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Effectiveness of post-decision stage of the environmental impact assessment process in Kenya in managing environmental and social impacts of water supply dams : Case of Kiserian Dam, Kajiado County.

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Abstract

This is a case-study design research of Kiserian dam, a water supply dam located in a peri-urban area of Nairobi, the capital city of Kenya. The objective of the study was to analyse the effectiveness of post-decision stage of the environmental impact assessment process (EIA) in Kenya in managing environmental and social impacts of the dam. For the study, the EIA process has been looked at in two stages; pre-decision and post-decision stages with the interest being on the post-decision EIA stage. The Environmental Management Plan (EMP) provided in the EIA report for the dam formed the basis of the study. Christopher Wood (1995) criteria for evaluating the effectiveness of EIA systems was modified for use in achieving the objectives of the study. The study involved review of secondary data and focus group discussions with the target group provided in the EMP. The EMP gave seven anticipated impacts from the dam. The only impact reported not to have occurred was an increase in waterborne diseases. Some other negative impacts that were not reported in the EMP but have been reported are; introduction of flora and fauna, water pollution, dried inflowing rivers and conflicts with the neighbouring community. Several positive impacts have accrued from the dam. They include: offering training opportunities for students through internships, attachments and field visits and provision of non-consumptive use as it is scenic and people from the vicinity come to relax around the dam.

1.0 Introduction

Although an act of parliament, Environmental Management and Coordination Act, 1999 (EMCA, 1999) formally introduced Environmental Impact Assessment (EIA) process in Kenya, it wasn't until the gazettment of Environmental (Impact Assessment and Audit) Regulations, 2003 that EIA and Environmental Audit (EA) was conducted for development projects listed in the second schedule of the Act. The Act defines EIA as a systematic examination conducted to determine whether or not a project will have any adverse impacts on the environment whereas EA has been defined as a systematic evaluation of activities and processes of an ongoing project to determine how far these activities conform to the approved Environmental Management Plan (EMP) of that specific project. The regulations requires that a project proponent conducts an initial EA study to provide baseline information upon which subsequent environmental control audit studies shall be based. The initial EA scope includes appraisal of all the project activities, internal control mechanisms put in place to identify and mitigate activities with a negative environmental impact and the existence of environmental awareness and sensitization measures, including environmental standards, and regulations, law and policy, for the managerial and operational personnel. Control EA on the other hand is carried out by the Environmental Agency (NEMA) whenever it deems it necessary to check compliance with the environmental parameters set for the project or to verify self-auditing reports. A control audit therefore confirms that the EMP of the project is being adhered to and verifies the adequacy of the EMP in mitigating the negative impacts of a project.

EIA as Environmental Management tool

EIA can be seen as an effective environmental management tool if it achieves its goals for environmental protection and assesses project's impacts throughout the life of a project (ELAW, 2010). EIA is therefore not effective if it simply stops when the decision has been made. However, in many cases, EIA is primarily related to the pre-decision stage of development as most EIA systems tend to result in the final granting or refusal of development consent being perceived as the endpoint of the process. Also, after obtaining EIA approval the proponents least bother to adopt the mitigation measures while the self-monitoring and reporting system indicated in the environmental management plans (EMPs) are rarely practiced by project proponents.

Pre-decision and post-decision stages of EIA

For this study, the EIA process has been looked at in two stages; pre-decision and post-decision stages. The pre-decision stage incorporates the early components of EIA prior to project implementation/ approval i.e. screening, scoping, impact prediction (Arts, Caldwell & Morrison-Saunders, 2001 & ELAW, 2010). The emphasis in EIA has frequently been on the pre-decision stages and on preparation of the report, and using EIA purely to achieve development consent rather than as a tool for sound environmental management and protection.

The post-decision stage on the other hand is concerned with the various components of the project's life cycle after approval (ELAW, 2010) and includes monitoring & auditing, evaluation, management and communication (Arts, Caldwell & Morrison-Saunders, 2001). There is normally very little emphasis on comparing what was predicted with what really happened, and on feeding the results of such exercises back into the EIA process (Dipper, Jones & Wood, 1998). Generally, post-EIA has been poorly implemented with the implementation of an environmental management plan, mitigation measures and post-decision monitoring being some of the weakest facets of EIA system. The link between EIA and EA processes in Kenya can be illustrated in Figure 1.

