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AN ASSESSMENT OF THE SOCIO-ECONOMIC IMPACTS OF THE CONSTRUCTION OF SIYA DAM IN THE MAZUNGUNYE AREA: BIKITA DISTRICT OF ZIMBABWE

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ABSTRACT

The construction of dams results in widespread socio-economic impacts on communities. The results from the study show that Siya Dam has both positive and negative socio-economic impacts in the Mazungunye area. The impacts tend to be selective both spatially and socially. The study noted that the dam can be used for irrigation making agriculture viable in the face of climate change. Fish resources from the dam can also be used to augment dietary protein requirements thereby improving community health and contributing to the achievement of Millennium Development Goals. Further, the benefits of Siya Dam can be enhanced by using its water resources for the development of a mini hydro-electric power plant project that would augment the national power grid and contribute to clean energy production. It is hoped the study will contribute to the sustainable development and utilization of water resources provided by the dam.

Keywords: sustainable development, water-based recreation, water-borne diseases, community, inundation

INTRODUCTION

Dams are large socio-economic investments built to fulfill such purposes as domestic and industrial water supply, energy production, irrigation and flood control. Canter (1985) notes that water resources projects such as dams represent large-scale engineering works or activities that can cause significant impacts on socio-economic components of the environment. The positive and negative socio-economic impacts of dam construction are very selective both spatially and socially. For example, while the Kariba Dam provide hydro-electric power to the industries of Zimbabwe and the Zambian Copperbelt, it cost the Tonga people most aspects of their traditional riverside domestic economy, and caused devastating disease and loss of livelihoods (Bond & Manyanya, 2002).

The growing worldwide environmental awareness has increased attention on the impacts of dams on communities (Canter, 1985). Church (1968) states that few of humans' modifications of the landscape can initiate such profound physical, economic and social changes as dams. This suggests the need for a better understanding of the socio-economic impacts of dam construction.

SOCIO-ECONOMIC IMPACTS OF DAM CONSTRUCTION CITED IN THE LITERATURE

Inundation of Settled Areas and Destruction of Natural Habitats

Dams raise the natural level of rivers, so flooding lands previously settled, farmed or periodically grazed. Dam construction results in the loss of productive land beneath the reservoir. The largest reservoirs in Africa include the Volta Lake formed behind the Akosombo Dam, which covers 8 500 square kilometres, flooding a substantial area of Central Ghana (Canter, 1985). The Kainji Dam in Nigeria impounded 1 200 square kilometres, including 15 000 hectares of farmland while the Lagdo Dam on the Benue flooded 70 000 hectares, including floodplain land stretching 2-5 kilometres on both banks of the river (Adams, 1992).

Dams also result in the destruction of natural habitats. According to Canter (1985) the shift from river to lake environment can result in the reduction of species diversity. Dams may lead to the loss of rare flora and fauna species. Impoundments lead to decreased woodland thereby adversely affecting wildlife communities. This leads to decreased hunting and associated uses. Medicinal herbs will also be lost. Furthermore, decreased forest plant communities lead to decreased timber production and attractiveness of an area to recreationists (Canter, 1985).

Resettlement of the Population Displaced by Dams

The creation of large dams in Africa has been responsible for the relocation of large numbers of people. The Kossou Dam in the Ivory Coast displaced 85 000 people, the Akosombo Dam 84 000, the Kariba Dam in Zimbabwe 57 000, the Kainji Dam 55 000 and the Lagdo Dam 35 000 people. The Aswan High Dam on the Nile displaced an even greater number of people, 120 000 Nubians, both in Egypt and Sudan (Adams, 1992).

The economic and human costs of resettlement are huge. The financial costs of resettlement include surveying people and property, compensation or rebuilding of settlements and infrastructure and the actual translocation. There is also the human cost of the stress caused by uprooting (Adams, 1992; Scudder, 2005).

Spread of Diseases

Large dam projects often lead to the spread of schistosomiasis and other communicable diseases. Newson (1997) notes that devastating water-borne diseases are introduced by reservoirs and their associated irrigation works. Furthermore, Newson (1997) argues that dams have reduced the quality of drinking water for hundreds of millions of people. Clarke (1991) states that when large new volumes of water are created, the risk of disease in tropical countries rises sharply. The diseases associated with dams include schistosomiasis, yellow fever, malaria, river blindness and liverfluke infections. Adams (1992) argues that although water-borne diseases are widespread in African floodplains, dam construction can increase their prevalence. According to Tucker (1983) water resource development projects create additional habitats for disease vectors beyond those already present. Water-borne diseases lead to debilitation and vulnerability to other diseases. This results in working hours being lost due to illness and medical costs increasing (Clarke, 1991).

The Kariba Dam caused devastating diseases among the Tonga people (Bond & Manyanya, 2002). The Gezira Irrigation Scheme in Sudan increased the prevalence of schistosomiasis, malaria and yellow fever in the region (Canter, 1985). Moreover, Clarke (1991) notes that a survey after the construction of the dam to create Lake Volta showed that the incidence of infection with schistosomiasis among children under 16 years in the resettled areas rose from 3 to 37 percent in just one year.

