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# Knowledge Relationships in Freshwater Governance

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## Abstract

Freshwater governance (policy formulation and implementation) because governance is about policy formulation and implementation are usually undertaken with little consideration to the thought process of the owners of the resources and resource environment. Even though considerable efforts have been made to the social change theory by incorporating stakeholder's views, the individual-level or local-level insights as well as constructs and environmental connections (cognitive view) in freshwater challenges are usually left out. Using the case study research design, with emphasis on the descriptive design helped to access local knowledge in freshwater governance. The mixed method approach, helped to put together information based on behavioural concerns, the spirituality of the people, and the resource environmental issues required for the analysis and discussion of the data, while drawing meaningful conclusion from data. The results provide a framework, which will help to address interventions that simultaneously address both development and behavioural determinants of freshwater degradation, toward social change conservation policy in reducing crisis in freshwater governance.

## Keywords

Cognitive View, Freshwater Governance, Indigenous Knowledge, Conservation

## 1. Introduction

Information acquired by an individual based on the person's perception and

interpretation of the reality in a given situation at a particular time differs from person to person based on the person's environment. Knowledge helps to give meaning to people's environment whilst providing informed solutions to challenges. Therefore, knowledge can be said to derive from ideas, experiences, practices, intuition and information that has been generated by people in a particular place and time. According to de Groot's (1969) idea of cognition, knowledge includes observation, supposition, expectation, testing and evaluation.

This means that the local people or owners of the resources are involved in obtaining, storing, using and working on informed policy through their cognition processes. Furthermore, these thought processes are assumed to result in the formation of one's mental image or cognitive view for the particular freshwater resource to be able to understand the principles and processes that work within the catchment area of the resource. According to Lawas (1997) and Odame-Ababio (2013), imposed externalities disrupt the cognitive process or state of mind and behaviours towards conservation.

The principles and processes for water governance policy should be achieved through the mental or cognitive process and symbolism of the freshwater resources at the local level. The cognitive processes include sensing, perceiving, remembering, imagining, judging and making a decision, thus providing a better integrated freshwater policy (RKNOW, 2016; UNDP, 2013). Therefore, if a person does not understand the symbolism of a particular system in an environment or does not go through the cognitive process of a resource it would be difficult to draw up an appropriate policy to improve the resource (Bressers & Cheryl de Boer, 2013; Schmidt, 2005; Akrong, 2006). According to Giddens (1998), in his structure and agency theory, the understanding of risk differs in their approaches; this is basically due to the separation of powers, to ownership control and the use of the resource (Opoku-Ankomah et al., 2006). Freshwater policies developed and transferred to different resources and environment are based on the thought processes or interpretation of a different environment which may not be appropriate for a different water resources system or environment (African Development Bank [AfDB], 2005). This external imposition of policies has also contributed to current ignorance and neglect of indigenous/traditional knowledge in freshwater governance (Adjewodah & Beier, 2004; Akrong, 2006; Bressers & Cheryl de Boer, 2013).

## 2. Study Area

Lake Bosomtwe, found in the Ashanti Region of Ghana, was used as the case for this study. It is located between longitude 0.15˚W and 2.25˚W, and latitude 5.50˚N and 7.46˚N. It is located 90 - 250 km inland from the sea and shares its administrative boundary with the Eastern, Central, Western and Brong-Ahafo Regions. The Lake has a crater which rises to heights above 350 m with varying slopes all of which are rather steep (Amu-Mensah et al., 2014). On the south of

the basin lies the Obosum Range, with a peak of 710 m (Asamoah et al., 2015). Lake Bosomtwe is located about 30 km south-west of Kumasi in the forest zone of the Ashanti Region of Ghana. The Lake Bosomtwe is enclosed within two administrative districts, Bosomtwe District and the relatively new Bosome-Freho District (**Figure 1**).

Until recently the lake was within the Bosomtwe/Atwima/Kwanwoma District. The Bosome-Freho District has a population density of 106.2 persons per square kilometre, whiles the Bosomtwe District has a population density of 222.3 persons per square kilometre. The districts cover a total land area of about 630 square kilometres with the North-South stretch from Bosomtwe District to Adansi South District (Ghana Statistical Service, 2014a, 2014b).

## 2.1. Physical Structures of Lake Bosomtwe

**Table 1** gives a summary of the physical characteristic of Lake Bosomtwe.

The drainage pattern around Bosomtwe district is dendritic and centripetal in outlook (Ghana Statistical Service, 2014a, 2014b; Turner, Gardner, & Sharp, 1996a). Around Lake Bosomtwe, there is an internal drainage where the streams flow from surrounding highlands into the lake in a centripetal fashion. The lake has no outlet, although it did overflow in the recent geologic past (Turner, Gardner, & Sharp, 1996b). The lake is an endorheic lake with a totally detached drainage system from the general Kumasi or regional drainage due to the high crater rim surrounding it (Koeberl et al., 2007).

