



A REVIEW OF STAKEHOLDERS PARTICIPATION IMPORTANCE IN THE DEVELOPMENT OF WATER DIVERSION SYSTEMS IN DEVELOPING COUNTRIES: A CASE FROM GURARA WATER DIVERSION SYSTEM, NIGERIA

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ABSTRACT

Water diversion arguably generates significant controversies and deep conflicts in water resources management. Although diverted water is useful in meeting water demands and used as a tool especially in developing countries to reconcile the problem of uneven water distribution, there is still an ongoing debate on the best management option for water diversion systems in terms of the complex engineering, technical and management inputs required. Accordingly, there have also been the emergences of ecological impacts and social implications which have the potentials of discontinuing a particular system if not inadequately addressed. This has preempted the need to have stakeholders fully participating, with the aim of ensuring benefits and concerns are well understood and reduce possible divisions and in-fights amongst diverting regions. This study has reviewed the benefits and concerns from stakeholder's participation in water diversion systems at a global scale, using the Gurara water diversion system located in north central Nigeria as a case study. The findings shows the more water is diverted, the more complex the management of the system, indicating the peculiarity of the regions as being an important planning unit. This calls for a collaborative approach emphasizing on stakeholders participation to develop a system for policy formation especially in developing countries with existing water diversion systems or prospect of building in the future. Consequently the degree of benefit and concerns from water diversion varies widely with much dependence on the region. Though water diversion can be highly problematic, there is the call to keenly consider stakeholders participation in ensuring strict adherence to the benefits and concerns in planning, construction and management of water diversion systems for sustainability.

Keywords: Benefit and Concerns, Stakeholder Participation, Water Diversion, Gurara Reservoir and Lower Usman Reservoir.

1. INTRODUCTION

The distribution of available water globally varies both in time and space even though global water remains constant while there remains a constant fluctuation in volume accessed due to possibly increase in human-induced activities coupled with climate change and the demand is continuously on the increase. Thatte [1] discussed, when the available water and demand begun to approach equilibrium position, there is the need to develop new approaches to effectively manage water, from the conventional supply oriented (usually the construction of hydraulic structures) to a much more holistic approach that attempts to balance environmental, social and economic

considerations in decision-making. This, when probably done will typically result in measures that intend to influence (and decrease) the demand for water, which increase the efficient use of water, and that optimizes the economic return on water through re-allocating water to higher-value uses.

When demand for water outstrips the amounts that are generated within the river basin, supply- oriented approaches will remain important and new water sources will have to be found either by desalinating seawater in coastal regions or by taking water from neighboring river basins, i.e. through water diversion systems. This is a point which seems to present a paradigm shift that [1] observed

leading to the dynamics of the economical importance of the demanding population. Such economic assessment tends to secure the continued supply of the essential resources that keep them ticking, including such a vital resource as water. Given the magnitude of the economic and political interests involved, such heartlands can afford to invest large amounts of money in the form of water diversion systems to ensure that the required supplies continue to flow. The latter seems to be becoming the prevailing solution among water resources practitioners, amongst them is the Central Arizona Project (CAP) and the California State Water Project in the United States [2], the Indira Gandhi Canal and Telugu Ganga project in India [2], the three-route (East, Middle, and West) South-to-North Water Transfer Project in China [3]. Besides, in Africa, amongst the most noticeable are the Eastern National Water Carrier (ENWC) in Namibia [3] and the Lesotho Highlands Water Project (LHWP) in South Africa [4].

Water diversion is one of the most innovative concepts significantly designed to eliminate water resources deficits and to solve water management problems, especially shortages. With this in mind, water diversion has been described with different terminologies ranging from interbasin water diversion, interlake water diversion, inter-catchment water diversion, inter-river transfer, large-scale water diversion, and long-distance water diversion, all in an attempt to describe the man-made hydraulic infrastructure conveying water from one area to another where the water demand has exceeded, or will potentially exceed available supply.

Since water diversion which is an integral part of the management of water resources systems, thus, the classification of water diversion systems will enable practitioners to formulate a regulatory body for effective management. The criteria for classifying water diversion are based on the National Water Development Agency report [5]. In the report, the volume of water diverted (V) and distance (L) of the diversion are the most important components to be considered in the characterization of a water diversion systems as these components determine the impact of the diverted water on the environment as well as the cost of its establishment. According to analysis from stakeholders, this is a justifiable conclusion to classify water diversion systems based on a combined index volume and length [6]. Listed in Table 1 is the classification index of widely accepted water diversion systems globally.

Table 1: Classification of water diversion systems

Category of Transfer	Volume (V, km ³ /yr)	Distance (L, km)	Scale Index (V x L km ³ /yr.km)
Small	<1	<10	<100
Medium	1 – 2.5	100 – 400	100 – 1000
Large	2.5 -5	400 – 1000	1000 – 5000
Very large	5 – 10	1000 – 2500	5000 – 25000
Largest	>10	>2500	>25000

Sources [6]

Although water diversion tends to trigger many questions from different interest groups, riparian involved and affected, these questions address a variety of issues related to different disciplines and academic traditions, including technical feasibility, technological challenges, and the need for stakeholder's participation in the design, planning, and management of water diversion systems. The issues arising from the questions mostly to one central focus point: how do water diversion systems relate to the concept of stakeholder's participation? Is it indeed true (and possible) that stakeholder's participation remains the leading principle of a water diversion system involving two regions in a shared effort to attain sustainability? Is it possible to carefully consider all the dimensions of stakeholder's views involved when deciding to establish such diversion systems, and when operating them? These are large questions that are provoked by water diversion systems [1].

This paper will not be able to provide all answers. What it will do is to critically review some approaches that have been proposed following exhaustive consideration of stakeholders for an integrated assessment of such large man-made water infrastructures. This paper is structured as follows. It first provides an overview of the benefits and concerns of water diversion with success stories of stakeholder's participation in order to draw key lessons behind this review. It then applies this set of conclusions derived to the Gurara water diversion systems Nigeria in order to provide a preliminary assessment before discussing the identified shortcoming. Finally to draw conclusions about the need to fully integrate stakeholders in changing policy environments concerning water diversion in developing countries.