Loss of Sites of Historical, Archaeological and Religious Importance

River valleys are important sources of African history. The construction of dams results in the loss of African historical, archaeological, cultural and religious sites. These sites are relevant in Africa, where local indigenous people were seen as inferior and culturally static by the European colonizers. African post-independence governments are also playing an active role in attempting to discover more about the cultural history of the indigenous peoples as a way promoting nationhood (Brokensha & Scudder, 1968).

Pollution

Dam construction can lead to noise and visual pollution. Noise is generated at the impoundment construction site during the construction phase (Canter, 1985). Noise can be defined as objectionable or unwanted sound. Complaints of noise nuisance generally arise when a noise interferes with work, communication, recreation or sleep.

Damming can also adversely affect the visual quality of an area. Furthermore, it can result in the water resource producing a bad odour. This reduces the attractiveness of the area to recreationists (Canter, 1985). Preservationists argue that free-flowing rivers should be left intact in order to avoid spoiling the beauty of the landscape (Henwood & Coop, 1973).

Social and Cultural Disruption

Canter (1985) notes that during the dam construction phase there can be social conflict between the local villagers and some dam construction workers that maybe foreign. Foreign construction workers may disregard and disrespect local culture and authority.

People displaced by dam construction maybe moved to land claimed by others. Friction can occur, arising from the resentment felt by the original owners of the land towards the newcomers who have been foisted on them. The resettled people may also be angry over having had to leave their old lands (Brokensha & Scudder, 1968).

Disruption of Transport and Communication

Canter (1985) notes that a dam can be a barrier leading to the disruption of transport and communication. This results from the replacement of a relatively narrow river by a wide dam.

Occurrence of Drowning

The occurrence of drowning may increase due to dam construction. People may drown while fishing or swimming.

Constant Supply of Water for Domestic, Industrial, Energy Production and Irrigation Purposes

Dams ensure a constant supply of water for domestic, industrial, energy production and irrigation purposes. Dams provide a balanced supply of water for all seasons and conditions (Ministry of Water Development, 1973). Dam construction is of great significance as most parts of Southern Africa have relatively undeveloped surface water, while most of the population lacks access to improved water supply. In fact forty percent (40%) of the population in Southern Africa has no access to potable water (Mazvimavi, 2010). Lack of access to clean water increases the incidences of diseases making it difficult to achieve the Millennium Development Goals.

A number of Zimbabwean dams were built mainly to provide cities and towns with domestic and industrial water. These dams include Chivero and Manyame for Harare water supply, Mayfair for Bulawayo water supply, Gwenoro for Gweru water supply, Sebakwe for Kwekwe water supply and Mutirikwe for Masvingo water supply. Kariba Dam also harnesses the waters of the Zambezi River to generate hydro-electrical power (Chenje, Sola & Paleczny, 1998).

Dams also provide a constant supply of water for irrigation purposes. Dams such as Mutirikwe, Manjirenji, Siya and Bangala were mainly built to provide irrigation water to the Zimbabwean South-East Lowveld Plantations (Chenje, Sola & Paleczny, 1998). Newson (1997) notes that the benefit of irrigation is stable yields, since weather conditions are largely controlled. The long growing season that permits several crops per year make irrigation economically feasible. Auret (1990) states that the need for irrigation development in Zimbabwean communal areas is vitally necessary to supplement dryland cropping and to provide food security in grain deficient areas. Irrigation development is of great significance in the face of climate change and the associated increased frequencies of extreme climatic events, particularly El Nino and related droughts. Droughts have over time exerted a heavy toll on the inhabitants and the economy of Zimbabwe which are largely depended on agricultural production (Yanda, 2010).

Dams also provide a constant supply of water for livestock which is important in the face of increased incidences of droughts in Zimbabwe. These droughts result in the death of livestock thereby devastating the fragile economy of the country. For example, the drought of 1991/1992 resulted in the death of an estimated 423 000 cattle out of 4.4 million and the doubling of the normal off-take (Yanda, 2010). Even the animals that could be sold only fetched a pitiful Z$ 24 per head as compared to an average normal price of Z$ 500 per head (UNEP &ICRAF, 2006).

Creation of Employment and other Income Generating Activities

Dam construction results in employment creation. People are employed to construct the dam and as management staff. Furthermore, labour needs during dam construction can lead to a population influx resulting in local villagers having an expanded market for their agricultural products (Canter, 1985).

Fishing, recreation and tourism may also be enhanced by dam construction thereby creating employment and income. Zimbabwean dams like Kariba, Mutirikwe, Manyame, Chivero, Mazvikadei and Mayfair are used as fishing, recreational and tourist resources (Chenje, Sola & Paleczny, 1998). Furthermore, fish provide communities with animal protein in their diets. A large number of Zimbabwean dams have been stocked with fish and are being fished (Chimbuya & Shoniwa, 1988). Volta

Lake fish are also a major source of protein in Ghana. The fishing industry rates as one of the most significant benefits of the dam to the Ghanaian economy (Adams, 1992). Fishing and aquaculture also provide food and livelihoods for millions of resource-poor people in Southern Africa, and may become even more important to regional food security as the climate changes and other sources of food increasingly become less reliable (Makungwa, 2010).

Justification of study

There are many times and situations in which more and better information can materially improve planning and significantly enhance the beneficial impacts of developmental projects such as dam construction. A number of dams which were constructed during the colonial era in Zimbabwe were mainly aimed at providing irrigation water for the large-scale commercial farming activities controlled by a small section of the farming community (Magadlela, 2000). Moreover, little effort was made to assess the socio-economic impacts of dam construction in the communal areas that were reserved for the indigenous African population. In fact the indigenous population was largely neglected in development planning during the colonial era (Auret, 1990). Further, there was no attempt that was made to carry out an Environmental Impact Assessment (EIA) prior to the development of such dams as Siya.