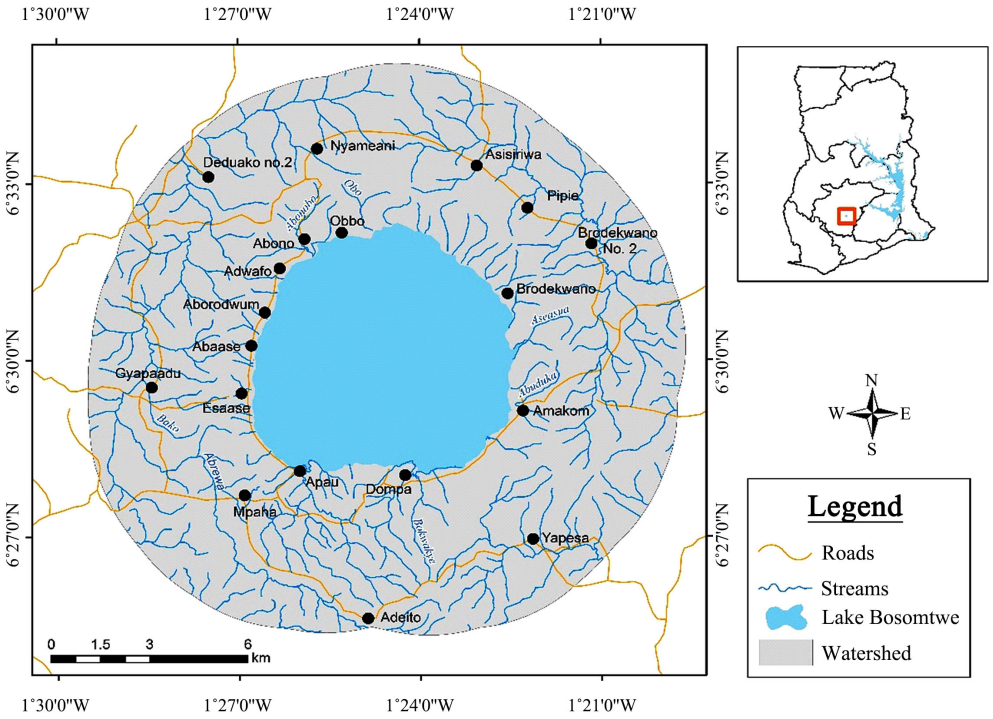


**Figure 1.** Map of Lake Bosomtwe. Source: remote sensing cartographic unit, University of Cape Coast, 2017.

**Table 1.** Summary of the physical features of Lake Bosomtwe.

| *Location* | *Ashanti Region, Ghana* |
|---|---|
| *Coordinates* | 6˚30.3'*N*, 1˚24.5'*W* |
| *Lake Type* | *Impact Crater Lake* |
| *Primary Inflows* | *Rainfall* |
| *Primary Outflows* | *None* |
| *Catchment Area* | 400 $km^2$ |
| *Basin Country* | *Ghana* |
| *Max Length* | 8.6 *km* |
| *Max Width* | 8.1 *km* |
| *Lake Surface* | 49 $km^2$ |

Source: Bosomtwe LakeNet (2015).

## 2.2. Behavioural Determinants to the Lake's Degradation

The fairly uniform distribution of temperature and rainfall enhances the cultivation of many foods and cash crops including, cocoa, plantain, cassava, cocoyam, maize. In addition, vegetables such as cabbages, pepper, tomatoes, okra and garden eggs are cultivated. The dominant method for preparing the land is slashing and mulching especially areas close to the lake, however the culture is dying (Amu-Mensah et al., 2014; Yamba, 2016). Currently farmers prefer a combination of the slash and burn method and the application of weedicides to clear the land (Amu-Mensah et al., 2014; MOFA, 2017).

The slash and burn method as seen in (**Figure 2**) ends up destroying or causing bushfires thus depriving the forest of its vast areas of vegetated land that is not intended to be burnt thereby contributing to sediment loads and changing the geomorphology of the streams as seen in (**Figure 3**) showing a sandy stream bed thus confirming Kusimi, Amisigo, & Banoeng-Yakubo (2014). It also depletes the soil of its essential nutrients after some years according to Hirst (2019), though that is not to say that slash and burn method is not good in another environment, since this method adds another layer of nutrients to the soil.

The weedicides eventually ends up being washed into the lake during the rains thus killing aquatic plant required by the funa in the lake. Additionally toxicity of fish tolerance to weedicides varies with their size and species as well as plankton species, meanwhile residual chemicals can be transferred from fishes to humans when eaten (Keith, Kristoffer, Volz, & Kraak, 2013).

Chemicals (fertilizers and herbicides) used on the farms to increase crop yield and sludge from human activity also enter the Lake just like runoff from crop and animal residues. The impact of such farming activities is confirmed by the Water Resources Commission (WRC) (2012) and Darko, Ansa-Asare, & Paintsil's (2013) reports. Indications are that Lake Bosomtwe's quality has deteriorated from a quality index of 56.3 (grade II) in 2010, to 49.8 (grade III) in 2011.

Animal rearing is also a major agricultural activity around Lake Bosomtwe. Faecal materials from sheep, dogs, pigs, ducks, and fowls are washed into the lake, consequently increasing the bacteria load in the lake. The presence of *E.coli* in water indicates recent faecal contamination and may indicate the possible presence of disease-causing pathogens, such as bacteria, viruses, and parasites. *E. coli* is normally found in humans and animal intestine (Amu-Mensah et al., 2014).