2. REVIEW: EMERGENCE AND UNDERSTANDING OF WATER DIVERSION SYSTEMS

The increase in water demand for domestic, agriculture, hydropower, and other sectors respectively have propagated the view increasingly describing water diversion systems as a quick and strategic human response to global water scarcity, variability in climate, the rapid increase in population, and other emerging environmental constraints. Globally there are several water diversion systems in operation to tackle the uneven distribution of available surface water resources [2- 4]. In all areas where water systems have been put to use, they play an active role in the stabilization of water supply systems especially in arid or semiarid regions, where they most needed [7]. The emerging concern is that the receiving region benefits from additional water been supplied through the diversion operation whereas, in the donor region, water is removed from it by under its name, thereby leading to a reduction in its available water [8]. In the donor region, the potential effects of reducing its water source include alterations to a natural flow regime [7], weakening its ability to absorb pollutants and to support the riparian ecosystem and

health [9] and a reduction in its ability to provide water-based recreational activities due to decrease in availability [10].

Accordingly, Water diversion between two regions usually generates controversies and conflicts among stakeholders particularly those from donor regions with sometimes enough to terminate or avoid such diversion systems from being constructed. Over the years these controversies have led to a steady increase and widening of research scope to include a variety of topics concerning issues water diversion [9]. These topics range from fish migration, economic assessment, and hydrological impact of water diversions and views of risk assessments associated with water diversion for domestic water supply [11], ecological impact the water diversion [12], effects of water diversion on groundwater resources [13], water diversions for downstream and upstream irrigated agriculture [14] and the viable options of water diversion for sustainability and adapting to accelerating global challenges [15]. This has informed the need to have a quantitative and comprehensive understanding of the statistical and scientific output of diversion system research. These outcomes will no doubt attempt to provide a basis for a better understanding in the field of water diversion, which may serve as a potential guide for future novel research. Therefore, a stakeholder analysis in reviewing the water diversion benefits and concerns is warranted.

3. BENEFITS AND CONCERNS WATER DIVERSION SYSTEMS

The motivation by authorities from stakeholder's analysis in driving water diversion systems is the conception surrounding the strategic role it plays in alleviating water deficits and ensuring water security. This is because water diversion in itself is a coalition of outcomes, resulting from the complex interconnection between interests and professionalism displayed by politicians, engineers, and financiers [8]; making such systems one of the most debatable topics in water resource planning and management in the world [12]. The debate mostly is centered on the stakeholder analysis between the benefit and concern of such systems. In an attempt to assess the benefits and concerns about water diversion systems, it is interesting to note that most of the analysis trending is skewed towards the divide between governmental and non-governmental sources as portrayed in the review of the literature concerning water diversion. While the benefits are propagated by stakeholder's analysis from government sources justifying a particular diversion operation, the opposition is from non-governmental sources.

3.1 The Benefits of Water Diversion Systems

Water diversion systems are conceived and establish predominantly on the aim of augmenting municipal water supply, irrigated agriculture, and as well for hydroelectric

power generation [9]. Although both irrigation and municipal water supply have been in contention as to which will be a priority in terms of allocation in a particular system of water diversion. Ye, *et. al* [13], supports the view that water for irrigation is given precedence, whereas the support for municipal water supply is perceived to have higher priority [14]. However, a global report on major water diversion systems reported according to Albiac-Murillo, *et. al* [15] upholding the standpoint, supporting municipal water supply as a basic benefits-driven rationale for which a water diversion system is developed especially in developing countries. With this submission not out of place, it important to note that besides municipal water supply, water diverted for irrigation and hydropower also brings appreciable benefits as well environmental flow for ecosystem functioning, recreation, and navigation [16].

The benefits from water diversion systems are further highlighted in this review study from stakeholder analysis to better drive home the point that water diversion systems bring economic prosperity to regions where they are established around the world [15]. For instance, water diversion systems enhance socio-economic development, enhances allocated water for best value use, strengthened regional co-operation, and equality between donor and recipient regions [15]. Furthermore, water diversion improves a nation's welfare [16]. Subsequently in china, the role of water diversion systems in the energy sector presents an enormous benefit and thus well acknowledged [5]. Overall, water diversion systems have been advantageous in many regions and improved the water supply of various sectors [17]. However, it is important to note that despite these benefits, there is the concern of extensive costs ranging from financial to environmental and social which needed to be reviewed from the stakeholder's perspective.

3.2 Concerns about Water Diversion Systems

The close interlinks surrounding the controversies surrounding water diversion systems have made even the advocates acknowledge these concerns [18]. Accordingly Gro Volckmar Dyrnes and Arild Vatn [8], discussed the issues of concerns as cutting across various disciplines and civilizations. The concern arises from the review of several publications encompassing a range of highlighted issues associated with water diversion by other researchers [16]. However, it is worthy to note for this review has made medication to these concerns raised to affirm and buttress the novelty and uniqueness of this study. This is done through reflecting in areas of discussion: the scale of stakeholder's participation in water diversion systems and approaches for integrating stakeholder's participation and the shortcoming. The way forward in water diversion systems for research is also highlighted. More immediate is the network of connection showing the interrelationships as well the complex interrelations of concerns regarding water diversion systems as illustrated in Figure 1.