This research will draw attention to the experience gained from the socio-economic impacts of Siya Dam construction. The subject is not only of obvious interest to policy makers in view of the scale of human, natural and financial resources involved. It has also aroused considerable public curiosity, enthusiasm and concern as a result of the sheer size of the dam project. The results from this study might also have a wider application beyond the immediate study area.

It is hoped the study will result in the sustainable use of Siya Dam in order to achieve intra-generational socio-economic equity, inter-generational socio-economic equity and ecological integrity. The concept of sustainability first appeared in the public scene in the report put out by the World Commission on Environment and Development (Brundtland Commission) in 1987. The Commission report advances the idea of sustainable development by noting that economic growth and environmental conservation are not only compatible but they are necessary partners. One cannot exist without the other.

Objectives

The main objective of the study is to assess the socio-economic impacts of the construction of Siya Dam in the Mazungunye area.

Specific objectives

- To identify the social benefits and disruptions of the construction of Siya Dam on the communities of the Mazungunye area.
- To assess the health impacts of the construction of Siya Dam in the Mazungunye area.
- To determine the economic benefits and disruptions of the construction of Siya Dam in the Mazungunye area.
- To recommend preventive and remedial measures that may minimize adverse impacts and enhance the beneficial impacts of dam construction.

STUDY AREA

Siya Dam is located in the Mazungunye area of Bikita District, Masvingo Province. The dam was constructed between 1974 and 1977 on Turwi River mainly to provide irrigation water to the sugar-cane and citrus plantations in the South-East Lowveld of Zimbabwe. The dam flooded 810 hectares of land.

Mazungunye lies in Zimbabwean Agro-ecological Region 4. This is a semi-intensive farming region experiencing a mean annual rainfall between 300-600mm with a 40-45 percent coefficient of variation. It is subject to periodic seasonal droughts and prolonged dry spells during the rainy season. Mean annual temperature is between 25-27.5 degrees Celsius (Chenje, Sola & Paleczny, 1998).

The study area is made up of 6 villages which are Bengura, Marufu, Jere, Ngorima, Njaravani and Chiwawa. The majority of people in the study area are peasant farmers practicing farming based on growing crops and livestock rearing. The crops grown include maize, groundnuts, roundnuts, rapoko and sorghum. The livestock raised include cattle, goats, pigs and sheep. The other economic activity of the people in the study area is fishing. Fishing cooperatives and individual fishers do the fish harvesting. The Zimbabwe Parks and Wildlife Management Authority manages and controls the fishing.