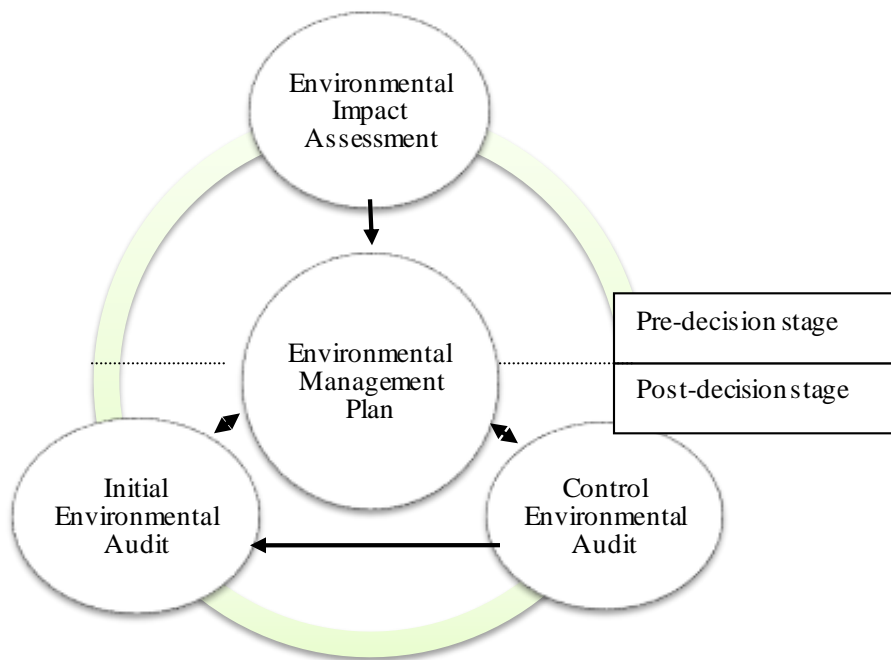


Figure 1. The link between EIA and EA in Kenya

So as to understand the EIA process in Kenya, a case study was undertaken using a dam (Kiserian dam). The dam is a water supply dam located in a peri-urban area of the capital city of Kenya. As a requirement by EMCA, 1999, EIA study for the project was undertaken in 2005 whose main purpose as stated in the EIA report was to identify potential positive and negative impacts associated with the proposed project and to provide recommendations on how to take advantage of the positive impacts on one hand and how to mitigate the negative environmental impacts on the other hand. Case study approach has been used for the study. This was similarly done by Sandham, *et al*, (2007) in their study of assessing quality of environmental impact reports for projects with the potential of affecting wetlands in South Africa.

1.1 Objectives

The objective of this study was to analyse the effectiveness of post-decision stage of the environmental impact assessment process in Kenya in managing environmental and social impacts of the water supply dam. The answers to the following questions were therefore sought.

- (1) Has the environmental management plan provided in the EIA report been implemented
- (2) What actual social and environmental impacts that have been experienced as a result of the dam
- (3) What mitigation measures have been implemented?
- (4) What monitoring data is available and how is it used?
- (5) Has there been consultation and participation after approval of the EIA?

2.0 Methodology

The Environmental Management Plan (EMP) provided in the Environmental Impact Assessment (EIA) report for Kiserian Dam formed the basis of the study. The anticipated environmental and social concerns of the dam with their proposed mitigation measures in the EIA report are summarised in Table 1.

Table 1. The EMP for the dam's operation phase

Concern	Mitigation measures	Responsibility
Altered hydraulic regime downstream of the dam	Release of compensation flow for the maintenance of channel ecosystems downstream of the dam	Water operator, Water board, Client
Erosion in drawdown zone	Planting annual vegetation along the margins of the impoundment and construction of submersible barrages at the mouth of inlets along the margins of the reservoir to maintain water level at inlet	District government and agencies
Nutrient loading	Construction of a sanitary landfill and wastewater treatment facility Promotion of use of biogas units in the rural section Training of local farmers in the use of fertilizers	District government and agencies
Anoxic water	Provision for multilevel releases to avoid discharge of anoxic water	Water board
Sedimentation and loss of storage capacity	Mechanically remove sediments by periodic dredging or through periodic flushing of the reservoir	Water board
Proliferation of aquatic weeds in reservoir and downstream	Weed control measures including harvesting of weeds for compost, fodder or biogas Regulation of water discharge and manipulation of water levels to discourage weed growth	Water board, Client
Increase in waterborne diseases 1. Malaria 2. Schistosomiasis	1. Introduction of fish into the reservoir that feed on mosquito larva that are also edible; planting of vegetation that repels mosquitoes; treatment of infected people 2. Provision of infrastructure along the reservoir shore to reduce water contact for fishermen, women and children	District government

Christopher Wood in 1995 developed criteria for evaluating the effectiveness of EIA systems (McGrath, 2010). The criterion has 14 items and for this study, the criterion has been grouped as shown in Table 2.