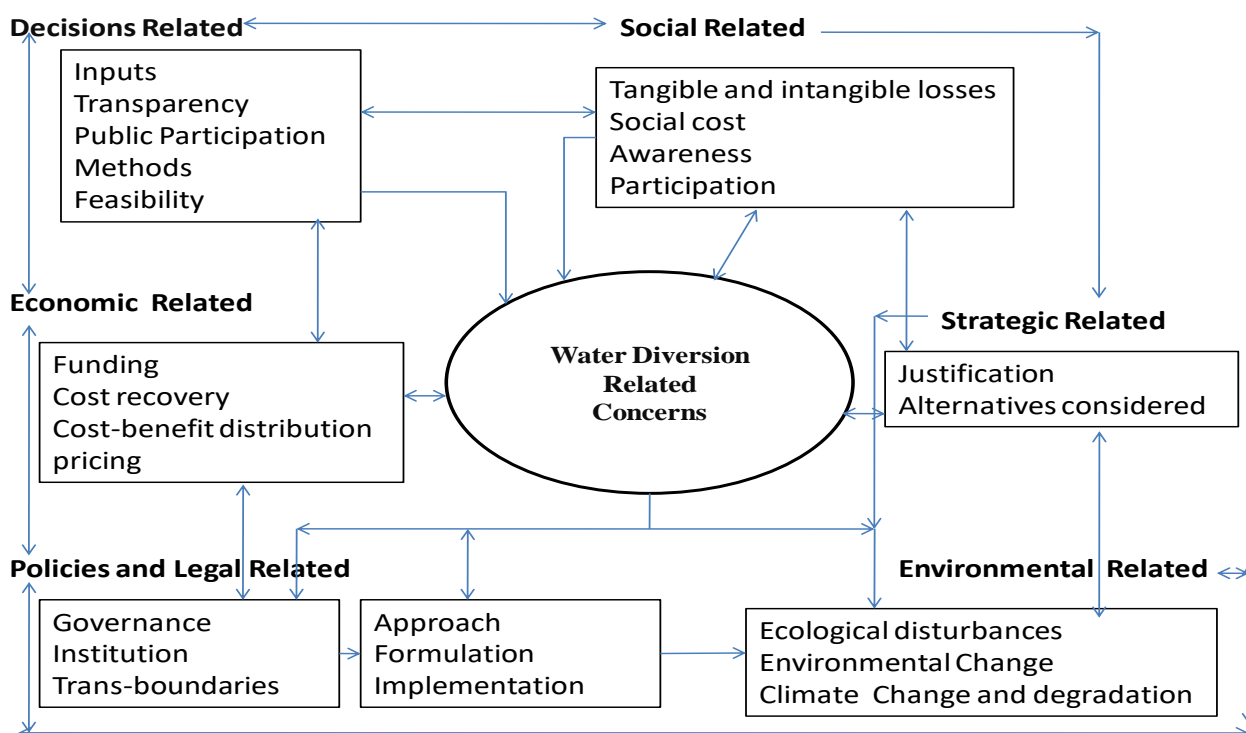


Figure 1: The network of connecting links showing the interrelationships of concerns with water diversion Source [4]

3.2.1 Management Decisions Related to Concerns

The decision-making processes concerning water diversion systems are multi-disciplinary in nature and often complicated [20].

These complications have resulted in the decision processes at management level of these systems, prone to a chain of reoccurring inconsistencies in the process of their planning and management. This is because water diversion usually involves the management and planning of water resources of two or more regions [9]. In the review of stakeholders analysis concerning these complications, Weihua, et. al [21] report that these inconsistencies arise from temporal to the spatial magnitude and volume of water distributed.

Wrong assumptions and incorrect input data for water availability assessment, demand, and seasonal water level dynamics respectively has also been reported by Albiac-Murillo, et. al [15]. This view agrees with Kruger, et. al [22]. For example, when inaccurate assessments are done especially in water demand and availability, the outcome can result in either overestimation or underestimation of the water balance within the system. The overall concern on the decision-related concern of water diversion is the fact that it will weaken the dependability of the decisions that may concern a particular system [23].

The decisions on climate variability can influence the viability of water diversion systems as climate change is greatly interlinked with water availability [24]. However, in

most developed countries, these influences have been well explored and integrated into the management and planning processes of water diversion [16], while the situation is different for developing countries as they are well far behind in exploring. This undermines the decisions made in these developing countries concerning water diversion, as is further complicated by the fact that the decision-making process of water diversion on data collection, compilation faces enormous challenges [25]. There is also the problem of inadequacies in technological development [2].

Furthermore, the management-based challenges encountered by practitioners of water diversion systems especially in the water sector of developing countries consider methods traditionally regarded as outdated and therefore the confidence of the outcome is seriously undermined [16]. The participation of stakeholders in the decision making concerning the management water diversion will create a degree of transparency and such positioned such system as complying to global best practices especially "The Dublin Principles" as reported by Lund, [26]. However, in developing countries, there is the challenge of diminishing the credibility of water diversion systems due to a lack of transparency of decisions made on such systems [9].

Very recently, there has been an extensive challenge on the quantity objective approach which is the traditional practice for water diversion adopted by water resources

planners especially in developing countries [9]. This has led to Kibiyi, *et. al* [15], calling for the propagation and promotion of a more robust approach integrating stakeholder participation into the management levels of water diversion system in both the donor and the receiving regions. This is because, in most assessment stages of developing countries, water diversion system planners concentrated more on technicalities rather than the vital components of environmental, economic, and social issues which can result in several issues as illustrated in Figure 1. For the successful establishment of the water diversion systems, at the management level of decision making, incorporating stakeholder views is highly significant as its absence can weaken the willingness of the stakeholder's participation [15].

3.2.2 Strategic Decisions Related Concerns

Water diversion systems over the years have sustained their positions as infrastructures critical in the quest to solving the problem of water deficit both natural and man-induced amongst water managers [16]. However, it is important to note that water diversion systems should only be carried out after a detailed study exploring all possible options meeting the demands and the best way of managing them. This is because most water diversion systems in their establishment usually result in the displacement of people from one point to another, meaning there is the potential it could be influenced by social and environmental argument rather than the cost and benefit factor [15]. It is important to note that this consideration is mainly an argument from the stakeholders rather than water resources managers. But the view of managers in water diversions is anchored on a strong alliance comprising politicians, engineers, and investment experts (financiers) who normally propagate the support for the quantity object supply-side solution as against the demand-side. This is because, in their view these systems provide water in regions with deficit water supply, and the reason these systems are considered in most cases as advancement in technology to aid economic growth and national development [12]. Interestingly strategic concern of water diversion is often justified by water diversion planners as systems which are indeed for national interest by meeting water demand at the receiving region.

