THE PRACTICE AND CHALLENGES OF LAKE MANAGEMENT IN ETHIOPIA- THE CASE OF LAKE KOKA

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Abstract:

Lake Koka, found within the Ethiopian Rift Valley, is an artificial lake built in 1960 in order to generate hydroelectric power. Since then, it has been serving in parallel not less than 15,000 local people as source of water for drinking, cleaning, animal watering, recreation, irrigation, fishing, etc.

Basin wide unisectoral development, uncoordinated uses and management practices, lack of transparent and efficient regulatory institutions, through adequate policy and legal frameworks, uncontrolled human interactions with the ecosystem etc. have all led to the rise of a huge social and environmental problem, i.e. pollution of Lake Koka. This has consequently been adversely affecting the local people, whose livelihoods are entirely dependent up on the existence and continuity of the lake, and its ecosystem that something urgent needs to be done in order to curb the trend and create a convivial future.

Therefore, this study aims at analyzing and understanding the issue from the views and perspectives of different stakeholders, including the institutional contexts, and thereby initiates change for improvements. Soft System Methodology (SSM) was opted as method of dealing with such socially triggered complex and unstructured set of environmental problem so as to foster learning and knowledge development while appreciating the methodology

The study tries to address the existing challenges of using and managing the lake with the help of SSM and approaches of Integrated Water Resource Management(IWRM) by seeking answer to the major research question: '*given the existing condition of the lake Koka and the livelihoods of the local communities, which aspects of the Lake's integrated management offer opportunities for bringing about improvements and leading to restoration of the lake, and what desirable and feasible actions could be implemented?*''

Accordingly, the study revealed that, despite its limitations, there are considerable lacks of institutional coordination, environmental awareness and stakeholder participation. For this, a more sustained intervention of bringing coordination and collaboration among different stakeholders and actors, improving transparency and environmental awareness, fostered stakeholder participation, and effective local management, through empowerment of the local community, etc. are considered both desirable and feasible integrated aspects of the Lake Koka. This will subsequently lead to improvement and restoration of the Lake which will ultimately benefit both the community and the ecosystem. Otherwise, if the trend continues it is expected that the Lake will be in a condition to reach at its worst level that it can no longer support the different uses, especially for the local community.

To my deceased father, *MAMOAKIE*, by his nickname, for his lovely and meaningful character, who had relentlessly been doing his very best, at all costs, even performing typically women's task in rural Ethiopia, to providing me the best possible conducive and an enabling environment with a dream of seeing me always progressing to the next higher level!!

Preface

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I am also profoundly grateful to the Amude community and people from different institutions and organizations who humbly allowed me to have had stimulating engagements during the course of my field work. I'm fully indebted to their trust in my work which made them to cooperate and be of help to me in any way possible.

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Lastly but not least, I owe my deepest gratitude to my family, Adina Tegegne, my mother, Wondimu Hailu, Etenat Mengiste, Belay Tegegne, Atlabachew, Menge(!), and others, who have been relentlessly providing me the necessary care and support. I will never ever forget the times you all have been busy lending your hands, having me in your thoughts and prayers, to ensuring that I'm safe while I had been quite far away both during my field work and study periods. May God ceaselessly bless you all!! Amen!!

Acronyms

APAP	Action Professionals Association for People
BATWOVE	Beneficiaries, Actors, Transformation, Worldview, Owner, Victim and Environmental Constraints
CEO	Chief Executive Officer
EEPCO	Ethiopian Electric Power Corporation
EFY	Ethiopian Fiscal Year
EIAR	Ethiopian Institute of Agricultural Research
EIS	Environmental Information System
EPA	Ethiopian Environmental Protection Authority
ERTA	Ethiopian Radio and Television Agency
EWRIS	Ethiopian Water Resource Information System
EU	European Union
GWP	Global Water Partnership
IWMI	International Water Management Institute
IWRM	Integrated Water Resource Management
KHEPP	Koka Hydro Electric Power Plant
MNRDEP	Ministry of Natural Resources Development and Environmental Protection
MoARD	Ministry of Agriculture and Rural Development
MoE	Ministry of Education
MoH	Ministry of Health
MoI	Ministry of Information
MT	Medium Term
MoTI	Ministry of Trade and Industry
MOWE	Ministry of Water and Energy
NGOs	Non-Governmental Organizations

PB2	Policy Briefing Number 2
RD	Root Definition
SA	Stakeholder Analysis
SDI	Systems Development Institute
SLIM	Social Learning for the Integrated Management
SSM	Soft System Methodology
ST	Short Term
UK	United Kingdom
UN	The United Nations
USD	United States Dollar
USA	United States of America
T	Transformation
WSSD	World Summit on Sustainable Development

1. Introduction

It is obvious that having access to adequate and fresh supplies of water is a prerequisite for the existence of human being in particular and the ecosystem in general. More than such a meager survival, humans have also made significant social and economic developments in different parts of the globe with the help of the available freshwater.

Lakes, which also form the larger aquatic system such as rivers and wetlands, are one form of freshwater supplies. Accordingly, humans throughout history have been building artificial lakes (also called reservoirs, impoundments, dams or tanks), in addition to the natural lakes, for various purposes such as water supply, hydropower generation, fishing, irrigation, recreation, etc[1].

Ethiopia has a number of lakes, most of which are found within the rift valley, that are central for socio-economic developments. Lake Koka, one of the rift valley lakes in the Awash River basin, was created (artificially) for hydroelectric power generation in 1960[2] but later it has been also fulfilling different social and ecological needs.

However, excessive extractions, intractable human interactions with nature and extensive development activities in the basin have led significant changes in its state.

Therefore, this paper tries to explore and address the key challenges of managing lakes in Ethiopia, with a particular case on Lake Koka, using some of the guidelines and approaches of Integrated Water Resource Management (IWRM) based on the idea of integrating and coordinating the different water uses while sustainably preserving the ecosystem in order to create a convivial future.

[1] The World Lake(http://www.ilec.or.jp/eg/wlv/complete/wlv_c_english.PDF, June 12, 2011)

[2] According to information from Ethiopian Electric Power Corporation(March 2011)

1.2 Background to the Problem

Lake Koka, with a surface area of 250 km² and at an elevation of 1590 m^3, is found some 50 miles south of the Capital of Ethiopia, Addis Ababa. It has been for long supporting lives in the surrounding, including the Amude community.

The lake has been in use by different stakeholders with varying level of interest as well as degree of power to control this commonly shared resource. Some of the stakeholders who have stakes on include, but not limited to, the local communities, Ethiopian Electric Power Corporation (EEPCO), Ethiopian Environmental Protection Authority (EPA), Ministry of Trade and Industry (MoTI), Tannery Industries, Horticultures and Small Scale Factories, and Non-Governmental Organizations(NGOs) such as Intermon Oxfam and Action Professionals Association for People (APAP), etc.

There are about 15,000 local people who have been heavily relying on the lake as source of water for drinking, animal watering, cleaning, fishing, traditional irrigation practices, etc. However, due to the present condition of the lake-heavily polluted, they are left with no access to fresh water. They suffer from poor sanitation and water born diseases, according to the local health worker's belief, such as chronic diarrhea that are resulting from drinking the toxic water.

Women are especially the ones to suffer most as they are responsible in fetching water, making daily long hours journey having carried water pots on their back, and making use of it for various household activities such as drinking, cooking, cleaning, etc. Combined with very poor access to social services, the situation poses an enormous challenge to the local people. Generally, the community has been facing a range of problems, i.e. from social to environmental, due to the fact that water is a necessity for their lives and at the same time the lake from which they have been sourcing their only source of fresh water is under severe threat of pollution.

Ethiopian Electric Power Corporation (EEPCO) built a hydro electric dam in 1960 by creating the lake artificially. Since then, it has been source of hydroelectric power that generates and transmits electricity to different parts of the country for domestic and industrial uses. The company has been affecting the situation in that, according to a recent research finding,

[3] http://www.eosnap.com/?tag=lake-koka

'people living nearby this dam are very much exposed to malaria because of the presence of highest rates of malaria in communities living near the reservoirs.'[4]

Ethiopian Environmental Protection Authority (EPA) is responsible in regulating and maintaining the environmental safety by developing policy and regulatory frameworks. As stated on its website, it has mission of preparing and implementing environmental management system, providing information and facilitating participation in decision making, community empowerment, etc[5].

Ministry of Trade and Industry (MoTI) is also involved as a state institution which facilitates the granting of investment licenses for those industries and horticultures operating along the sides of the lake. A minster from the institution, when asked about the situation, viewed the social problems created around the lake to be very common and unavoidable given the fact that the institution in particular and the government in general have currently set investment, at all cost, as top priority which would help the country to be able to prosper and thereby improve the living condition of the population at large. He also stated that 'Ethiopia is not like European countries where the government should be stringent about the environment.' He further described saying that 'every human intervention with nature affects the ecology and there is nothing that can be done very much without such a compromise, especially if the country is to develop itself through investment.'

There are also industries, tanneries, horticultures and other small scale factories, which produce soaps, sugar and plastic, operationally situated across the banks of the lake and its tributaries over the past decades[6]. As a result of this, different reports[7] have been showing their primary involvement (waste disposal) in affecting the situation of the lake. According to a UK based laboratory result of the sample taken from the lake and the factories, it is evidenced that the industrial effluents containing chemicals and organic pollutants are

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[4] Study Shows Malaria Infections Increase Near Ethiopian Dam, September 17, 2010

http://www.circleofblue.org/waternews/2010/world/africa/study-shows-malaria-infections-increase-near-ethiopian-dam/,

[5] Ethiopian Environmental Protection Authority, October 15, 2010. http://www.epa.gov.et/Default.aspx,

[6] Gaada.com REPORTS, Environment in Peril, http://www.gadaa.com/LakeKoka.html, Date Accessed, September 25, 2010

[7] People and Power, *Green Lake* by Al Jazeera Television(Al Jazeera's Documentary) http://english.aljazeera.net/programmes/peopleandpower/2009/02/200922114211921697.html

streaming in to the lake and its tributaries which eventually affect the societies who solely depend up on the lake.

The report further disclosed the views of the local people and health workers who believed that recent (2009) deaths of both human and animal are caused by the toxic water. Similarly, different environmental and social activists such as Oxfam and Action Professionals Association for People (APAP) were accusing the EPA for failing to monitor and regulate the environmental impacts of the different actors. While they were asked about the situation by journalist, they explained that the case has been taken to court and they are hoping to get precedence. APAP and Oxfam are currently working on behalf of the environment and the local people's interest especially following the death of people which is reported to be caused by the water pollution.

Contrary to the forgoing facts, the lion's share of contribution by the industries in enhancing the lives of many nations(through job and employment creation) who would otherwise had the fate of those communities is undeniable. For instance, the statistical data showed that the country had secured 39.9 million USD per year (Ethiopian Ministry of Trade and Industry Annual Report 2007/8) foreign revenue only from the tannery industry which indicated that the country is benefiting from the investment.

However, the paradox is that there are still communities who have been suffering from the subsequent damage caused to the environment up on which that these people have been heavily relying on.

The facts such as lack of coordinated (unregulated) use of the lake by different actors and weak institutional (legal as well as political) arrangements show that the water resource utilization approaches and practices are sectorally fragmented leading to uncoordinated development and management of the various uses. Therefore, these challenges should be addressed according to the underlying principles of Integrated Water Resource Management (IWRM) which are ''bringing coordination and collaboration among the different stakeholders and actors, improving transparency, fostering stakeholder participation, and setting cost effective local management, etc.'' This way of intervening will lead to address the far reaching consequences of the pollution which is currently challenging to the livelihoods of the local communities in particular and the country in general.

1.3 Statement of the Problem

The high economic pressure, unisectoral development, uncoordinated uses and management practices, lack of transparent and efficient regulatory institutions through adequate policy and legal frameworks, etc. have all led to the rise of huge social and environmental problems, especially to the local community in the Amude who depend up on the lake as their only fresh supply of water. Involvement of different stakeholders such as users, planers and policy makers who are in different levels and at the same time have varying degree of control/ stake on the lake add up to the complexity and uncertainties of the problem. The issue, therefore, requires an urgent action that takes in to account all of these perspectives, linking social and economic development while protecting the natural ecosystem[8], for the subsequent improvement and ease of the situation.

Institutional arrangements, which are often characterized by very weak and less transparent institutional policies, corporate values and norms that have no resemblance/ congruency to that of the local people, have been giving too much emphasis in promoting investments while there has been very little or no attention given on the water- lake Koka- management and uses. Consequently, this has been adversely affecting the use and management practices of the lake which in turn has affected the local communities (people suffering from sanitation related diseases, misery and poverty) whose survivals are totally dependent on the presence of the lake. Therefore, it is important that the expected costs up on the environment and those who rely on it should not be underestimated. Because, having no or inadequate care to today's environment would lead to an environment that doesn't provide enough support not only to the current generation but also to the future generation. Thus, an intervention should be undertaken involving the different actors who have competing claims over the lake.

In this project work, the research will seek to answer major question of *'given the existing condition of the lake Koka and the livelihoods of the local communities, which aspects of the Lake's integrated management offer opportunities for bringing about improvements and leading to restoration of the lake, and what desirable and feasible actions could be implemented?* This will mainly be looked from the views and perspectives of different stakeholders and the institutional contexts toward the use and management of the lake.

[8] Global Water Partnership(GWP)

Some of the specific areas (questions) to be addressed include:

- How does the situation exist (analyzing and understanding the existing challenges and uncertainties of the lake, contradicting views, beliefs and values regarding the issue at hand)?
- How are the roles of gender and institutional arrangements playing in managing the lake?
- What are the challenges and prospects of implementing IWRM in the Ethiopian context, particularly in relation to improving the situation of Lake Koka?

1.4 Purpose of the Study

The study aims at analyzing and understanding of the issue from the views and perspectives of different stakeholders as well as the institutional contexts. This will serve as basis for proposing possible courses of actions-both desirable and feasible- for better use and management practices of the lake and thereby improve the livelihoods of the local communities. It is also aiming at applying Soft System Methodology (SSM) as method (tool of action learning) of dealing with socially triggered complex and unstructured set of environmental problems so as to foster learning and knowledge development while appreciating the methodology.

1.5 Limitation of the Study

Due to the resource constraints (time, finance), the scope of the study was limited to only one case study, i.e. Lake Koka, which may not necessarily be representing the lake management practices of Ethiopia in general. Absence of prior researches as well as some other historical data was partly limiting the study too.

1.6 Methodology

The research methodology applied in conducting this project was soft system methodology (SSM). SSM is an approach for dealing with messy (ill structured) problematic situations that involves human (political and social) activities[9]. It, according to Check land, helps in dealing with complex and unstructured problematic situations. The approach applies to problematic situations that are characterized by conflicting interests, presence of high stakes and multiple

[9] Checkland 1981, System thinking, System Practice

perspectives, and sense of urgency that something must be done. It is also believed that, according to Bunch (2003), ‘‘this method through declaration of world views and accompanying bundles of values, intention and norms that drive the expression and evolution of such institutions is a promising route to deal with complexities of environmental management.’’ This methodology is going to be explained in depth later in chapter three.

1.7 Methodological Challenges

While conducting the field work, I had some challenges to be faced. Methodologically, it was almost unlikely to apply the SSM as it should be. This was because the methodology requires ongoing and iterative processes of its different stages whereas for the sake of this project work, I had only just a onetime intervention. The participatory observation therefore was limited in this regard unlike to the traditional ethnographic field work where the field worker spends considerable time period while collecting data. It was also partly difficult to make documentation of everything while conducting a participatory observation in the field work as I needed to equally take part in the activities, as a participant observer, and listen to the different views attentively. Especially, collecting information in the form of informal talks was difficult as writing and listening affected the communication process.

Selecting and having the right mix of stakeholders in order to have adequate participation was to some extent affected by the poor level of democratization/practice of participating(tradition of freely expressing views and opinions), as well as stakeholders fear that the issue might be politicized. For instance, the various firms’ managers as well as government institutional heads were trying to distance themselves in engaging even with the media and some other stakeholders (NGOs) regarding the issue for the fear that they will be held accountable.

Besides, the society and institutional cultures (beaurocratic) were characterized by hierarchies which influenced the level and degree of participation[10]. The existing barriers of participation such as social rank, seniority, power relationship (between local people and those in power-both from the local and outside the local people) gender, etc did equally impair the participatory process. Thus, the local women did not find it at ease to take part in meetings initiated and ran by the zonal officials of the Oromia regional state.

[10] According to the SSM and Ecosystem Approach in Cooum River, India, it has been found out that natural resource management practices are mechanistic and are not as such participatory because of the hierarchical nature of the social and institutional cultures. (Bunch, 2003)

Identifying key informant and conducting interviews (semi structured) was also challenging for the reason that I don't speak the local communities' language which is Oromiffa. This lack of solid knowledge about their culture and tradition too in some way therefore posed a methodological challenge.

The site being away from urban areas (where other stakeholders like government institutional leaders, NGOs, academicians, etc. are found), it did also bring another challenge (in the form of logistics and communications) to conduct workshops during which the different world views and concerns would have been expressed well for learning and collaboration.

The SSM assumes that the researcher has to be an insider than merely observing as an outsider. This in turn affected my own subjectivity and biases regarding the issue. Therefore remaining neutral while facilitating the participatory approaches of solving natural resource problems was another challenge.

All these combined posed enormous challenges both in the process of collecting and analyzing the data.

1.8 Description of the Study Area

Ethiopia is located in the eastern part of Africa and is known as the 'water tower' of North East Africa. The country has about 12 major river basins, including the Nile River basin, the largest basin, with a combined an average discharge of 122.19 billion cubic meters[11].

Ethiopia is also endowed with lakes and wetlands. Among the 20 major lakes, most of which are rift valley lakes, except the Lake Tana which is the largest and the source of Blue Nile[12], 11 are fresh (water) and 9 salty. There are also a number of artificial lakes and one of them is Lake Koka. Ethiopia has an area, in total, of 8,800[13] square kilometers inland waters.

[11] State of Environemtn Report for Ethiopia(EPA, August 2003)

[12] http://www.selamta.net/lakes.htm(June June 20, 2011)

[13] Human Interactions and Water Quality in the Horn of Africa, Zinabu Gebre-mariam (http://www.aaas.org/international/africa/ewmi/zinabu.htm)

Figure 1: Lake Koka and Rift Valley Lakes (Source: World Lakes, www.worldlakes.org)

Figure 2: Lake Koka (Source: Google Maps)

Lake Koka is one of the rift valley lakes-chain of lakes that lie entirely in the southern part of the Ethiopian rift valley- that was made artificially to produce and supply hydroelectric power since 1960. The lake, as indicated earlier and the table below (Table 1), has a surface area of

250 km² and is at an elevation of 1590 m. It is found some 50 miles south of the Capital of Ethiopia, Addis Ababa at latitude and an altitude of8°28' N and 39°10' E respectively[14].

Table 1: basic data about Lake Koka (Source: International Lake Environment Committee, http://www.ilec.or.jp/eg/index.html, May15, 2011 and EEPCO, March 2011)

Lake Koka	
Surface Area	250 km²
Volume	2.28 km³
Maximum Depth	13 m
Mean Depth	9.14 m
Latitude	8°28' N
Longitude	39°10' E
Altitude	1590 m
Catchment Area	10000 km²
Reservior Area	180 km²
River Basin	Awash River basin

Apart from the power generation, it has been for long supporting the lives of people in the surrounding and a variety of aquatic and terrestrial wildlife. However, due to its proximity to the capital as well as some other industrial towns in the country and its being in the most developed river basin (Awash River basin, shown in 3), the lake and its aquatic ecosystem has been under increasing pressure. The major contributing factors[15] are such as pollution, caused by industrial and urban discharges, siltation, and environmental degradation. As a result, people in the surrounding have been severely impacted by the existing situation.

[14] International Lake Environment Committe: Promoting Sustainable Management of the World's Lakes and Reservoirs (http://www.ilec.or.jp/eg/index.html, May15, 2011)

[15] State of Environemtn Report for Ethiopia(EPA, August 2003)

Figure 3: Awash River Basin (Source: agricultural water management information system of Ethiopia, http://www.mowr.gov.et/AWMISET/Index.php)

1.9 Organization of the Thesis

The overall organization of the project work constitutes introduction (background information highlighting about the Challenges of managing Lake Koka, SSM-the method I employed for my research, problem statement, research questions, objective, delimitation of the study, etc.), literature review (theoretical frame work and other related literatures), analysis and discussion of data (where I have tried to create linkages among the theoretical frameworks in relation to IWRM, methods of applying SSM and evidences gathered during a two month field work) conclusion and recommendation (possible courses of actions for improvement) and finally bibliography, and appendix.

2. Theoretical Framework

In this section, a review of different theoretical approaches in dealing with water use and management, and challenges in relation to Integrated Water Resource Management (IWRM) will be made.

2.1 Challenges and Practices of Integrated Water Resources Management

Integrated Water Resource Management (IWRM) is ‘‘a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem,’’[16] with an emphasis that water shall be managed with the underlying principles of good governance and public participation.

IWRM is a systematic process of sustainable development, allocation and monitoring of water resource uses in the context of social, economic and environmental objectives. It is different from the sectoral approach of water resource management which is applied in many countries, i.e. the responsibility of say drinking water rests with one agency, for irrigation water with another, for the environment with yet another. Therefore, the lack of cross-sectoral linkages leads to uncoordinated water resource use, development and management, leading to conflict, waste and unsustainable systems.[17]

The basic idea of IWRM is to adopt a comprehensive, interdisciplinary, and a holistic approach while dealing with water resource issues, including their social, political, economic, technical, and environmental aspects. Such an approach focuses on water cycle as a whole rather than specific water sectors or water uses in isolation, and therefore focuses on river basins and water sheds as most appropriate geographic units for water management.[18]

[16] As defined by Technical Advisory Committee of the Global Water Partnership on its Johannesburg World Summit on Sustainable Development-WSSD-in 2002(Rahaman, M.M. & Varis, O. (2005) Integrated Water Resources Management: Evolution, Prospects and Future Challenges, Sustainability: Science, Practice and Policy (USA), Vol.1, Issue 1, pp. 15-21)

[17] http://www.archive.cap-net.org/iwrm_tutorial/1_3.htm#

[18] Global Water Partnership(GWP), 200b; World Bank, 1993

There are four (Dublin) principles that aid and facilitate the adoption of IWRM in a comprehensive and holistic approach for actions at local, national and international level. These are[19]:

- Principle 1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment

  Since water sustains both life and livelihoods, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or groundwater aquifer.
- Principle 2: Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels

  The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.
- Principle 3: Women play a central part in the provision, management and safeguarding of water

  This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.
- Principle 4: Water has an economic value in all its competing uses and should be recognized as an economic good

  Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

[19] The principles were agreed at the International Conference on Water and the Environment in Dublin. The International Conference on Water and Environment, Dublin, Ireland, January 1992.

According to the Global Water Partnership (GWP), IWRM challenges the conventional practices and attitudes by confronting the entrenched sectoral interests in such a way that the water resource is managed holistically for the benefits of all users.

IWRM (Rahaman et al. 2005), seeks to address the dilemma, uncertainty and complexity of water issue through coordination of the different water uses, that are interdependent, such as agricultural, environmental, domestic and industrial, tourism, energy, mining, fishing, transport, etc. It also stresses on the importance of good governance/management and participation of the various stakeholders that could directly or indirectly be affected by the decision in the allocation and uses of water.[20]

Water being one of the basic necessities, the various stakeholders, some of whose uses are specified above, are affected by the use and decision made by one party in relation to water. All of these stakeholders have varying degree of interests in exploiting the limited water resource no matter how their choice in doing so is affecting or is being affected by others (choice and/ or decision). And the underlying reason for the IWRM is therefore to sustainably develop, allocate and regulate water resource utilization practices among these stakeholders in a way that it can confront the social, economic and environmental challenges[21]. In this process (GWP, 2000), ensuring a democratic stakeholders' participation brings both a new perspectives (insights) and a challenge to the existing practices which may result in a dilemma in order to make choices and decision of allocating the water resources among the different stakeholders. On the other hand lack of sufficient stakeholders participation causes a challenge in implementing IWRM as there won't be sufficient information, leading to have a higher likely of overlooking stakeholders interest. Hence decision making is always under conditions of uncertainty. In addition as described on SLIM PB2(2004), in analyzing stakeholders, judgments are required to be made on the basis of imperfect information that lead to constrain an understanding and involvement of stake changes over a period of time.

[20] Rahaman, M. & Varis, O. 2005. Integrated water resources management: evolution, prospects and future challenges. *Sustainability: Science, Practice, & Policy* 1(1):15-21. http://sspp.proquest.com/archives/vol1iss1/0407-03.rahaman.html.