Table 2. Christopher Wood developed criteria

Scope	Item(s)
Legal requirement	1
Pre-decision stage	2-8
Post-decision stage	9-12
Costs and time	13
Scope of EIA system	14

The Christopher Wood criteria items 9 – 12 (post-decision stage) have been modified (Table 3) for achieving the objectives of the study.

Table 3. Modified criteria for evaluating the effectiveness of EIA post-decision

Question in Wood criteria	Modified questions
9. Must monitoring of action impacts be undertaken and is it linked to the earlier stages of the EIA process?	1. Has monitoring of action impacts been undertaken and is it linked to the earlier stages of the EIA process?
10. Must the mitigation of action impacts be considered at the various stages of the EIA process?	2. Has the proposed mitigation of action impacts in the EMP been considered at the post-EIA stages?
11. Must consultation and participation take place prior to, and following EIA report publication?	3. Has there been consultation and participation after approval of the EIA?
12. Must the EIA system be monitored and, if necessary, be amended to incorporate feedback from experience	4. Which monitoring data is available and does it incorporate feedback in to the management

The study involved review of secondary data and interviews with the target group provided in the EMP (Water Board, Water Service provider, government agencies (local administration, public health, Water resource users association (WRUA)).

3.0 Results and discussion

Implementation of the EMP

The EMP stated seven anticipated impacts from the dam. The only impact reported not to have occurred was an increase in waterborne diseases. The other six impacts; Altered hydraulic regime downstream of the dam, erosion in drawdown zone, nutrient loading, anoxic water, sedimentation and loss of storage capacity and proliferation of aquatic weeds in reservoir and downstream were reported to have occurred (Table 4). The anticipated impacts in the EMP were however not exhaustive as not all possible anticipated impacts were reported in the EIA report. During the research more impacts that have been experienced were reported and are provided in Table 5.

Table 4. Environmental management plan

Concern	Occurred Yes (Y)/ No (N)	Mitigation measure implemented Yes (Y)/ No (N)
1. Altered hydraulic regime downstream of the dam	Y	Y
2. Erosion in drawdown zone	Y	Y

3. Nutrient loading	Y	N
4. Anoxic water	Y	N
5. Sedimentation and loss of storage capacity	Y	N
6. Proliferation of aquatic weeds in reservoir and downstream	Y	N
7. Increase in waterborne diseases	N	N
1. Malaria		
2. Schistosomiasis		

Social and environmental impacts experienced

Several impacts that were not anticipated in the EIA report were reported to have been experienced. These have been summarised and discussed under the following four headings;

- (1) Introduced flora and fauna
- (2) Water pollution
- (3) Dried inflowing rivers
- (4) Conflicts with the neighbouring community

Introduced flora and fauna

There is a change in fish and bird life of the dam. There has also been noted an increase in mosquitoes in the area but since the area is classified as a non-malarial zone, mosquitoes are therefore treated only as a nuisance. The EMP had anticipated an increase in malaria, a disease whose vector is a mosquito. The cases of malaria in the area could not be attributed to the presence of mosquitoes as the cases were very negligible and could have been brought in from other areas.

Dried inflowing rivers

Floods have been reported occasionally during long season rains, with flooding of the surrounding homes being witnessed. Generally the rivers feeding the dam are drying and the dam water volume has declined leading to closure of the dam’s water supply in August 2017. The dam has 3 inflowing rivers which have been drying during extended periods of dry spell. Upstream users over-abstract the water from the rivers for use in farming. Dug out holes were also noticed in the dry river beds where farmers use as source of water for their small scale farming. The Water Service Provider (WSP) is a member of Kiserian Water Resource Users Association (WRUA). WRUA is provided for in the legislation and play an important role in protecting water catchments and resources.

Water pollution

The water quality of inflowing rivers and of the dam has been declining. The decline in water quality has been attributed to soil erosion upstream, dumping of excavated soils by developers on the dam and riparian boundaries, discharge of untreated sewage from nearby settlements, and from slaughter houses. The residents living on the boundary of the dam occasionally pump sewage to the dam to avoid cost wastewater exhaustion services since they use septic tanks. The slaughter houses and runoff from the township which are located on a higher ground than the dam also channel their wastes in to the dam especially during periods of heavy rainfall.