When water diversion results from inaccurate strategic decisions, it is evident that such systems will likely not fulfill the hypothesis surrounding their construction [28]. This usually occurs when key assumptions made in most cases are overestimated. For example, the China South-North Water Transfer Project [18], outlined that the strategic decision concerning diverting water from the South as the donor region with surplus water to the North as the receiving region with water shortage promoting wasteful water usage portraying wrongful assumptions, hence, there was the case of unrealistic water demand from the south with the potential of leading to water crisis.

3.2.3 Ecological and Environmental Related Concerns

The fact that water diversion systems are built with challenges including the need to maintain environmental flow in the donating region, makes it necessary to ensure the system is properly planned [29]. In a situation of poor planning, these systems can result in reduced flow in the donor region thereby violating the limit of minimum environmental flow as required by regulators [20]. Accordingly, any additional remedy to salvage will attract more cost to the construction there making it economically unsustainable according to Ghassemi and White [17] and in the long run posing a major challenge to the rationale behind the establishment of such a system in the first place. Furthermore, reduced flow resulting from poorly planned water diversion systems in the donor region can result in visible shrinkage in the volume of water especially in wetlands [29], whereas in the receiving river region, there is a potential problem of inefficient water use [15] resulting in unnecessary water pounding [29]. Diverting water from one region to another can serve a medium for contaminant and sediment transport, thus, affecting the water quality in the receiving region as well as introducing alien species in the recipient water bodies.

3.2.4 Social Related Concerns

Despite the presence of a sound knowledge concerning the benefits associated with water diversion systems, there is still the continuous debate on the substantial social costs including tangible and intangible costs surrounding the successful rehabilitation and resettlement of the displaced population directly affected by reservoirs created in the receiving regions [30]. The social consequences of resettling usually constitute a major challenge for stakeholders at all levels. This complication can be compounded if the process is mismanaged for large scale water diversion systems [16]. Not only will resettlements affect the stakeholders, but increase costs drastically especially when they are considered after the construction is done.

The intangible cost comprising cultural, emotional livelihood loss and loss of valued land through submergence of initially inhabited lands have previously not been given attention by planners of water diversion systems [29]. These concerns can have a tremendous effect on diversion systems [30], as, over the years, these affected regions have had little or no compensation, especially in developing countries [16]. These concerns if allowed to grow with poor management mechanisms in place will result in stakeholders opposing the progress of these diversion systems thereby creating a lasting impression even after completion and can instigate social and political conflicts.

3.2.5 Economic Related Concerns

The economic concerns of water diversion systems are mostly anchored on the cost-benefit analysis, although the fact remains that there are no discrepancies regarding the huge financial implications of such systems as its currently been debated by stakeholders from opposite sides at worlds stage [9]. While the propagators suggest that the high cost is justified because water diversion systems promote economic prosperity globally, critics decline to accept the view insinuating that the huge financial implication simply puts unrealistic pressure on public financial resources and some with little or return on investment [17]. This because the high cost associated with water diversion systems can practically make it almost impossible to commence if the targeted stakeholders are asked to fund it. With this in mind, integrating stakeholder's participation as measures to discourage wasteful use of water is viewed as progressive from the economic point of view. This is putting the right value of water to be diverted from the donating region where its supply is in excess to the receiving region where its demand is in excess.

The challenge most often encountered is in the donating region in case of a lopsided mechanism for distributing benefits between the donor and the receiving regions. Accordingly, *Albiac-Murillo, et, al* [15] reported, this scenario has the potential of igniting socio-political conflicts amongst the relevant stakeholders. Consequently, the fact that the water diversion system accrued additional financial implications at an advanced stage of construction is a reoccurring phenomenon most unaccepted, as such stakeholders propagating its establishment. This is the case when there is a poorly planned economic evaluation of the system, leading to underestimation of the final cost of construction [15]. This has attracted criticism for planners of water diversion system for undermining the importance of stakeholders in fully understanding the environmental and socio cost in the planning of water diversion systems in developing countries.

4. CASE STUDY

4.1 The Gurara Water Diversion System: (The Water Need in Abuja)

Abuja is the driest city to have ever hosted Nigeria's Federal Capital Territory and arguably one of the fastest growing and ranked currently as the most urbanized city in West Africa. Overall, the water demand in the city is expected to have a 19 % increase by the year 2035, increasing in demand for new water appropriation for the almost 1769 km² of land as reported by [31]. Most of Abuja's surface water system is sourced from the Lower Usman Reservoir which is experiencing decline preempting a need for additional sources to augment its supply during periods of low flows. This was the recommendation from the study conducted by the Federal Government of Nigeria

in an attempt to address the potential water crisis in the city. In the study, the Gurara River project initially which started as a search for places where a battery of boreholes can be drilled to augment water supply to the Nigerian Federal Capital Territory (FCT), later hatched the idea for an alternative after the initial concept of the borehole were dropped due after multiple failures in preliminary trials. The first trial was the Directorate for Foods, Roads and Rural Infrastructure project to drill several boreholes in the FCT. Secondly, the River Usman was dammed and this was later found inadequate for future water supply. According to Abdullahi, and Panse [31], further search studies continued while investigating the watercourse from Jere town along Abuja-Kaduna road which ended up eastwards, and finally, a dam across River Gurara (straddling Kaduna and Niger States) in north-central Nigeria was conceived. The reservoir which now serves both as a source for water diversion to Lower Usman Reservoir is also the source of hydro-electric power generation. In their conclusion, the Gurara River flowing into the River Niger upstream of Lokoja a confluence town be dammed and diverted for future needs. According to Olasehinde and Awojobi [32], before damming the Gurara River to create the Gurara Reservoir, there were six villages namely Atara, Akama, Asawa, Akwana, Dokah, and Kadah which were within the reservoir area, and one village (Maje) within the irrigation area were all relocated to a new settlement as their villages were submerged with water. The Gurara Water Diversion System (GWDS) from Gurara Reservoir Catchment to Lower Usman Reservoir Catchment as suitable for a case study in this review is shown in Figure 2.