Other anthropogenic activities around the Lake Bosomtwe are hunting, unplanned infrastructural development for tourism, residential and commercial activities due to tourism. As more and more of the hills are developed, this further exposes the land to erosion, resulting in the degradation of the area (UNESCO, 2016). Increased waste disposal from residents, and tourism activities as seen in **Figure 4** and other uses of the Lake such as bathing, washing of clothes, pots, and pans, further impact on the quality of the lake water (Amu-Mensah et al., 2014; UNESCO, 2016).

**Figure 2.** Slash and burn method in the catchment of Bosomtwe (Tuesday, 29 January, 2013, 07:25:38 GMT).

**Figure 3.** Observation of a Bosomtwe channel (Abono stream) with plantain trees in the Channel (Tuesday, 10 July, 2012, 13:01:31 GMT).

**Figure 4.** Rubbish dump close to the water course (Stream) and an example of land (gulley) erosion around Lake Bosomtwe (13 October, 2015, 09:34 GMT).

The Lake is of great religious importance to all the communities as asserted to by Amu-Mensah et al. (2017), yet it's spirituality, contributing to man's and economic benefit has facilitated considerably to its degradation, bearing in mind the number of people who come in as tourist as well as those coming in for spiritual consultation to improve their economic wellbeing.

## 2.3. Lake Bosomtwe's Current Formal and Informal Governance

Freshwater governance comes about as one of the mechanisms to improve on the sustainability of freshwater resources, besides responding to the global freshwater crisis. Although there is an abundance of freshwater resources to satisfy human needs, there is a crisis in the system of actors, resources, tools, and processes or systems which reconciles humans' access and use of freshwater Richard (2011).

At Lake Bosomtwe, there is the introduction of political conditions and imposition of Western liberal models of democracy (Nanda, 2006; NEPAD, 2007) thereby instituting the very context or process of inequality that does not ensure inclusiveness; the "one-way-best model" of the West as explained by (Kendie & Mensah 2008). UNESCO, (2006b: p. 177) also explains that the indiscriminate and narrow application of modern scientific tools and technologies contribute to the loss and degradation of freshwater. There is failure in achieving conservation and livelihood empowerment through institutional regulations despite numerous participatory initiatives. UNESCO (2006b) emphasises that such situation, shows that there is no straightforward solution to the protection of freshwater resources without the embedded knowledge from the local context.

Customary laws and practices based on indigenous knowledge systems have existed over the years as freshwater conservation measures around Lake Bosomtwe. Reverence for Chiefs, spirituality of locals, village community cooperation, queen mothers and age-sets helped to give protection to freshwater bodies. The Asantehene (King of the Asante), is the ultimate custodian of the lake. The Asantehene is said to have entrusted the lake to Asamanhene who reports to the Asantehene on issues pertaining to the Lake (Appiah-Kubi II, undated).

McCaskie (2003) and Appiah-Kubi II (n.d) stress that the Asantehene is responsible for enforcing prohibitions and officiates at the annual rites which involve the sacrifice of a cow, fowls, and dogs at the Abrodwum stone at Abrodwum village in **Figure 5**. This stone signifies the spirit of the Lake and the sacrifice is performed to ensure compliance, alterations and reminders to rules and regulations (Müller, 2013; Ofosu, 2006). The new era or modernisation of the governance system created negative perceptions out of the stringent measures on freshwater conservation by the colonial settlers. There is therefore, a disconnection between the western laws or rules and the local practice (Meer & Campbell, 2004; Tuhiwai-Smith, 2002). Knowledge about western laws around Lake Bosomtwe, has strained government relationship with members of the community on who's right it is, to ensure freshwater conservation. After independence, the continuation of the western structures did not help the local people to construct new conservational structures or maintain the old ones. The disconnection created a gap driven by changes in freshwater resource rights to control, use and ownership. This is what Giddens (1984, 1998) explains as the principal effect of colonialism, as the cultural disruptions that intensified the effects of dispossession through the creation of total dependency on the state, a reference to state property and stewardship theory.

## 3. Methodology

### 3.1. Theoretical Framework

The structure and agency theory by Giddens (1998), is used here in relation to knowledge and governance, grounding it in functionalism and structuralism. The focal point of structural functionalism is how changes in one aspect of the social system affect other aspects of society (the butterfly effect). The implication is that a change in the system of governance affects the values, norms and practices of a community within which the change has occurred.

**Figure 5.** The Abrodwom stone (Taakofi Shrine). Source: Field data, Amu-Mensah et al. (2017).

The theory of structuration in relation to IK also places emphasis on the knowledge which is gained through social practices, ordered across space and time. Giddens (1998) explains that knowledge is always being recreated by actors or the society through the very means by which they express themselves (cognitive processes). To understand and interpret knowledge, the action and intentions become significant in explaining human behaviour. It is imperative to note that from the structuration theory, issues relating to governance, participation, ownership, access, control and maintenance of freshwater resources, leads to the understanding of the actor's knowledge systems.

Here the action or inaction due to the constraints of the structured knowledge in water policies, can lead to a negative or positive impact on freshwater resources. In view of this, knowledge with respect to action and meaning, calls for a more critical inquiry and interpretation. According to Giddens (1998), the social structure and human agency are in relationship with each other. The traditions, institutions, moral codes and established ways of collecting data or information within the social structure of the freshwater resources are expected to be interlinked with each other. In the case where different structures are superimposed on another social structure, without proper understanding of the superimposed structure, the practices within the local social structure can be changed though not totally. In such situations, people start to ignore, replace or reproduce the social structure differently, contributing to the problem of separation of ownership, control and use of the resources (Davis, Schoorman, & Donaldson 1997). This would inadvertently lead to a breakdown in the governing structures leading to a degradation of the natural resources.