[21] Integrated management means that all the different uses of water resources are considered together. Water allocations and management decisions consider the effects of each use on the others. They are able to take account of overall social and economic goals, including the achievement of sustainable development http://www.archive.cap-net.org/iwrm_tutorial/1_2.htm

The complexity can also be noted that there are stakeholders that are having divergent interests, different social status (ranking), difference in gender, different power of decision making (political power), different culture and religious background, difference in national interests, etc., which all together adds up on the complexity of the water problem. So the presence of a number of variables in a given environmental setting (system) coupled with uncertainties (not being able to predict the outcome as a result of adopting a certain water management strategy) can cause the problem of managing water resource to be very problematic especially as trying to handle the variables independently (individually) by using reductionist approach won't work in this case.

When looking at the existing realities (practices) regarding water, nowadays the world's freshwater resources are under increasing pressures. For example, about 2 million tons per day of human waste are deposited in water courses, half of the population of the developing world are exposed to polluted sources of water that increase disease incidence, 90% of natural disasters in the 1990s were water related, and the increase in the number of population(from 6 billion to 9 billion), etc. These and some other facts about the world water are good reasons indicating the sense of urgency for action regarding water resource.

Besides, sectoral water resources management approaches have been dominating leading to the uncoordinated and fragmented development as well as management. On top of this, according to the principles of IWRM, it is assumed that ''water management is usually in the hands of top-down institutions, the legitimacy and effectiveness of which have increasingly been questioned. Thus, increased competition for the finite resource is aggravated by inefficient governance. IWRM brings coordination and collaboration among the individual sectors, plus a fostering of stakeholder participation, transparency and cost-effective local management.''[22]

Generally, growth in population, increased economic activity and improved standards of living lead to increased competition for and conflicts over the limited freshwater resource. A combination of social inequity and economic marginalization forces people living in extreme poverty to overexploit soil and forestry resources, with damaging impacts on water resources.

[22] Tutoriaö Basic Principles of Integrated Water Resources Managmenet (http://www.pacificwater.org/userfiles/file/IWRM/Toolboxes/introduction%20to%20iwrm/Tutorial_text.pdf)

Here are a few reasons why most people argue that the world faces an impending water crisis[23]:

- Water resources are increasingly under pressure from population growth, economic activity and intensifying competition for the water among users;
- Water withdrawals have increased more than twice as fast as population growth and currently one third of the world's population live in countries that experience medium to high water stress;
- Pollution is further enhancing water scarcity by reducing water usability downstream;
- Shortcomings in the management of water, a focus on developing new sources rather than managing existing ones better, and top-down sector approaches to water management result in uncoordinated development and management of the resource;
- More and more development means greater impacts on the environment;
- Current concerns about climate variability and climate change demand improved management of water resources to cope with more intense floods and droughts.

2.2 Land, Water and Development

According to Newson, Malcolm D. (1997, p.392), 98% of the rain fall passes over or through land on its way. Meaning, land use and management is highly interdependent to that of setting up water schemes. However, the major problem here is ownership and history of land use and management where water agencies seldom own land in the basin (river) leading for them to have only indirect control.

It is also essential to notice that humans often manipulate various landscape components in the form of physical (which affects soil permeability, water courses, slopes, river flow and water tables), and chemical (such as agricultural chemicals leached to rivers and aquifers; waste products emitted to the atmosphere/reaching the ground as fall-out/wash-out, disposed on to land/reaching the rivers and aquifers through leaching) for the purpose of satisfying needs for water, food, energy, goods and services. [24]

[23] Capacity Building for Sustainable Water Resource Management (http://www.archive.cap-net.org/iwrm_tutorial/2_1.htm)

[24] Malin Falkenmark (2001): The Greatest Water Problem: The Inability to Link Environmental Security, Water Security and Food Security, International Journal of Water Resources Development, 17:4, 539-554 (http://dx.doi.org/10.1080/07900620120094073, August 01, 2011)

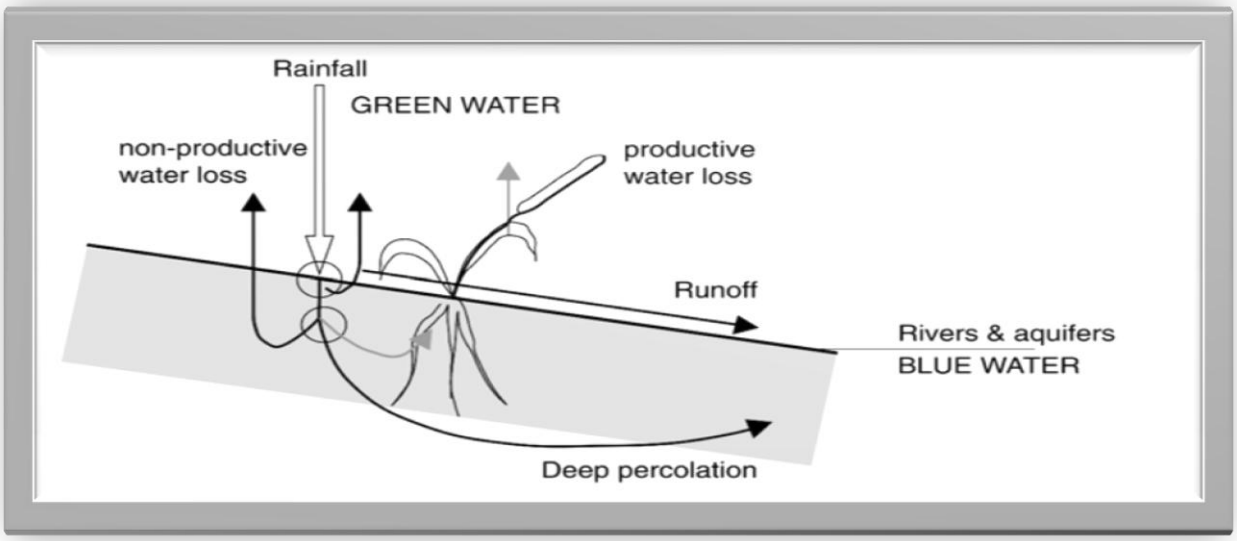


Figure 4: partitioning of rainfall into two main branches of green water flow (water vapor), the vertical branch, and blue water flow (liquid water), the semi-horizontal branch, passing through aquifers and rivers.

(Source: Falkenmark 2001: The Greatest Water Problem: The Inability to Link Environmental Security, Water Security and Food Security, International Journal of Water Resources Development, p. 545)

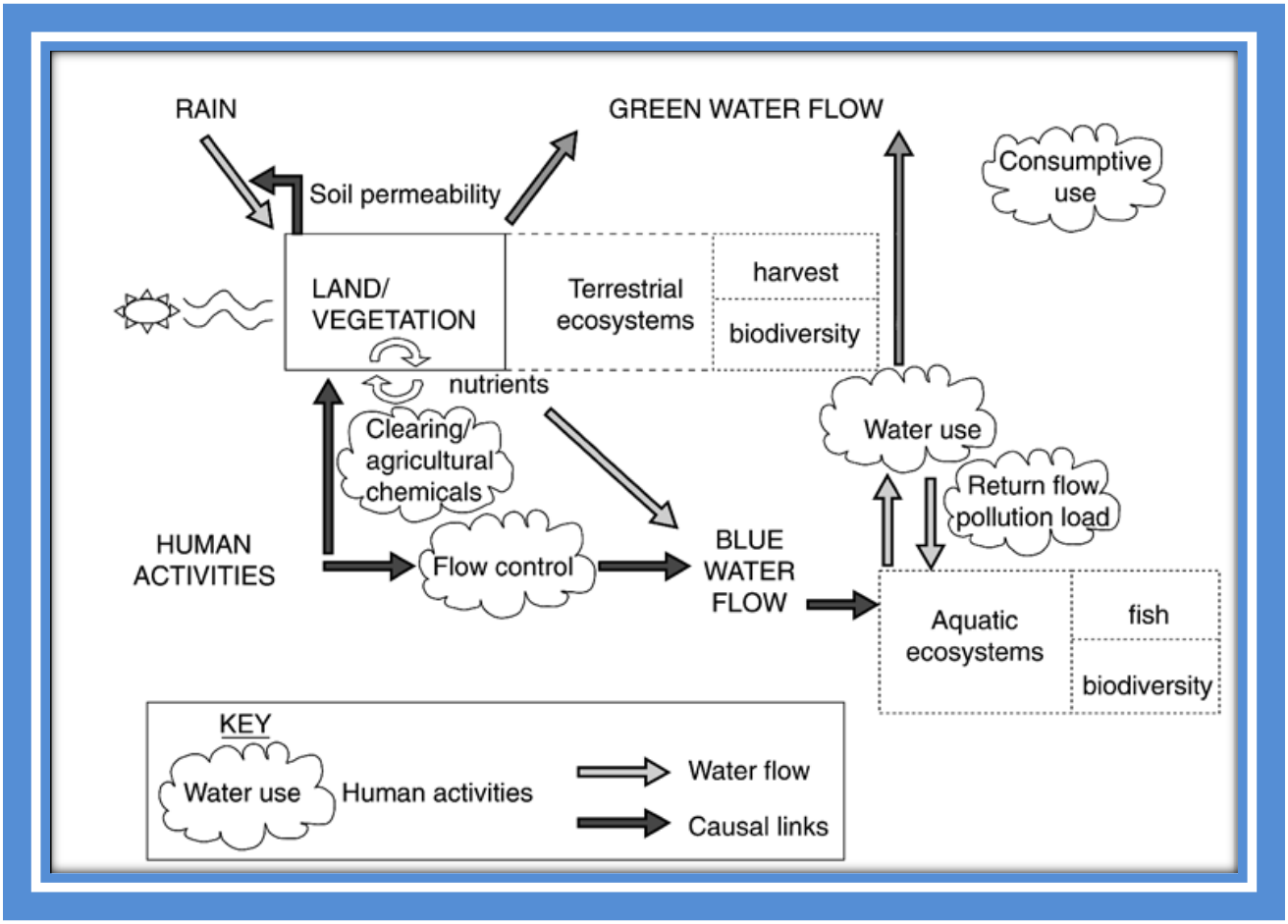
Some of the environmental side-effects of the different landscape activities involve the following water phenomena (Falkenmark 2001, 545):

- Water partitioning at the ground surface , as shown in the figure above, influencing both the water flow down the catchment and the vapor flow to the atmosphere, available for the production of precipitation downwind;
- water's function as a unique solvent and carrier of solutes and silt*;* the side-effects manifest themselves in changes in water quality and quantity, with higher-order effects on water-dependent flora, fauna and biodiversity;
- Water cycle continuity, generating chain effects from the atmosphere to the land and the terrestrial ecosystems, to groundwater, rivers and lakes and aquatic ecosystems and to coastal waters and ecosystems.

Newson and Malcon (1997), there are two routes for influences over land. These are 'catchment control' and catchment planning. Catchment control (allocation) refers to

ownership or legislative circumscription of land use[25] where as catchment planning (accommodation) describes the consultative indirect manipulation of land management rather than land use.

The water interest is also sometimes weak and hence needs to accommodate to the existing patterns in the basin; where it has entered early it has earned a poor reputation for land planning of its own holdings (e.g. careless afforestation, disruption of traditional land rights, salinised irrigation fields, etc.). Land use and management may mean little in some basins compared with tectonic activity; in others climate changes are the main concern. In yet others only urban land use may be important and so the problem of conjunctive management of resources is contained within a small area of point pollution controls or flood runoff detention. (Newson, Malcolm D., 1997, p.392)



[25] e.g. South Africa's Mountain Catchment Areas Act, which allows direct intervention in catchments vital to water conservation

Figure 5: Water-related causal chains between key ecosystem and human activities in the landscape, involving land and water manipulation.

(Source: Falkenmark 2001: The Greatest Water Problem: The Inability to Link Environmental Security, Water Security and Food Security, International Journal of Water Resources Development, p. 549)

In countries undergoing rapid development and embarking on major water schemes it should not be beyond a wit to warn that a concern for supplies, power, crops and other water benefits bespeaks a relatively rapid transition to the hygienic and then ecological concerns of an urbanized population.[26]

Likewise, as development continues, albeit at different rates and taking different forms, it is tempting to say that there are many problems to be faced by both developed and developing countries while developing (river) basin resources. Some of these, as described by Newson and Malcolm D.,1997, are, especially the social aspect being a common thread, institutional problems of integration and application, pollution controls(that are permissive to further development), hazard management, recreational and conservational priorities, problems of inadequate data(leading to irrational decisions regarding land and water use and management), etc.

Generally, a holistic thinking has a special, almost visionary role in helping politicians and people understand that rapid 'fixes' are impossible, but that strategies can help a lot where rural (urban) resource management (such as soil conservation, land-use management, ecosystem management, etc.) go hand in hand with that of water resources management (flood control, navigation, power, irrigation, conservation, water supply, outdoor recreation, etc) while following avenues of development. (Newson and Malcolm D., 1997. p 396)

In order to avoid inappropriate use and management of land and water for development, there are some guiding principles. These principles[27], which are essential for sustainable water development plans, are:

- In order to maintain the amenity and nature conservation value of rivers and other water bodies, and the purity of drinking water, there should be no long

[26] Newson, Malcolm D.. Land, Water, and Development: Sustainable Management of River Basin Systems. London, GBR: Routledge, 1997. p 392(http://site.ebrary.com/lib/slub/Doc?id=10057179&ppg=395)

[27] Current sustainability principles for water quality(Newson, Malcolm D.,1997, p.403), http://site.ebrary.com/lib/slub/Doc?id=10057179&ppg=403

term deterioration in the quality of surface and ground water caused by human activity

- Development, including waste disposal, which is likely to place the quality of water at risk should be resisted, at least until any necessary infrastructure to protect water quality is in place
- Monitoring the quality of water is essential to determine if waters are of an appropriate quality for their agreed uses, and for identifying where improvement is justified
- Initiatives which would lead to an improvement in water quality should be identified and encouraged and the principles of waste minimization and good pollution prevention practice should be promoted
- Financial penalties should be imposed to deter potential polluters''

2.3 Institutional, Legal and Policy Frameworks of Water Resources Governance

Water resource governance, as described by Tropp (2007) is the broad range of political, social, environmental, economic and administrative systems that are in place to regulate the development and management of water resources and the provision of water services.[28] Water governance consists of four dimensions namely social dimension (equitable use), economic dimension (efficient use), political dimension (equal democratic opportunities), and environmental dimension (sustainable use) as presented in the four governance dimensions of the UN World Water Development Report (2006).

It is clear that harder decisions have to be made in order to implement some of the principles of IWRM into a water sector policy as achieving political support may also be challenging. And that is why major legal and institutional reforms are unlikely to take place at least until serious water management problems have been faced. The process of revising water policy is therefore a key step, requiring extensive consultation and demanding political commitment.
Water legislation converts policy into law and should[29]:

- Clarify the entitlement and responsibilities of users and water providers;
- Clarify the roles of the state in relation to other stakeholders;

[28] Tropp, H. (2007) Water governance: trends and needs for new capacity development, Water Policy 9 Supplement 2 19– 30 (http://www.watergovernance.org/documents/WGF/Reports/Water_Governance_trends_and_needs_paper.pdf)
[29] Capacity Building for Sustainable Water Resource Management(http://www.cap-net.org/node/1519)

- Formalize the transfer of water allocations;
- Provide legal status for water management institutions of government and water user groups;
- Ensure sustainable use of the resource.

When looking at the institutional framework, governments in developing country consider water resources planning and management to be a central part of their responsibility. This view is consistent with the international consensus that promotes the concept of government as a facilitator and regulator, rather than an implementer of projects. However, the challenge again here is to mutual agree up on the level at which government responsibility should cease, or be partnered by autonomous water services management bodies and/or community-based organizations.

In order to bring IWRM into effect, institutional arrangements are needed to enable[30]:

- The functioning of a consortium of stakeholders involved in decision making, with representation of all sections of society, and a good gender balance;
- Water resources management based on hydrological boundaries;
- Organizational structures at basin and sub-basin levels to enable decision making at the lowest appropriate level;
- Government to co-ordinate the national management of water resources across water use sectors.

2.4 Power, Gender and Stakeholders' Participation in Water Resource Governance

Gender denotes to the roles, rights, and responsibilities of men and women as well as their relations that the society constructs. It also refers to the way their qualities, behaviors, and identities are determined through the process of socialization. Gender is generally associated with unequal power and access to choices and resources and these differences (positions of women and men) are influenced by historical, religious, economic and cultural realities. However, these relations and responsibilities can and do change over time too. [31]

[30] Basic Principles of Integrated Water Resource Management, http://www.cap-net.org/node/1519

[31] Mainstreaming Gender in Water Resource Management, Gender_and_IWRM_Resource_Guide_complete_200610.doc , http://www.genderandwater.org/page/5390

Mostly, water management practice is a male dominated activity, i.e. the representation of women in water sector institutions is very low even if the way that water resources are managed affects women (mainly), and men. For example, as custodians of family health and hygiene and providers of domestic water and food, women are the primary stakeholders in household water and sanitation. Still decisions on water supply and sanitation technologies, locations of water points and operation and maintenance systems are mostly made by men. (www.genderandwateralliance.org, August 11, 2011)

The gender issue has been a primary concern in almost all conferences of water when the principles and guidance of IRM have been agreed and developed. For example, according to the Dublin (1992) international conference on 'Water and Environment', one of the four guiding principles for action at local, national and international levels, was that ''women play a central role in the provision, management and safeguarding of water.'' IWRM, therefore, calls for addressing women's specific needs to equip and empower them to participate at all levels of water resources decision making and implementation. (Rahaman et al. 2004)

Similarly, Johannesburg's (2002) World Summit on Sustainable Development (WSSD) stressed on the same issue, gender. In this particular summit, ''developing gender sensitive policies and programmes'' was considered as one of the main points of the WSSD plan of implementation relating to IWRM so that water.[32] The WSSD Plan of Implementation also urges to enhancing the role of women in the areas of rural development, sustainable agriculture, nutrition, and food security. It further prioritizes the need for developing and implementing gender sensitive policies and programmes for the purpose of eliminating social inequalities. (Rahaman et al. 2004, PP.570)

Rahaman et al. (2004) described that, when looking at EU Water Framework Directives Vs. IWRM, women, especially in most developing countries, do possess a significant role in providing and using water, and guarding the environment.
For millions of women around the world fetch and carry water every day. They are generally responsible for their family and the community at large in many regards, not just carrying and using and managing water.

[32] MUHAMMAD MIZANUR RAHAMAN, OLLI VARIS & TOMMI KAJANDER (2004): EU Water Framework Directive vs. Integrated Water Resources Management: The Seven Mismatches, International Journal of Water Resources Development, 20:4, 565-575 (http://dx.doi.org/10.1080/07900620412331319199)

For example, women are found doing typical men activities (such as farming, entrepreneurship, etc.) in order to support their family but men neither do fetch water nor carry out other typical activities of women. Therefore, the role of gender (women) needs to be reflected in the institutional arrangements of water resource governance so that better and efficient water resources management will be in place. (Rahaman et al. 2004)

In the Hague 2000's second World Water Forum & Ministerial Conference, one of the pressing issues was the importance of considering water as 'a basic human right' (Rahaman et al. 2004) in that ''water is not only considered essential for human health, it is also desperately needed by millions of poor women and men in rural areas for productive reasons: to grow food for the family or generate income. Almost 90% of water resources are used for agriculture. Right of land and use of water are key determinates for people's potential to break down the poverty trap''. (Rahaman et al. 2004, 567)

Stakeholders' participation is also another core aspect of IWRM. According to the Dublin principle 2 (Rahaman et al. 2004, PP.571), water resource management and development has to be through stakeholders participation which incorporate the interests of the public and all other stakeholders and even special care need to be given in order to ensure the participation of those poor people and /or women, who are often excluded.

Participatory development initiatives, according to the Gender and IWRM Resource Guide, may not automatically include women or poor people and therefore greater effort shall be put to recognize and take measures regarding the gender and class differences, power relations and other factors so that participation is real.[33]

Power relations in communities would become barriers for participation because the differences (in age, religion, class, gender, etc) don't make all people(particularly the poor and women) have the options of voicing their opinions especially if their idea(view points) opposes those viewpoint of the people in power (authority) for fear of different consequences. Power can even be misused by the officials (outside) in precluding those who are voiceless.

[33] Gender and Water Alliance:IWRM Resource Guide Gender and IWRM Resource Guide

(http://www.genderandwater.org/page/4117, August 28, 2011)

Apart from the power relations in communities, there are also generally some other barriers to participation such as intra-household and intra-family relations (say some women having trouble to speak out in front of their husbands, fathers, community leaders, religious leaders, etc.), different constraints to participation (responsibilities/work load between men and women, norms and community institutions that often deny women the right to participate), abilities to participate (men are more educated/have access to education than women making women less confident and disadvantaged in ensuring that their voices are heard), and perceived benefits of participation(usually women have less time to participate and hence their perceived benefits of taking part in meetings of water and other related issues that affect their lives). (http://www.genderandwater.org/page/4117, August 28, 2011)

2.5 Water Pollution, its Prevention and Control

''Absolutely pure water does not exist in nature. Its quality can be affected by some dissolved or suspended substances, and consequently, it becomes polluted. Water pollution is a state of deviation of water purity from the normal condition to the abnormal and the affection of its function and properties. It is the addition of something to water, which changes its natural qualities, so that the riparian owner does not get the beneficial uses from it.'' [34]

According to the World Water Week Workshop on an Integrated Pollution Prevention and Control (2010), industrial revolution has led many societies to perceive that rivers and streams are convenient conduits of transporting wastes. This has been affecting aquatic biodiversity, human activities and health, and coastal and marine waters (pollution). In addition to water courses, pollutants are transported through the air, which is equally important source of water quality degradation, such as from particulate matter, high tropospheric ozone concentrations, acidification and long range transport of hazardous substances.

On the other hand, progress has been made during recent years in terms of increasing awareness and concern about water pollution all over the world. As a result, new approaches towards achieving sustainable exploitation of water resources have been developed at an international level widely agreeing that a properly developed policy framework is a key element in the sound management of water resources.[35](Helmer et al. 1997, P.18)

[34] Assessment Report on the Status of Akaki Rivers Water Pollution, Environmental Protection Authority, Addis Ababa, Ethiopia(2005, p.1)

[35] Helmer, Richard (Editor); Hespanhol, Ivanildo (Editor); United Nations Environment Programme Staff (Contributor). Water Pollution Control: A Guide to the Use of Water Quality Management Principles.London, GBR: Spon Press, 1997. p 20.

Progress has been made in treating sewage and industrial wastes in developed countries, unlike to developing countries where measurable improvement in water quality needed to be made, but activities in sectors such as agriculture, forestry, extracting activities, transport and other diffuse sources of pollution are still sources of widespread problems that need remedy. Likewise, increasing population, urbanization and expanding economies are putting greater demand on water resources quality. Yet, the challenge greatly varies in different contexts and is therefore necessary to address it in an integrated manner based on recognition of the myriad of sources and pathways for water quality degradation.[36]

There are some guiding principles (Helmer et al. 1997, P.20-26) that are recommended for sound management of water pollution. These are:

- Prevent pollution rather than treating symptoms of pollution- past experience has shown that remedial actions to clean up polluted sites and water bodies are much more expensive than preventive measures. Therefore, water pollution control focusing on wastewater minimization, in-plant refinement of raw materials and production processes, recycling of waste products, etc., should be given priority over traditional end-of-pipe treatments.
- Polluter-pays principle- even if this has social and economic implications, as its full application would upset existing subsidized programmes (implemented for social reasons) for supply of water and removal of wastewater in many developing countries, it still should be maintained as the ultimate goal.
- Apply realistic standards and regulations- involve the formulation of realistic standards (achievable), and enforceable regulations that are tailed to both economic

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Policy statements, often hidden in official documents (such as regulations and master plans), regarding water pollution are mostly found within the legislative framework of most countries. Moreover, government statutes and constitutional documents often include paragraphs about environmental policies which are rarely coherent/consistencies with other policies as they have been developed separately with different purposes. Water pollution control is usually specifically addressed in connection with the establishment of environmental legislation and action plans, but also within the framework of water resources management planning. Moreover, documents related to public health aspects may also consider water pollution. These three interacting areas are often administered in different line ministries— typically a Ministry of Environment, a Ministry of Water and a Ministry of Health. In addition, the policy making process, if it exists, may often take place independently. To reach a situation where the adopted political intentions can result in a real impact on the practical management of water resources, it is important to define policy statements clearly and in proper policy documents.

[36] The workshop focuses on an integrated pollution prevention and control approach that facilitates protection of the entire environment. The role of subsidies and institutional arrangements that may improve or harm introduction of cost-effective technologies and practices were also scrutinised. Besides, during the work shop methodologies that take into account the numerous media through which pollutants are transported and the associated trade-offs between air, land and were also discussed.''(http://www.worldwaterweek.org/sa/node.asp?node=750&skip=50&sa_content_url=%2Fplugins%2FEventFinder%2Fevent.asp&sa_title=Workshop+1%3A+Integrated+Pollution+Prevention+and+Control&id=3&event=224, 30th July 2011)

and administrative capacity and capability. Unrealistic standards and non-enforceable regulations can harm more than having no standards and regulations as polluters and administrators would develop an attitude of indifference towards rules and regulations in general. Standards ought to be tightened over time as progress is achieved in general development and in the economic capability of the private sector. Thus, the setting of standards and regulations should be an iterative and on-going process.

