2014 had chosen based on the lake degradation (sedimentation, pollution, eutrophication, water quality degradation); lake function (hydropower electricity, agriculture, fisheries, drinking water, social and religious life, tourism); commitment between government and community; strategic function of the lakes; biodiversity; and level of risk disaster. The 15 national lakes priority are 3 lakes in Sumatra (Lake Toba, Maninjau, Singkarak), 1 lake in Jambi (Kerinci), 5 lakes in Sulawesi (Tondano, Limboto, Poso, Tempe, Matano), 2 lakes in Kalimantan (Cascade Mahakam Semayam-Melintang-Jempang, Sentarum), 1 lake in Papua (Sentani), 1 lake in Banten (Rawa Danau), 1 lake in Bali (Batur), and 1 lake in Central Java (Rawapening)[6]. Before this conference, actually, many Indonesian lakes had managed locally, optimizing local wisdom to improve community involvement on the lake conservation. There was long ways before Lake Toba Ecosystem Management Plan (LTEMP) developed in 2004. National green week had started in 1961 as a first step saving Lake Toba. In 1990 regional rule had developed. The LTEMP was strengthened by Governor Rule about Environmental Standard 2009 and action of one man one tree. Since then, every year there was action to improve environmental quality of Toba Lake. Nationally, the Ministry of Environment had developed the guideline for lake management in 2008[8].

The preparation and initiation process in ILBM had done by The Ministry of Environment that choose Rawapening Lakes as a pilot project for further action of Bali Agreement based on the smallest size of the lake but have huge problems. On the 2nd National Conference of Indonesian Lake, held in Semarang, 3-4 September 2011, GERMADAN Rawapening was launched as pilot project Indonesian Lake Management, as a reference to be implemented for other lakes with modification based on lake’s characteristics.

Rawapening Lake is a tectono-volcanic lake situated in Central Java, Indonesia, 45 km to the south of the city of Semarang. It is a circular lake of ~ 2,000 Ha surface areas situated at 400 mASL. It is supplied by flows from 16 stream inlets, many of which are used for domestic water supply for the 17 villages surrounding the lake, or diverted for paddy field development. In the early 1900s its only 1 outlet was impounded to ensure supplies for hydroelectricity development and to mitigate the risk of flooding downstream[7]. Sedimentation, eutrophication and water quality deterioration is the main problem of Rawapening Lake that had induced lake shallowness. It was predicted that in 2021 the lake will become land, related to heavily erosion Since 1930s Rawapening Lake was invaded by water hyacinth (Eichhornia crassipes (Mart.) Solms) and other aquatic invasive plants, Hydrilla and...
Salvinia. Now, over 70% of the lake is covered with water hyacinth. The degraded state of this lake has drawn the attention of the United Nations Environment Program and Indonesian authorities and there is, within the Indonesian Environmental Regulatory Report Number 32 (2009), a directive to establish management plans for the lake to improve its water quality and amenity. Rawapening Lake acts as a sink for pollutants released across the intensively used catchment and within the lake itself. Industrial, urban and agricultural development has increased the loads of fertilizers and metal pollutants to the lake. The development of the step catchment slopes has resulted in increased turbidity in the inlet streams and increased sediment loads to the lake[10].

There were 3 approach in GERMADAN Rawapening, namely science and technology application to remediate water and catchment area, develop governance for lake conservation, and improve community empowerment on lake conservation[9] (Fig. 3). In comparison with ILBM developed by ILEC, the 3 approach in GERMADAN were actually inline with 6 pillars in ILBM. The approach technologies and knowledge information of ILBM was merger into the application of science and technology for lake remediation in GERMADAN. The pilar of institution, policies, and finance of ILBM was merger into good governance in GERMADAN, whereas participation in ILBM was develop into community empowerment in GERMADAN. This 3 approach of GERMADAN was integrated and support each other.

GERMADAN Rawapening divided into super priority and prioritity programs[10].

6 super priority programs are:
1) management of water hyacinth bloom;
2) management of critical landuse, erosion, flooding, and sedimentation;
3) reducing nutrient entering to Rawapening Lake;
4) neo and paleo - limnological study;
5) implementing environmental friendly agriculture; and
6) improving community empowerment for the lake conservation.