### 3.2. Conceptual Framework

Taking a cue from Giddens (1998) structuration theory, it can be deduced that "Freshwater resources" (the materials from which human interaction and social structures are constructed) are drawn upon in different ways by actors (individuals, groups, the state). This helps to build the mechanisms of freshwater governance. In addition, it shows how water resource policy processes are affected and in turn affects water management and use, leading to the deterioration of freshwater resources. It also provides an explanation to how the understanding of the symbolism or root-word of IK could help reduce lake integrity.

Daniels (2008) perspective on IK indicates that social structures are constructed and best characterised within the stakeholder's approach which is also pragmatic in nature. Against this backdrop, knowledge should be generated closely in connection to humans and the resources environment they live in (Maxcy, 2003). In addition, Woodley (2002) illustrates on how local knowledge for resource conservation is influenced by the worldview or socio-ecological change using the Cognized Model. The model indicates an initial disruption in the knowledge production cycle. Here traditional systems of knowledge transfer through situated oral histories, no longer influence (or have minimal influence

on) knowledge production. This is because knowledge acquisition occurs outside the ecosystem. In other words, knowledge production is dis-embedded from "place" or context of the resource.

Woodley explains that the impact of globalisation has replaced traditional knowledge transfer mechanisms from the old to the young. In this situation, Woodley explains that knowledge from outside the community is aimed directly at the younger people through formal education. This has led to the loss of IK and its root-word and therefore, it does not make any meaning to the generation.

The mix method approach was used as the underlying philosophy guiding the study. Interview guides, focus group discussion, observations and interview schedules were developed to collect primary data from the field. Data collected from secondary and primary sources included, institutions and structures that govern the use of Lake Bosomtwe, perceptions of stakeholder's challenges around the Lake, the differentiation of the cognitive view which represents indigenous knowledge and factual view or western knowledge of freshwater governance practices in freshwater governance of Lake Bosomtwe. In addition, data was collected for the perceptions of stakeholders on the use IK in water governance.

### 3.3. Sampling Design

In studying the institutions and institutional structures that govern the use of Lake Bosomtwe, an in-depth interview was used. Semi-structured questionnaires and well-structured interview schedules were administered to 103 respondents. These were mainly, local leaders, opinion leaders and other respondents well informed in IK. The selection was based on their in-depth information on the nature of indigenous knowledge in freshwater governance and community participation and ownership situation. Secondly similar interviews were conducted with eight (8) respondents in government institutions responsible for water policy formulation and implementation. The questionnaires were read to the respondents and the answers were written as well as tape recorded to allow the free flow of information and the concentration of the researcher on the response for further enquiry, Figure 6.

**Figure 6.** Researcher conducting in-depth Interviews with opinion leaders (Tuesday, 10 July, 2012, 15:30 GMT and 14 October 2015, 09:57 GM).

### 3.4. Focus Group Discussion (FDG)

The FDG helped to provide consented views on the symbolism of practices and the meanings ascribed to them from all 19 available communities around the Lake Bosomtwe. Data was collected for the FDG situation analysis in freshwater governance at Lake Bosomtwe during one of their days of rest (Tuesday), to ensure inclusion of all gender and age groups. The purpose of the study was read to the group and issues pertaining to the protection of the lake was discussed, using the Freshwater Resources Profile on access, use and control. The discussions were also recorded and handwritten as well for further coding and analysis based on information power (Patton, 2015). Respondents numbering 108 were selected from 6 communities, these were engaged separately in each community. The communities were selected based on dependence on the Lake Bosomtwe for its socio-economic activities as well as the individual knowledge and experiences in IK water related issues.

### 3.5. Questionnaire

The questionnaire tool was also used for collecting and recording information. It was used in obtaining statistically valuable and individual information using structured and semi-structured questionnaire developed (Datt, 2016). The key parameters in evaluating freshwater governance were determined by the interviews of key informants and FGD. Three sets of structured and semi-structured questionnaires were administered to Chiefs, government officials and finally to three hundred and fifty-four (354) respondents from nineteen communities within the Lake Bosomtwe catchment area.

Using accidental and voluntary selection, for the general survey for the 354 respondents, data collection started very early each morning at six (6) a.m. before the farmers left for their respective farms till six in the evening. The interviews were recorded with a Sony recorder, as well as taking handwritten note. The results helped to complement and confirm issues from earlier in-depth and FDG interviews and observations that came up in the course of data collection.

Selection of technical or official respondents was based on the water Data Management Institutions. Table 2 presents the classification of respondents selected for the study.

### 3.6. Data Analysis

Information collected were later transcribed and coded using Qualitative Data Analysis Software (QDAS) NVIVO version 10 for Windows and Excel. The coding also helped to keep the record of thoughts about the meaning or significance of things mentioned in line with IK practices and systems. Qualitative data generated were analysed using a thematic approach (Yin, 2003, 2014; Creswell, 2009). For ease of analysis, data was presented under the following thematic headings: emotions, motivations, needs, desires towards the access, use and control of freshwater resources. The study also took into consideration the semantics of language and substance of the practices in freshwater governance.