Figure 1: The location of Masvingo Province in Zimbabwe

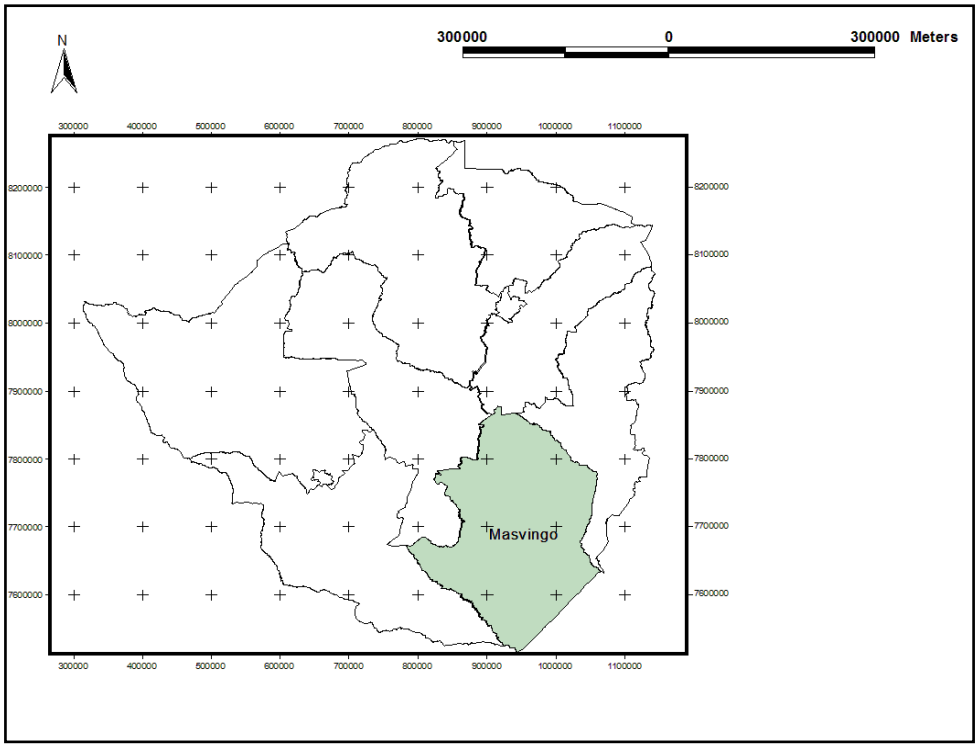


Figure 2: The Location of Bikita District in Masvingo Province

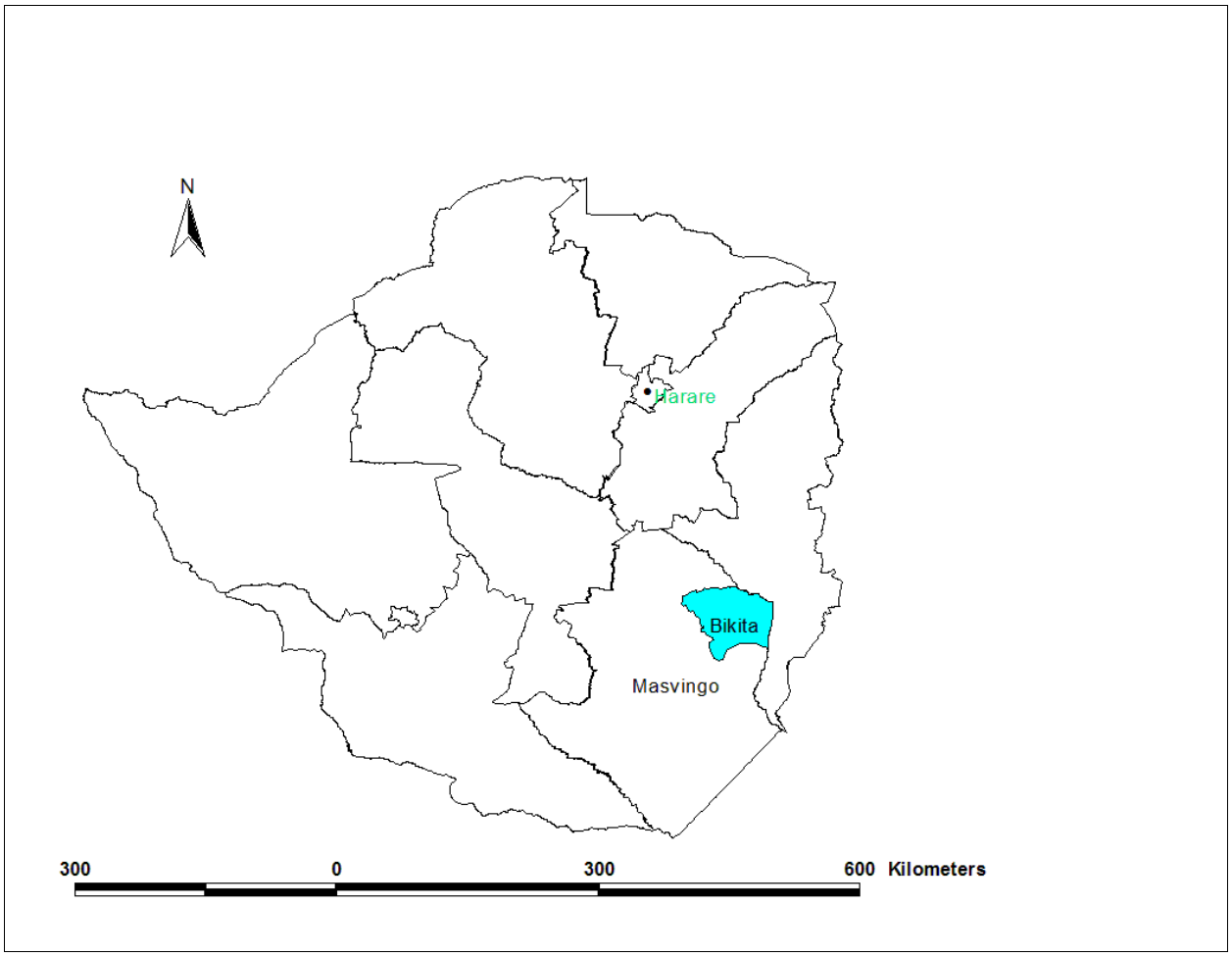


Figure 3: The Location of Siya Dam in Bikita District

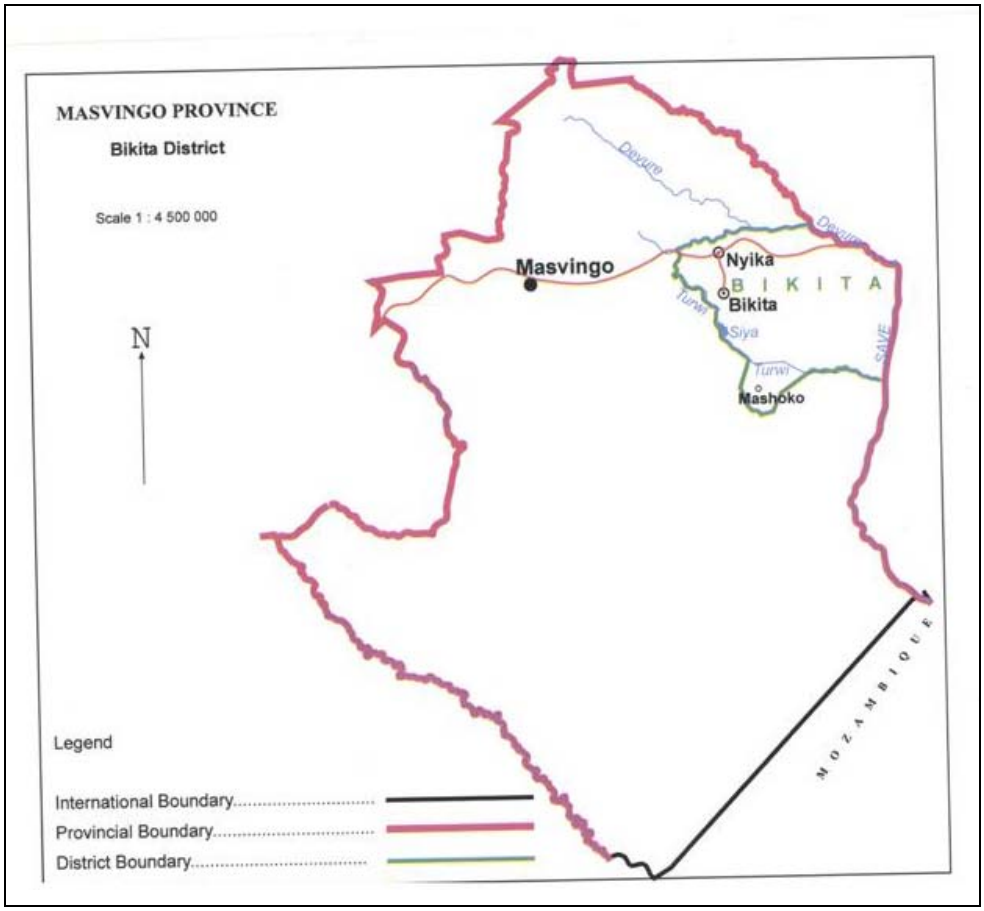
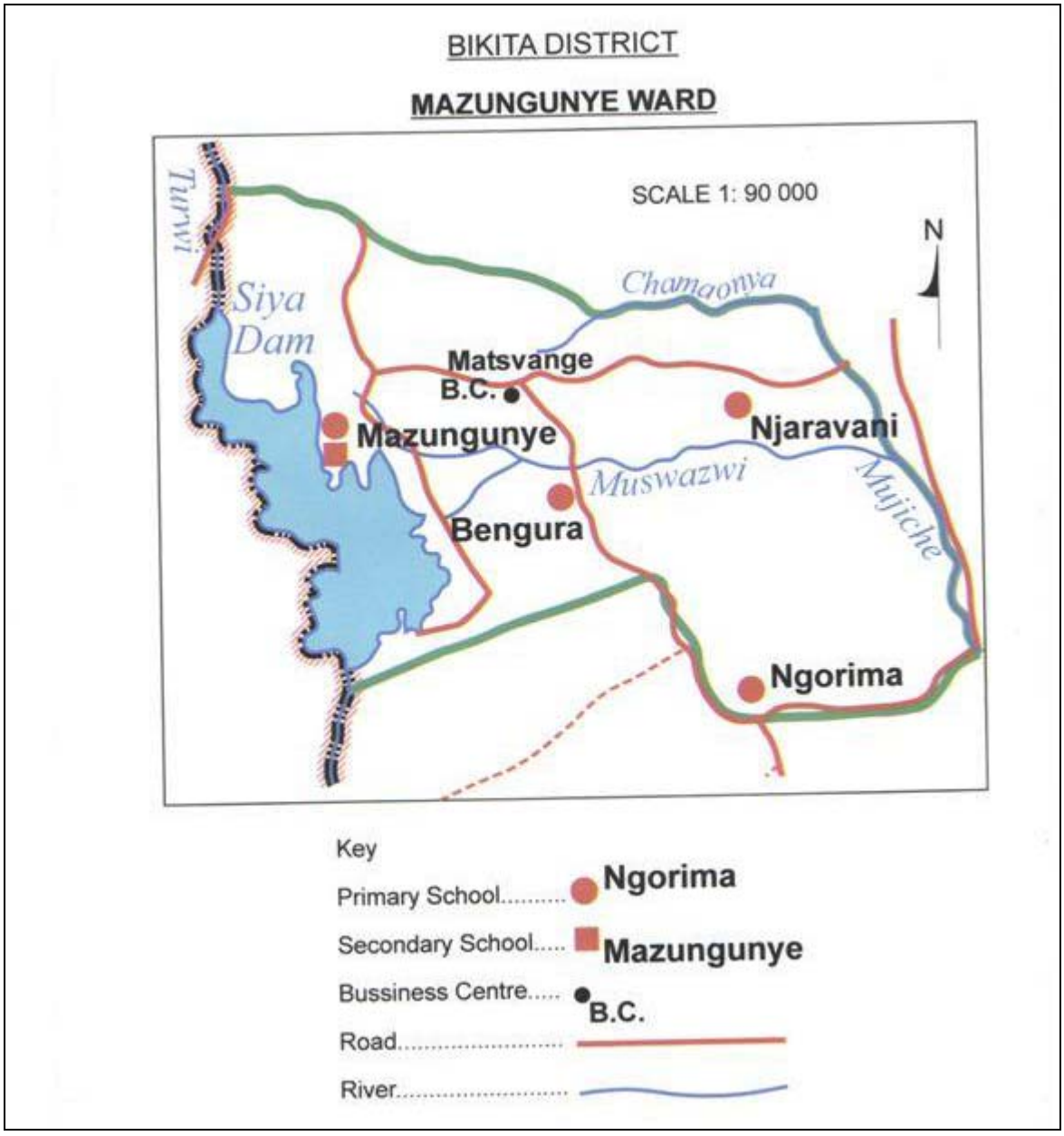


Figure 4: The Location of Mazungunye Ward



RESEARCH METHODOLOGY

Primary Data Collection

It was not possible to carry out a questionnaire survey involving all the households in the study area. A sample survey was therefore carried out. Krathwohl (1993) states that a sample survey selects a small number of units from a population to enable researchers to make reliable inferences about the nature of that population.