- Balance economic and regulatory instruments- Economic instruments, typically in the form of waste water discharge fees and fines, have been introduced mainly by industrialized countries, have the advantages (over the regulatory approach which is heavily relied up on by government as in many countries and has economic inefficiency) of offering a reasonable degree of predictability about the reduction of pollution (Bartone et al., 1994). Economic instruments provide incentives to polluters to modify their behavior in support of pollution control and of providing revenue to finance pollution control activities. They are also much better suited to combating non-point sources of pollution. The setting of prices and charges are crucial to the success of economic instruments. If charges are too low, polluters may opt to pollute and to pay, whereas if charges are too high they may inhibit economic development. Therefore, it seems appropriate for most countries to apply both regulatory and economic instruments for controlling water pollution. In developing countries, where financial resources and institutional capacity are very limited, the most important criteria for balancing economic and regulatory instruments should be cost-effectiveness (those that achieve the objectives at the least cost) and administrative feasibility.
- Apply water pollution control at the lowest appropriate level- the appropriate level refers to the level at which significant pollution impacts are experienced. If, for example, a specific water quality issue only has a possible impact within a local community, then the community level is the proper management level. But if the impacts affect a neighboring community, then the appropriate management level is one level higher than the community level, say the river basin level. On a wider scale, the appropriate management level may be the national level for major water bodies where no significant water pollution impacts are anticipated for neighboring states. The important point is that decisions or actions concerning water pollution control should be taken as close as possible to those affected, and that higher administrative levels should enable lower levels to carry out decentralized management. However, in

considering whether a given administrative level is appropriate for certain water pollution control functions, the actual capacity to achieve these functions (or the possibility of building it) at that level should also be taken into account. Thus, this guiding principle intends to initiate a process of decentralization of water pollution control functions that is adapted to administrative and technical feasibility. Establish mechanisms for cross-sectoral integration. In order to ensure the co-ordination of water pollution control efforts within water-related sectors, such as health and agriculture, formal mechanisms and means of co-operation and information exchange need to be established.

- Give open access to information on water pollution: it is directly related to the principle of participation (of the general public) in the decision-making process based on free access to information held by public authorities. This helps to stimulating understanding, discussions and suggestions for solutions of water quality problems. In many developing countries, there is no tradition of open access to environmental information. This attitude may seriously jeopardize the outcome of any cooperation, by all those involved, that is required on water pollution control.

Generally, water pollution control strategy should be formulated with due consideration of the aforementioned guiding principles as well as other principles of IWRM.

2.6 Implementing IWRM

IWRM provides a guiding conceptual framework for the purpose of achieving a sustainable management and development of water resources. It requires that people need to try to change their working practices by looking at the bigger picture that surrounds their actions. It does also seek to introduce an element of decentralized democracy into how water is managed, with its emphasis on stakeholder participation and decision making at the lowest appropriate level.

IWRM requires that platforms be developed to allow very different stakeholders, often with apparently irreconcilable differences to somehow work together. Because of the existing institutional and legislative frameworks, implementing IWRM is likely to require reform at all stages in the water planning and management (example: transforming and having a new water policy to reflect the principles of sustainable management of water resources).

Accordingly, putting policy into practice requires the reform of water law and water institutions. This can be a long process and needs to involve extensive consultations with affected agencies and the public. Generally, implementing IWRM is best accomplished in a step-by-step process, with some changes taking place immediately and others requiring several years of planning and capacity building.[37]

According to Moriarty, Butterworth and Batchelor (2004) "IWRM is about people (professionals and users) talking to each other more; about joint planning activities across sector boundaries; about integrated planning at the basin, but also at the community level. Critically IWRM is about information, and communication; about good planning based on a sound, and broadly based understanding of people's wants, and needs, but also their abilities and the constraints imposed by working with a finite resource."[38] Therefore, implementing it can require reforms of water management laws, institutions and regulatory systems, and capacity building at a range of levels. It aims for a more coordinated use of land and water, surface and groundwater and up- and downstream users.

According to the Global Water Partnership (2000) guiding principles (on why, what and how of IWRM), successful implementation of IWRM relies on three pillars[39]:

- An enabling legislative and policy environment
- An appropriate institutional framework composed of a mixture of central, local, river basin specific and public/private organizations, which provides the governance arrangements for administration
- A set of management instruments for gathering data and information, assessing resource availability and needs, and allocating resources

All these three pillars need to be linked across, cross sector integration, various sectors such as water for people, water for food, water for nature, water for industry and other water uses through an enabling environment, institutional roles and management instruments.

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[37] Tutorial Basic Principles of Integrated Water Resources Management, Capacity Building for Sustainable Water Resource Management(http://www.cap-net.org/node/1519)

[38] Moriarty, P. Butterworth, J. and C. Batchelor (2004) *integrated Water Resources Management and the domestic water and sanitation sub-sector*. Thematic Overview Paper. IRC International Water and Sanitation Centre, the Netherlands. www.irc.watsan.net/page/10431

[39] Training Manual on Water Integrity, http://www.cap-net.org/sites/cap-net.org/files/water-integrity-final-English.pdf

There are generally obvious social and economic benefits of the different water use sectors in terms of food production, energy production, drinking water, job creation (providing employment creation), recreation, etc. However, the relative values of these benefits are more difficult to assess, especially when trying to justify and make allocation of water resources among the competing claims. This value assessment should therefore take into account both the benefits and the negative impacts. The input from users, politicians and society in general is necessary as the allocation may not be most efficient when valued in terms of only economic aspect or when made acceptable only on political basis.[40]

[40] Tutoriaö Basic Principles of Integrated Water Resources Managmenet, http://www.pacificwater.org/userfiles/file/IWRM/Toolboxes/introduction%20to%20iwrm/Tutorial_text.pdf)

3. Methodology of the Study

3.1 Stakeholder, Stakeholding and Stakeholder Participation in IWRM

Stakeholders: according to SLIM PB 2 (2004)[41], stakeholders ‘‘are those who have a ‘stake’ - that may be of a real, material interest, from their perspective – in the situation or in the resource under consideration. A person’s stake can be formed in any number of ways: for example, as a resident, domestic water user, angler, farmer, professional water manager, or government official.’’ Stakeholders, with or without an overlapping stakes, can posses different concerns over an issue under consideration such as water pollution caused by industrialization as well as urbanization, road building resulting in wetland damages, etc.

Stakeholders may also be[42]:

- Primary stakeholders are those who will be ultimately affected by the intervention, either positively or negatively. These are, as described in the United nations’ Stakeholders and Conflict Resolution in IWRM, Module 4 (April 2005), groups or individuals who will be most impacted by the pursuing change. Example may include village, farmers, consumers, or even riparian nations at the international level;
- Secondary stakeholders are intermediaries such as implementing organizations, or other individuals, persons, groups or institutions involved in an intervention (including funders);
- Key stakeholders are those of the primary and secondary stakeholders who can significantly affect or influence an intervention either positively or negatively.

Stakeholding: according to SLIM PB2 (2004), it refers to the notion that individuals actively construct, promote and defend their stake. A stakeholder also can assert influence by not participating in key multi-stakeholder events. Groups’ stakeholding also implies a shared interest among group members, although individual members might still perceive their own stakes in different ways.

[41] Social Learning for the Integrated Management and Sustainable Use of Water at Catchment Scale, Policy Briefing Number 2, May 2004(http://slim.open.ac.uk)

[42] Mainstreaming Gender Equality, Sida’s support for the promotion of gender equality in partner countries, Country Report South Africa/.A Sida EVALUATION REPORT 02/01:3 (http://www.oecd.org/dataoecd/55/48/35199326.pdf)

Stakes and stakeholders might be defined during the course of discussing, questioning and acting around a material object and as these identities emerge they may come to be shared by wider communities (and networks of stakeholders).

However, there is a (governance) dilemma particularly in a stakeholder society as to whether or not one seeks to engage all those whose lives are affected by decisions made in public decision making processes. Because, as described by SLIM PB2 (2004), some see this as increasing democratic legitimacy where as others question the extent to which stakeholder groups speak for the public at large. The political legitimacy, authorization and accountability of stakeholder processes are often unclear.

From policy makers as well as practitioners' point of view, the increased awareness of stakeholders and stakeholding can be both an opportunity in that it can help bring new perspectives to an intractable issue, and a challenge as it also brings to the surface new issues which challenge the existing practices, institutions and policies. This can make a situation increasingly complex as the number and diversity of stakeholders increase. Thus increased awareness of stakeholders and stakeholding gives rise to governance dilemma. (SLIM PB2, 2004)

Therefore, the key question in this governance dilemma would be how to recognize the stakeholders and stakes that should be included in a decision-making process. According to SLIM PB2 (2004), stakeholder analysis (SA) can be seen as an attempt to gain some analytic power and guidance for action in the face of this dilemma. SA, as an analytic tool, is widely used in the start-up phases of collaborative stakeholder processes. It is conducted in a participatory fashion where (sub) sets of stakeholders jointly carry out the analysis.

SLIM PB2 (2004) specified the following basic steps in SA. These are:

- Drawing up a table or 'map' of those stakeholders considered to be primary, intermediate and key (customers, actors, owners), on the basis of information presently available;
- Assessing stakeholders' importance with regard to the situation, problem or activity addressed by the analysis, and their relative importance or influence;
- Identifying assumptions about how stakeholders might affect relation-ships, outcomes or the viability of the proposed activity.

SA has its own pitfalls and therefore is not a neutral or precise instrument because it is based on judgments with limited information. For instance, the analysis tends to provide a static view of stakeholders and their stakes which by itself can constrain involvement and understanding of how stakes change over time. Usually, at the outset there is no agreement about the 'boundary' of the resource system and the human activities that affect it. This is mainly due to the fact that technical experts will tend to focus on hydro-logical boundaries; policy makers might focus on administrative boundaries. Accordingly, who is considered to be a stakeholder depends in part on these perceptions of the boundaries and the biases of those conducting the SA. Some stakeholders, such as women in farming households, or non-human stakes such as wildlife interests, are routinely overlooked. Many of the pitfalls can be overcome by involving stakeholders themselves in the analysis. (SLIM PB2, 2004)

Stakeholder participation: participation may carry on different meaning to different people in different settings. For some, it may be a matter of principle; for others, a practice; and for still others, an end in itself. Its definition, however, in the context of IWRM, is stated as:

''a *process through which stakeholders influence and share control over development initiatives and the decisions, and resources which affect them.*''[43]

Stakeholder participation, as indicated earlier while referring to the principles of IWRM, is also about the adequate involvement of planners, policy makers, donors, NGOs, water managers, users (of water resources), etc. in the process of water management and strategy formulation. The process has to be on the basis of a clearly defined process that leads to clear benefits of participation. Stakeholders ought to not only express their opinions and needs freely but also be able to see on how their needs are going to be realized through ongoing participation.[44]

There are four levels of stakeholders' participation (United Nations, Module 4 Stakeholders and Conflict Resolution in IWRM, April 2005):

- Information: one-way flow of information
- Consultation: two-way flow of information

[43] United nations, Stakeholders and Conflict Resolution in IWRM, Module 4(April 2005, P 4), http://cap-net.org/sites/cap-net.org/files/training_materials/Module_4_-Stakeholders_and_conflict_resolution_in_IWRM.pdf

[44] Guideline for Stakeholder Participation In Integrated Water Resource Management in Water Management Areas in South Africa, March 2004(http://www.iwrm.co.za/resource%20doc/irwm%201/Stakeholder%20Participation/Guidelines/GUIDELINES%20FOR%20STAKEHOLDER%20PARTICIPATION%20LEVEL%203.pdf)

- Collaboration: shared control over decision-making and
- Empowerment: transfer of control over decisions and resources

Having adequate stakeholders' participation is crucial for the purpose of obtaining the desired outcome. It helps in having a long lasting consensus and common agreements. By adequate participation, it is meant that all stakeholders are part of the decision (process) where their contributions are incorporated; not merely a consultation to legitimize the decision made and thereby defuse the political opposition. For this, governments at national, regional, zonal and at very local levels (catchment and basin levels) have the responsibility in ensuring that participation is possible.

Effective stakeholder participation serves as pavement for better transparency and public accountability in integrated water resource management projects. A transparent participation process, on-going dialogue and advocacy mechanism helps in ensuring that all voices are heard, that needs and concerns of the stakeholders are recognized and to the possible extent incorporated. (United Nations, Module 4 Stakeholders and Conflict Resolution in IWRM, April 2005, P.5)

According to the UN Module 4 Stakeholders and Conflict Resolution (April 2005, P.5-6), the involvement of a variety of decision makers and stakeholders at a multiple levels makes the process of policy development and implementation complex. Accordingly methods and tools of measuring how policies meet stakeholders' interests, identifying potential conflicts and their preventive actions, and public participation have been identified. These are: indicators, conceptual frameworks, environmental impact assessments, public surveys, interviews, participatory rural appraisals (PRAs), census data, etc. Balancing stakeholder involvement remains a complex task, due to the technical and scientific nature of IWRM, but still the size of stakeholders should be limited to make the participation process manageable and more selective inclusion needs to be done when the topic of investigation becomes more specific and/or more technical and specialized because it is obvious that different stakeholders are suitable for different levels of involvement.

Furthermore, the different factors, often building blocks to an effective and adequate participation, need to be taken in to account such as gender inequality, level of democratization and empowerment (of local people to manage their water resources), willingness to give voice to smaller or weaker interests that would otherwise be

outvoted(especially in communities where one group dominates in number and power position), existing boundaries among different authorities, high (opportunity) cost of participation(say by marginalized and poor communities), etc.[45]

The following eight (main) steps, shown as in the guidelines for Stakeholder Participation in IWRM (March 2004, P. 16-25): can also be used in the process of (stakeholders) participation. These are[46]:

- Identification of stakeholders;
- Awareness creation;
- Establishing a process of change through the identification of long-term goals for use of the resource;
- Identification of conflicting needs for use of the resource;
- Developing a common objective;
- Establishment of interim objectives;
- Obtaining agreement on management objectives and local actions, and
- Contributing to the water management strategy.

These consecutive steps help to gradually engage stakeholders in the process of managing and formulating strategies of water.

3.2 Systems Thinking

Systems' thinking is a more holistic approach to dealing with very complex problem which is caused by multiple factors, multiple causality nature, instead of viewing the problem from a single perspective where the problem is viewed to have a linear causality nature. This approach helps to improve human capability to manage and improve systems. (Wilson and Morren, 1990)

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[45] The Beauty of the Beast: Multi-Stakeholder Participation for Integrated Catchment Management, Jeroen Warner

(http://www.ashgatepublishing.com/pdf/SamplePages/Multi_Stakeholder_Platforms_for_Integrated_Water_Management_Ch1.pdf)

[46] *GUIDELINES FOR STAKEHOLDER PARTICIPATION IN IWRM, South Africa, MARCH 2004, Date Acessed August 13, 2011*

http://www.iwrm.co.za/resource%20doc/irwm%201/Stakeholder%20Participation/Guidelines/GUIDELINES%20FOR%20STAKEHOLDER%20PARTICIPATION%20LEVEL%203.pdf

Systems approach is of vital use in the process of sustainably managing natural resources at a local, regional, national or global scale. There are two types of systems approach, namely: Hard Systems approach and Soft Systems approach. Their basic differences are outlined in the table below. For the reasons specified bellow, soft system thinking was preferred to hard system in carrying out this project.

Table 2: Comparison of Hard and Soft systems thinking (Source: **ICRA Learning Materials – Defining the System, Systems Thinking Approaches, P.5,** http://www.icra-edu.org/objects/anglolearn/Systems_Thinking-Approaches.pdf, August 12, 2011)

	Hard system thinking	**Soft system thinking**
Philosophical approach	Positivism	Constructivism
Ontological position (about the form and nature of reality)	Reality exists Systems do exist and do have a clear purpose and well-defined boundaries	Multiple perceptions of reality Systems do exist only to the extent that people agree on the goals, the boundaries and their components
Epistemological position **(about the relationship between the researcher and the researched)**	Observations are not colored by subjective aspects of the scientist or his/her instruments	Neutral observations are impossible
How are phenomena experienced?	Biophysical and social phenomena are experienced as constant, regular, reoccurring and predictable	Biophysical and social phenomena are experienced as dynamic, chaotic, changing and unpredictable
Research design	Strong focus on the testing of hypothesis Focus on the use of quantitative methods Focus on improving current problem	Less focus on the use of hypothesis Focus on the use of qualitative methods Focusing on how to realize a desired future situation
Purpose	Objective knowledge Generalizations Maximizing efficiency	Socially constructed knowledge to increase our understanding for more effective action Particularities or generalizations for one particular context Innovations

3.3 Soft System Methodology

SSM (Soft Systems Methodology): the research methodology used in conducting this project is soft systems methodology. SSM is an approach for dealing with messy (ill structured) problematic situations that involves human (political and social) activities[47]. It, according to Checkland, helps in dealing with complex and unstructured problematic situations and is a qualitative technique of applying systemic thinking to non-systemic situation. The approach applies to problematic situations that are characterized by conflicting interests, presence of high stakes and multiple perspectives, and sense of urgency that something must be done. It is also believed that, according to Bunch (2003), ‘‘this method through declaration of world views and accompanying bundles of values, intention and norms that drive the expression and evolution of such institutions is a promising route to deal with complexities of environmental management.’’

SSM was developed by Peter Checkland in response to the failure of system analysis to adequately address messy problems that are involving human activity. It was designed for, and has been applied in the context of, human, organizational and institutional change. The method (Bunch, 2001) provides techniques and general guidelines for expression of situations that are considered to be problematic[48]. This expression will help to identify key themes and make models of systems of purposeful human activity that are relevant for further debate about the situation.

Comparison of the conceptual models to the expression of the real-world situation is intended to stimulate debate about systemically desirable and culturally feasible change. Action in the real-world, informed by such debate, changes the situation, which in turn requires new expression, etc. The process is intended to be iterative and ongoing. Thus, as with adaptive management, SSM formally operates a learning cycle, employing learning from the experience of applying the methodology to further inform action in real-world situations. (Checkl & Scholes, 1990, Checkland 1999)

[47]Checkland 1981, System thinking, System Practice

[48]Bunch, M.J.2003, An adaptive ecosystem approach to rehabilitation and management of the Cooum River environmental system in Chennai, India.

‘’SSM offers a methodological approach and toolbox to deal with human activity in complex problematic situations. It is human activity that so often makes environmental problem situations complex and intractable. Declaration of world views and accompanying bundles of values, intentions, and norms that drive the expression and evolution of such situations is a promising route to deal with complexity in urban and environmental management.’’ (Bunch, 2001)

Despite those strengths of SSM in addressing socio-environmental problems, it has also got its own limitations. These are[49]:

- SSM requires participants to adapt to the overall approach;
- The greater risk of narrowing the scope of the investigation too early;
- The difficulty of assembling the richest picture, without imposing a particular structure and solution on problem situation;
- Requires a continuous (iterative) intervention, not just a one time;
- People have difficulties of interpreting the world in a loose way because they often show an over-urgent desire for action.

Therefore, according to Checkland in his book of ‘Systems Thinking, Systems Practice’, it vital important to be aware of these limitations while working on SSM in order to address socially triggered complex environmental problem (situation).

According to Checkland, there are seven sequential stages of SSM where some of them represent the real world where as others address the conceptual world. These stages and their brief explanations are presented as follows[50].

[49]http://www.12manage.com/methods_checkland_soft_systems_methodology.html(August1, 2011)

[50] Bob Williams, 2005, **Soft Systems - Modified December 2005, The Kellogg Foundation** (http://www.kapiti.co.nz/bobwill/ssm.pdf)

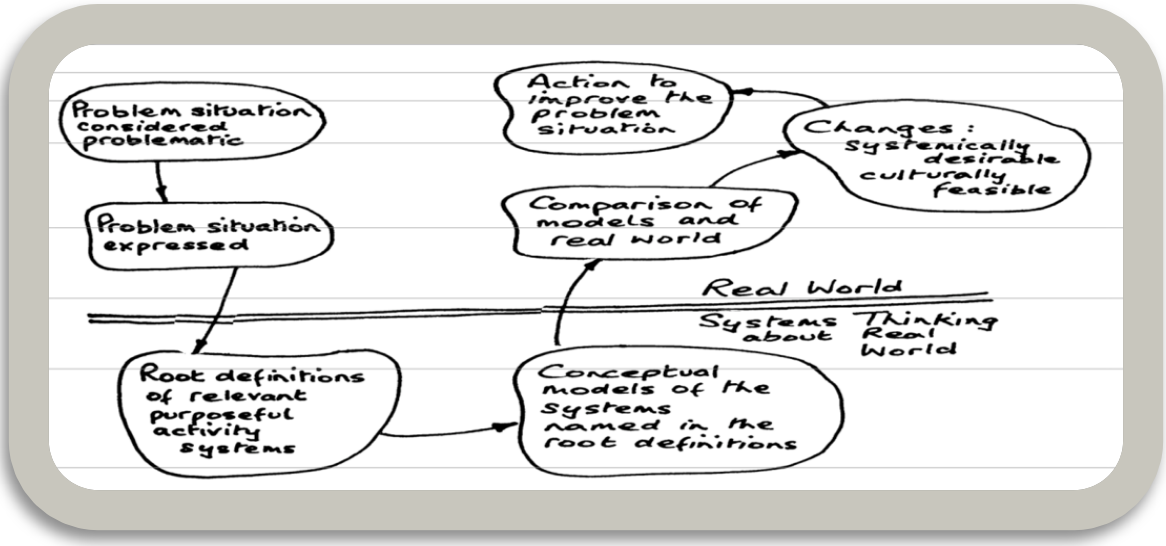


Figure 6: Different stages of SSM representing both the conceptual and the real world (Source: Modified Soft System by Bob Williams-December 2005)

3.3.1 Stage 1 and 2-the situation defined

Here in stages 1 and 2, according to Checkland (1981), it is in some way to acknowledge, explore and define the situation. The first stage is very much connected to the real world. So first, it is about making decision of what is actually going to be explored. At this stage, the problem won't be defined but an assessment of the general area of interest.

According to Williams, in his Checkland's modified Soft System (2005), this is an arbitrary starting point and it may shift at some stage by opting to open out the boundary for the purpose of sweeping in more aspects of the situation.

In stage 2, the issue will be expressed in unstructured way keeping in its all richness as well as pictorial form and for this reason Checkland calls it a rich picture. According to Checkland (1981), this stage needs to include in some way:

- Structures
- Processes
- Climate
- People
- Issues expressed by people
- Conflicts

3.3.2 Stage 3: Root definition of relevant purposeful human activity system

Here, the stage becomes completely out of the real world, i.e. it becomes in the world of systems. At this stage everything else starts to grow and is therefore termed as root definition. It is said to be uniquely the most challenging stage of SSM. This stage is preceded by an understanding of the concepts of different perspectives that can be drawn out of the rich picturing stage.

According to Checkland, the perspectives are termed as holons. Each holons, providing a separate value base by which to evaluate the situation, represent plausible relevant purposeful perspectives that can describe the real world activities. No matter how these perspectives are accepted by different stakeholders, they all are validly held by those affected by the situation and each in turn will affect the relevance and success of any possible intervention. (Williams, 2005)

In short, root definition is ‘‘a statement that concisely describes a system of interest. It is usually a single sentence starting ‘A system to…’ and it should include all the key elements of the system.’’[51] However, several iterations are usually required before a complete definition is agreed.

The basis of SSM, Checkland (1998), is to try to address key perspectives separately due to the fact that addressing all perspectives as a whole is too complex. Accordingly, selection of a particular perspective and putting it through a structured and rigorous model development has to be made with the help of mnemonics. Various mnemonics have been suggested and one way of doing so, as described in the ‘Key techniques for ECOSENSUS’ by Reynolds, is BATWOVE[52], a modification of TWOCAGES- an extension of CATWOE which was developed by Checkland (1990) and later further developed by the Systemic Development Institute in Australia (SDI, 2005).

[51] Key techniques for ECOSENSUS: Martin Reynolds(Ecosensus, SSM in more detail, http://projects.kmi.open.ac.uk/ecosensus/about/ssm-more.html, date accessed August 13, 2011)

[52] One of the drawbacks of CATWOE and TWOCAGES is in conflating what might be called the 'beneficiaries' of the system with 'victims' of the system, under 'C' (clients). In a workshop centred on developing operational research (OR) methods for environmental management held at Hull University, UK s(Midgley and Reynolds 2001) participant OR practitioners in the field of environmental management decided to modify the CATWOE mnemonic to BATWOV(Midgley, G. and M. Reynolds (2001). Operational Research and Environmental Management: A New Agenda. Birmingham, Operational Research Society.)