Conflicts with the neighbouring community

The dam land has no complete perimeter fence/wall securing it but still the section of the boundary that has been fenced experiences challenges of fence vandalism and trespass. Residents living on the other side of the dam use the dam as a shortcut to get into their homes. The dam fence is also vandalized for access to the reservoir where people carry out illegal fishing, illegal grazing and also pump water for farming. No buffer zone was provided leading to dam encroachment and homes are located very close to the dam as a result of this wastewater from the nearby by residential areas is discharged to the dam. Solid waste pollution also poses a major concern for the dam. In addition, residents living downstream complain of reduced water flow therefore don't get water. Illegal abstraction of water for use in farming and illegal fishing has led to cases of people falling into water and drowning.

Implemented mitigation measures

The question, 'what mitigation measures have been implemented', was answered through interviews with the institutions listed in the EMP of the EIA report. These are provided in Table 1. Table 5 provides a summary of the mitigation measures that have/are being implemented.

Table 5: Mitigation measures

Impact	Mitigation measures
Introduction of flora and fauna	Mosquitoes are treated as a nuisance and people around are provided with mosquito nets
Drying inflowing rivers	The Water Service Provider is a member of Water Resource Users Association (WRUA) that plays a role in how a water resource is used and managed. WRUA is provided for in the legislation.

Water pollution	<ul style="list-style-type: none"> <i>i.</i> Construction of sewerage works is ongoing <i>ii.</i> Ensuring that houses have septic tanks that are adequate to avoid overflow, having effective lagoons for the slaughter house wastes. <i>iii.</i> Legal measures have also been implemented where the local administration and police have made arrests and several cases have been taken to court. <i>iv.</i> The locals also work together with the local administration where they assist in arresting the culprits e.g. locals call the chief to alert them of sewage being pumped the chiefs then work with Public Health Office and police. <i>v.</i> The public health offices also do undertake monitoring through frequent sampling of the slaughter house lagoons and residential houses septic tanks. <i>vi.</i> Sensitization is also another measure that has been implemented where the WRUA sensitize farmers upstream on the need to plant trees especially income generating trees as a way of reducing soil erosion.
Conflicts with the neighbouring community	<ul style="list-style-type: none"> <i>i.</i> To overcome the challenges of conflicts with the neighbouring community, bamboo fencing is being undertaken along the buffer zone of the dam. <i>ii.</i> The local administration conducts constant education and sensitization of the residents on disaster preparedness and on the consequences of improper solid waste disposal and management and have tasked the community leaders to be in charge of managing solid waste.

Availability and use of monitoring data

The EIA report did not indicate the kind of monitoring data needed. The research therefore sought to establish the monitoring data is available and how the data is used.

The monitoring data available that was obtained/ is available include:

1. Monthly Rainfall
2. Spillage
3. Water quality
4. Monthly dam water volume

4.0 Conclusions

Several positive impacts have accrued from the dam;

- i.* The dam has is offering good training opportunities for students through internships, attachments and field visits.
- ii.* The dam is located within a semi-arid area where surface water is normally less occurring.

The presence of the dam especially when it is full is very scenic and people from the vicinity come to relax around the dam. This provides one non-consumptive use of the dam.

Although the EMP in the EIA report had anticipated some impacts, the list was not exhaustive as key impacts were left out including;

- i.* Introduced flora and fauna,
- ii.* Water pollution,
- iii.* Dried inflowing rivers and
- iv.* Conflicts with the neighbouring community.

On the implementation of mitigation measures, those provided for in the EMP have not been implemented except for the following concerns;

- i.* Altered hydraulic regime downstream of the dam
- ii.* Erosion in drawdown zone.

Several other mitigation measures have however been implemented for the other impacts that have been experienced but had not been anticipated in the EIA report. The question that remains to be asked is whether these measures have been effective. For instance;

- i.* People have been arrested and charged in courts for illegal fishing yet it still goes on
- ii.* Fence vandalism and illegal abstraction of water from the dam still persists with arrests being carried out.

The EIA report did not indicate the kind of monitoring data needed and how the data was to be used. The WSP however collects the kind of data necessary for its operations and not for environmental management for instance water quality data, dam volume, rainfall data, and spillage. ELAW (2010) stated that every promise in an EIA runs the risk of being an illusion unless the EIA sets out measures to monitor performance of the project and its impact on the environment. The availability of monitoring data is a pre-requisite for post-auditing. Several studies highlight the almost complete lack of monitoring data relating specifically to the predictions set out in the report as a major hindrance to environmental management.

5.0 Recommendations

1. Carry out quarterly dam water analysis so as to establish trend in water quality
2. Carry out an assessment of flora and fauna of the dam and riparian areas so as to establish any change of species over time

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