Table 2. Classification of respondents.

| *[1] | Respondents categorisation | Number | Total |
|---|---|---|---|
| GI | WRC | 1 | 8 |
| | MWR&S | 1 | |
| | CSIR WRI | 1 | |
| | GMA | 1 | |
| | DCE | 2 | |
| | DAO | 2 | |
| IK | IK knowledgeable | 2 | 2 |
| CM, TA, &OL | Native priest | 2 | 101 |
| | Chiefs | 2 | |
| | Sub-chiefs/queen mothers | 17 | |
| | Local Assembly persons | 19 | |
| | Opinion Leaders | 9 | |
| | Fifteen-year-olds | 2 | |
| | Native Respondents | 50 | |
| | **Total IDI** | **111** | |
| | FGD | **108** | |
| | Questionnaire | **354** | |
| | **Total** | **573** | |

GI = Government Institution, TA & OL = Traditional Authority and Opinion Leaders, IK = Knowledgeable in Indigenous Knowledge, CM = Community Members, IDI = In-depth Interview. Source: Feld data (Amu-Mensah et al., 2017).

## 4. Results

### 4.1. Background Characteristics of Respondents

Results indicated that gender divisions vary substantially by age. Indications were that the older female respondents age 79 - 99 were in the minority while younger females in the 18 - 38 years age-group were in the majority. Implications are that the older female respondents who have skill and experience around the Lake and its environment were dropping in number. Table 3 gives an indication of the age and gender relationship around Lake Bosomtwe.

The older men and women who have irreplaceable skills, experience, insights, and operation on the maintenance of the Lake Bosomtwe, reflecting the communities' needs and preferences are reducing in number. It is therefore expected that fewer experienced people would be available to provide information on the lake's conservational practices to reduce degradation of the Lake. This assertion is confirmed by Khulif and Elfarouk (2014) that the older generation most im-

[1]WRC—Water Resouces Commission; MWR & S-Ministry of Wateer Reseources and Sanitation; CSIR, WRI—Council for Scientific and Industrial Research, Water Research Institute; GMA-Ghana Meteorological Agency; DCE—District Chief Executive; DAO—District Assemblies Planning Officers.

portantly women with invaluable insights about the design, operation, and maintenance of water systems, reflect the needs and preferences as the environment's primary user. Therefore, the fewer older people in the community could reflect the Lake Bosomtwe's declining situation.

Within the government sector, Table 4 shows that the number of females within freshwater policy formulation framework were few compared to that of their male counterparts within the categories selected. As observed, there was no woman within the high-level position in the water sector of the government institutions. All the Government Officials (GOOF) such as the director and chief executive were males.

Table 3. Respondents age and gender relationships.

| | | Gender | | | Total No. | Percent % |
|---|---|---|---|---|---|---|
| | | Female | Male | N/A | | |
| Age Range | 0 | 0 | 0 | 2 | 2 | 0.6 |
| | 18 - 38 | 84 | 70 | 0 | 154 | 43.5 |
| | 39 - 58 | 63 | 63 | 0 | 126 | 35.6 |
| | 59 - 78 | 27 | 29 | 0 | 56 | 15.8 |
| | 79 - 98 | 7 | 6 | 0 | 13 | 3.7 |
| | 99- | 1 | 2 | 0 | 3 | 0.8 |
| **Total** | | **182** | **170** | **2** | **354** | **100.0** |

Source: Field data, Amu-Mensah et al. (2017).

Table 4. Gender, educational level and position.

| Respondents | Frequency | Female | Male | Level of education | Position |
|---|---|---|---|---|---|
| Water Resources Commission | 1 | 0 | 1 | MPhil | Executive Secretary GOOF 1 |
| Water Research Institute | 2 | 0 | 2 | Ph.D./ MPhil | Snr. Environmental Hydrologist GOOF 2 /Chief Director for Water GOOF 3 |
| Ghana | 1 | 0 | 1 | MPhil | Director GOOF 4 Synoptic Meteorology and Forecasting |
| University/ Traditional Authority | 6 | 1 | 5 | First-degree/ MPhil/ PhD | Priests P1 & P2/Professor P3/ Queen Mother Kuntanase P4/ Chiefs P5 |
| Bosomtwe /Bosome-Freho Districts | 4 | 2 | 2 | First-degree/MPhil | DCEs/Planning officers P5 |
| **Total** | **14** | 3 | 9 | | |

(P) Represents respondents in other government institutions. Source: Field data, Amu-Mensah et al., 2017.

Secondly, there were no women expects knowledgeable in water governance who could be identified for the interview. Amongst the policy formulators as indicated in **Table 4**, there were also no respondent within that level of education to bring in the human or anthropogenic issues. This does not give a true reflection of actors in the freshwater policy processes which controls society's access to freshwater according to Drechsel, P., Scott, C. A., Raschid-Sally, L., Redwood, M., Bahri Saunders M. (2012) and also indicated by the International Water Management Institute [IWMI] as the criteria for freshwater governance (Giordano, \Samad, & Namara, 2006).

The in-depth interview also indicated lack of interaction between the different actors or stakeholders in the decision-making process as well as in policy formulation. Finally, there is a clear lack of relationship between the local traditional governance and government in policy formulation processes for integration of ideas. This was expressed by both Chiefs interviewed and the Water sector heads of institutions.