BATWOVE stands, as presented in the key techniques for ecosensus (http://projects.kmi.open.ac.uk/ecosensus/about/ssm-more.html), for:

- **B**eneficiaries: 'immediate' and 'ultimate' beneficiaries of the proposed transformation;
- **A**ctors: those who should make the transformation happen—the people involved in making the system work;
- **T**ransformation: the purpose of the system—what input is changed into what output, i.e. from one state to another.
- **W**orld-view: the perspective (including values) from which the transformation looks meaningful and desirable;
- **O**wners: those who have the power to stop the transformation happening (to stop the system from working);
- **V**ictims: those affected in a negative way (in their terms) by the transformation; and
- **E**nvironmental constraints: those factors that have to be taken as given in designing a system.

3.3.3 Stage 4: Developing the model

Once the root definition is over, at least for the first iteration, a conceptual model should be developed using the systems convention which includes, as described by Checkland (1981):

- an ongoing purpose
- a means of assessment (of performance)
- a decision making process
- components (sub systems)
- an environment with which the system may or may not interact
- a system boundary (from the environment within which it is functioning) that may be open or closed
- inputs (resources-material, information, finance, human...) and out puts
- continuity, etc.

Checkland (1981) recommended that a considerable time should not be spent on initial model building; rather it would be better to move to the comparison stage, have discussions, have more insights, and go back to the model. The reason behind is that SSM process deals with cycles of discussion, debate, and learning rather than producing the ideal solution right at the start.

Stage 5 to 7 are back in the real world during which the model is compared with reality, insights drawn from that comparison, and ideas for improvements are determined.

3.3.4 Stage 5: Comparison of the model with the real world

At this stage of SSM (Wilson & Morren, 1990), the conceptual models (stage 4) are compared with the reality by stepping out from the conceptual world and getting in to the real world in order to identify the human activity system. Here, the facilitator continues further to involve the participants and thereby foster the process of learning and cooperation among themselves.

There are different techniques of comparison including question generation technique (structured and unstructured) during which ordered questions regarding the reality of the problematic situation are generated based on the knowledge of activities in the conceptual model (Checkland, 1981). During this stage, proposals and ideas for improvement start to emerge. Written questions in the table format are answered by the involved participants and facilitator.

3.3.5 Stage 6: Develop desirable and feasible change (intervention)

Right at this stage, the SSM tends to stop being sequential and starts swinging back and forth through all seven stages of the methodology for the purpose of gaining the greatest leverage. From this analysis possible interventions are explored. Assessing the feasibility of these interventions is an important aspect of the methodology, and Checkland suggests several ways of doing this (Wiiliams, 2005) such as by:

1. Run through the model again using different CATWOE/BATWOVE, different perspectives, different scales (i.e. model sub-systems)
2. Undertake different systems based analysis
3. “Owner” analysis. Who fundamentally has the authority to take action?

4. “Social system analysis” How do the various roles, norms and values present in the real world relate to the conceptual model?
5. “Political analysis”. How is power expressed in the situation being studied?

Like the comparison stage, the debating stage of SSM too aims at testing the conceptual model in stage 4. The debate phase looks forward by taking up the recommended changes of the model and discussing if they are needed and workable. The desirability and feasibility refer to the W and E in BATWOVE (TWOCAGES) respectively. (Wilson and Morren, 1990)

3.3.6 Stage 7: Action to improve the situation

This is the stage where the methodology comes to its full cycle, and maybe starts a new cycle as in the cycle of expansive learning (Williams, 2005). If the actions, agreed on changes, are developed by the collaboration with participants then can then be more easily accepted and implemented. The main tasks of the implementation phase include (WIlson and Morren, 1990):

- designing implementation(action plan)’
- carrying out actions of the plan
- communicating the specifics to all affected
- monitoring performance and the environment, and evaluating results
- modifying aspects of the plan

Besides to the foregoing tasks, there are also set of items that need to be included in each implementation plan. These are (Wilson and Morren, 1990):

1. benchmarking activities/strategic actions- what are the key activities to be carried out for the realization of each of the subsystems(how part)
2. responsible actors- what individual or groups are responsible for undertaking each benchmark activity(who)
3. timetable- indicating the time(period) that each benchmark activity will be completed, including their order(When)
4. needed resources-what sort of resources(financial and other) are needed and from where will they come from for the purpose of accomplishing the activities(Want)

5. communication- how can be an effective and efficient communication be made to the different actors and other concerned parties in such a way that cooperation and coordination is assured in a non-conflicting

3.3.7 Tools, Techniques and Methods

During the application of SSM, different tools, methods and techniques of gathering, presenting and analyzing information were employed. Some of these are:

- Participatory observation: a way of gathering data by actually taking part in the subject under study. It is, in action research, usually conducted over a long period of time during which the researcher is presumed to gain a deeper understanding than perhaps other methods, such as questionnaire, of data gathering[53]. This method is advantageous in that it relies on first hand information, increases validity of data, and relies on relatively simple and inexpensive methods. However, it is also downsides of such as bias (objectivity) of the researcher him/herself, unsystematic gathering of data, reliance on subjective measurement, and possible effects of observer/observation (people will tend to behave differently than what they actually do if they knew that they are being observed).
- Mind mapping: helps to capture data more easily especially during participatory observation as well different engagements (such as interviews, meetings, etc.) with stakeholders.
- Community meetings (formal and informal): way of obtaining data where diverse groups of participants are involved.
- Rich picture: as described earlier, it helps to present the collected data and show the entire picture of the situation (subject) under study.
- Structured and semi-structured interview: use of structured and unstructured set of questions in conducting interviews.
- Informal and formal talk: another way to gather data by having both formal and informal talks with people whom the researcher thinks as knowledgeable about the issue under consideration.

[53] Participant Observation and Action Research, http://faculty.chass.ncsu.edu/garson/PA765/particip.htm (September 28, 2011)

4. Methodology-SSM- in Action

In this section, the actual applications (operation) of SSM, with the help of different tools and techniques described earlier, will be presented. However, it should also be noted that prior to the applications of the first two stages of SSM, i.e. defining the problem situation by stepping in to the situation, an analysis and identification of relevant stakeholders as well as key informants were made based on the information that was gathered to that point in time. The reason for doing so was primarily in order to minimize the complexity of meeting a large number and mix of stakeholders and thereby make the process smooth and manageable given the time and some other resource constraints. Besides this, the different stakeholders were needed for different level of involvement given the fact that most them were situated farther apart geographically, some being in the capital (about 50 miles away from the 'problem situation' where the local communities are), others in between these and the local communities, which made the efforts of bringing them all together and share their views regarding the situation of the Lake Koka more difficult, as well as their different roles.

Nevertheless, the involvement of EPA and MOWE, particularly in drawing a map of different stakeholder, assessing stakeholders' importance with regard to the Lake Koka, later during the analysis is believed to reasonably limit the judgmental bias in determining(defining the boundaries of) whether or not to include a given stakeholder. I also had been very much conscious not to limit the scope of the learning process (investigation) quite at an earlier stage.

With this in mind, the following stakeholders (see Table 1) were engaged in the process. Some were met in the beginning and others later, through a more selective inclusion, as the process became more technical and specific.

The relationships, degree of their power in affecting the situation, and their interests regarding the possible intervention for improvement/management (of the problem situation) of those stakeholders specified in this table (shown below) are presented in Appendix IV.

Table 3: Stakeholders involved while working on Lake Koka using SSM

Item No.	Stakeholder(type)	Number of participants	Remark
1	Amude(local) communities	10	Out of these, 4 were women whom I met while conducting a participatory observation in Lake Koka's problem situation
2	Local health officers	2	Both of them were women
3	Ministry of Water and Energy(MOWE)	4	
4	Ethiopian Environmental Protection Authority (EPA)	2	
5	Ethiopian Electric Power Corporation (EEPCO)	3	
6	Ministry of Trade and Industry	***	***My attempt to reach them out did not succeed for a number of reasons but I have tried to incorporate their views that they have expressed during different times
7	Tannery Industries	***	
8	Horticultures and Small Scale Factories	***	
9	NGOs such as Intermon Oxfam(International) and Action Professionals Association for People(APAP)	***	
Total		**21**	

4.1 Stage 1 and 2: Defining the situation

According to Checkland, here the situation need to explored and expressed from which then a rich picture has to be built. So there were different sessions that I undertook in order to gather as much information as possible.

The first was during my visit to the actual problem area, meeting people form Amude (the local people as well as health officers) communities and observing the situation of Lake Koka there on the ground. The local people tried to exhaustively present all problems associated to the lake and their respective relations towards it according to their perspectives, which were used later to develop a composite (rich picture of 'rich pictures') picture from which again selection of viewpoints were made for further analysis of the problem situation. There were even contrasting views held by the local communities.

These were, however, important inputs for the subsequent sessions of SSM as well as working on the same stages of defining the situation but with different stakeholders. Most of the issues identified at the local level were mainly physical (the Lake itself) and social issues.

Some of the issues raised as a result of using (drinking) the water from the lake were sickness and illness especially children, death of cattle, sheep, goats, fish, foul smell (coming from the lake to the communities' residents, especially when it is windy and is believed to be associated with the death of fish and dumped wastes of leather and tannery factories), poor sanitation and water born diseases, lack of access to fresh water, etc.

The local communities also identified some of the basic uses of the lake, which is essential to sustain their lives, such as source of drinking water, animal watering, crop and vegetable irrigation by both individual and group of households, in the form of farmers union, fishing (again both at an individual household and group of households level-who formed an association/farmers union of up to 100 households through which they trade fish to people in the capital, Addis Ababa, Nazret and Alemtena especially during times of fasting when fish has more demand in the cities' market), etc. Fishing is one of the important sources of income for the local especially due to the fact that Lake Koka has a fishery potential of 1194 tonnes/year (FAO country specific report on fisheries). For instance in the year 2001 the total number of tones of caught fish was 625, which is the highest among other major reservoir/dam fishing.[54] Generally, according to the Ethiopian Water Sector Development Programme (WSDP) 2002-2016, it is estimated that Ethiopian lakes, most of them in the rift valley, have a sustainable yield of 30,000 to 40,000 tons of fish per year. Fishing is also considered as vital for food security.

Interestingly, there was a local resident who used the existing situation (problem) as an opportunity to generate income by purifying the water (using sand to filter it) and selling it to the community member who would like to have safer water. Another person that I met during my observation was also indifferent about the situation saying that he is used to it and it did not have that much effect up on his life and even if it does, there is nothing that he can do much about it.

[54] Information on Fisheries Management in the Federal Democratic Republic of Ethiopia(http://www.fao.org/fi/oldsite/FCP/en/ETH/body.htm, August 22, 2011)

The local health officers also shared this view that more or less the community has chosen to live with it; they have started to not worry that much about the situation. However, they also said that ‘‘they had been requesting WUHA AGAR-water purifying chemical but it no longer is availed to the health center in the community’’. When asked about what possible solution they think of, they again explained from their perspective, that it would be better to teach the community about use of solid waste disposal (areas) especially as their wastes are contributing to the pollution of the lake because of their so close to the lake settlement. Besides, they have been triggered (during the course of this field work that engaged them to discuss with others and me too) to ask for the Wereda Health Office for them to be able to get WUHA AGAR so that the locals can resume using it to purify at least the water that is being used for drinking.

During my field observation, there were people on Lorries transporting sands from the shoreline of the lake to the cities where construction material is sought.

The second session was conducting the same situation definition (issue identification) of SSM with people in the authority, i.e. EPA and MOWE, there in the capital of Ethiopia, Addis Ababa. Even if they all agreed that pollution is one of the biggest environmental challenges of Ethiopia that has sources of industrial wastes (ranked high), municipal and human (household) and other wastes, they explained that the situation of Lake Koka is not considered as such problematic as described by other stakeholders and there had never been too any scientific study supporting these strong views held by different actors. So with this regard they differed from the views and beliefs of the local communities as well as people from EEPCO who had been working in the reservoir for over 10 years. Participants from MOWE further described that the local communities might rather have contributed to the current situation of the lake by cultivating and over grazing the buffer zone, cutting down trees (for firing as well as for expanding agricultural land) that contributed to catchment and environmental degradation. During my observation, I also witnessed that (as shown in Appendix I, photo 1 & 2) a farmer farming very close to the lake where trees are completely cleared off.

According to the views of the participants from the EPA, at the moment there are only 1% and 20% of households (who are proper users of sewerage systems) and industries (with waste treatments) respectively that actually treat their wastes properly. Even the way

industries are built is in such a way that they can easily discharge off their wastes to streams. This was partly due to lacks of adequate infrastructure and up to date technology. During the discussion, legal issue was also considered as a barrier to effectively implement the rules and regulations of EPA. This has come from the fact that like most of the industries that are currently working along the side of the river and streams that drain in to Awash river were situated when there were no environmental rules and regulations (eg EPA was established in 1995) of the country and as a result they are made to discharge their wastes to the nearby river (streams). The other legal obstacle is that the government (MoTI) has a policy of granting them a 5 years grace period during which EPA can't do any balance and check on whether or not they are strictly adhering to the environmental requirements.

Moreover, lack of awareness about environmental issues, not to mention poverty as a result of which all development initiatives are considered primary at all costs(of the environment), by the public at large and the different actors was considered as the major problem that has contributed greatly to the present environmental conditions.

Similarly, one of the participants from the MOWE (involved in water quality) described his worries that the problem is directly or indirectly linked to what is actually being carried out in the capital. For instance, according to a research conducted on the water pollution status of Akaki river[55], one of the major tributaries of Awash River, from which lake Koka is formed, wastes of in and around Addis Ababa such as from over 35 industrial processing plants (with a quantity of industrial waste water 4,877,371 m^3/yr), municipal solid wastes (with a daily waste production that is dumped in to the river and its tributaries amounting to 765 tones), municipal liquid wastes(picture in Appendix 2), liquid wastes from toilets, open urination and defecation(out of the total population of Addis Ababa, 12.4% uses flash toilet, 57% uses pit latrine and 30% have no facility at all, according to a report in 1999), liquid wastes from kitchen and bathrooms that are discharged in to the nearby water courses which later flow in to the river(with an estimated amount of 100,000m^3 wastewater), wastes of medical sources(from hospitals and clinical laboratories), etc. which all together contributed to have made it as the most polluted river in the country.

[55] Assessment report on the status of Akaki River Water Pollution, Federal Democratic republic of Ethiopia, EPA, Addis Ababa City Administration, EPA, and Oromia Regional National State, Environemtal Protection office, August 2005

The third and the last session during the first two stages of SSM, which is defining the situation (according to Checkland), was trying to again conduct a participatory observation in the upper most part of the lake where the reservoir, which is owned and operated by EEPCO, under the supervision of MOWE, particularly with regard to its siltation, is found.

This was conducted by walking all around the reservoir, guided by an engineer who has been working there in the Koka Hydro Electric Power Plant (KHEPP), by carrying out different measurements, of all kind of changes such as water flow, water quality, water quantity, etc. and reporting them to different concerned bodies, for many years.

KHEPP is located in the Oromia regional state, Lome wereda, in the Awash River basin. It has an installed capacity of 43.2 MW with an annual generation capability of 80GWH. The reservoir has a total area of 180 square kilometers (according to the information accessed from EEPCO) and storage capacity of 1,850 million cubic meters and usable storage of 1,680 million cubic meters. The total investment was 34.6 million Ethiopian birr, in 1960, which was covered by the Italian government in the form of compensation for the loss that Ethiopia sustained while fighting with Italian fascist regime.

However, getting access to the power plant was even so much troublesome than meeting the local people who are on the other side of the lake because I had to get a prior permission from the CEO of EEPCO. As a result, it took some time especially as I needed to resubmit a different letter that is meant only for the corporation, not just the 'To Whom It May Concern' that I had before. But, as I had been working in the corporation before I left it for study, it was then later easy for people to cooperate with me in terms of providing me a ride from the nearby town, Nazareth, also called Adama, to the site as well as explaining me everything around the reservoir.

The main issues raised were problems of siltation (increasing sedimentation caused by environmental degradation), causing to lower the water level (decreasing the reservoir's original capacity by 40%), and bad odor coming from the lake to the camps where employees of the power plant are residing.

Under normal circumstance, there is a gate (can be notice in Photo 6, Appendix I) which serves to control the silt, diluting and passing on the accumulated silt but, one of the site engineer explained, if operated accordingly it might again create a problem of flowing over the fincha town, where another power plant called Awash II, an extension of the Koka Hydro Power Plant (Awash I), and sugar cane farm and factory, are found on its downstream. He further stressed the bureaucracy even makes it impossible that a prior permission from a prime minister's office of Ethiopia is required. Therefore, it has never been in use to regulate the excessive accumulation of silt in the reservoir.

On the other hand, there were two dredging machines that are left inside the lake (near the regulators of the dam, photo 6, Appendix II). It was MOWE that started dredging long ago but for unknown reason, according to the engineer that I met, it has been stopped. According to the MOWE, they believed that the dam is now working beyond its expected life time, which was 40 years (since 1960), and hence it is not worth investing anymore unless otherwise a complete rehabilitation, which is of course under consideration, is to be made. Rehabilitating the reservoir, i.e. heightening the Koka Dam and thereby increase the impounding capacity, according to the views of participants from the MOWE, would lead to an increase not only in supply of water but also in restoring the ecosystem, such as more supply in fish and the like.

Regarding the different particles and remains of dead fish (as a result of the polluted lake), I had been shown that there is a trash crasher where they all are refined, collected and burnt, disallowing them from entering in to the canal through which water flows down to the turbine. This way they can reduce problems of water blockages caused by different remains, solid wastes and particles that are drawn from industries working along the Awash River basin and some other smaller streams.

During summer, the water level has been also raised as an issue because of runoff (as a result of heavy rain and flooding) when the water has to be discharged directly in to the river in order to minimize the risk of overflowing water from the reservoir that might cause problem both on the dam and people on the downstream.

High water release from (lake) Koka dam has always been causing, according to his view, flooding in the lower Awash River basin. According to the MOWE's 'Water Sector Development Programme 2002-2016'[56], Koka dam provides the only control of the Awash River by supplying water for irrigation and hydroelectric power generation at three of the power stations on the river (Awash I-Koka HEEPP, Awash II and Awsh III). Therefore, it is believed that rehabilitating the dam would serve many purposes, including controlling the flooding and increasing the needed water supply for downstream developments, mainly irrigation and hydro electric power generation, of the river basin.

With regard to the smell that is threatening them, they believed that the bad smell and color of the lake is caused by industrial activities in the upstream of the lake, especially by Ethiopian Tannery Share Company, which is operated and managed by a British company, Pittards PLC[57], and East African Tanner Plc which are located nearby streams that drain in to the river Awash, that involve chemicals in processing leather and leather products. However, it was also described that there are some other large and smaller factories, and different municipals (such as Addis Ababa, Akaki, Mojo, etc.) from which different wastes are carried over to the Awash River and then to the lake Koka. They also had attempted to communicate the problem to heads of the tannery companies, inviting them to have had the experience of what it feels to live by the power plant station (side of the lake) filled with bad odor.

The participant told me that the people from the factories even had taken sample (having all that pressure) of the water to see the causality of their activities in the upstream but they never came back with their laboratory results. He was, on the other hand, aware that the government allows them to discharge off their wastes during rainy season, i.e. mostly starting from June to end of August every year.

According to a letter in 2009 sent to former Prime Minister of United Kingdom, Gordon Brown, by Environmental Law Society, University of Minnesota Law School, USA, citing a research made to determine the concentration of heavy metals in the extract from watermelon grown around Lake Koka, it was found out that the lake has higher concentration of chromium, iron, nickel, lead, and is filled with toxic green algae (microcystis algae).

[56] Federa Democratic Republic of Ethiopia, Ministry of Water Resources: Water Sectro Development Programme 2002-2016(Ethiopian Calander)', Water Resources Programmes

[57] http://www.ethiopiatannery.com.et/pittards_partnership.html

The letter further explained that, citing again a scientific finding at the University of Durham, U.K., the water sample taken from the lake Koka still showed the same result that it is severely contaminated with some of the most toxic molecules.[58]

Lastly, growing of water weeds is also mentioned as an issue for them. This happens, according to their views, mostly during Ethiopian rainy (summer) season.

All of these validly multiple perspectives (with their uncoordinated coexistence and conflicting manner), indicate the typical messiness, as Checkland calls it, of the problem situation where there is no a single understanding of the problem situation. And it was almost impossible to be free of my own world view, as a participant observer, regarding the situation, let alone the involved actors. This is I think that in line with Checland's idea of applying SSM as an action research in that I was studying the situation while observing and had an influence on the situation, which is the essence of intervention in experiential learning (Checkland, 2006), knowingly and/or unknowingly. For a summary of the issues expressed, refer to the table number 4 (next page).

Following all these, a rich picture (Appendix 4) was developed expressing the different issues (concerns) and their relationships, which are the essentials to applying SSM (Checkland, 2006), that are voiced by the different actors during the participatory observations, a thorough, structured and semi-structured interviews.
From there on again, three issues, namely creating awareness, coordination and participation of stakeholders, with the participation of EPA and MOWE, have been chosen for further analysis. The reason is that addressing all perspectives as a whole would be very complex and difficult task, as Checkland noted it. Therefore, it is important to address each one of them selectively according to their degree of importance in addressing/improving the problem situation.

[58]http://www.gadaa.com/CampaigntoPreserveLakeKokaAwashBasin.pdf, January 2010

Table 4: Issues (problems, needs, concerns, etc.) of Lake Koka identified by the participated stakeholders

S.No.	**Some of the identified problems(issues)**	**Remark (**from whose world view**)**
1	death of animals (cattle, goats, sheep, fish) as a result of drinking the polluted lake, illness (stomach diseases, diarrhea, malaria and others caused by poor sanitation), bad smell (caused by the different pollutants that have been discharged to the Lake Koka), lack of access to fresh water for the local people (drinking, washing, fishing and agricultural uses, and recreation) and animal watering, the lake has a very limited outlet making all accumulated wastes to remain in it, hippopotamus eating grown cereals (maize) around the lake, women and children, who often are responsible in fetching water and carrying out household activities, are more vulnerable, youths are denied of recreation activities/swimming in the lake as a result of the bad smell and color of the lake, the local communities excrete in an open and nearby to the lake area, animals' dung (waste), restoring the lake, requesting and supplying WUHA AGRA (water purification chemical), the lake doesn't have an outlet/reduced water flow	Amude communities (including health officers)
2	lacks of awareness (knowledge) on environmental issues by the public, sectoral developments, very poor coordination, lack of adequate infrastructures, lack or presence of outdated technologies, lack of enforcement mechanisms (legal, especially in connection to the 5 years grace period given to investors by the government to promote investment), poverty, inadequate capacity, absence of waste treatments (by the factories, hospitals, municipals), absence and lack of proper sewerage systems (sewerages are connected to rivers and streams), population growth, land degradation (cultivating the buffer zone by the local people), lack of transparency, lack of open solid waste disposal site (only one so far in Addis Ababa), too much focus on economic aspect and less focus on the environment, lack of environmental certification	Institutions(EPA and MOWE)
3	Siltation, foul smell (due to the chemicals and dead -fish-remains), industrial wastes discharged in to the lake, reduction in water level due to the pollution load and siltation (it is particularly a problem as the reservoir gets easily full during rainy season, having less carrying capacity), presence of non-functioning dredging machines inside the lake that are owned by MOWE)	EEPCO (the Hydro Electric Power Plant)
4	political motive (government's inaction by purposely neglecting the suffering of the voiceless, Oromo, marginalized, and poor communities of Amude), higher concentration of chromium, iron, nickel and lead, toxic green algae (microcystis algae), there is no accountability, lack of enforcements, industries wrong doings that threaten the environment and the society, violation of human and constitutional rights of access to clean and safe environment (water), lack of institutional coordination and communications, etc.	Others (NGOs, Environmentalists, Human Right and other Activists-APAFP, etc.)

4.2 Stage 3: Root definition (RD) of relevant purposeful human activity system

This is the stage where it becomes out of the real world, as opposed to the previous stages of defining the problem situation, i.e. rather in the world of systems (Checkland, 1998) by identifying themes and modeling them in to systems. In SSM, BATWOVE analysis of an issue serves to develop a sentence description (root definition) of the core nature of the system (of interest).

In BATWOVE, B stands for **B**eneficiaries- 'immediate' and 'ultimate' beneficiaries of the proposed transformation; A for **A**ctors- those who should make the transformation happen—the people involved in making the system work; T for **T**ransformation- the purpose of the system—what input is changed into what output, i.e. from one state to another, W for **W**orld-view- the perspective (including values) from which the transformation looks meaningful and desirable for **O**wners- those who have the power to stop the transformation happening (to stop the system from working); V for **V**ictims- those affected in a negative way (in their terms) by the transformation; and E for **E**nvironmental constraints- those factors that have to be taken as given in designing a system.