Households were used as sampling units. The sampling frame consisted of all the 1 597 households in the study area. This sampling frame was obtained from the local councilor and was listed according to villages. The total population in the study area according to the 2002 census was 7 795 (Central Statistical Office, 2002).

Sample Size Determination

The number of households selected to take part in the research was determined using the Pagoso Formula (Lauraya & Sala, 1995). The method estimates sample size *n* from, population size *N* and sampling error *E* using the following formula:

$$n = \frac{N}{1+NE^2}$$

Thus, in the study area: $n = \frac{1\,597}{1+1\,597(0.05)^2}$

$$n = \frac{1\,597}{4.9925}$$

$$n = 319.8$$

$n = 320$ (To the nearest whole number)

Therefore, a total of 320 households took part in the research.

Sampling Method

The stratified systematic sampling method was used to select households to take part in the questionnaire survey. The households were first stratified according to village boundaries in the study area. Marufu and Jere Villages were combined to form 1 stratum. This is because these 2 villages are the ones that are located nearest to Siya Dam. Njaravani and Chiwawa Villages were also combined to form 1 stratum. Ngorima Village formed a distinct stratum because most of the people displaced by the dam were resettled there. The households in the study area were therefore, stratified into 4 strata namely Bengura, Marufu-Jere, Ngorima and Njaravani-Chiwawa. Krathwohl (1993) notes that stratification classifies units in the sampling frame into strata on the basis of a characteristic that, if not properly represented might bias the inferences.

Systematic sampling was then used in each stratum to select the households where questionnaires were to be administered. The sampling interval in the 4 strata was obtained by dividing the population size *N* by the desired sample size *n*.

Therefore sampling interval $= \frac{N}{n}$

$= \frac{1597}{320}$

$= 4.99$

$= 5$ (To the nearest whole number)

Therefore, the sampling interval was 5.

Table 1: Stratified Systematic Sample for Study Strata

Stratum	Number of Households	Sample size
Bengura	303	61
Marufu-Jere	352	70
Ngorima	387	77
Njaravani-Chiwawa	565	112
Total	1 597	320

Source: Field Survey, 2010

Stratified systematic sampling ensured that no village in the study area was underrepresented or overrepresented. The sampling procedure also ensured greater accuracy and confidence in the estimates. Furthermore, it facilitates analysis of strata and hence of subgroups of population. It thus, eases spatial comparisons.

Questionnaires

Survey questionnaires were targeted at household heads. 320 household heads in the study area completed the questionnaires. The questionnaires were personally administered to the respondents in the field. The self-administered questionnaires enabled the researcher to allay respondents' fears, distress and anxiety over issues raised in the questionnaires. They also enabled the researcher to put the respondents at ease and create good rapport. However, the main limitation of self-administered questionnaires was that in the presence of the researcher some respondents could have given responses they deemed socially or culturally acceptable. Therefore respondents might have given responses that do not truly represent their situation. Hoggart, Lees & Davies (2002) note that respondents may express different views according to their reaction to the interviewer.

The questionnaire content captured data on the socio-economic impacts of Siya Dam construction in the study area as well as the socio-demographic aspects of the population. The survey questionnaires had both closed-end and open-ended questions. Most questions were closed-end questions. Closed-end questions ensured that the data were easily coded. Anderson (1989) notes that closed-end questions are easy to answer and analyse as opposed to open-end questions. The main limitation of closed-end questions is that they may introduce bias into the research. This is because they may force respondents to choose from responses that do not truly represent their situation.

Interviews

Structured interviews with government officials and other key informants were also conducted. These included the Agricultural and Rural Extension Officer for Mazungunye, Health Officer at Ngorima Clinic, headmasters of local schools, Zimbabwe National Water Authority Siya Dam Manager and the Zimbabwe Parks and Wildlife Management Authority Warden based in Masvingo City.

Pilot Study

A pilot study was carried out in the study area. The pilot study enabled the researcher to check the operational effectiveness of survey instruments. Hoggart, Lees & Davies (2002) note that a pilot study involves a scaled-down version of the proposed survey procedure. Anderson (1989) notes that a pilot study is a 'pre-test' that checks the feasibility of the survey.

RESULTS AND DISCUSSION

ECONOMIC BENEFITS AND COSTS OF THE CONSTRUCTION OF SIYA DAM

Constant Supply of Water for Livestock

The constant supply of water for livestock is one of the economic benefits of the dam. The percentage of respondents in all the strata who own some livestock is ninety two percent (92%). Livestock ownership is however, skewed against child-headed households. Ninety five percent (95%) of the questionnaire respondents from Bengura and Marufu-Jere Villages ranked constant supply of water for livestock by the dam as of great importance. These are the villages located closest to the dam. However, the importance of constant supply of water for livestock decreases as the distance of village location from the dam increases as only twenty six (26%) of the respondents from Ngorima Village ranked the benefit as of great importance. This is largely due to the fact that the village is the furthest away from the dam and therefore villagers are less likely to use the dam as a source of water for livestock. Thus, the livestock from the village rarely drink from the dam. It is only during drought years when nearer shallower livestock watering points run dry that villagers from Ngorima are willing to move their livestock to go and drink water from Siya Dam.