### 4.2. Participation in Policy Formulation and Implementation

The issue of policy formulation and implementation is key to a successful freshwater governance. In-depth interviews with key experts from Government Institutions on the (12/10/2016) revealed that water governance at Lake Bosomtwe is dependent on the local environmental issues that comes up occasionally. Although freshwater problems are general, the issue of ensuring quality and maintaining the quantity is defined by the governance of the activities within the environment and the seasonality of rainfall. In the case of Lake Bosomtwe, its nature also contributes to the current state, although the activities intensify the problem of quality. Policies are enacted from the ministries and then their agencies or institutions at the districts level ensure implementation of rules and regulations.

"*The government institutions provide the technical inputs or data before the policies are developed for the Ministry of Environment Science and Technology Innovation* (MESTI) *and agencies under the Ministry implements them*".

The officer explained that there are three categories of institutions: first the Water-Related Management Institutes and Agencies, the Regulatory Institutions and the Water User institutions & Data Management Institutions.

Under the Data Management Institutions are CSIR Water Research Institute responsible for quality and sediment data collection; Hydrological Services Department collects streamflow data and the Ghana Meteorological Agency which provides key data for temperature and rainfall that feed into water management policy. WRC then collects the data, processes the information for the Ministry of Environment and Sanitation, however, they are not a data gathering institution. There was no mention of any institution that collects information on social or anthropogenic and cultural issues pertaining to the catchment area that could impact on the freshwater resources. This is a clear indication of top-down, ste-

wardship style of governance likened to Giddens (1998) structuration theory which states that the externalities or improvised knowledge from the state, create restraints within the structure or in the resource's environment. Invariably governance around the Lake is not of the stakeholder or IWRM approach that forms the basis of integrated system of water governance.

This statement, by the government official was confirmed in a Focus Group Discussion (FGD). Two of the respondents, an elderly and a young woman had this to say:

"*We are only informed after they have prepared the law. Due to Christianity, everybody does what they want. Our norms and values are seen as idolatry. The children are taught a lot of things in school and sometimes they teach us, instead of the adults training the young ones. There used to be very little collaboration, in* 2015."

Another explained that:

"*The only form of interaction was done during a durbar by government institutions like the Water Research Institute, UNESCO, the district assembly and some other NGO organisations who came to ask us questions about the Bosomtwe Lake. After this, some by-laws were prepared and brought to us to help protect the lake. We debated on the laws and we accepted it but it is not everybody who accepted the laws. People do not adhere to the laws because it is not everyone who was in favour of the laws, unfortunately, there is no one to help enforce the law.*" [FGD, 2016]

"*The lake water is currently not good for drinking we can only use it for cooking plantain which enhances the taste of the cooked plantain, this is how useful the Lake is to us.*" [Opinion Leader 68 years old]

Under ownership all the respondents indicated that the Lake belongs to the Asantehene and the Asamanhene who is the caretaker and all decision on rules and regulations are by the Chiefs. In case of any problem, they inform the chiefs who will consult the chief or the Okomfo who is in charge of the lake who then tells us what to do. Otumfuo (the Asantehene) is informed and the chiefs deliberate on it, rules are made and we are informed. Under the ability to participate, a fifty-four-year-old man explained that they recently provided ideas on bye-laws to the government. This puts the control of water use, in the hands of government (Opoku-Ankomah et al., 2006).

Questions raised on the issue of stakeholders' perception of governance with respect to the government's policy formulation, brought out several responses. One of the facilitators for policy formulation said:

"*Sometimes the key stakeholders or local communities, are not involved in policy formulation. It is better to involve them so that they would own it. Broad stakeholder consultation is the best option.*" [*GOOF* 3, 12/10/2016]

Another policy formulation facilitator explained that:

"*The challenge we have is that the basin authority is supposed to work with the local authorities but the relationships are not very strong, the reasons being that the assemblies have their own challenges* (*financial and other logistics*).

*There are expectations from the traditional authorities that are difficult for the District Assemblies to comply with for example, who buys the schnapps and with what money to initiate a collaboration.*". [*GOOF* 2, 4/9/2016].

On the foregoing, participants for the in-depth interview mentioned that the CSIR Water Research Institute (WRI) is involved in quality and sediment data collection. The Hydrological Services Department (HSD) has the mandate to collect data on streamflow and Ghana Meteorological Agency provides the key data for temperature and rainfall which feed into freshwater policy for management. With the current system of governance of the water body, one of top-bottom approach, respondents explained that fishes in the lake are dying and the lake is drying up. In Detieso a 62-year-old male participant explained:

"*When the rules are brought, we only debate on it, and after they have explained we accept but it is not adhered to because it is not everybody who accepts. Unfortunately, there is no one to enforce these rules. Yet within the Bansocommunity, they respect the rules*". [Native 62-year-old male], confirming the Ibrahim Indicator for Africa Governance [IIAG] (2017) report on the rule of Law in Governance.

Different opinions, interests, and views of communities, who are also stakeholders are not considered in all decisions made. This confirms the gap identified in Structuration Theory (ST) that the structures are built on the government executives' understanding or perception of the phenomena. **Table 5** shows respondents' participation in policy formulation using the Likert Scale to determine how involved they are in freshwater governance.