Accordingly, the respective transformations (T) and other elements of the mnemonic BATWOVE for these identified themes (issues) above are:

- **Lack of awareness about environmental problems(issues and concerns) →T→ Created awareness on environmental problems**

RD 1. A system of creating awareness about environmental problems, particularly in reference to the situation of Lake Koka, so that environmental problems (eg. pollution) can be improved over time.

World View: People are aware about the environment means that they will protect and care for the environment, including protecting the quality and quantity of water, from household, municipal and industrial wastes-pollutants, which is important for sustainable socio-economic development.

Beneficiaries: citizens, tourists, local, zonal and regional institutions, industrial groups, local communities.

Actor: EPA, MOWE, Ministry of Information (MoInf), Ministry of Education (MoE), Ministry of Health (MoH), Regional Bureaus Environmental Protection, Addis Ababa City Administration, Local Health Workers, NGOs (Inter Oxfam and APAP).

Owner: EPA, MOWE and the Ethiopian Government.

Victims: Industrial groups, manufacturers, etc who are currently excessively extracting and or misusing the lake for their own purpose.

Environment: capacity and resource constraints (human, financial, and material-such as access to the different communication mediums/channels, etc.)

- **Lack of coordination among various sectors (institutions) →T→ Coordinated institutions**

RD2. A system of coordinating various institutions (actors) so that coordinated institutions will be formed which are subsequently capable of working on a cross-sectoral basis in an effort to promote an integrated approach to water resources management that is based on hydrological boundaries than administrative boundaries.

World View: Integrating the water resource management practices across a range of formal and informal institutions through coordination and collaboration helps better address the growing challenges of water problem (quality and quantity) in Lake Koka more efficient and effectively. Coordinating the different individual sectors fosters stakeholder participation, transparency and cost effective local management, as described in the guiding principles of IWRM.

Beneficiaries: Local Communities (of Amude), EEPCO, fisheries, tourists and others who depend up on the lake (Koka) as well as the river basin (Awash).

Actor: EPA, MOWE, MoH, MoTI, EEPCO, Regional Environmental Protection Bureaux, Addis Ababa City Administration, Local Health Center, NGOs (Inter Oxfam and APAP), Local Communities.

Owner: EPA, MOWE, EEPCO and the Ethiopian Government

Victims: Industrial groups, manufacturers, etc who are currently excessively extracting and or misusing the lake for their own purpose.

Environment: capacity related problems (such as finance and technology where different institutions are right now lacking laboratories to carry out water quality related researches and investigations), achieving political support/government inaction (because the existing policies promote sectoral development such as compromising environment/water quality while pursuing economic development, etc.).

- **Lack of participating stakeholders →T→ Having participating (engaging) stakeholders (SHs)**

RD3. A system of participation (SHs' engagement) in order to identify and manage issues/ problems as well as potential sources of conflicts on Lake Koka more fairly and equitably.

World View: It is a fundamental right for SHs to influence and share control over development initiatives and decisions up on resources that are affecting them (are being affected by) both directly and indirectly.

Having an adequate SHs' participation is crucial for the purpose of achieving a desired outcome.

SHs ought to have a democratic opportunity of expressing their views, opinions and concerns with regard to the use and management of shared (water) resource that they possess a stake up on.

Beneficiaries: Local Communities (of Amude), EEPCO, fisheries, tourists and others who depend up on the lake (Koka) as well as the river basin (Awash).

Actor: EPA, MOWE, MoH, EEPCO, Oromia Regional Bureau of Environmental Protection, Addis Ababa City Administration, Local Health Center, NGOs (Intermon Oxfam, Water Aid Ethiopia, and APAP), Local Communities

Owner: EPA, MOWE, EEPCO and the Ethiopian Government

Victims: Industrial groups, manufacturers, etc who are currently excessively extracting and or misusing the lake for their own purpose, existing bureaucratic institutions that might need to be reformed so that their policies for implementation, at the local level, are meant for the needs of the local people.

Environment: existing governance structure (degree of democratization), existing norms, traditions and norms (such as gender issue, class and power difference, variation in perceived benefits of participation when viewed from women's perspective), financial constraints (while setting up a platform for forum, discussion and debate among the various stakeholders, inability for some stakeholders to attend meeting scheduled elsewhere, as opposed to the place where they live and work).

4.3 Stage 4: Developing the Conceptual Model

In Stage 4 of SSM, a conceptual model has to be built for each of the above named transformations (in stage 3 of SSM) using systems convention, as suggested by Checkland (1981), that includes components(activities characterizing the system) such as an ongoing purpose, a decision making process, a component (sub systems), an environment with which the system may or may not interact, a s system boundary (from the environment within which it is functioning) that may be open or closed, inputs (resources-material, information, finance, human...) and out puts, continuity, etc. The models (conceptual), shown below, therefore define the different human purposeful activities of creating awareness, coordination, and stakeholder participation.

Arrows have been used to indicate the dependency between different key activities within each system, as suggested by Checkland.

The inner circles, in each of the conceptual models described below, show the sub-systems of each (purposeful human activities numbered 1 to 6) which is going to be monitored, evaluated (based on the criteria of effectiveness-outcome orientation, efficiency- resource use, and efficacy-how well does the means work) and controlled by taking action (SDI, 2008).

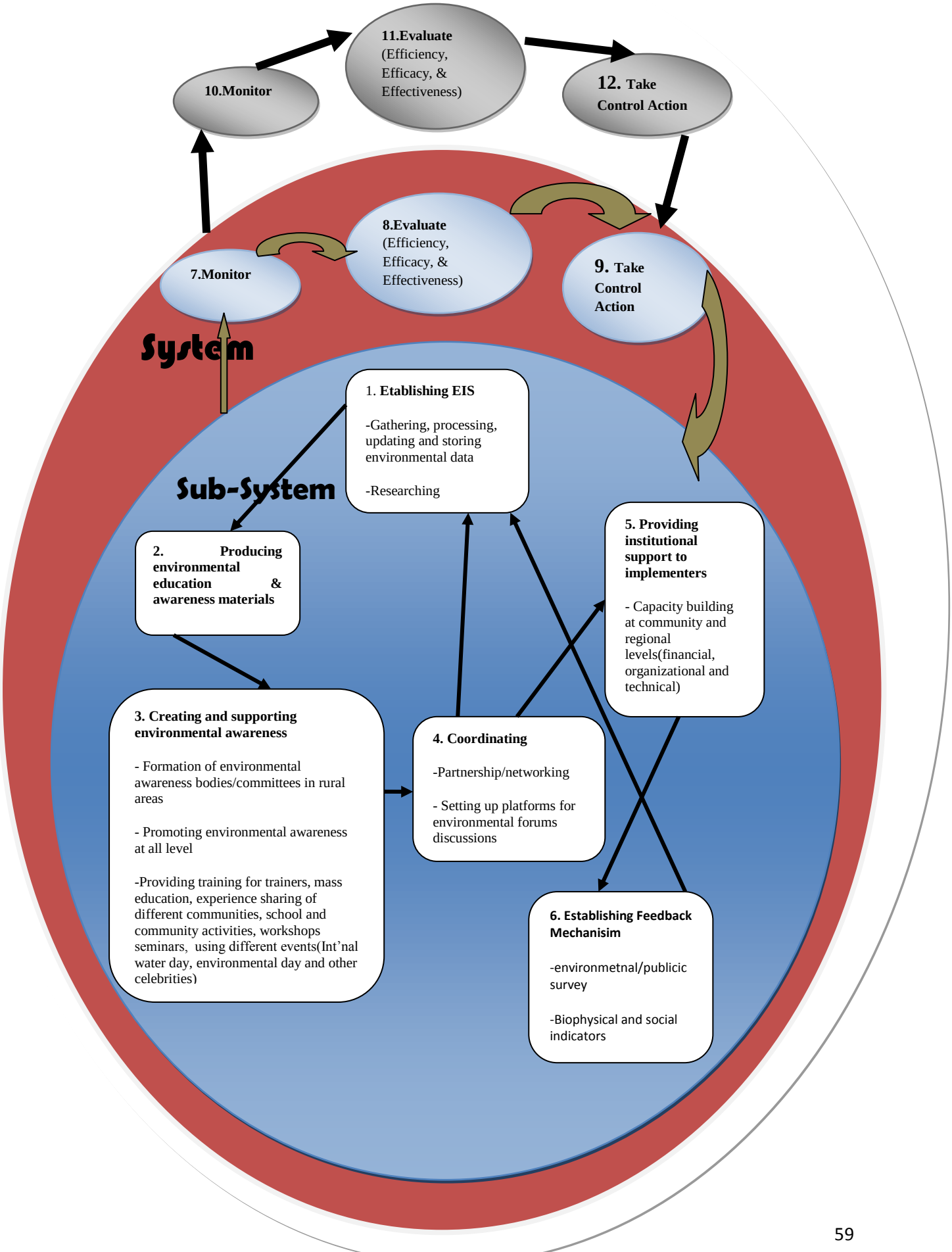
The middle circle containing activities from 1 to 9 represent the different systems, i.e., systems of creating awareness, coordination and stakeholder participation. Again, each whole system, complex, according to system theory, needs to be arranged in such a way that it has the capacity to organize itself using the same criteria of evaluation described above(monitoring, evaluating/feedback, and finally taking control action if the system is not meeting the desired purpose).

4.3.1 Conceptual Model for 'Creating Awareness'

The key purposeful human activities in the system of 'creating awareness' are:

- Establishing efficient and consistent 'Environmental Information System'-some of the sub activities within this human activity include undertaking researches, exchanging data, gathering, processing and storing new data, updating existing information, etc.
- Producing environmental education and awareness materials for use by mass media.
- Creating and supporting environmental awareness- involves sub activities of such as formation of environmental awareness bodies/committees in rural areas-short term, promoting environmental awareness at all levels of the society through provision of training for trainers, experience sharing/visiting other places of different communities, mass education, teaching materials, magazines, flyers during water/environment related events/celebrities such as water day, school and community activities, workshops, seminars, etc.
- Coordinating- here again the sets of sub activities involve setting up platform for forums and discussions, networking, partnering/public-private partnership/, etc. among all those involved actors.
- Providing institutional support to implementers- activities of building capacity at community and different levels-organizational capacity, financial capacity and technical capacity, etc.
- Establishing Feedback mechanisms – this is in turn done by ensuring that the public is aware through environmental survey/public opinion survey, ongoing monitoring and evaluation of activities.

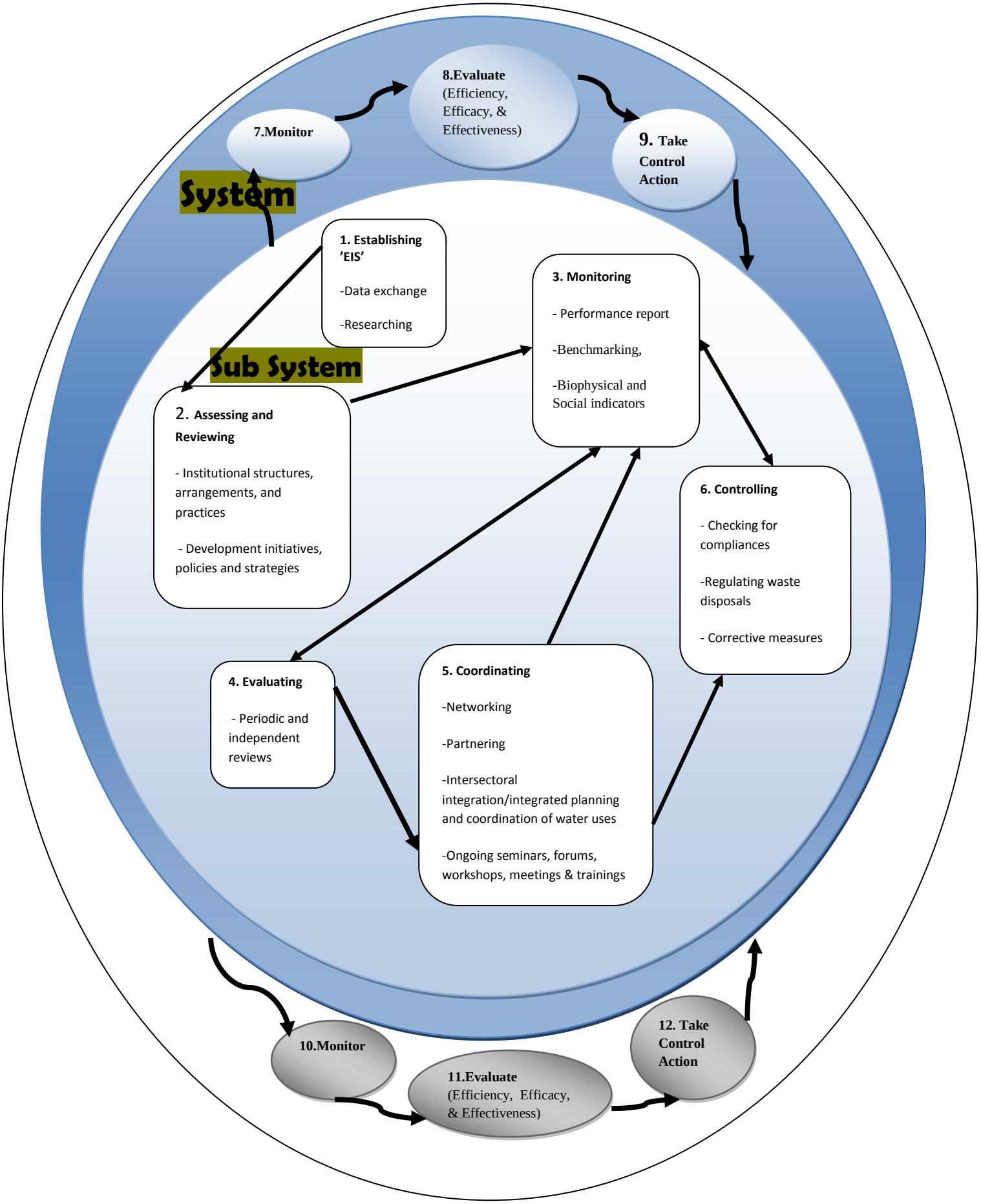
Figure 7: System of Creating Awareness (See next page)


11.Evaluate (Efficiency, Efficacy, & Effectiveness)
10.Monitor
12. Take Control Action
8.Evaluate (Efficiency, Efficacy, & Effectiveness)
7.Monitor
9. Take Control Action
System
Sub-System
1. Etablishing EIS
-Gathering, processing, updating and storing environmental data
-Researching
2. Producing environmental education & awareness materials
5. Providing institutional support to implementers
- Capacity building at community and regional levels(financial, organizational and technical)
3. Creating and supporting environmental awareness
- Formation of environmental awareness bodies/committees in rural areas
- Promoting environmental awareness at all level
-Providing training for trainers, mass education, experience sharing of different communities, school and community activities, workshops seminars, using different events(Int'nal water day, environmental day and other celebrities)
4. Coordinating
-Partnership/networking
- Setting up platforms for environmental forums discussions
6. Establishing Feedback Mechanisim
-environmetnal/publicic survey
-Biophysical and social indicators

4.3.2 Conceptual Model for 'Coordination'

- Establishing 'Environmental Information System-EIS'- this consists of sub-activities of undertaking researches and exchanging of data among various institutions.
- Assessing and reviewing- relates to activities of assessing and reviewing existing practices, structures and arrangements of the different institutions as well as other involved stakeholders, including developmental initiatives, policies and strategies in relation to the shared natural resources, waters.
- Monitoring- performance report and benchmarking, against which performance will be measured, shall be undertaken under this purposeful human activity. Monitoring should be based on bio-physical indicators (such as water quality, vegetation/land cover/use changes, change in wildlife), and social indicators (such as water borne diseases, water use, availability of safe drinking water, efficiency of the community in managing water, etc.)
- Evaluating- involves sub activities of undertaking periodic and independent reviews based on fairness, equity and sustainability.
- Coordinating - refers to activities of networking, partnership, intersectoral integration/planning and coordination of water uses.
- Controlling- includes such as checking for compliances, regulating waste disposal, and taking corrective measures.

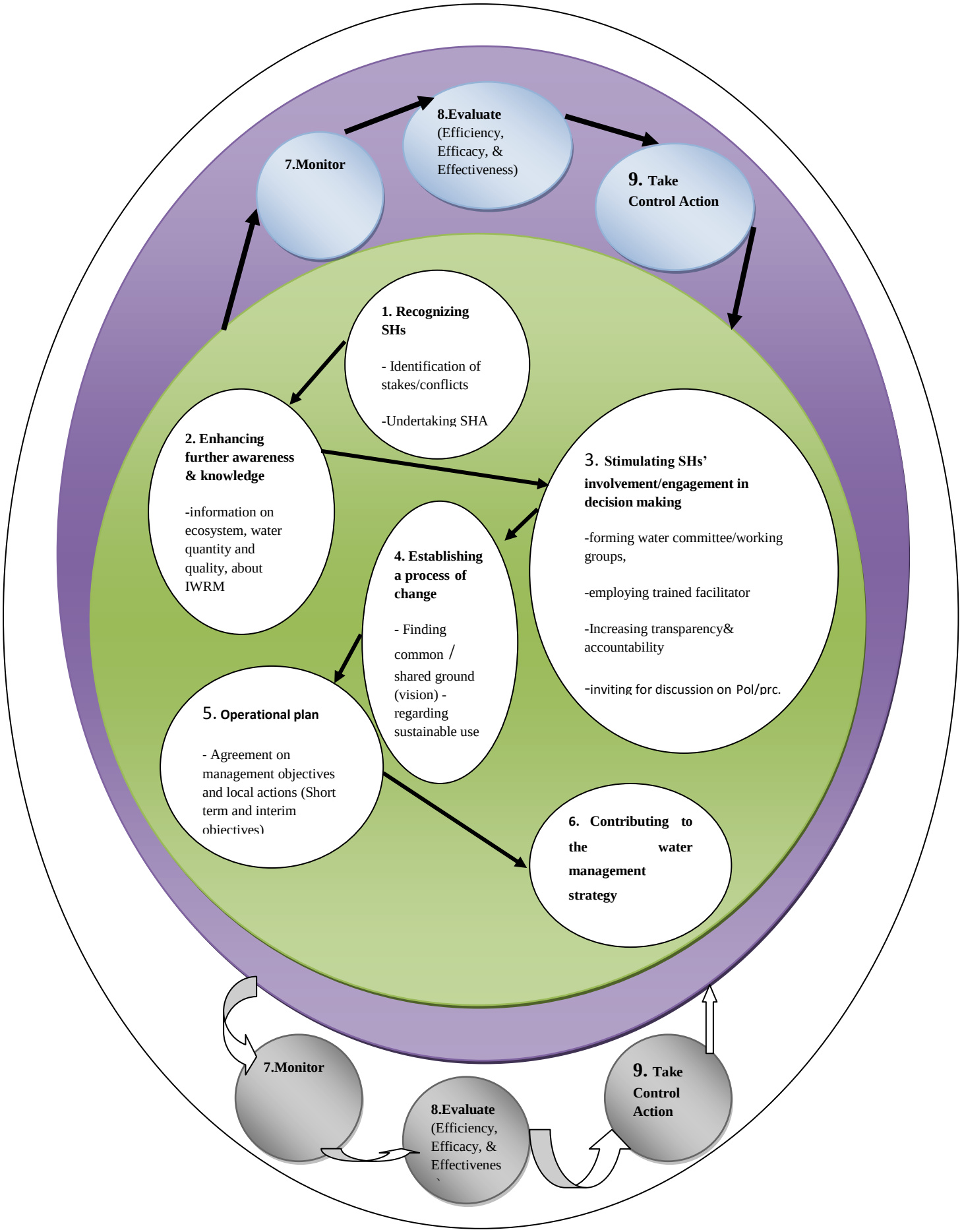
Figure 8: System of Coordination (see next page)


System
7.Monitor
8.Evaluate (Efficiency, Efficacy, & Effectiveness)
9. Take Control Action
Sub System
1. Establishing 'EIS'
-Data exchange
-Researching
2. Assessing and Reviewing
- Institutional structures, arrangements, and practices
- Development initiatives, policies and strategies
3. Monitoring
- Performance report
-Benchmarking,
-Biophysical and Social indicators
4. Evaluating
- Periodic and independent reviews
5. Coordinating
-Networking
-Partnering
-Intersectoral integration/integrated planning and coordination of water uses
-Ongoing seminars, forums, workshops, meetings & trainings
6. Controlling
- Checking for compliances
-Regulating waste disposals
- Corrective measures
10.Monitor
11.Evaluate (Efficiency, Efficacy, & Effectiveness)
12. Take Control Action

4.3.3 Conceptual Model for 'Stakeholders Participation'

1. Recognizing various stakeholders as well as their vested interests- this is done through identification and management of conflicts of different SHs such as women and youth, employing SA-stakeholder analysis, knowing the different water use patterns as well as economic benefits from different SHs perspective, etc.
2. Enhance further awareness and knowledge development- involves sub activities of gathering, processing and disseminating information regarding the ecosystem, existing water quality and quantity problems, creating awareness about IWRM, etc., and thereby promoting knowledge.
3. Stimulating SHs' involvement/engagement in decision making- refers to the formation of water committee/working groups and undertaking ongoing workshops, opening up for discussion on issues of existing policies, institutions and practices, facilitation-employing trained facilitators, increasing transparency and accountability in decision making such as through partnership-with the affected community groups, youths, women, etc.
4. Establishing a process of change – the activities needed to establish a process of change is finding common ground/shared ground (vision) regarding sustainable uses of the lake.
5. Devise operational plans for implementation/process of change- this entails activities of agreeing on management objectives, by finding and working on common grounds from a range of issues and problems of the lake, and local actions (short term as well as interim objectives).
6. Contributing to the water management strategy – this will finalize and expedite the processes within the system of stakeholders participation for the purpose of having an increased (stakeholder) participation, from lack in participation.

Figure 9: System of SHs Participation (Next page)


7.Monitor
8.Evaluate (Efficiency, Efficacy, & Effectiveness)
9. Take Control Action
1. Recognizing SHs
- Identification of stakes/conflicts
-Undertaking SHA
2. Enhancing further awareness & knowledge
-information on ecosystem, water quantity and quality, about IWRM
3. Stimulating SHs' involvement/engagement in decision making
-forming water committee/working groups,
-employing trained facilitator
-Increasing transparency& accountability
-inviting for discussion on Pol/prc.
4. Establishing a process of change
- Finding common / shared ground (vision) - regarding sustainable use
5. Operational plan
- Agreement on management objectives and local actions (Short term and interim objectives)
6. Contributing to the water management strategy
7.Monitor
8.Evaluate (Efficiency, Efficacy, & Effectivenes
9. Take Control Action

4.4 Comparison of the Conceptual Model with the Reality

The three models that were built above now have to be compared with the reality by stepping out of the conceptual world, i.e., by going back to the real world. The technique employed for undertaking the comparison was by answering question using the table format as shown in Appendix VI (Table 1-3).

4.5 Stage 6 and 7: Develop desirable and feasible change and action to improve the situation

According Check land (1999), SSM needs not anymore be sequential and rather it should be swinging back and forth through all the stages so that the greatest leverage can obtained through debating. However, due to the constraints that I had, during the facilitation of this process, it was beyond the scope to do so.

Therefore, it was just only once that the process has been followed based on which desirable and feasible changes (of the intervention process) have been identified as follows for further actions (stage 7 of SSM) of improving the Lake Koka situation. This way, the methodology comes to its full cycle. The detailed action plan for each of the recommended changes is shown in the appendix VII.

5. Finding and Discussion

5.1. Findings

Some of the major findings, for which actions plans for improvements were developed above in table number 8 to 10, of this particular case study are lacks of awareness about environmental issues (and problems) by the public and the different actors, coordination among different institutions, and stakeholders' participation in process of managing and using water resources, which ultimately has been impacting them, particularly the communities settled nearby Lake Koka, in many ways. These three major findings are going to be discussed bellow in relation to both the theoretical basis of IWRM and the applications of the SSM, based on the concepts of system's thinking, as the preferred method of managing the complex and interrelated environmental problems that are triggered by uncontrolled human interaction with the Lake Koka.

5.2. Discussion

5.2.1 Lack of Environmental Awareness

Till the time that this intervention was made, and even now by some of the stakeholders (such as groups of industries, factories and horticultures) who did not actually express their world views regarding Lake Koka, using SSM as a tool of addressing messy and ill structured problem (Checkland, 1999), most of the stakeholders did not have the same level of awareness as well as ways of looking at the issue, which is of course the essence of applying SSM, as described earlier, for situation that is characterized by multiple perspectives, often conflicting, and lack of consensus in the problem itself and possible solution for improvement.

In general it might be agreed that most people in Ethiopia, as described by the participants, including those working in public institutions as well as those owning and running different forms of businesses (that seek only the economic benefits), do care less about the environment that they live in. For this, there could be a number of explanations. However, in this report the focus will be in discussing only on the contributing causes that were identified during the field work and their explanations with regard to the application and challenges of IWRM while aiming at identifying the integrated management aspects of the Lake Koka which are believed to offer opportunities for bringing about improvements.

