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Full Length Research Paper

Evaluation of present operational performances of Dams in Nigeria: A case study of Bakolori Dam in Zamfara State

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The Economic development of any Country that aspires to meet the International standard depends on the proper utilization, expansion, and maintenance of the available facilities that are within reach. Such facilities abound in professions like Biotechnology, Bioengineering, and Health care systems, communication systems, transportation systems, Agricultural systems, construction Engineering, Hydro power and Dams. The proper use of the aforementioned facilities is the major secret behind the Economic growth of many countries such as Indian, Spain, China, Brazil, Malaysia, Korea, Germany, Yugoslavia, e.t.c. These countries attained International recognition in all ramification based on their expansion and maintenance of their facilities. This paper examines the present operational performance of Dams in Nigeria, with a focus on Bokolori Dam in Zamfara State, which has deteriorated due to lack of maintenance culture since its construction in the late 70s. This study also proffers Engineering recommendation and conclusion for the stated Dam.

Key words: Bakolori Dam, present operational performance.

INTRODUCTION

A dam is a hydraulic structure that is usually built across a river to create a reservoir on its upstream side for the purpose of impounding water. Dams are constructed to impound water for the purpose of flood control, water supply, irrigation, Energy generation, recreation as well as pollution control of different forms. Dams can be classified based on the functions they served. These functions can be illustrated as follows:

Classification based on:

i. Storage
ii. Diversion
iii. Detention
iv. Debris

Classification based on hydraulic design:

i. Overflow dams and

ii. Non- overflow dam

Classification based on materials of construction:

i. Concrete dams built of concrete
ii. Earth dams made of Earth
iii. Rock fill dams made of rock fill materials
iv. Timber dams made of timbers
v. Steel dams made of steel

Classification based on rigidity:

i. Rigid dams constructed of stiff materials such as concrete, steel and Timber. They possess very little deformation and deflection.

ii. Non-rigid dams constructed of earth and rock fill materials. They are also liable to large settlement and deformation

Table 1. Over-view of dams in Nigeria.

S/N	States	Dams	Capacity in millions of M^3	Surface area hectares	Primary usage
1	Zamfara State	Bakolori Dam	450	8,000	Irrigation
2	Kano State	Challawa gorge Dam	930	10,117	Water supply
3	Gombe State	Dadin kowa Dam	2,800	29,000	Irrigation
4	Sokoto State	Goronyo Dam	942	20,000	irrigation
5	Oyo State	Ikere gorge dam	690	4,700	Hydro electric water supply
6	Niger State	Jebba dam	3,600	35,000	Hydro electric water supply
7	Katsina State	Jibiya dam	142	4,000	Water supply irrigation
8	Bauch State	Kafin zaki dam	2,700	22,000	Planned irrigation
9	Niger State	Kainji dam	15,000	130,000	Hydro electric
10	Adamawa State	Kiri dam	615	11,500	Irrigation plans for Hydro electric
11	Ogun State	Oyan river dam	270	4,000	Water supply irrigation, Hydro electric
12	Niger State	Shiroro dam	Nil	31,200	Hydro electric power
13	Kano Sate	Tipa dam	1,874	17,800	Irrigation water supply
14	Kebbi State	Zauro polder dam	_____	____	Irrigation
15	Katsina State	Zobe dam	177	5,000	Water supply

Source: Kate (2013) News Agency of Nigeria.

Based on the structural Engineering actions of dams, their types are of gravity (mass concrete) dam, Earth dam, Rock fill dam, Arch dam, Buttress dam, Timber dam, and Steel dam.

An over-view of dams in Nigeria

Nigeria as a country is blessed with many built dams for various purposes. The major available ones in the country, their capacity, surface areas, and their primary functions are presented in the Table 1.

At a National water conference held in calabar, experts advocated for the construction of dams at strategic. Locations to check flooding; and more dams were still needed in Nigeria's especially in places like Lokoja and Onitsha to control floods occurrences and also provide water for irrigation (News Agency of Nigeria (NAN) December 12, 2013)

METHODOLOGY

The method adopted for this paper was through documentation involving theoretical appraisal of National water conference reports held in Calabar, Cross-Rivers State in 2013, Newsletter publication on the water Engineer of the water division of the Nigerian Society of Engineer (NSE) December 2013, and the information reports of Daily Sun, September 19, 2014. The paper also utilized secondary information via text books and available related journals on the subject.

DISCUSSION

Bakolori dam is located in Maradun Local Government Area of Zamfara State. The dam was constructed in the late 70^S by President Shehu Shagari's Administration, in order to facilitate rice farming irrigation in the locations comprising Maradun, Talata, Marafa and Bakura. These are places known to have great potentials for rice production. Past records about the dam shows that it could accommodate about 450 millions cube meters of body of water that could facilitate large scale fish farming, poultry as well as generation of about three mega watts of electrical supply to Local Community.

Current structural state of the dam

A critical analysis of the dam shows the following:

i. Some facilities belonging to the dam have been vandalized by the Local Community.

ii. A good number of Irrigation canals are already decayed due to lack of proper maintenance.

iii. The power generating turbines have completely broken down.

iv. One-third of the total size of the irrigation site, reflecting about 8000 ha is now being use by dry season farmers.