4.1.1 Description of the case study Area

The case study is a system connecting the two regions for the GWDS is between Latitude 09° 38'N to 09° 48'N and Longitude 07° 42'E to 07° 49'E and covers an area of approximately 2,150km². The diversion route covers a distance of 75km from the Gurara Reservoir in Kaduna State to the existing lower Usman Reservoir in the FCT, Abuja as illustrated in Figure 2. The climate is the tropical continental climate characterized by the wet and dry season. The mean annual temperature is about 27°C, while the mean monthly temperature varies from 25°C in July to a maximum of 35°C in February/March. The mean relative humidity vary from 50% to 60% [31].

4.1.1.1. The Donating Region: The Gurara Reservoir covering an area 150 km² is the donating region. The region which hosts the reservoir completed in 2007 has a capacity of 880 mcm and 61km² surface area of an artificial lake, created by the water impounded from the Gurara River. The reservoir provides water supply, for up to 6,000 hectares, for the Azara-Jere irrigation scheme.

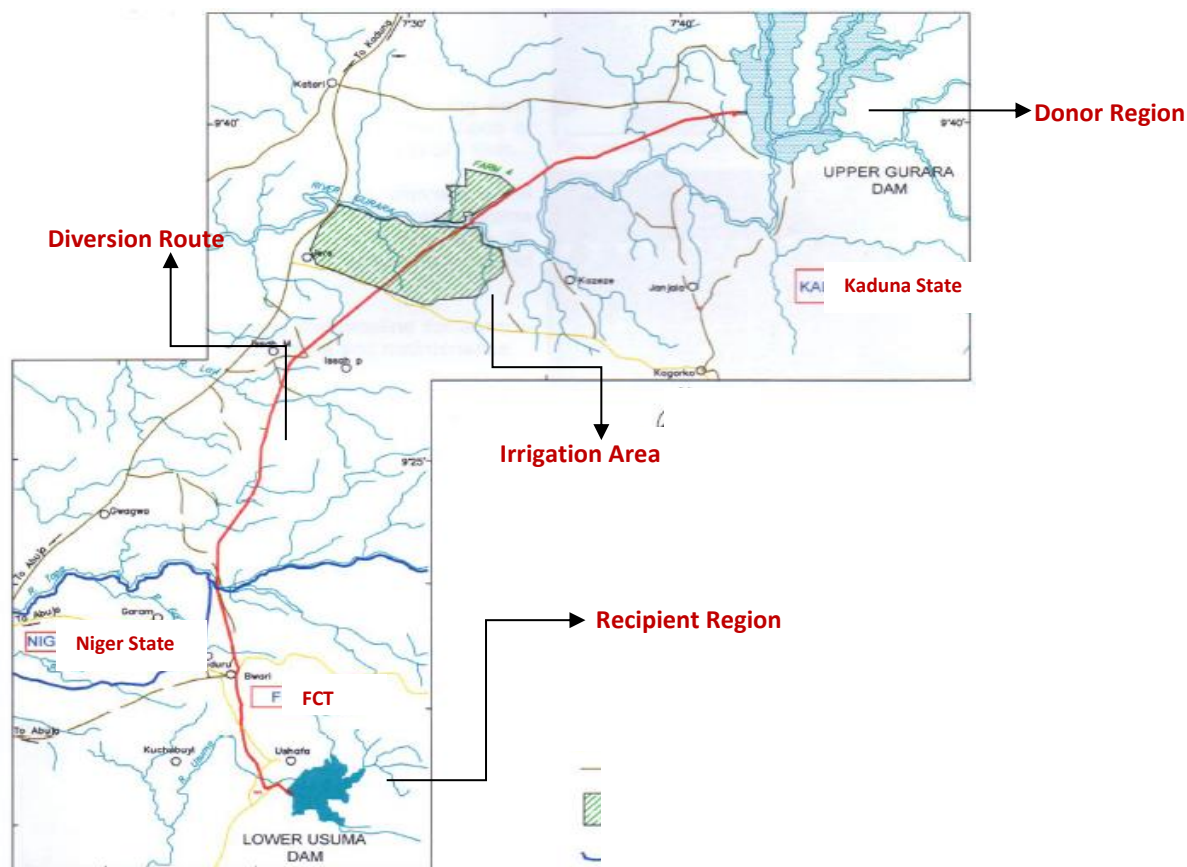


Figure 2: Gurara Water Diversion System Layout in Nigeria. Source [33]

The need for the Gurara Reservoir arises from the fact that by 1999, the FCT had a population of 2.1 million and this number has been projected to increase to about 7 million in the next 50 years [30]. This rapid population growth and its accompanying developments have brought about a tremendous surge in the demand for water, essential in sustaining its inhabitants.

4.1.1.2. The Receiving Region: The Lower Usman Reservoir commenced operation in 1987 and serves as the receiving region. The reservoir site is about 26 km from the FCT, Abuja. The Reservoir has a capacity of 120 mcm of raw and untreated water. The Gurara River is situated at an elevation of 50 m below the donating region. The need to divert water was conceived following the inability of the Lower Usman Reservoir to cope with the water needs of FCT's spiraling population, whose daily demand for water was expected to hit the high mark of one million cubic meters in 2030, up from the 210,000 cubic meters [30].

4.1.1.3. The Regions Connecting Route: The route connecting the regions begins from the Gurara Reservoir and follows a toe of plateaus before arriving at the Lower Usman Reservoir. The outlet of the connecting route in the Lower Usman Reservoir is a free-flow weir, allowing for the

discharge of water with a low head, and also providing aeration.