Apart from poverty, which can easily be associated as causes to a number of unintended consequences/effects, lack of adequate and accessible 'environmental information system' was viewed by the participants of this project as crucial factor that has been prohibitive of creating the environmental awareness in the country at local, regional, and national level.

Lack of environmental information also created a problem that environmental monitoring, evaluation and control has not been supported by adequate information. Presently, as shown in the Water Sector Development Programme 2002-2016, except the hydrological data, monitoring of water resources data such as ground water level, water quality(including absence of drinking water standards to non-piped supplies), effluent discharges into inland waters, etc. is not an established practice in the country. The reality that most of the Ethiopian lakes have not been adequately studied (Gebre-Mariam, 1998) shows the available information to be so scanty that decision making regarding any possible intervention is meaningless. That is why such as EPA and MOWE found it difficult in the first place to consider the situation of Lake Koka as problematic irrespective of the observable biophysical and social indications in the surrounding.

The limitedly available data were collected in the past, like in the year 2003 and before, by different bodies, as there was not any responsible institution for this particular purpose till recently, in order for serving different purposes and therefore couldn't be accessed any longer in a useable form. However recently it has become the responsibility of MOWE and partly EPA to establish and regularly update the 'environmental information system'.

The Ethiopian Water Resources Management Policy (1999)[59] states that recognizing the link between properly managed water resources and the availability of viable information systems, by developing a practically coherent, well-designed and smoothly functioning Ethiopian Water Resource Information System (EWRIS), is crucial for the sustainable use and management of water resources. However, during my visits, there was hardly as such any system of environmental information either in the water sector and /or some other relevant institutions of the country.

One of the principles of IWRM (Dublin, 1992) was that water development and management should be based on participatory process (approach) which involves raising awareness about

[59] The Federal Democratic Republic of Ethiopia, Ministry of Water Resources: Ethiopian Water Resources Management Policy, Comprehensive and Integrated Water Resource Management, 1999

the importance of water and the environment among the policy-makers and the general public. However, it is evident that the country's integrated water resource management strategy, though it appears following the principle for the sake of formalizing it in its policy routines, it is quite far from the reality that IWRM, with the help of its guiding principles, is actually put in place. Therefore, implementing IWRM in the absence of sufficient information, due to lack of sufficient stakeholders' participation, is rather a challenge (GWP, 2000) that it leads to overlooking the interest (of different stakeholders) and irrational decisions (Newson and Malcolm D, 1997) regarding land and water use and management, etc.

The (IWRM) principle of participation is so wider in scope that it also relates to the establishment and giving of open access information on water (pollution) to the various stakeholders, including the general public (Helmer et al. 1997) in order to stimulate understanding, discussion and suggestion for solutions of water quality and quantity problems. As discussed with the EPA, it has been pointed out that most stakeholders give due emphasis on just the economic aspects while underestimating the environment. But the fact that 'water has an economic value and should be recognized an economic good', the principle which was agreed in Dublin (1992), was adopted and clearly stated in the country's water resource management policy (1999) that ''water should be recognized as economic good, for its substantive and significant contribution to the country's economy as well as to the annual Gross Domestic Product, through its rational development.''

Recently, EPA has been working on creating awareness, dedicating a directorate (for creating awareness), partly with the industrial groups of stakeholders as a result of which some of them have already started recycling wastes instead of discharging them to the streams in the Awash River basin, the most polluted basin in the country, according to an 'Assessment report on the status of Akaki River Water Pollution' (EPA, 2005). But it seemed that, given the scale of the problem, much work is needed and the focus in raising awareness shouldn't only rest on EPA and therefore efforts to engage government and non-government organizations, community based institutions (churches and mosques, EDIR…), etc should be sought for.

On top of this, the awareness target has to be all-inclusive that community members (with an emphasis on the already affected community of the Amude town) and some other areas need to be considered. Because human activity and catchment mismanagement[60], not knowing the interconnectedness and interdependence of land cover (changes) and lake management, has a parallel application to the environmental degradation which eventually leads to the deterioration of the quality and quantity of inland waters (lakes). For instance, during my filled visit, I discovered that people in the Amude community have no knowledge about this causality between land and water and to that effect they have overstressed the catchment as a result of farming and overgrazing activities that left with no buffer zone.

The other related challenge with regard to creating environmental awareness is that, as is the case with most developing countries, usually characterized by poor democratic governance and/or capacity, there is not that much tradition of giving open access to environmental information (Helmer et al. 1997) and this has an ultimate result, as proved in the pollution of Lake Koka that resulted from excessive and uncontrolled uses of its waters in the basin, in that it impedes any water development and management interventions. Such interventions, however, with proper and timely information, of say proper treatment of wastes and prevention of pollution from municipal and other wastes would lead to improvement so that waters, which are essential for supporting the lives of desperate poor, are kept clean and of in the appropriate quality standards. And for this a prior works of creating awareness among citizens and all other stakeholders, and promoting an enabling and conducive learning environment for their involvements are very decisive.

5.2.2 Coordination and IWRM

Another big problem, yet related and highly interdependent up on the other two problems-lacks of awareness and participation (stakeholder), that has hugely contributed to the demise of Lake Koka in particular, and states of the Ethiopian environment in general is lack of coordination among various institutions that are seemingly working together in managing and using water, land and related resources of the environment for socio-economic developments.

[60] It is evident that human activity and catchment mismanagement have accelerated water quality changes in some of the Ethiopian lakes.(http://www.aaas.org/international/africa/ewmi/zinabu.htm, August 15, 2011)

Ethiopia doesn't actually have a long history of an independent environmental protection institution.

EPA was established under 'Ministry of Natural Resources Development and Environmental Protection (MNRD&EP)'[61] in 1994. But more importantly EPA, as environmental regulatory and monitoring body, has become independent institution and re-established by proclamation no. 295/2002 in 2002. Before that and even today, according to the views of participants of from EPA, too much focus has been on policy and development initiatives that take care of poverty reduction by enhancing food-self-sufficiency at a household level and by sustaining the economy such as through agriculture-based industrial development in the long run. Nevertheless, according to the irrigation policy, the approach is considered achievable through the augmentation of agricultural productivity, which by itself calls for mitigating water shortage problems as a precondition.

Improving water resources utilization, gender equality, good governance, etc., were also some other prioritized policies of the government that have not yet been given a fair share of actions so far.

Therefore, the changes in policy, which favored the establishment and flourishing of many factories and industries along the streams and rivers in the Awash River basin, have exacerbated the water pollution problem, which is believed to have been caused (according to the different sources that this action research is based on) by lack of integrated planning and management of water resources. For instance, MoTI has the mandate of giving licenses to different investors without even consulting to EPA or any other stakeholder on whether or not those envisaged businesses are environmentally certified that there wouldn't be any business activity that will harm and compromise the environment.

Above all, as described by the respondents during the field work, these firms have also been given five year grace period within which time frame EPA won't be able to enforce and apply any compliance mechanisms as per its mission and objective for which it is established.

[61] EPA(http://www.epa.gov.et/default.aspx, August 31, 2011)

In other words, EPA doesn't have the actual power to regulate the environment. As a result most industries groups, tanneries, horticultures, and other small scale factories which produce soaps, sugar and plastic, have been severely affecting the streams and rivers in the Awash River basin that Lake Koka is found.

This legal and some other gaps of coordinating the use and development of water for industries, agriculture (irrigation), hydro power, water supply, etc. created are clear indications that the different institutions have been acting up on water and the environment in uncoordinated and sectoral manner that don't consider the guidelines of IWRM, i.e., managing water on a hydrological boundary (basin-wide approach) rather than the institutional (administrative) boundaries. This consequently has resulted in making water resource more scarcest (limitedly accessible quality and quantity of water) especially in many rural communities (such as Amude) where water, besides its being a necessity for survival in the form of fresh and healthy drinking water, is required by many poor men and women to grow plants and animals as their only source of food/income.

Despite those mismatches, according to the Ethiopian Water Management Policy (1999), under its general policies of 'Water Supply', it states that ''rural drinking water and livestock water supply undertakings shall be integral part of the overall socio-economic development, centered on self-reliance, community participation and management'', which is quite consistent with the guiding principles of implementing IWRM. ''Objectives for Environmental Protection'' of the Ethiopian Constitution (1995), also states that ''no development activities shall be disruptive to the ecological balance.''

As part of the current government's reform[62], water development initiatives, particularly small-scale irrigation and rural water supply, have been passed on to the regional bureau through decentralization with the idea that local authorities are better able to identify and meet local water needs and priorities. However the problem is that regional water development bureaux don't have the necessary capacity (such as technical expertise) and this coupled with lack of clear policy and coordination makes every efforts of coordination and development of water unsuccessful.

[62] Water Resource Development in Ethiopia: Issues of Sustainability and Participation (http://www.ethiopians.com/Main_FSS_Paper1.htm#rfparticipation, August 30, 2011)

Generally, one can infer that sectorally planned and executed poverty alleviation policies and development strategies, which deprive the poor access to fresh water, could rather contribute to the vicious cycle of poverty than its reduction. Above all, according to the Dublin principle of IWRM (1992), it is vital to recognize first the basic right of all human beings to have access to fresh water and sanitation. According to the 'UN World Water Development Report (2006)', for quality water governance, that coordinates the different uses of water, an equitable uses of water should be made taking in to account the social dimensions.

Hence, reviewing Ethiopian development initiatives and reshaping policies, strategies and laws might, as suggested in the 'State of Environmental Report for Ethiopia (2003)', help towards the practical integration and coordination of the different institutions in order for them to be able to confront the challenges(such as pollution) in the efforts of managing and developing water more sustainably.

5.2.3 Stakeholder Participation in the Context of IWRM

One of the ideals in implementing IWRM, through its guiding conceptual framework for the purpose of achieving a sustainable management and development of water resources, is having stakeholders' participation which incorporates the interest of the public, all other stakeholders (Rahaman et al., 2004), and particularly the poor people and/or women who are often excluded. According to the Ethiopian Water Sector Strategy (2001), it is also clearly stated that water resources management requires stakeholders' participation at each level, giving particular attention to disadvantaged groups, especially women, who normally have little say in water management planning, using mechanisms such as water committees, water boards, water-users associations, professional and civic associations.

In Ethiopia, however, participation is in most of the cases plagued by social and cultural (age, gender, religion, beliefs and norms), political (power and authority), and economic (class) factors (Rahmato, 1999). These factors have been often hindering the public, especially women and the disadvantaged poor communities of the rural people, from taking part in decisions and policy issues of water and other natural resources that they depend upon for their livelihood.

For instance, during the field work that I participated, I observed that women in the Amude community were carrying out activities such as fetching water from the nearby water source-Lake Koka, cooking for their family, taking care of children, collecting firewood, washing clothes, shopping at the local markets, etc. The unevenly distributed workload between men and women makes the possibility of having a spare time to engage themselves in activity like community based meeting, which is always male dominated, impossible. Therefore, women in that particular community do usually have less or no perceived benefits[63] at all of participation and hence there was not as such a gender balance in two community based meetings that I had the chance to observe during the course of the field work. Besides, women, including poor men, also had the impression that they are less capable of influencing other men and those in power.

Interestingly the (two) women, working at the local health center, I met in that locality were able to express their views very freely and did not have any trouble of even participating in male dominated meetings because they had both the ability and of course the perception of benefiting from participation.

On the contrary, people from industrial groups, who are considered by many of the participants as primary stakeholder[64] and are powerful in influencing those policy makers, were excluding themselves from participating in activities in relation to the water pollution problem of Lake Koka. I even approached some of them a number of times but did not have the chance to listen to their perspectives as well as possible suggestions that they might think in improving the lake. For this the main reason, as shown in a number of reports, was mainly that they were fearing in one or the other way, as has been the case in a number of previous occasions[65] that they appeared to declare their views, that people would blame and perhaps rather held them accountable for the pollution problem of the lake.

Besides to the issue of perceived benefits (due to the work load) and ability to voice one's idea, power relation, as explained in Gender and Water, in communities is also important considerations to be made while planning to have a participatory approach to water management issues of like Lake Koka. Because such as intra-household and intra-family relations where say some women having trouble to speak out in front of their husbands,

[63] http://www.genderandwater.org/page/4117

[64] SLIM PB2

[65] People and Power, *Green Lake* by Al Jazeera Television(Al Jazeera's Documentary) http://english.aljazeera.net/programmes/peopleandpower/2009/02/200922114211921697.html

fathers, community leaders, religious leaders, etc would jeopardize participation. This would be very problematic especially if those in power, who could be both locals and outside from the locals, misuses it by excluding those who have strong opposing viewpoints.

Despite these and other practical challenges of having stakeholder participation in Ethiopia, the Ethiopian MOWE[66] has policies and strategies using which issues of stakeholder participation and gender (empowering women) are addressed at least in principle. Yet again, given this particular context, participation might not carry on different meaning other than the principle itself[67] and therefore the emphasis should rather be in having a real and adequate stakeholders' participation.

Therefore, ensuring stakeholders' (such as EPA, MOWE, Ammude community, group of industries and factories-owners/managers, local health center, regional environmental and health bureaux, EEPCO, EPA, Oromia regional government, Addis Ababa City Administration/municipality, etc.) participation is crucial because their lasting consensus and common agreements are determinants of obtaining the desired outcome, i.e., improving the lake (Koka).

Furthermore, it should be taken care in ensuring that ''all stakeholders are part of the decision where their contributions are incorporated; not merely a consultation to legitimize the decision made. For this, governments at national, regional, zonal and at very local levels (catchment and basin levels) have the responsibility in ensuring that participation is possible. A transparent participation process, on-going dialogue and advocacy mechanism helps in ensuring that all voices are heard, that needs and concerns of the stakeholders are recognized and to the possible extent incorporated.''[68]

[66] Ethiopian Water Resource Managemnet Policy(1999) and Ethiopian Water Sector Strategy(2001)

[67] The UN Stakeholders and Conflict Resolution in IWRM(2005)

[68] The UN Stakeholders and Conflict Resolution in IWRM(2005)

6. Conclusion and Recommendation

6.1 Conclusion

Based on the systemic analysis and understanding of the various issues from the views and perspectives of different stakeholders as well as the institutional contexts, the study revealed that the existing practices of water use and management (of Lake Koka) by different actors are so fragmented and uncoordinated, which resulted from weak institutional (legal and political) arrangements, that bringing coordination and collaboration among the different stakeholders and actors has been challenging.

There has been inadequate (lack of) stakeholder participation in managing and using water for social and economic developments, especially with regard to various development activities that have been vastly carried out in the Awash River basin, which is also induced by different barriers to participation such as issues of gender and power as well as the country's pronounced initiatives on development. This again imposes a serious challenge to every attempt of restoring the lake and thereby benefiting all users, especially the poor community whose livelihood is too dependent on the Lake, through improved transparency, fostered stakeholder participation, and effective local management.

Besides, lack in environmental awareness, which by itself resulted from absence of environmental information (system) and/or the available information is so scanty and unusable, which is very decisive for the continuous monitoring, evaluation and control of the environment, was also another serious challenge uncovered by this study.

Generally, the prevailing poor water resource governance, reflected on the institutional arrangements, made implementing IWRM in Ethiopia (Lake Koka) without holistically embracing the social, economic, political, and environmental dimensions proves to be profoundly impractical in the context of addressing the current dilemmas.

Therefore, the study concludes, despite its limitations, that a more sustained intervention that moves the initiated change further is sought by capitalizing on the already identified integrated aspects of the Lake Koka, which include coordination, participation and environmental awareness, that are considered both desirable and feasible to restoring the lake for the subsequent betterment of the livelihoods in the local community and its ecosystem. Otherwise, if the trend continues it is expected that the Lake will be in a condition to reach at its worst level that it can no longer support the different uses.

Lastly, applying SSM by me, the researcher, with the idea of initiating change while trying to generate and develop new knowledge being insider (unlike the outsider expert approach) on one hand and having had people's purposeful engagement with a legitimate hope that their action, through learning from dialogue and exchanging of world views, would lead to an improvement of the same situation on the other hand found out to be a promising route to dealing with such a tangled situation and hence I believe that it indeed offered in some way another possibility to a way forward.

6.2 Recommendation

In addition to the already prioritized purposeful activities, for which detailed action plans were prepared (Appendix VII), the following general recommendations too will reinforce them and have a parallel application to the restoration of Lake Koka as well as successful implementation of IWRM. These are:

- Undertaking legal as well as institutional reforms in such a way that entitlement and responsibilities of local people and various institutions are precisely defined and clarified; the role of the national and regional states in relation to other stakeholders (such as local people, group of industries, etc.) is clear in using and managing the Lake; providing and facilitating an enabling legislative and policy environment (such as the legal status of EPA as well as other water user groups/committees) so that they are discharging their duties and responsibilities accordingly;
- Empowering the local people (making them part of the problem identification as well as solution for improvements), with a particular focus on women and the poor whose survival has been greatly affected by the existing condition of the Lake;
- MOWE has to effectively co-ordinate the management of Lake Koka across various users and for this the government's commitment through a concerted action of such as reconsideration of all development initiatives and strategies that are risking the quality and quantity of water in Lake Koka in particular and the country in general;
- Establishing mechanism of gathering, processing and disseminating data/information (including information on water pollution).
- Preventing pollution rather than trying to treat symptoms of pollution such as through the application of water pollution control focusing on wastewater minimization, in-plant refinement of raw materials and production processes, recycling of waste products, etc.

- Applying polluter-pays principle
- Applying realistic standards and regulations by formulating realistic standards (achievable), and enforceable regulations that are tailored to both economic and administrative capacity and capability.
- Applying water pollution control at the lowest appropriate level, i.e. the levels at which significant pollution impacts are experienced as in the Case of Lake Koka, etc.

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Appendix I. Interview and Discussion Questions

Some questions that were used for discussion and identification of the main issues/concerns such as needs, wants, visions, etc.

- How the situation has been changing over time?
- What are the different uses of the lake, including social and cultural issues?
- Why it has been difficult for anything to be done in improving the situation?
- What are the sustained as well as expected consequences to the local people, etc?
- How could the possible causes of pollution be managed?
- How do the existing use and lake management practices look like?
- How the institutional views (stands), regarding the issue, are affecting the problem?
- How the situation could be improved, according to the views of the various stakeholders?

Appendix II. Bio-Physical Aspects

Photos showing the existing condition and various uses of Lake Koka.

(Source: They all were taken by me during my participatory observation, March-April 2011)

Photo 1: a photo showing agricultural activities in the catchment area (buffer zone) of the Lake Koka

Photo 2: a photo showing agricultural activities in the catchment area (buffer zone) of the Lake Koka

Photo 3: The local people washing their clothes, watering their animals and fetching water from Lake Koka

Photo 4: A 15 year old boy that I met him while fishing, recreating in the lake and ploughing nearby the lake.

Photo 5: a girl fetching water and animals watering

Photo 6: part of the Lake, upstream, where the power plant is located. The machine inside, owned by MOWE, was meant for dredging purpose.

Photo 7: Changes in land cover/vegetation of Lake Koka due to ongoing agricultural activities in the surrounding.

Photo 8: Changes in land cover/vegetation around Lake Koka.

Photo 9: Recreational use of Lake Koka.

Photo 10: Local people (of Amude) who were transporting piped water from the nearby town, Dera, paying both for transportation and the water itself in order to get clean water for their domestic consumption.

Appendix III. Statistics about Water Pollution

Statistical data about water (rivers and streams) pollution in the up streams and rivers of Lake Koka, Ethiopia

Table 1: Major pollutants generated from industries around 'Little and Great Akaki rivers', which later drain into Awash River, source of Lake Koka.

Industrial Sector	Major Pollutants
Food and Beverages	• Food preservatives. • Cleaning chemicals, e.g. (NaOH, detergents). •Air pollution from dust and fuel combustion
Textile, clothing, tanning and leather goods	• Waste water from scouring, mercerizing, bleaching and dying (e.g. NaOH, peroxides, aluminum compounds and dyestuffs) • Wastewater from tannery, chrome, sulphides, ammonium salts. Chlorides etc. • Solid wastes from de haring, fleshing and trimming of hides and skins
Wood & wood products	• Sawdust/wood preservatives, paints, varnishes
Paper, paper products & printing	• Printing chemicals, lead in granule form • Trimmed papers and inorganic chemical wastes
Chemical, rubber & plastic products	• Solid wastes of scorched rubber, scraps of rubber and PVC, plastics, dust • Organic and inorganic chemical wastes
Non-metallic mineral products	• Dust and particulates, air pollution from fuel combustion
Basic iron & steel	• Scrap metal, air pollution from combustion
Machinery & Equipment	• Inorganic waste water, scrap metals

Source: Akaki(Little and Great) rivers assessment report by EPA, 2005.

Table 2: Waste disposal of selected industries in Addis Ababa

Name of Industry	**Wastewater disposed into**
Awash Tannery	Little Akaki river
Ethio-pickling and Tanning	"
Teramage Edible Oil	"
Awash Wineries	"
National Alcohol and Liquor	"
Addis Ababa Abattoir	"
East Africa Bottling Ltd.	"
Ethiopia Marble	"
National Tobacco Enterprise	"
Ethiopian Meat Concentrate	"
Ediget Yarn and Sewing Thread	Tributary of Little Akaki river
St. Gorge Brewery	"
Addis Ababa Bottle and Glass	"
Equatorial Paint	Open drainage
Nefas Silk Paint	"
Gulele Soap	"
Chora Oxygen and Acetylene	Drainage
Alkyd Resin	Open drainage
Addis Tyre	Drainage
Dil Edible Oil	Drainage
Adie Ababa Yarn	Open drainage
MOH Soft Drinks	Drainage
East Africa Soap and Detergents	Drainage
Kadisco Chemical	Drainage
Ethiopian Pharmaceuticals	Drainage

Source: EPA, 2005

Table 3: Number of industries with treatment plants

Industry sub-sector	No.of industries Reached	Replied	No. of industries with pollution of Air	Land	Water	With treatment plant
Tanneries	9	6	0	5	5	
Chemical	10	7	2	5	7	
Textile	9	7	2	4	7	1
Metal	8	7	2	4	7	1
Non-metal	2	2	1			
Beverage	7	4	1	1	4	
Food	5	4	1	2	3	
Abattoir	1	1	1	1	1	
Total	53	39	10	32	23	2

Source: EPA, 2005

Picture: the picture above shows liquid waste discharges into the river through drainage line.