### 4.3. Community Participation in Governance

It is evident that the perspectives of owners of the resources or the direct actors are not usually considered. Analysis of the data presented in **Table 5** confirms this assertion, since about 92 percent of the respondents indicated that the local communities were not involved in the management and policy formulation of the lake.

There is a clear indication that very little or no IK is incorporated into policy formulation. Giddens (1984) moves the theory that IK is based on mediated experience where the prime mediator is the body and its "umwelt", that is the immediate environment. This is where in oral cultures, the mediating vehicles are the physical presence, the perceptual and communicative modalities of the body. In the sense that "umwelt" refers to a person's subjective world that acts through, ecological relationships involve signs, perceptions, and interpretations and are semiotic or the functions of signs and symbols.

Concerning participation and involvement in policy formulation and implementation, this is what one of the elderly women, had to say:

"*We have visitors coming to swim during the* "*meet-me-there*", *these people use the Lake without any regard to our customs. Twenty years since the lake was sanctified and therefore, people become adamant. The place is too open with visitors for me to participate. People have cut down the trees and are now farming close to the lake. This is destroying the lake because the areas around the lake*

**Table 5.** Community involvement in governance.

| | Frequency | Percent |
|---|---|---|
| Very much | 1 | 0.3 |
| Sometimes | 27 | 7.6 |
| Not really | 76 | 21.5 |
| Not at all | 248 | 70.1 |
| Neutral | 2 | 0.6 |
| Total | 354 | 100.0 |

Source: Field data, Amu-Mensah et al. (2017).

*and steams are now exposed to the weather. Small nets are being used to catch all sizes of fish; by this, the fishes are not growing to the right sizes. No one even listens or pays attention to us; I only play with my grandchildren when my daughter is busy with her shop*. She further explained: *we are now manning shops and this does not give us time to concern ourselves with the Lake anymore sometimes we travel to Kumasi to buy things that the tourist would like to buy when they come*." [Native elderly woman, age 78]

### 4.4. Concept of Knowledge and Cognitive View Models

Knowing the range of what one understands or perceives as what it really is, Professor Farhad Analoui of the Bradford University, Faculty of Social Sciences, in a conversation in 2016, had this to say: "indigenous knowledge looks at the reality as experienced by the participant and as a social construct". He explained that meanings are given to practices in water governance, which considers the symbolism or representation of IK by the local community. He emphasised that IK is created gradually by the people through their everyday life and spirituality, so that everybody in the community can understand and use it.

The models developed help to differentiate between the cognitive view which represents indigenous knowledge and factual view or western knowledge of freshwater governance. The construct in **Figure 7**, tries to show the interrelationship of IK between the physical, biological, social and spiritual environment of the people, which gives sound advice for effective governance. It can be recognised that IK is constructed for everybody in the community to use because it is part of their being. IK is such that it is perpetuated through culture and therefore it is the reality, as experienced by the participant.

As socially constructed, it uses social meanings, which is the symbolism within their knowledge as well as spiritualism, for environmentally sound advice or rules to protect the freshwater resources. Therefore, IK governance of the freshwater is socially sustained and supported by spiritualism. This positive knowledge relationship leads to the protection of the freshwater body.

From the model in **Figure 7**, the local participant's interactive process is influenced by the cognitive process in the environment and spiritualism associated

with the resources. The cognitive process provides the cognitive view, which is socially and spiritually sustained. This leads to embedded and meaningful, easy to understand symbols (positive knowledge) for the protection of the lake or environment.

Although the participant's emotions, motivations, needs, desires, and objectives influence the interaction process, the positive relationship response and support generated, sustains the interaction process, to reduce overexploitation or degradation of the resources. Here Saunders (2014) points out that the structural institutional capacity from the grassroots, helps the individual to make a rational choice which could be positive or a negative impact, postulated from the Common Pool Resources (CPR) theory and also Daniels (2008) submission on pragmatism. Daniels explained that the nature of knowledge, language, concepts, meaning, or the semantics and beliefs, are best viewed in terms of their practical needs or environment.

In the second model, which is more of the scientific or western paradigm of freshwater resources governance, there is an externally imposed system of governance. Its knowledge generation is only meaningful and understandable to the generator of the symbols. The cognitive views are disconnected from the physical and social environment, as well as from the participant, affecting the cognitive view leading to negative response as shown in the broken lines in **Figure 8**.