11 priority programs are:
1) environmental friendly fisheries management;
2) integrated waste water treatment;
3) integrating drainage;
4) developing Center for Rawapening Lake Management;
5) planning for development Rawapening region;
6) governance and regulation for Rawapening Management;
7) protection of natural resources;
8) zoning of Rawapening Lake;
9) improving community welfare by diversification of water hyacinth use;
10) ecotourism development; and
11) improving forum for environmental care

There were success stories in some Indonesian lakes, however, there was a rise problems in other lakes. ILBM had been developed in Indonesia before 9 ministers’ agreement called Bali Agreement 2009. For example, LTEMP had been developed in 2004 as a joint planning of stakeholders. There were 7 points in LTEMP i.e. Lake Toba for drinking water, open access for community, optimal land function in the catchment area, non contamination of fish and agricultural product, increasing function for electricity water power and tourism, biodiversity, and air for healthy ecosystem[12]. LTEMP was developing for solving problems of net culture fisheries, river bank and aquatic plants in such place. As a deep lake, the problems of Lake Toba do not as worse as Rawapening Lake. The problem of fish aqua culture had been solving nationally. LTEMP was then strengthened with GERMADAN Toba in 2014. The draft of GERMADAN Toba had been discussed in Semi Workshop 13 – 15 August 2014.
Another problem was Maninjau Lake. Fish mass killed occurred very often. On August 2014, 350 ton fish of net culture fisheries in Maninjau Lake were died\textsuperscript{13}. Fish mass killed phenomenon in Maninjau Lake occurred every 2 years\textsuperscript{11}. It was related to the overturn upwelling process on volcanic lake. There was commitment to conserve Maninjau Lake. Co management had been implemented to protect, solve, and rehabilitate of Maninjau Lake and its catchment area. Baden Pengelola Kelestarian Kawasan Danau Maninjau (2009) was proof that ILBM had implement in Maninjau Lake especially on governance pillar. GERMADAN Maninjau was launched 2013.

Almost every year there were programs for Rawapening Lake, both in the catchment area or in the lake. The program to harvest water hyacinth had been run every year with the amount funding from millions to billions rupiah. But the actions were not integrating into a holistic program, therefore there were no significant result of reducing water hyacinth bloom. The Departments of Water Resource, Forestry, Natural Resource Conservation, Agriculture; Marine and Fisheries Office, Environmental Protection Authority, Regional Planning Institute developed programs for Rawapening. Sometimes overlapping program occurred due to miss coordination, no institutional leader of Rawapening. The Ministry of Environment as a conceptor of GERMADAN Rawapening have to act as a leader and conduct the implementation of GERMADAN. In 2011, there was a collaboration action between community and army. However, the funding from the Ministry of Environment only enough to harvest 30 hectares water hyacinth out of more than 1,500 hectare of water hyacinth. Water hyacinth covered 70% of Rawapening Lake\textsuperscript{14}. 2 months after the program, water hyacinth covered more wider of the surface lake. 1 plant of water hyacinth wills doubling within 14 days, and covered 1 m\textsuperscript{2} within 52 days\textsuperscript{15}. That is why water hyacinth problems are worse, cause of its fast reproduction. Research still develops on water hyacinth growth rate, seems that the growth rate of water hyacinth Rawapening are faster than in India.

The bottle neck of GERMADAN seems to be a governence, particularly on the policies and finance. GERMADAN has to be used as a reference of developing program for department both in national and regional level. Radical action required to overcome lake degradation problem, with one action, one big funding and strong institutional collaborations. Strong leadership has to conduct and to embrace scientists, communities and stakeholders as one team to work together. GERMADAN do not only a document, real actions are waiting.
4. Conclusion

There is no difference between ILBM and GERMADAN. The approach technologies and knowledge information of ILBM was merger into the application of science and technology for lake remediation in GERMADAN. The pilar of institution, policies, and finance of ILBM was merger into good governance in GERMADAN, whereas participation in ILBM was develop into community empowerment in GERMADAN. This 3 pillars of GERMADAN was integrated and support each other. The bottle neck of GERMADAN seems to be a governance, particularly on the policies and finance. It needs radical action: one action, one big funding and strong institutional collaboration.

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