Source: EPA, 2005

Appendix IV. SH Matrix and Venn diagram, Rich Picture, Mind Map, and Timeline

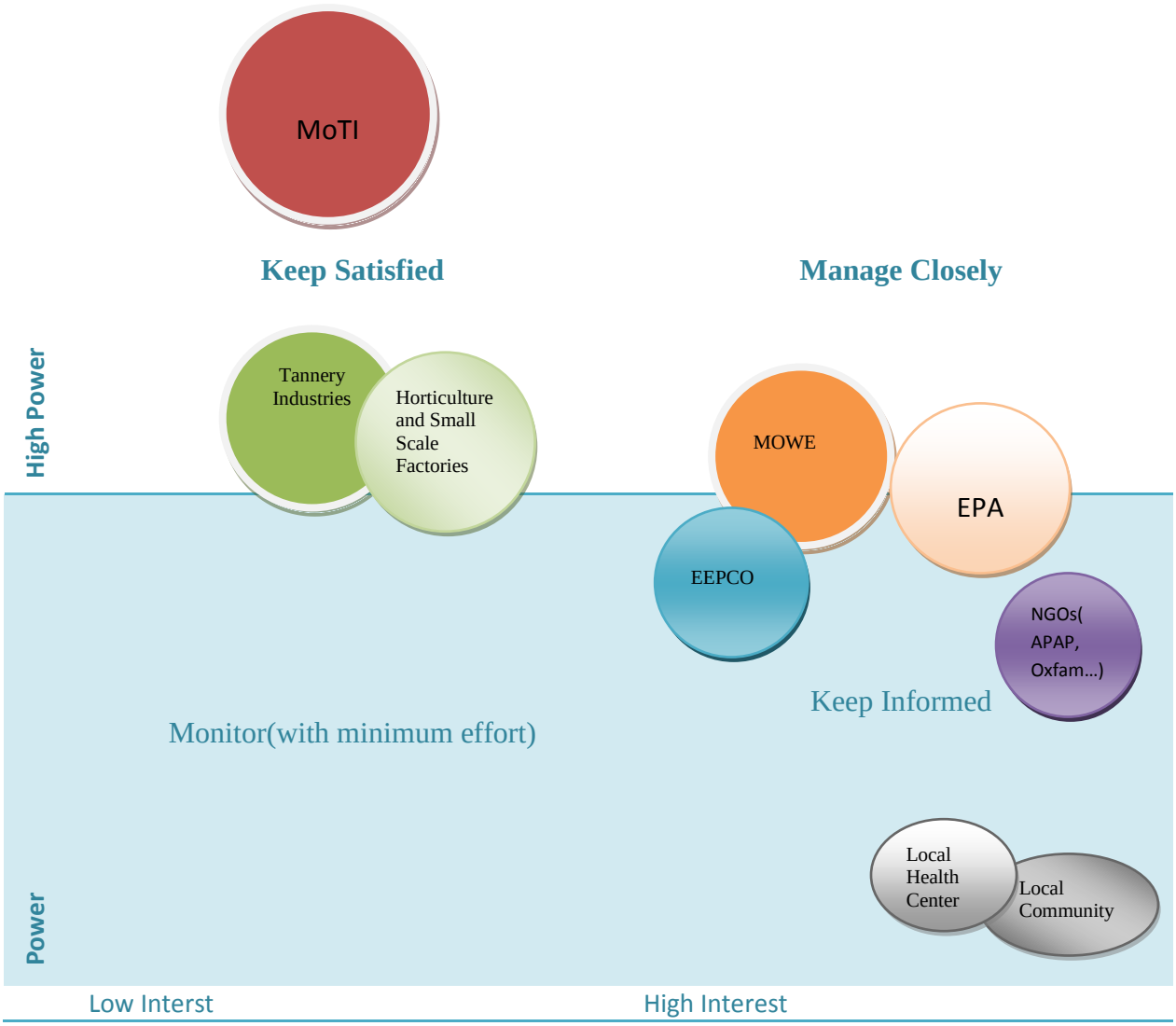
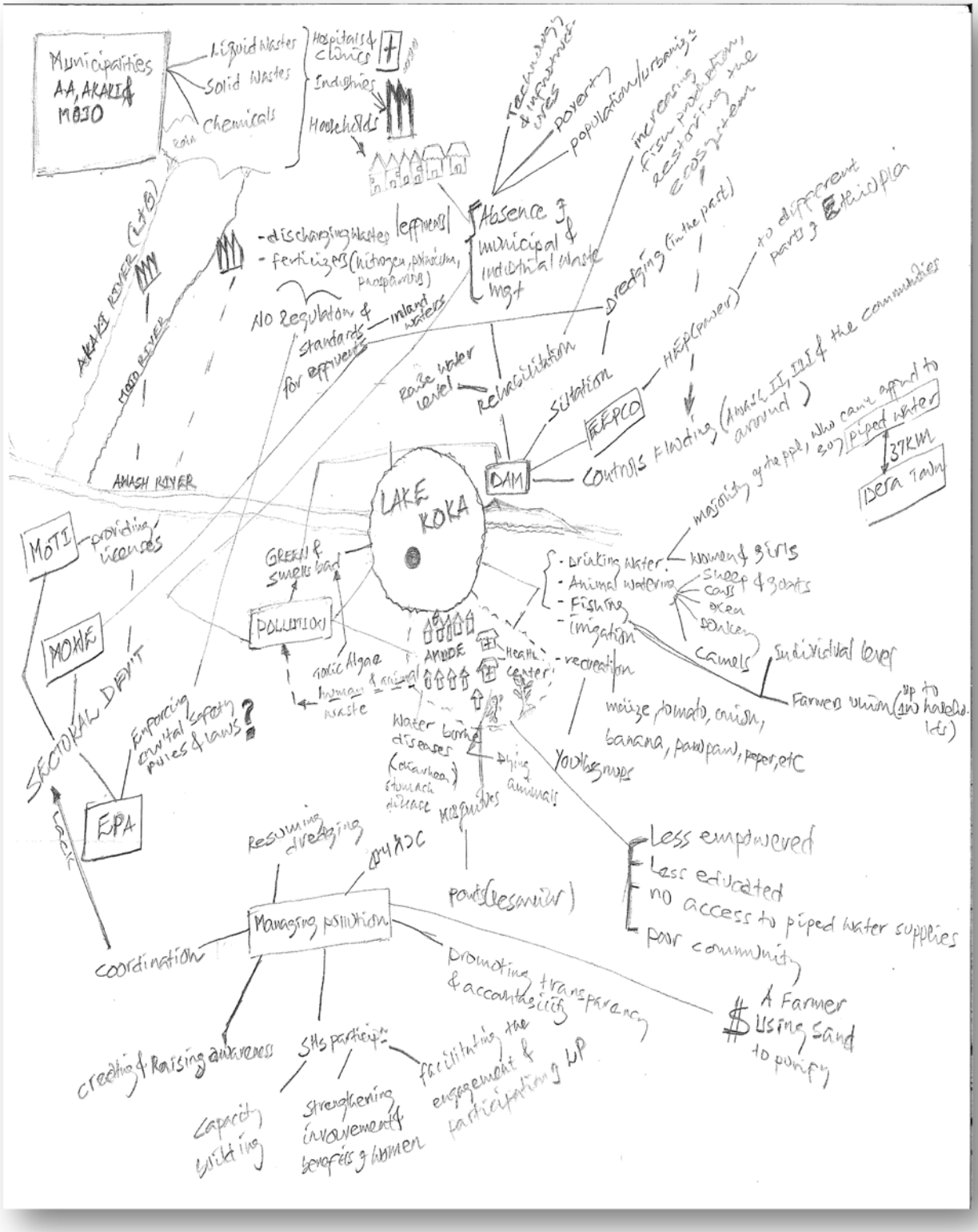


Figure: Power/Interest grid(Stakeholder Matrix) of *various stakeholders for Lake Koka* *(Source: Adopted from Mind Tools, Stakeholder Analysis, http://www.mindtools.com/pages/article/newPPM_07.htm)*

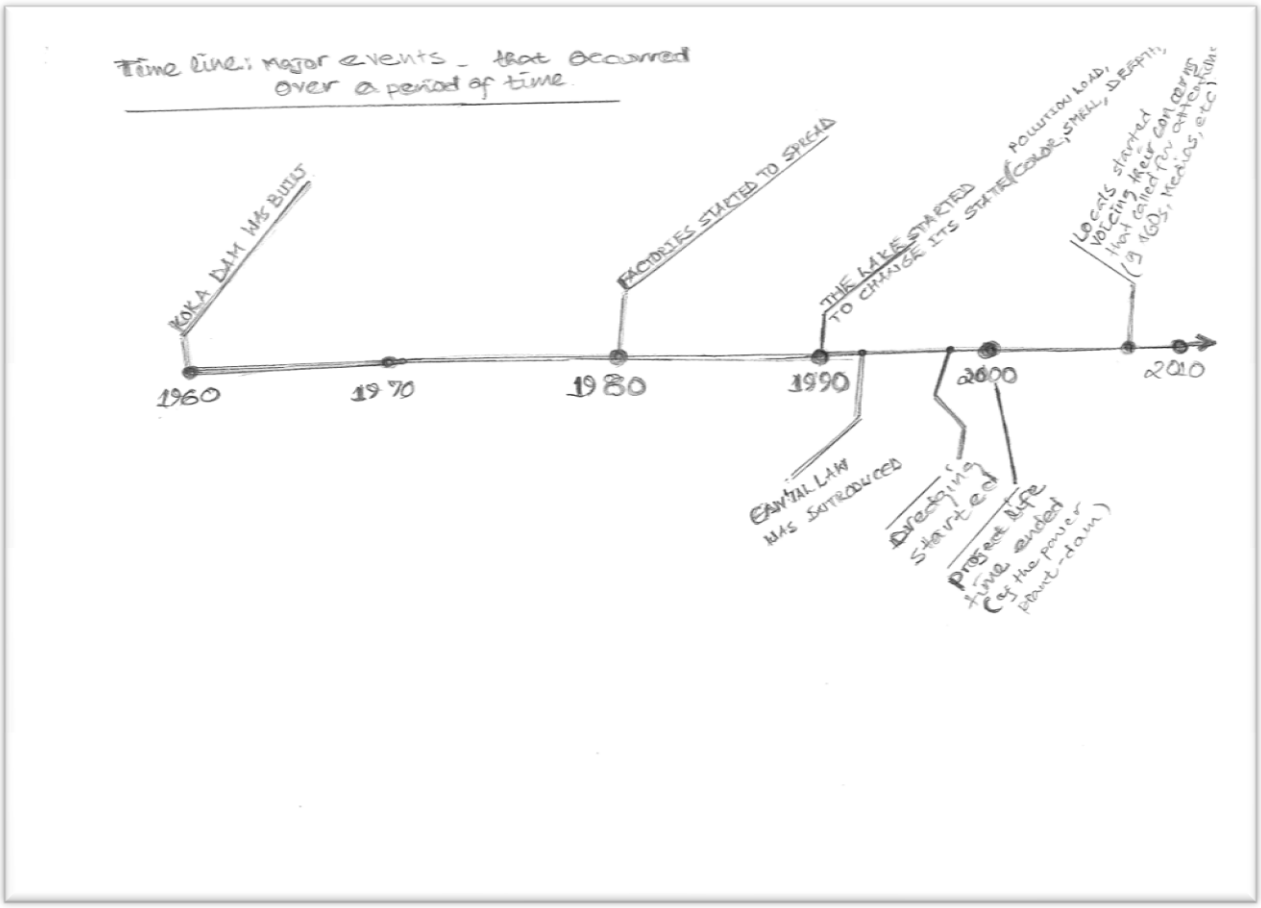
- High power, interested SHs: MOWE and EPA fall in this category and they should fully engage for which again greatest efforts shall be made to their satisfaction.
- High power, less interested SHs: here is again where enough work has to be done to keep these stakeholders satisfied. It includes MoTI, Tannery Industries and horticulture and small scale factories
- Low power, interested SH: they shall be kept adequately informed, and talking to them to ensure that all issues are considered/raised. These are mainly EEPCO, Local Health Center (officers), local people, NGOs.
- Low power, less interested SH: not shown in here for the sake of simplicity in narrowing the scope and dimension of SHs but there still might be group of people in this category too.

Rich Picture

It shows the complexity of the situation with its richness



Time line


Time line: major events that occurred over a period of time
KOKA DAM WAS BUILT
FACTORIES STARTED TO SPREAD
THE LAKE STARTED TO CHANGE ITS STATE (COLOR, SMELL, DEPTH, POLLUTION LOAD)
Locals started voicing their concerns that called for intervention (eg HDS, Meetings, etc)
1960
1970
1980
1990
2000
2010
CAPITAL LAW WAS INTRODUCED
Dredging started
Project life time ended (eg the power plant shut-down)

Mind map

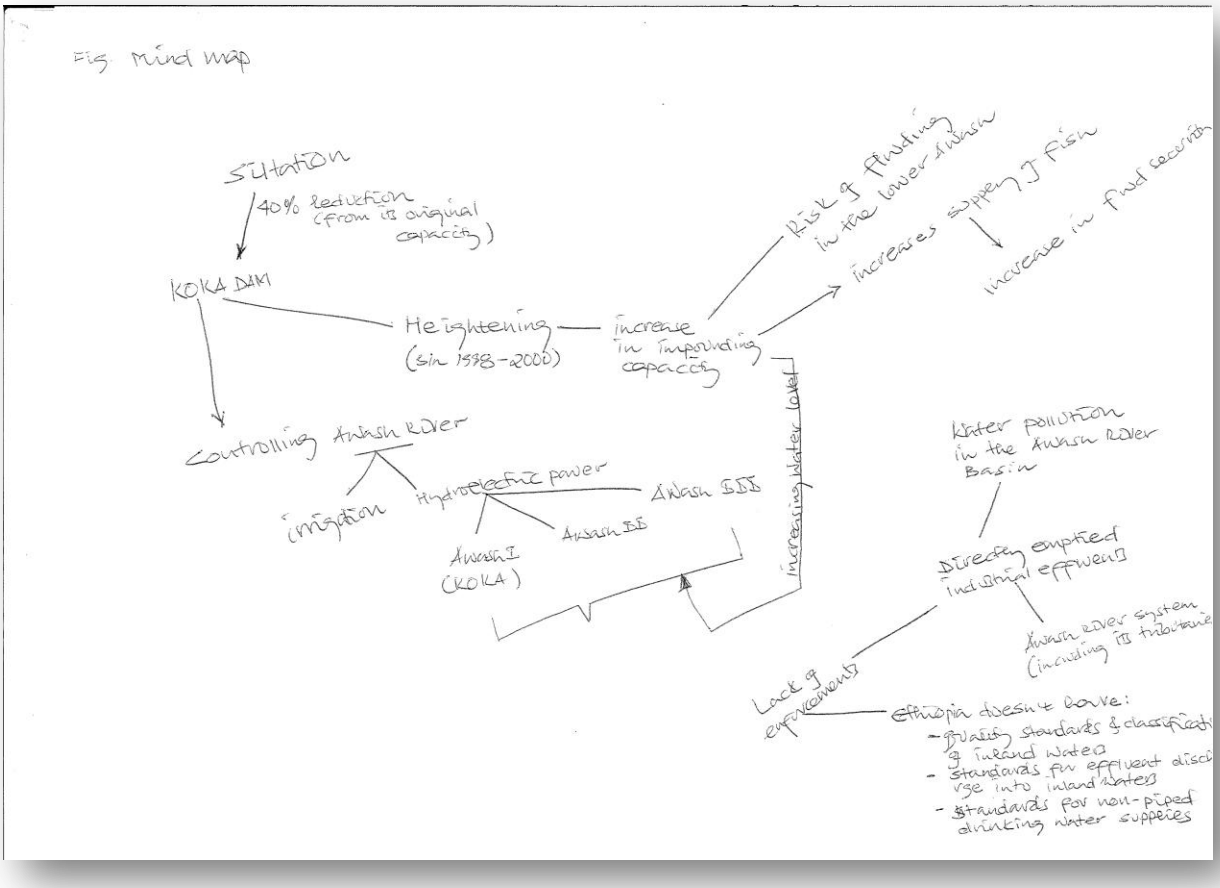
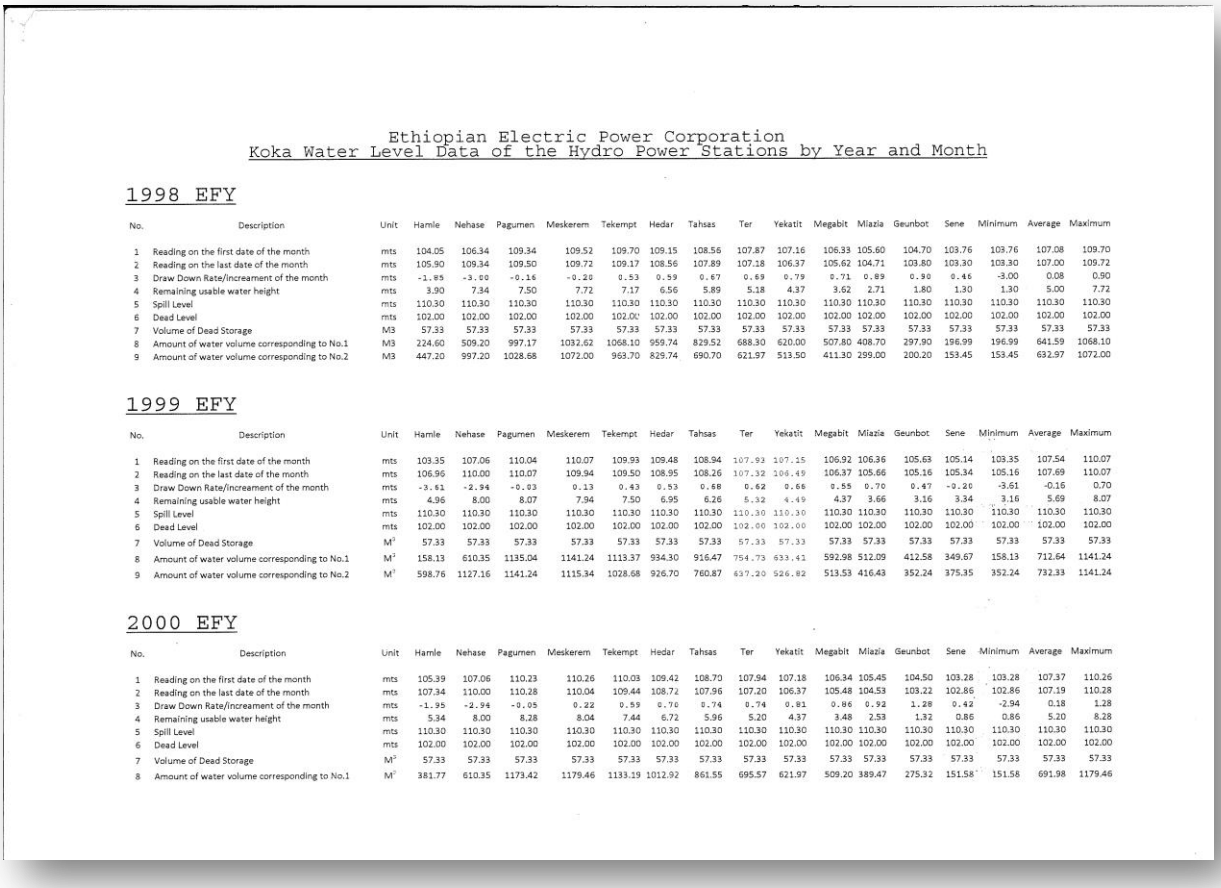


Fig Mind map
Situation
40% reduction (from its original capacity)
KOKA DAM
Heightening (in 1998-2000)
increase in impounding capacity
Risk of flooding in the lower Awash
increases stopping of fish
increase in food security
controlling Awash River
irigation
Hydroelectric power
Awash III
Awash I (KOKA)
Awash II
increasing water level
water pollution in the Awash River Basin
Directly emptied industrial effluents
Awash river system (including its tributarie
Lack of enforcement
Ethiopia doesn't have:
- quality standards & classificati of inland water
- standards for effluent disch rge into inland waters
- standards for non-piped drinking water supplies

Appendix V. Historical Data about the Lake Koka

(Source: EEPCO, March 2011)

Water Level Data (1998 to 2003EFY)



Ethiopian Electric Power Corporation
Koka Water Level Data of the Hydro Power Stations by Year and Month

1998 EFY

No.	Description	Unit	Hamle	Nehase	Pagumen	Meskerem	Tekempt	Hedar	Tahsas	Ter	Yekatit	Megabit	Miazia	Geunbot	Sene	Minimum	Average	Maximum
1	Reading on the first date of the month	mts	104.05	106.34	109.34	109.52	109.70	109.15	108.56	107.87	107.16	106.33	105.60	104.70	103.76	103.76	107.08	109.70
2	Reading on the last date of the month	mts	105.90	109.34	109.50	109.72	109.17	108.56	107.89	107.18	106.37	105.62	104.71	103.80	103.30	103.30	107.00	109.72
3	Draw Down Rate/increament of the month	mts	-1.85	-3.00	-0.16	-0.20	0.53	0.59	0.67	0.69	0.79	0.71	0.89	0.90	0.46	-3.00	0.08	0.90
4	Remaining usable water height	mts	3.90	7.34	7.50	7.72	7.17	6.56	5.89	5.18	4.37	3.62	2.71	1.80	1.30	1.30	5.00	7.72
5	Spill Level	mts	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30
6	Dead Level	mts	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00
7	Volume of Dead Storage	M3	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33
8	Amount of water volume corresponding to No.1	M3	224.60	509.20	997.17	1032.62	1068.10	959.74	829.52	688.30	620.00	507.80	408.70	297.90	196.99	196.99	641.59	1068.10
9	Amount of water volume corresponding to No.2	M3	447.20	997.20	1028.68	1072.00	963.70	829.74	690.70	621.97	513.50	411.30	299.00	200.20	153.45	153.45	632.97	1072.00

1999 EFY

No.	Description	Unit	Hamle	Nehase	Pagumen	Meskerem	Tekempt	Hedar	Tahsas	Ter	Yekatit	Megabit	Miazia	Geunbot	Sene	Minimum	Average	Maximum
1	Reading on the first date of the month	mts	103.35	107.06	110.04	110.07	109.93	109.48	108.94	107.93	107.15	106.92	106.36	105.63	105.14	103.35	107.54	110.07
2	Reading on the last date of the month	mts	106.96	110.00	110.07	109.94	109.50	108.95	108.26	107.32	106.49	106.37	105.66	105.16	105.34	105.16	107.69	110.07
3	Draw Down Rate/increament of the month	mts	-3.61	-2.94	-0.03	0.13	0.43	0.53	0.68	0.62	0.66	0.55	0.70	0.47	-0.20	-3.61	-0.16	0.70
4	Remaining usable water height	mts	4.96	8.00	8.07	7.94	7.50	6.95	6.26	5.32	4.49	4.37	3.66	3.16	3.34	3.16	5.69	8.07
5	Spill Level	mts	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30
6	Dead Level	mts	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00
7	Volume of Dead Storage	M^3	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33
8	Amount of water volume corresponding to No.1	M^3	158.13	610.35	1135.04	1141.24	1113.37	934.30	916.47	754.73	633.41	592.98	512.09	412.58	349.67	158.13	712.64	1141.24
9	Amount of water volume corresponding to No.2	M^3	598.76	1127.16	1141.24	1115.34	1028.68	926.70	760.87	637.20	526.82	513.53	416.43	352.24	375.35	352.24	732.33	1141.24

2000 EFY

No.	Description	Unit	Hamle	Nehase	Pagumen	Meskerem	Tekempt	Hedar	Tahsas	Ter	Yekatit	Megabit	Miazia	Geunbot	Sene	Minimum	Average	Maximum
1	Reading on the first date of the month	mts	105.39	107.06	110.23	110.26	110.03	109.42	108.70	107.94	107.18	106.34	105.45	104.50	103.28	103.28	107.37	110.26
2	Reading on the last date of the month	mts	107.34	110.00	110.28	110.04	109.44	108.72	107.96	107.20	106.37	105.48	104.53	103.22	102.86	102.86	107.19	110.28
3	Draw Down Rate/increament of the month	mts	-1.95	-2.94	-0.05	0.22	0.59	0.70	0.74	0.74	0.81	0.86	0.92	1.28	0.42	-2.94	0.18	1.28
4	Remaining usable water height	mts	5.34	8.00	8.28	8.04	7.44	6.72	5.96	5.20	4.37	3.48	2.53	1.32	0.86	0.86	5.20	8.28
5	Spill Level	mts	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30
6	Dead Level	mts	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00
7	Volume of Dead Storage	M^3	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33
8	Amount of water volume corresponding to No.1	M^3	381.77	610.35	1173.42	1179.46	1133.19	1012.92	861.55	695.57	621.97	509.20	389.47	275.32	151.58	151.58	691.98	1179.46

2001 EFY

No.	Description	Unit	Hamle	Nehase	Pagumen	Meskerem	Tekempt	Hedar	Tahsas	Ter	Yekatit	Megabit	Miazia	Geunbot	Sene	Minimum	Average	Maximum
1	Reading on the first date of the month	mts	103.02	107.06	110.14	110.33	109.85	109.53	108.91	108.10	107.29	106.38	105.54	104.37	103.03	103.02	107.20	110.33
2	Reading on the last date of the month	mts	106.32	110.00	110.33	109.87	109.55	108.94	108.13	107.32	106.41	105.56	104.43	103.07	102.45	102.45	107.11	110.33
3	Draw Down Rate/increament of the month	mts	-3.30	-2.94	-0.19	0.46	0.30	0.59	0.78	0.78	0.88	0.82	1.11	1.30	0.58	-3.30	0.09	1.30
4	Remaining usable water height	mts	4.32	8.00	8.33	7.87	7.55	6.94	6.13	5.32	4.41	3.56	2.43	1.07	0.45	0.45	5.11	8.33
5	Spill Level	mts	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30
6	Dead Level	mts	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00
7	Volume of Dead Storage	M^3	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33
8	Amount of water volume corresponding to No.1	M^3	127.25	610.35	1155.32	1193.54	1097.62	1034.59	909.61	724.26	632.62	514.97	401.03	260.66	128.19	127.25	676.15	1193.54
9	Amount of water volume corresponding to No.2	M^3	506.31	1127.16	1193.54	1101.56	1038.53	916.47	731.13	635.53	519.31	403.59	267.43	131.93	87.95	87.95	666.19	1193.54