4.2 The Gurara Water Diversion System: Uncertainties and Advice

The Gurara water diversion system built to address the water-related issues of the FCT when the city's waterworks must have been completed 2070, as well as augmenting for environmental flow downstream for ecosystem functioning [31]. Although the system attracted huge financial implications, the Department of Dams and Reservoir under the Federal Ministry of Water Resources expressed confidence that its derived benefits will greatly outweigh its costs and will attract socio-economic development in Nigeria [31]. The other major component of the GWDS includes a supply of water to support irrigable area of 100,00 hectares (6,000 currently in use) and a generation of 30 MW of hydropower (currently not in use). For optimal and effective deliverables of the GWDS in terms of reviewing the dynamics of management and planning, there is the need to have a sound understanding covering the operations of the system and the regions involved. This is due to the emerging concerns that claimed, the assumptions made on the diverted water are in away too vague and most likely look overestimated. Secondly, the projections made on benefits and concerns with stakeholders are unlikely to be reached for systems

50 years design period. The advice is to incorporate an integrated participatory approach involving stakeholder participations investigates the latest multidisciplinary tools and methods for optimal management of water diversion systems. Thus, fact-oriented research review of the GWDS as a case study is defensible under stakeholder participatory model approach.

An attempt that meticulously addressing these major concerns early, will optimally help in managing the GWDS operations in the long run, as well as meeting the projected claims towards the year 2070. In this regard, the need for equity in resolving the growing criticism from a perceived alliance between stakeholders regarding the unequal distributions of benefits from GWDS is dire for best management option. Owing to this, the novelty of this review as independent research with stakeholder's participatory approach cannot be overemphasized. On the other hand, for success to be recorded with water diversion system, there is the need to have a high level of accountability coupled with a well-coordinated inter-disciplinary mechanism as well an integrated model incorporating both the organizational, historical and projected changes in the regional climatic as well as human-induced activities of the regions involved in the water diversion.

4.3 Stakeholder Participation in Gurara Water Diversion System

Stakeholder participation as earlier discussed is a key instrument for assuring social inclusion and sustainable development in water diversion systems. Consequently, within the case study reviewed for this paper, consultation was held at various levels considering the views of stakeholders including the riparian populations, as well as relevant Ministries, Departments, and Agencies (MDAs), both at Kachia and Kagarko LGA secretariats as well as Bwari Area Council secretariat, with the presence of representatives from the Gurara Water Management Agency, Federal Ministry of Environment, Abuja Environmental Protection Board, Federal Capital Territory Water Board, Kaduna State Ministry of Environment and Natural Resources, Kaduna State Environmental Protection Authority, Salini Nigeria Limited, Coyne et Bellier and De Crown joint ventures, Water and Dam Services Company, traditional rulers, community leaders, community development associations as well as women and youth groups. Through this process, stakeholder's concerns were addressed, views, and inputs as regards the development of the system, and the measure of the proposed benefits and concerns were obtained. Although, these consultations with the stakeholders were invaluable in designing and coming up with appropriate solutions and recommendations, their participation is to ensure ownership is claimed for sustainability of the system as a whole. The confident of ownership can prevent conflicts situations both present and in the future by creating a

participative mechanism through an enabling environment in which various views with different interests and concerns.

4.4 Discussion: Scale of stakeholders participation in GWDS

This paper has raised the question of whether water diversion systems are successful the more when recognizing the importance of stakeholder participation. The Gurara reviewed as a case study indicates that such diversion mostly when operational do not easily align with the values of equity, ecological integrity, and economic efficiency that buttress integrated water resources management [8]. While water diversion systems globally are responsible for 14% of all water withdrawals, they form a special category of engineering interventions and require the inputs of the end-user directly or indirectly. This section explores why this is the case, by considering issues of decision-making processes and the important need for stakeholder's participation, as well as the specific resource scale that characterizes water diversion.

Participatory management is based on the idea that riparian involved can share their perception of a problem, offer their opinions and thoughts, and have the chance to contribute towards the decision-making processes. Stakeholder's participation in the management of water diversion systems on which they depend is one of the building blocks of the concept of integrated water resources management. This will, in the long run enable water resources managers to 1) analyze their needs, 2) identify a possible solution to meet those needs and 3) develop, implement, and evaluate an action plan, in an attempt to accommodate stakeholder at all levels. According to [34], it has become obvious that water resources policy especially concerning water diversion can no longer be limited to technical interventions, but increasingly needs to be implemented through people and their participation. Thus, the institution framework for water diversion system management should enable active stakeholder participation and integrated at all levels. For an elaborate discussion on the subject, a way forward for application in the Gurara Water Diversion system with the different approaches and stages for stakeholders participation is highlighted. The general format comprises information sharing, consultation, and initiating action as a communication approach. The second section will highlight the strategies for integrating the feedbacks from the riparian populations referred to as participatory approach.

4.4.1 Stakeholders Informative and Participatory Approach

Information Sharing: The act of sharing information is the simplest of stakeholder's participation, as it informs the stakeholders what has been decided or has already been implemented. Although information sharing is necessarily

not participation, it can help in passing information through meeting to stakeholders for example about government policy, but not really participating. Sharing of information among stakeholders enhances understanding concerning specific issues.

Consultation: These are evident in situations where stakeholders especially at the local population level are being consulted or by answering questions. In these instances, the concerned stakeholders are only informed and their views sought on key important issues, but no really considered on the board of decision making. The most common method of consulting is the use of socio-economic surveys, beneficial assessments that involve the willingness to pay for conducting the consultation assessment.

Initiating Action: Stakeholders own a cumulative body of knowledge that can be essential for the success of most water infrastructural systems. Effectively initiating action presents the highest form of stakeholder participation in joint analysis, which leads to action plans and strengthens the information that determine effective management of water diversion systems and its resources. Although, the most appropriate level of stakeholders participation is dependent on who is initiating the action plan within the context of water diversion systems management. Hence, Tables 2 and 3 presents a comparative analysis of stakeholder’s participation.