Engineering analysis and assessment of the dam

Engineering facilities that are designed and constructed are not usually abandoned or left uncared for during their useful life time. Such facilities are usually accorded adequate maintenance, so that their operations and services can last long. Bakolori Dam lacks this experience. Reports show that the dam has never been DE – SILTED since it was constructed over 30 years ago

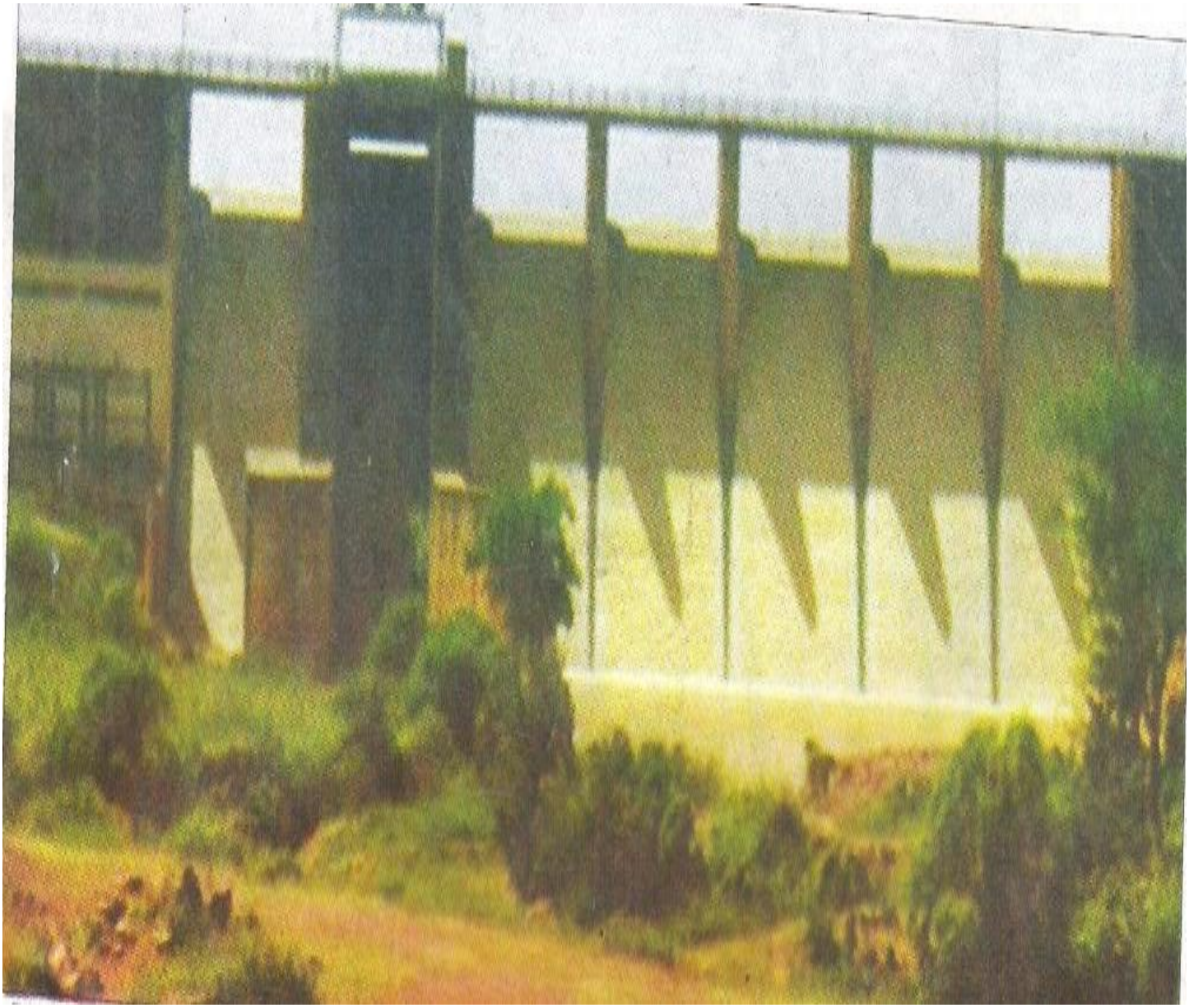

Figure 1. Dilapidated dam and abandoned farmland at Bakolori Irrigation site in Zamfara State.

(Figure 1). This implies that NO maintenance has been done on the dam since it was constructed in the late 70s. This is the major reason or failure of the Dam.

Deteriorating state of the Bakolori Dam means a state towards failure because of lack of maintenance culture. Other failures factors which have not been discovered now, and can take place in future; if urgent action is not taking can be any of these:

i. Punmia and Lai (1992) attributed 40% of failure in any Dam to hydraulic side of a Dam, 30% to seepage, while structural failures carried the remaining 30%.

ii. In his study, Arora (2001) also showed that about 35% of failure of earth Dams are due to hydraulic failures, about 30% are attributed to seepage failures and about 20% are as result of structural failures. The remaining 7% of the failures are due to other miscellaneous causes, such as accidents, Natural disasters and maintenance.

ENGINEERING RECOMMENDATION

i. With the present situation of Bakolori Dam, a revisitation of the Dam by seasoned Engineers is urgent. This would avail the Engineers the opportunity to carry out proper assessment on the Dam before maintenance state.

ii. The Federal and State Governments are enjoy to shoulder the responsibility of proper maintenance that is

needed by the Dam. There should be no hesitation on this, in order to avoid further deterioration on the Dam.

iii. Permanent working staff should be employed for the Dam site. This would guide against penetration in to the Dam premises, which would result into tampering with the facilities around the Dam site by the local communities.

Iv. Since Dams are constructed for specific purposes, such as hydro power, Navigation, flood control, water source, and recreation, more Dams should be constructed by the federal government across the country, more so that the Dams would effectively check the recurrences of floods in the country.

Conclusion

The Federal Government of Nigeria has always place the development of the country as a major task among other objectives to be pursuit. This development includes provision of food percentage requirements for the nation, and as well as creating employment for millions of her citizens. However, Dams construction, expansion in to other parts of the country, and proper maintenance should continue to have major priority like other infrastructural facilities. This is the gate way for the country's National development and sustainability.

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