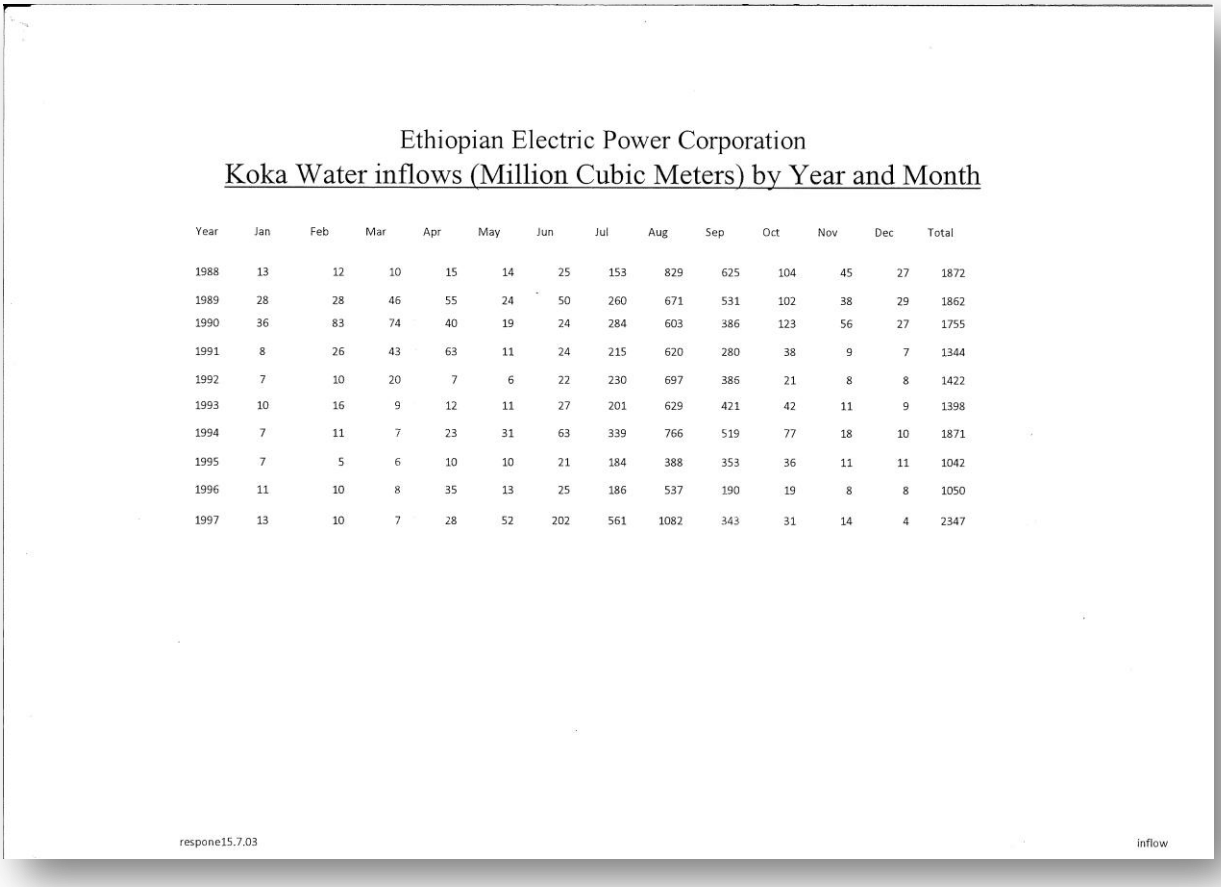
2002 EFY

No.	Description	Unit	Hamle	Nehase	Pagumen	Meskerem	Tekempt	Hedar	Tahsas	Ter	Yekatit	Megabit	Miazia	Geunbot	Sene	Minimum	Average	Maximum
1	Reading on the first date of the month	mts	102.45	104.34	108.17	108.70	108.67	108.20	107.49	106.80	106.11	105.78	105.26	104.89	104.89	102	106	109
2	Reading on the last date of the month	mts	104.24	108.03	108.60	108.65	108.22	107.52	106.83	106.12	105.79	105.28	104.90	104.29	104.29	104	106	109
3	Draw Down Rate/increament of the month	mts	-1.79	-3.69	-0.43	0.05	0.45	0.68	0.66	0.68	0.32	0.50	0.36	0.60	0.60	-4	0	1
4	Remaining usable water height	mts	2.24	6.03	6.60	6.65	6.22	5.52	4.83	4.12	3.79	3.28	2.90	2.29	2.29	2	4	7
5	Spill Level	mts	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110	110	110
6	Dead Level	mts	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102	102	102
7	Volume of Dead Storage	M^3	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57	57	57
8	Amount of water volume corresponding to No.1	M^3	87.95	257.28	740.28	861.55	854.69	747.14	651.99	575.65	475.97	431.84	365.08	319.30	319.30	88	514	862
9	Amount of water volume corresponding to No.2	M^3	246.00	708.24	838.67	850.11	751.72	654.90	579.98	477.42	433.12	367.65	320.42	251.64	251.64	246	518	850

2003 EFY

No.	Description	Unit	Hamle	Nehase	Pagumen	Meskerem	Tekempt	Hedar	Tahsas	Ter
1	Reading on the first date of the month	mts	104.38	107.32	109.63	109.82	110.02	109.40	108.66	107.88
2	Reading on the last date of the month	mts	107.30	109.54	109.80	110.03	109.42	108.69	107.90	107.20
3	Draw Down Rate/increament of the month	mts	2.92	2.22	0.17	0.21	-0.60	-0.71	-0.76	-0.68
4	Remaining usable water height	mts	5.30	7.54	7.80	8.03	7.42	6.69	5.90	5.20
5	Spill Level	mts	110.30	110.30	110.30	110.30	110.30	110.30	110.30	110.30
6	Dead Level	mts	102.00	102.00	102.00	102.00	102.00	102.00	102.00	102.00
7	Volume of Dead Storage	M^3	57.33	57.33	57.33	57.33	57.33	57.33	57.33	57.33
8	Amount of water volume corresponding to No.1	M^3	261.79	635.53	1054.28	1091.71	1131.18	1008.98	852.40	689.76
9	Amount of water volume corresponding to No.2	M^3	633.59	1036.56	1087.77	1133.19	1012.92	859.27	691.70	623.91

Water Inflow in to the Lake Koka (1988-1997EFY)



Ethiopian Electric Power Corporation

Koka Water inflows (Million Cubic Meters) by Year and Month

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1988	13	12	10	15	14	25	153	829	625	104	45	27	1872
1989	28	28	46	55	24	50	260	671	531	102	38	29	1862
1990	36	83	74	40	19	24	284	603	386	123	56	27	1755
1991	8	26	43	63	11	24	215	620	280	38	9	7	1344
1992	7	10	20	7	6	22	230	697	386	21	8	8	1422
1993	10	16	9	12	11	27	201	629	421	42	11	9	1398
1994	7	11	7	23	31	63	339	766	519	77	18	10	1871
1995	7	5	6	10	10	21	184	388	353	36	11	11	1042
1996	11	10	8	35	13	25	186	537	190	19	8	8	1050
1997	13	10	7	28	52	202	561	1082	343	31	14	4	2347

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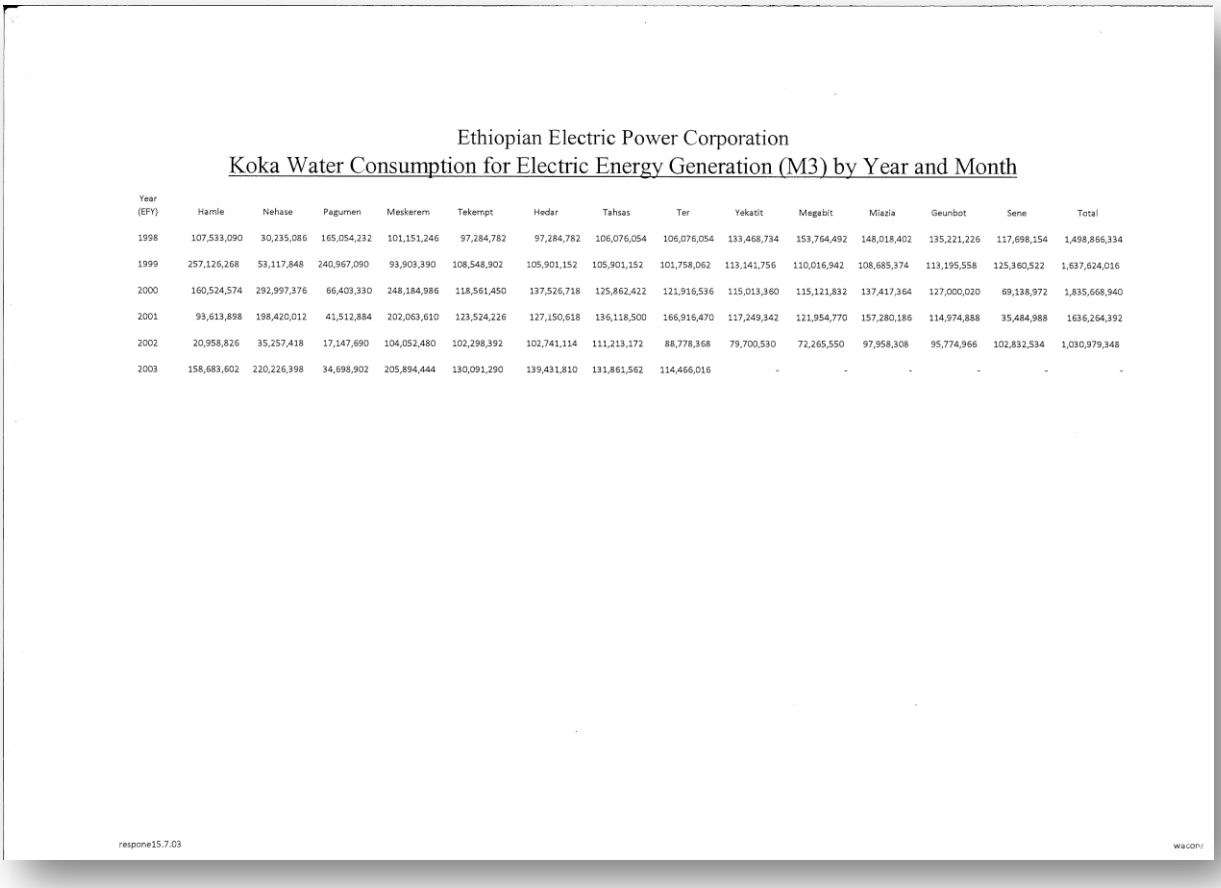
Water Consumption for Hydroelectric Power Generation (Year 1998 to 2003EFY)



Ethiopian Electric Power Corporation

Koka Water Consumption for Electric Energy Generation (M3) by Year and Month

Year (EFY)	Hamle	Nehase	Pagumen	Meskerem	Tekempt	Hedar	Tahsas	Ter	Yekatit	Megabit	Miazia	Geunbot	Sene	Total
1998	107,533,090	30,235,086	165,054,232	101,151,246	97,284,782	97,284,782	106,076,054	106,076,054	133,468,734	153,764,492	148,018,402	135,221,226	117,698,154	1,498,866,334
1999	257,126,268	53,117,848	240,967,090	93,903,390	108,548,902	105,901,152	105,901,152	101,758,062	113,141,756	110,016,942	108,685,374	113,195,558	125,360,522	1,637,624,016
2000	160,524,574	292,997,376	66,403,330	248,184,986	118,561,450	137,526,718	125,862,422	121,916,536	115,013,360	115,121,832	137,417,364	127,000,020	69,138,972	1,835,668,940
2001	93,613,898	198,420,012	41,512,884	202,063,610	123,524,226	127,150,618	136,118,500	166,916,470	117,249,342	121,954,770	157,280,186	114,974,888	35,484,988	1636,264,392
2002	20,958,826	35,257,418	17,147,690	104,052,480	102,298,392	102,741,114	111,213,172	88,778,368	79,700,530	72,265,550	97,958,308	95,774,966	102,832,534	1,030,979,348
2003	158,683,602	220,226,398	34,698,902	205,894,444	130,091,290	139,431,810	131,861,562	114,466,016	-	-	-	-	-	-

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Appendix VI. Comparison Tables

a) **The table below illustrates the comparison stage of SSM, i.e., how the conceptual model of creating awareness is compared with the real world situation**.

Table 1: a table showing comparison of the conceptual model for 'creating awareness' with the reality

Activity		Present in reality	Way activity is done	Measure of success of activity	Desirability	Feasibility	Include in further debate
1.	**Establishing EIS**						
	Gathering, processing, updating and storing environmental data	No	Collaborating with different entities and carrying out field research(basin-wide)	Presence of adequately and easily accessible environmental data(quality and quantity)	Very Desirable	Feasible	Yes
	Researching	No	Collaborating with formal educational institution as well as other institutions	How well is the research outcome contributing to EIS (quality and quantity)	Very Desirable	Feasible	Yes
2.	**Producing environmental education & awareness materials**	Nearly none	Engaging all working in the areas of environment, converting all the data/information gathered in activity 1 in to meaningful and communicable way to the public, using trained community based health extension workers	Quality and quantity- the quality of the to be spoken material itself as well as how far will it reach to the public	Very Desirable	Feasible	Yes
3.	**Creating and supporting environmental awareness**						
	Formation of environmental awareness bodies/committees in urban and rural communities, industrial groups, small scale and large scale factories, etc.	No	Collaborating with regional and zonal environmental bureaus	The numbers of established community based bodies(quantity) and their efficiency to serving as a bridge in effectively transfer knowledge	Very Desirable	Feasible	Yes
	Promoting environmental awareness at all level	No	With the help of different medias(national and regional TVs, radios, newspapers, meetings and public events)	How effective is the environmental awareness promotion…	Very Desirable	Feasible	Yes
	Providing training for trainers, mass education, experience sharing of different communities, school and community activities, workshops seminars, using different events(Int'nal water day, environmental day and other celebrities)	No	As stated in the activities	Setting targets (Quantity/amount)	Very Desirable	Feasible	Yes
4.	**Coordinating**						

	Partnering/networking	No	Collaborating with Water Aid Ethiopia, APAP, Oxfam, Private companies and businesses, and other SHs	Based on how well is the network functioning/serving the purpose	Very Desirable	Feasible	Yes
	Setting up platform for environmental forums and discussions	No	Inviting other SHs, providing and arranging facilities, planning, organizing and directing events	Its sustainability/continuity as well as how diverse the participants are going to be	Very Desirable	Feasible	Yes
5	**Providing institutional support to implementers**						
	Capacity building at community and regional levels	No	Financial, technical, organizational, material, and other capacity related supports	How effective and capable are the implementing agents	Very Desirable	Feasible	Yes
6.	**Establishing feedback mechanism**						
	Environmetnal/publicic survey	No	research	Representativeness and accuracy of the findings	Very Desirable	Feasible	Yes
	Researching based on biophysical and social indicators	No	research	Representativeness and accuracy of the findings	Very Desirable	Feasible	Yes

b) **Comparison of Conceptual Model of 'Coordination' with the Reality**

In the table below, the conceptual model of coordination is compared with the reality.

Table 2: a table showing comparison of the conceptual model for 'coordination' with the reality

Activity		**Present in reality**	**Way activity is done**	**Measure of success of activity**	**Desirability**	**Feasibility**	**Include in further debate**
1.	**Establishing EIS**						
	Gathering, processing, updating and storing environmental data, data exchanges	No	Collaborating with different entities and undertaking various field basin-wide researches	Presence of adequately and easily accessible environmental data (quality and quantity)	Very Desirable	Feasible	Yes
	Researching	No	Collaborating with formal educational institution as well as other institutions(such as International Water Management Institute-IWMI, based in East Africa, Addis Ababa, Ethiopia, Ethiopian Institute of Agricultural Research-EIAR, Ministry of Agriculture and Rural Development)	How well is the research contributing to EIS establishment (quality and quantity)	Very Desirable	Feasible	Yes
2.	**Assessing and Reviewing**						
	Institutional structures, arrangements,	None	Identifying the different institutions that have had	Its effectiveness	Very	Feasible	Yes

	and practices		impacts on, and then assessing and reviewing their practices, organizational structures, etc.		Desirable		
	Development initiatives, policies and strategies	None	Working with MoTI	How effective it is	Very Desirable	Feasible	Yes
3	**Monitoring**						
	Performance report	No	reports of performances of various actors	How effective it is	Very Desirable	Feasible	Yes
	Benchmarking	No	Setting bench marks/best practices	How effective it is	Very Desirable	Feasible	Yes
	Biophysical and Social indicators	No	Considering the biophysical as well social aspects while monitoring…	How effective it is	Very Desirable	Feasible	Yes
4	**Evaluating**						
	Periodic and independent reviews	No	Carrying out independent reviews on a periodic basis	How effective it is	Very Desirable	Feasible	Yes
5	**Co-ordinating**						
	Networking/partnering	No	Partnering with private and non-governmental organizations	How effective it is	Very Desirable	Feasible	Yes
	Intersectoral integration/integrated planning and coordination of water uses	No	Applying basin-wide water management approach	How effective it is	Very Desirable	Feasible	Yes
	Ongoing seminars, forums, workshops, meetings & trainings	No	In different levels(from top to the community level)	How effective it is	Very Desirable	Feasible	Yes
6	**Controlling**						
	Checking for compliances	No	Undertaking(a lab-based) assessment regarding the level of threat posed by various actors	Effectiveness	Very Desirable	Feasible	Yes
	Regulating waste disposals	No	Through enforcements	Effectiveness	Very Desirable	Feasible	Yes
	Corrective measures	No	Applying the 'polluter-pays' principle(fines), etc.	Effectiveness	Very Desirable	Feasible	Yes

c) **Comparison of Conceptual Model of 'Stakeholder Participation' with the Reality**

The last table of comparison demonstrated here under is between the conceptual model of stakeholder participation and the existing reality.

Table 3: a table showing comparison of the conceptual model for 'stakeholder participation' with the reality

Activity		Present in reality	Way activity is done	Measure of success of activity	Desirability	Feasibility	Include in fur. debate
1.	**Recognizing SHs**						
	Identification of stakes/conflicts	No	Inviting all potential stakeholders with regard to Lake Koka	How effective the process is in bringing as many stakeholders as possible	Very Desirable	Feasible	Yes
	Undertaking stakeholder analysis	No	Based on a joint and collaborative process of all stakeholders in identifying the primary, secondary and key SHs and their relative importance terms of influencing the problem situation of Lake Koka and their relationships…	How effective the process is in including primary, secondary and key stakeholders	Very Desirable	Feasible	Yes
2.	**Enhancing further awareness & knowledge**						
	Supplying information on ecosystem, water quantity and quality, about IWRM	None	Identifying the existing information/awareness gap, and filling the gap with the needed info./awareness	How effective the process is	Very Desirable	Feasible	Yes
3	**Stimulating SHs' involvement/engagement in decision making**						
	Forming water committee/working groups	No	From different groups of SHs(including the affected community)	How effective the process is(representative off all groups of SHs)	Very Desirable	Feasible	Yes
	Employing trained facilitator	No	Assigning a facilitator for different working groups/water committees	Effectiveness	Very Desirable	Feasible	Yes
	Increasing transparency& accountability	No	Letting SHs to have a say on and become part of the decision making process…	How effective the process in making others a part	Very Desirable	Feasible	Yes
	Inviting for discussion on Pol/prc.	No	Opening up the existing policies and practices, which are contributing to the existing problem, to the groups of stakeholders	Effectiveness	Very Desirable	Feasible	Yes
4	**Establishing a process of change**						
	Finding common ground/shared vision	No	Through identification of long term resource(lake Koka) uses	Effectiveness	Very Desirable	Feasible	Yes
	Re-indentifying conflicting needs of using the shared natural resource	No	Through identification of current/short term resource uses by all SHs	Effectiveness	Very Desirable	Feasible	Yes
5	**Operational plan**						
	Developing a common objective	No	On the basis of exploring existing resource uses and practices	Effectiveness	Very Desirable	Feasible	Yes
	Agreeing up on management objectives and local actions (short term & interim objectives)	No	Through the all inclusive process of reaching consensus	Effectiveness	Very Desirable	Feasible	Yes
6	**Contributing to the water management strategy**	No	Through ongoing process of social learning	Effectiveness	Very Desirable	Feasible	Yes

Appendix VII. Action Plans

a) Action plan for 'creating awareness'

The detailed action plan of creating awareness, coordination and stakeholders' participation for the purpose of improving the existing situation (problem) Lake Koka too is shown as follows.

Table 1: Action plan for 'creating awareness'

No.	Action/Activity	Who	How	When	With whose collaboration	Resources
1	Establishing EIS	MOWE, EPA	Researching,, data gathering, processing, storing…	Medium Term(MT)	EEPCO, MoH, Regional Environmental Protection Bureau, MoInf, Universities, IWMI, EIAR, Ministry of Agriculture and Rural Development(MoARD)	Human(experts), financial, technological, information and material
2	Producing environmental education & awareness materials	MOWE, EPA, Regional Environmental Offices, MoH(including local health centers)	Converting the data/information in a way that people can better understand/learn from (use of diagram, drawings, illustrations, local languages, etc.), employing trained health extension workers in rural areas(on hygiene and environmental health)	Short Term(ST)	National and Regional governments, NGOs(Donors)	Finance and human
3	Creating and supporting environmental awareness	EPA	Through mass media, national and regional TVs, radios, newspapers, flyers, brochures, events(conventional celebrating days), etc.	ST and MT	MoInf, Ethiopian Radio and Television Agency (ERTA), Addis Ababa City Environmental Protection Authority, Oromia Regional Environmental Protection Office, Forum for Environment, NGOs (Intermon Oxfam, Water Aid Ethiopia, APAP, Universities), local, formal and informal community based institutions (Churches, etc.)	Skilled labor force, material and logistics, finance
4	Coordinating	EPA	Working across different sectors/intersectoral integration-integrated planning and coordination/	ST and MT	MOWE, EEPCO, Regional Environmental Bureaus/Offices	Human and financial
5	Providing institutional support to implementers	MOWE, EPA, national and Regional Governments	Providing training, financial support, technical assistance, etc.	ST and MT	NGOs(APAP, Water Aid Ethiopia, Intermon Oxfam, Ethiopian) and Management Institute	Skilled labor force(technical and non-technical), organizational capabilities, finance(fund),
6	Establishing Feedback Mechanisim	MOWE, EPA, National and Regional Governments	Working in close cooperation	ST and MT	EEPCO, Regional Environmental Protection Bureaux, MoInf	Materials…

b) Action plan for 'coordination'

Creating coordination among various institutions is as described in the table which is deemed to subsequently improve the Lake Koka.

Table 2: Action plan for 'coordination'

No.	Action/Activity	Who	How	When	With whose collaboration	Resource
1	Establishing EIS	MOWE and EPA	As described in the comparison table	ST and MT	EEPCO, MOH, Regional Environmental Protection Bureau, MoA, MoInf, Universities, IWMI, EIAR, Ministry of Agriculture and Rural Development	Human(experts), financial, technological, information and material
2	Assessing and Reviewing	MOWE and EPA and Independent Body(Committee)		ST and MT	MOWE, MoTI and Regional Environmental Offices	Information
3	Monitoring	EPA		ST and MT	Local and Regional Offices(of Environment), MoTI	Financial and material and information
4	Evaluating	EPA		ST and MT	Local and Regional Offices(of Environment), MoTI	Financial and material and information
5	Coordinating	EPA		ST and MT	Local communities/ committees of of the affected area(Amude), MoTI	
6	Controlling	EPA		ST and MT	Legal Bodies and Local Communities, MOTI	Financial and material and information

c) Action plan for 'participation'

The following table also describes the actions and their plans if implementation in order to increase the level of participation among stakeholders of the lake.

Table 3: Action plan for increased level of 'participation'

No.	Action/Activity	Who	How	When	With whose collaboration	Resource
1	Recognizing SHs	MOWE, EPA, Industrial Groups, Local Communities(in and around Lake Koka), Factory Owners, Amude Health Center	Through exchanging world views, dialogue, seminars and workshops	ST	NGOs(APAP, Oxfam), MoTI	Human, financial and informational
2	Enhancing further awareness & knowledge	EPA	Continued workshops, seminars, formation of committees(water) that has fair representation of the voiceless/disadvantaged locals communities, facilitating the process, increasing transparency and accountability, etc.	ST	Intermon Oxfam, Water Air Ethiopia, local community(Amude), Industry owners/Managers, Factory owners/managers, EEPCO	Trained facilitator, information(data), and finance
3	Stimulating SHs' involvement/engagement in decision making	EPA	Continued workshops, seminars, formation of committees(water) that has fair representation of the voiceless/disadvantaged locals communities, facilitating the process, increasing transparency and accountability, etc	ST	MOWE, EPA, Industrial Groups, Local Communities(in and around Lake Koka), Factory Owners, Industries(Owners/managers), regional environmental offices, regional health bureau and local health offices(clinics), NGOs	Trained facilitator, information(data) and finance
4	Establishing a process of change	EPA, MOWE, Ammude community, Industries and factories(owners/managers)	Finding common ground, identifying conflicting needs towards the use of Lake Koka	ST	NGOs and MoTI	(skilled) human resource, finance and information
5	Operational plan	All involved SHs	Agreeing up possible management objectives and local actions of improving Lake Koka	ST and MT	NGOs, MoTI, Regional and national Governments	Human, material, information and finance
6	Contributing to the water management strategy	All involved SHs	Through social learning(with a demonstrated concerted action of improving the challenges of lake Koka and thereby restore the lake towards its sustainable uses)	ST and MT	NGOs…	