Higher percentages of the income obtained from livestock production are spend on paying school fees and buying educational books. Most questionnaire survey participants used more than seventy percent (70%) of the income for this purpose. Education has potential to empower the community. Other uses of the income obtained from livestock production are buying agricultural inputs, home furniture and groceries and paying health fees and transport costs.

Generation of Income from Fishing

Seventeen percent (17%) of all the respondents are involved in harvesting fish for marketing purposes. Ninety four percent (94%) of these are in the age group 18-59 years which is the most economically active. Males dominate the harvesting of fish for marketing purposes as ninety one percent (91%) of the respondents engaged in the activity belong to this gender. Seventy four percent (74%) of the respondents harvesting fish for marketing are from Bengura and Marufu-Jere Villages while twenty six percent (26%) are from Ngorima and Njaravani-Chiwawa. Thirty one percent (31%) of respondents harvesting fish for marketing obtain more than US$ 200 per month on average from the venture. In addition thirty five percent (35%) and thirty four percent (34%) of the respondents harvesting fish for marketing obtain between US$ 100-US$ 200 and less than US$ 100 per month on average from the venture respectively.

Fishing in the dam is managed by the Zimbabwe Parks and Wildlife Management Authority. The types of fishing boats used range from dug-out canoes to wooden boats. Most of the fishing is with gillnets. 3.5 inch mesh sizes are allowed. The managing authorities face the problem of fishers who use wire traps and hessian sacks as the use of these results in unsustainable fishing.

Economic Disruptions of Siya Dam

Eighty nine percent (89%) of the respondents felt that loss of productive agricultural land due to flooding was an economic disruption of great significance. Forests were also inundated resulting in loss of fauna and flora. The dam flooded 810 hectares. Flooding also led to displacement of people and the associated financial costs of rebuilding settlements.

Four percent (4%) of the respondents also felt that financial costs of hospitalization due to water-borne diseases introduced by the dam were of great significance. Furthermore, two percent (2%) of the respondents felt loss of working hours due to debilitation caused by water-borne diseases was of great significance.

SOCIAL BENEFITS AND COSTS OF THE CONSTRUCTION OF SIYA DAM

Increased Provision of Fish Protein

Ninety eighty (98%) of the respondents felt that increased provision of fish protein was of great importance. Fish protein contributes to boost the diet of local residents.

Use of Dam as a Recreational Resource

Recreational activities provided by the dam are swimming, fishing, bird watching and sight-seeing. Eighty five (85%) of the respondents using the dam for recreation are from Bengura and Marufu-Jere Villages and fifteen (15%) are from Ngorima and Njaravani-Chiwawa. Thus, villagers are less willing to travel longer journeys for recreation as Ngorima and Njaravani-Chiwawa Villages are further away from the dam. The main hindrances to water-based recreation are the fear of drowning and being trapped by crocodiles. Thirty eight (38%) of the respondents said they do not swim in the dam because it is crocodile-infested.

Social Disruptions of the Dam

Seventy four percent (74%) of the respondents felt the inundation of settled areas was a disruption of great significance. The majority of people whose settlements were inundated by the dam were resettled in Ngorima Village. The resettlement of these villagers resulted in the occurrence of social conflicts between the resettled people and those already residing in Ngorima Village. Nine percent (9%) of the respondents rank stress caused by uprooting as of great importance.

Fifty three (53%) of the respondents felt loss of historical and cultural sites is of great significance. Zimbabwe National Water Authority officials noted the little attempt that was made by colonial authorities to rescue archaeological and cultural sites such as graves and shrines.

Eight percent (8%) of the respondents felt disruption of transport and communication is of great significance. This was the result of the replacement of the relatively narrow Turwi River by the dam. The villagers now find it difficult to communicate with their relatives and friends across the dam in Zaka District. They now travel longer distances to get to Zaka District.

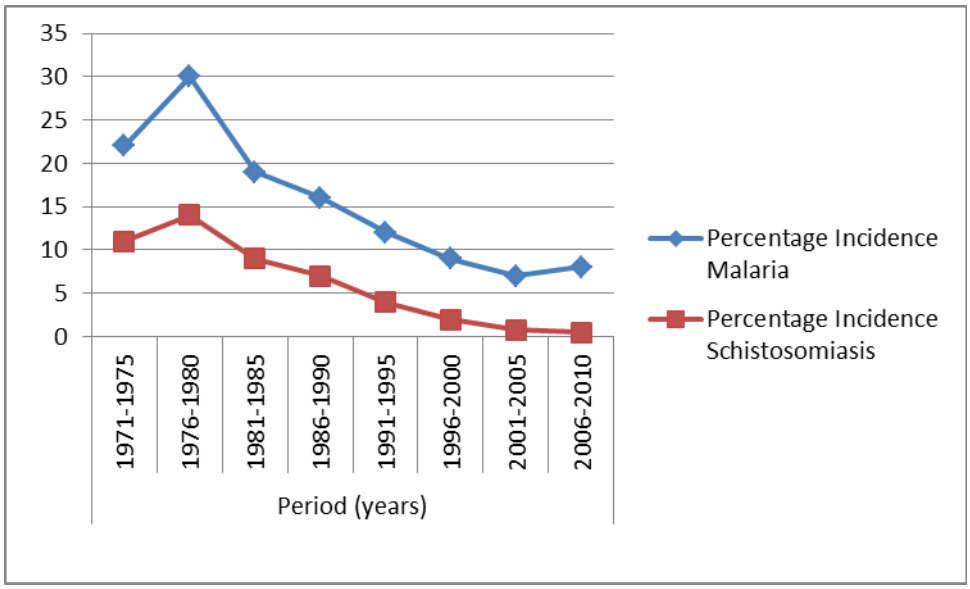
Ninety percent (90%) of the respondents felt drowning of people in the dam is of great significance. People drown in the dam while fishing, swimming and trying to cross the dam. The bodies of some people who drown are never recovered. The nearest police sub-aqua unit is only found at Masvingo City, the provincial capital about 115 kilometres away.