4.4.2 Strategic Approach for Integrating Stakeholders Participation

The effective management of the water diversion system to ensure deliverables is achievable through strategically adopting a stakeholder participatory approach [3]. This requires the creation of a stakeholder’s participatory process within the management of the water diversion system. The process although not exhaustive, but generally involves identification, mobilization, organization, and capacity building to maintain continued relevant participation over time.

Stakeholder’s Identification: The identification of stakeholders is the first step in ensuring qualitative participation in the operation and management of water diversion systems. In the identification, a basic description of a stakeholder will be “a person or group of persons who

have a direct interest in the operational dynamics of the system under consideration, as its existence will significantly affect their livelihood”. This will help to identify who is eligible to participate as a relevant stakeholder. Highlighted, enumerated below is the criterion for stakeholder identification.

1. Who are the potential beneficiaries of the water diversion system decisions-making?
2. Who are the closest riparian population?
3. Who are those that are the most influential riparian population?
4. Who are the vulnerable groups who might be adversely impacted?
5. Who are those that might facilitate policy improvement?
6. Are gender interests adequately identified and represented?
7. What are the relationships among the stakeholders?

In addition to the above, the following may need to be considered:

1. List all organizations that might be important including Government agencies, NGOs, companies, schools, colleges, research institutes and universities.
2. Classify stakeholders on the basis of your criteria. A matrix can be used to rank all the stakeholders based on how important they might be to the management of water diversion systems. One common way to categorize stakeholders is as follows:
 - a. Water users – those who need water for use such as farming communities, utilities, industries, hydropower.
 - b. Governmental institutions – those according to their public service role have a stake or influence in planning and management.
 - c. Civil society – those that may assist to create awareness or facilitate policy improvement.
3. Plan how and when to involve stakeholders. However, not all stakeholders may have a direct participatory relationship within the system. It may be necessary to involve certain “weak” groups to help them to strengthen their position or build their capacity. Also, some stakeholders may not want to participate because they are afraid that it will harm their interests.

Table 2: Extent of stakeholder participation, Sources [34]

S/N	Nature of participation	Degree of participation		
		Nominal	Partial	Full
1	Getting information	Δ		
2	Giving information	Δ		
3	Advising	Δ		
4	Participating in providing information	Δ		
5	Periodic functional relation	Δ	Δ	
6	Long term functional relations		Δ	
7	Establishing organizations with external initiatives		Δ	
8	Establishing the majority of peoples control in planning and implementation			Δ

Table 3: Comparison of Passive and Active Stakeholders Participation, Sources [34]

S/N	Passive Stakeholder Participation	Active Stakeholders Participation
1	Problems are not analyzed properly with community	Problems are analyzed with community
2	Needs of community are not determined but brushed over	Needs of community are determined and a plan is based on their felt needs
3	Decision is made by outsider and communities are merely informed	Decision is made by people concerned
4	Monitoring and evaluation is conducted by community by outsider	Monitoring and evaluation is conducted by community.
5	Quick implementation	Time-consuming process
6	Community is not involved in management	Community leads the management process.
7	Community is not involved in management	Community leads the management process.

Riparian Population Mobilization: The mobilization of the riparian population deals with creating awareness and stimulating the interest of stakeholders to obtain their acceptance. Riparian population mobilization for management water diversion systems is achievable through information sharing, visits to settlements of the population, participating in stakeholder meetings, or by bringing representatives to a specific consultation meeting. A common way of mobilizing a stakeholder is to invite them to workshops in which more information is provided, and in which problems or other situations with respect to water diversion at a lower level are heard and discussed. Figure 3 shows a sample of some steps to follow during riparian population mobilization.

Thus, when the riparian population is adequately mobilized, stakeholder's perceptions, attitudes, and behavior changes are achieved. This will help in the empowerment and capacity development of the riparian population, thereby ensuring sustainable management of water diversion systems through functional operation and maintenance systems. In addition, a well mobilized riparian population will result in stakeholders gaining confidence.

The Need for Stakeholders Management Structures: Ensuring stakeholder participation does not necessarily mean involving everyone in every activity. Although the significance of long-established management

structures amongst stakeholder should often be acknowledged, the general trend is that water diversion systems require new and improved management structure to accommodate their multipurpose nature. Thus, there is a need to have some kind of improved structure to represent stakeholder's views, since the riparian population as a whole cannot represent itself. This is particularly important as an improved formal stakeholder's management structure (riparian representative body) makes the work for a regulation body much easier, limiting the need for continued mobilization and ensuring a formal and regular link to the riparian population. A typical stakeholder's management structures set-ups and links with government agencies is shown in Figure 4.

An essential issue with water stakeholder's management structures is how riparian population is represented in a central forum. Procedures and guidelines must be clarified on how different representatives are selected and replaced from time to time. Clear and documented rules for this are important to obtain unbiased participation.

Maintaining Active Stakeholders Participation and Involvement: One of the biggest challenges in ensuring stakeholder's continued participation in the water diversion systems is to have and maintain an active stakeholder involvement mechanism at different levels of decision-making, thus promoting active participation through the following:

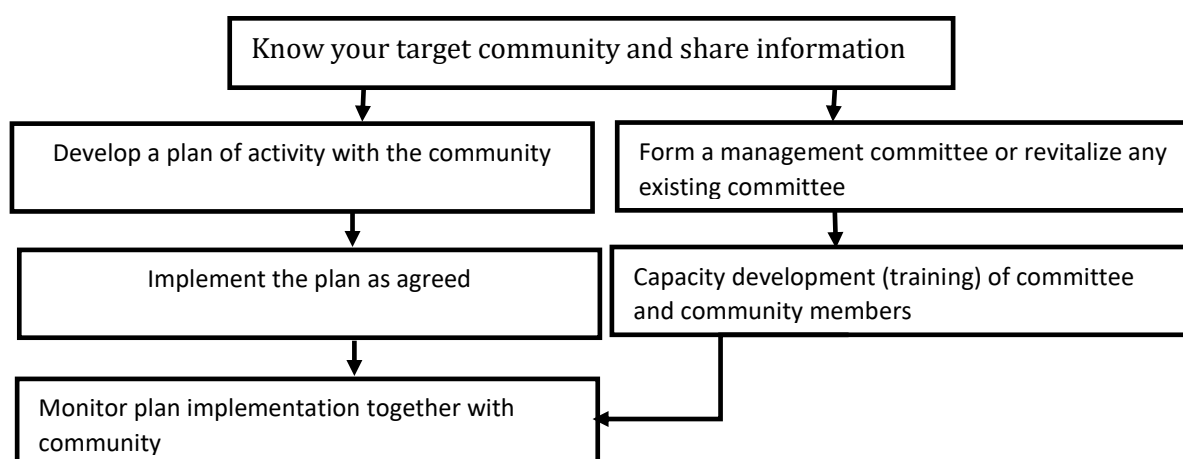


Figure 3: Sample of Steps to follow during Mobilization Process , Source [34]



Figure 4: Typical Water Stakeholders Management Structures Set-up and Links with Government Bodies, Source [34]

Information Dissemination: Information is important to keep up stakeholder's interest for the management of water diversion systems and to create a sense of local ownership of the systems. In doing this, an array of information tools may be used in achieving proper information dissemination, including but not limited to (meetings, workshops, pamphlets, visits, and consultations). This is aimed at keeping stakeholders continually informed of the status of systems either from the donating or receiving regions.

Collective Ownership of the System: This involves authorities collaborating with the different stakeholders concerning taking ownership and attendant obligations of the system such as: Participating in project planning and implementation, participating in operational and maintenance dynamics and deciding on technology options,

Capacity Building among Stakeholders: Stakeholder's participation is every so often vulnerable because the capacity of the stakeholders is sometimes too low to allow for effective participation. For this reason, the authorities managing water diversion systems should have regular capacity building programs for relevant stakeholders to enhance their knowledge and skills to enable them to perform any new role required of them.

Providing Services: The water diversion management authorities should serve as a knowledge and resource hub for the stakeholders providing information and extension services. These services amongst others should focus on the benefits and concerns of water diversion systems.

4.5 The Shortcoming and the way forward in GWDS

The reliance on technicality over time appears to limit the need to acknowledge the important role of stakeholder's

participation in the management of water diversion systems in developing countries. This is usually manifesting in instances whether the stakeholder's interest is not being served, and best described as shortcoming with potential of undermining the anticipated success of such a system. Haven reviewed the benefits and concerns of water diversion systems at a global scale, with the need for stakeholder's participation in developing countries its peculiarity to the GWDS, the following areas are highlighted from the case study and have been identified as areas needing active stakeholder's participation as the way forward, although the system is currently in operation.

4.5.1 Unequal Treatment of Participating stakeholders in GWDS

The reservoir built on the River Gurara is Nigeria's largest and pioneer water diversion system. According to the integrated water resources management for river basin organizations [35], in planning the construction of the GWDS, all likely social, cultural impediments which could have affected the project negatively were addressed thoroughly, with a view to enhance the socio-economic progress of the riparian population and all other relevant stakeholders In the decision-making process. Hence, the assumption that stakeholder's participation is being integrated as the system is a federal government initiative with the sole benefits of inhabitants of the FCT, Abuja. Though, aside the GWDS providing raw bulk water, hydropower generation, irrigation, it can also be used for tourism, fisheries as well as setting up small cottage industries for active economic participation [36]. This enamors benefits mean national interest will override local interest, hence its wide acceptance. However, evidence of the absence of large scale stakeholder's participation in GWDS has resulted in unequal treatment of participating stakeholders. Ekpo [37] reported, in spite of the fact that Kachia/Kagarko Local Government Areas of Kaduna State

are hosts to the Gurara Reservoir, the riparian population has not benefited from the system and their lands and houses have been destroyed in the course of constructing the reservoir, also serving as the source for the water diversion system. Consequently, it further stated the concerned that since the construction work started, the riparian populations have not been adequately compensated by way of providing access roads to the reservoir sites, thereby affecting their economic trees, farmlands, buildings and structures, graveyards and other cultural sites [38]. Also outlined are issues arising from the environmental and ecological concern from the review of the GWDS, it include the resettlement and rehabilitation of relevant stakeholders, which is still a concern. According to [39], stakeholders under the banner of Katurmi Unity Development Association, KUDA, saying they had lost about 34 people through boat mishaps on the reservoir, blaming the tragedy on the unequal treatment of participating stakeholders identified and non-fulfillment of the promise to build alternative roads to link relocated riparian populations to each other and to major roads. In evaluating GWDS, there seems to be absent a management process as well to cover for the current and emerging social concerns and benefits which requires maintaining active stakeholder's participation and Involvement for continued collective ownership of the system. This if properly implemented can effectively reduce the impact of GWDS on the riparian population. The question then is how much success is achievable in terms of management for smooth of water diversion systems (and any other hydraulic infrastructures) when stakeholder participation is fully integrated simultaneously in a robust manner while also responding to changing operational rules that are the result of changing policies and priorities. This is a post-review, design, planning, and construction challenge that requires further investigation.

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This review reveals that water diversion is among the most complex interdisciplinary water resources problems, requiring various physical and sociological components. Although it is not out of place not to argue that these problems are inevitable or unnecessary, the fact remains that, there should be more careful investigations and scientific collaborations incorporating stakeholder's participation in all stages of planning and management.

5.2 Recommendation

From this review, it is evident that proper analysis of stakeholder's participation in all aspects of water diversion is a decisive factor. Aside from the planning and structural design of diversion structures, it is recommended that a comprehensive assessment of stakeholder's views be considered and integrated with the political, social, economic, environmental, ecological, and legal concerns

as well the benefits of water diversion systems. This is often important as it can help in achieving more success rates in water diversion systems management than their physical aspects, as well as help to resolve controversies in the water diversion system in developing countries.

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