Incidence of Water-borne Diseases

Ninety nine percent (99%) of the respondents rank the incidence of malaria as of significance. Ninety percent (90%) also rank the incidence of schistosomiasis as of significance. The incidences of river blindness, liver fluke and yellow fever are less.

Health officials at Ngorima Clinic note that the incidence of infection with malaria in the study area rose from twenty two percent (22%) for the period 1971-1975 to thirty percent (30%) for the period 1976-1980. The incidence then declined reaching seven percent (7%) for the period 2001-2005 before increasing slightly to eight percent (8%) for the period 2006-2010. The incidence of schistosomiasis among the local community rose from eleven percent (11%) for the period 1971-1975 to fourteen percent (14%) for the period 1976-1980. The incidence then declined reaching less than one percent (1%) for the periods 2001-2005 and 2006-2010.

Figure 5: Percentage Incidences of Malaria and Schistosomiasis in the Study Area for the period 1971-2010



The increase in percentage incidences of both malaria and schistosomiasis for the period 1976-1980 is largely attributable to the construction of the dam although the intensification of the liberation war also played a negative role in facilitating health provision. Siya Dam construction ended in 1976. The decrease in percentage incidences of these water-borne diseases from 1981 is greatly attributed to increased use of prevention measures. Schools also intensified their awareness campaigns aimed at reducing incidences of water-borne diseases among pupils and their parents.

CONCLUSSION AND POLICY RECOMMENDATIONS

The study has revealed that Siya Dam has both positive and negative socio-economic impacts in the Mazungunye area. However, there is need to enhance the beneficial impacts and minimize the adverse impacts of the dam.

The beneficial economic impacts of the dam can be enhanced by developing local irrigation schemes. Lack of capital is the major hindrance to the development of the schemes. Funds should be made available for this purpose. Irrigation has the potential to boost local agricultural incomes through insuring constant supply of water for crops throughout the year. The development of irrigation schemes is also an important mitigation measure against climate change which is expected to result in increased occurrence of droughts in Zimbabwe. Thus, irrigation projects can ensure that agriculture continues to be viable in the face of climate change. In fact Zimbabwe is expected to have a warmer and drier climate by 2075 with some areas ceasing to be suitable for maize production (UNEP and ICRAF, 2006).

Fishers should also be provided with increased access to capital resources in order for them to purchase modern fishing gear. The modern fishing gear will help reduce the incidences of drowning and being attacked by crocodiles among fishers. Increased access to capital resources will also help fishers in processing and marketing their products. Further, aquaculture should be developed as a way of diversifying economic activities in the study area. Aquaculture will also increase access to

fish protein for the community. This will result in an expansion in income generating activities and help improve community health thereby contributing to the achievement of the Millennium Development Goals.

The Zimbabwe Parks and Wildlife Management Authority should also effectively control and monitor fishing in the dam. Fishers should use nets with the recommended mesh sizes. Efficient and effective monitoring and policy enforcement should be put in place to ensure that fishers do not use illegal fishing gear like wire traps and hessian sacks. This will prevent overfishing and promote sustainable fishing.

The provision of improved infrastructure for water-based recreation and tourism should also be made a priority if the benefits of Siya Dam are to be enhanced. The development of camping sites, restraunts and other leisure facilities can promote tourism and also expand the market for local agricultural products. The development of tourism will also provide employment for the growing number of unemployed people in the area. Thus, the development of water-based tourism has the potential to act as a catalyst for economic growth in the area. Further, ecotourism should be promoted in the study area as it contributes to sustainable development.

Further, the benefits of Siya Dam can be enhanced by using its water resources for the development of a mini hydro-electric power plant project. The mini hydro-electric power project would augment the national power grid and contribute to the production of clean energy. The project could also benefit from carbon trading as this will be one of the alternatives to achieving net carbon sink status. This will be a plus for combating global climate change and achieving sustainable development.

Local communities should also participate in water resource development planning. This empowers local people so that they regard the development projects as their own. The Mazungunye community did not actively participate in the development planning of Siya Dam. This has largely contributed to failure by authorities to ensure the local communities reap maximum benefits from the dam. Community involvement in dam construction also reduces the impact of uncertainties and stress caused by uprooting and resettlement. Thus, bottom up planning is necessary for the achievement of sustainable development.

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