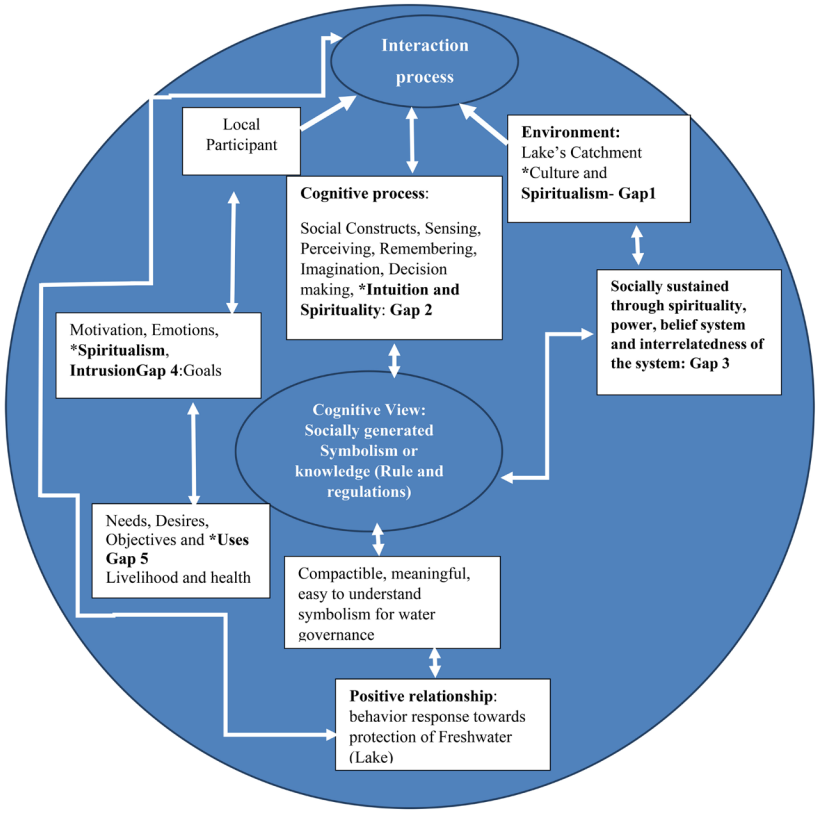


**Figure 7.** IK model for positive freshwater governance. The Positive Cognitive Relationship Model builds on (Lawas, 1997) Farmers Model.

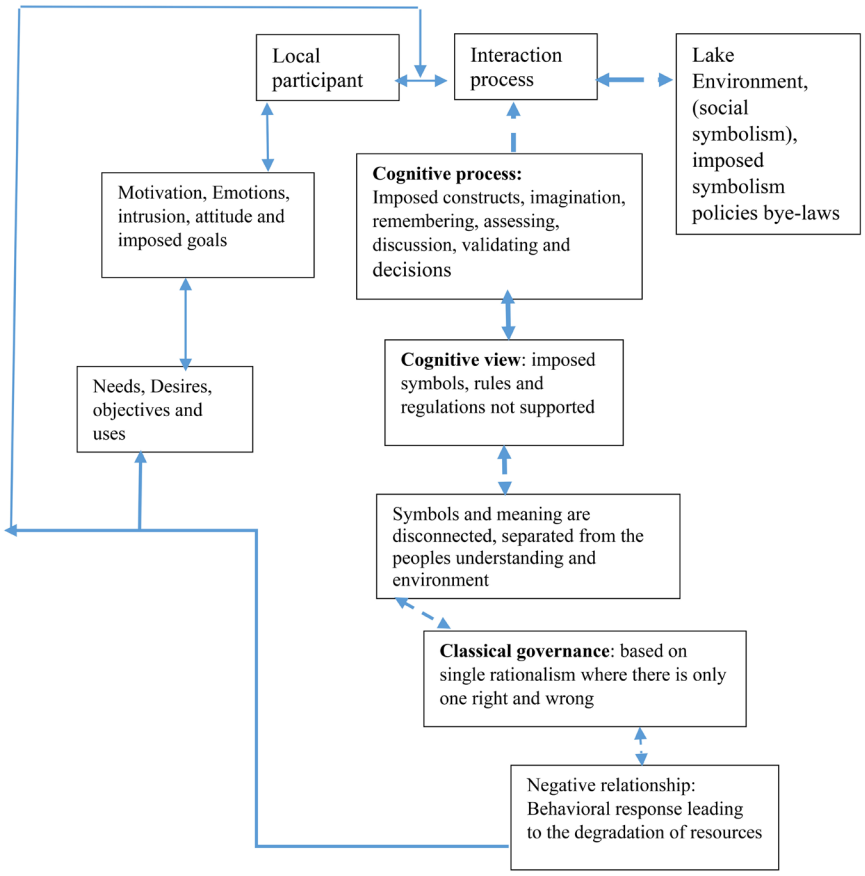


**Figure 8.** Negative knowledge relationship in freshwater governance. The Negative Relationship Model builds on (Lawas, 1997) Farmers Model.

In the case of negative knowledge relationship, as presented in **Figure 2**, the cognitive process or perception, learning and reasoning aspects were interrupted. This is represented by the broken lines from the interaction process to the cognitive process and the resource's environment. Because the cognitive process is disrupted or replaced with an improvised knowledge, interaction with the environmental and spiritual symbols are disrupted. The improvised symbols are difficult to comprehend for an effective relationship. This leads to a negative behavioural response since the emotions, motivations, needs, desires etc. are not supported by the environmental or spiritual symbols. The participant's impact on the resources therefore leads to its degradation. In this situation, Tuhiwai-Smith (2002) argues that the difficulty here is in the recognition, understanding and interpretation of the improvised symbols. So, such symbols become unfriendly, insufficient, less effective and out of context for an effective resource's governance. This point is also emphasised by Giddens (1998) that these externalities or improvised knowledge creates within the structure or environment.

Although there is an abundance of freshwater resources to satisfy human needs, there is a crisis in the system of actors, resources, mechanisms, and

knowledge processes which reconciles humans' access to freshwater and its use by all. Yet currently, water governance practices are unable to protect or reduce the exploitative practices on freshwater resources (Onuoha, 2008; Richards et al., 2000; UNDP, 2004; UNFPA, 1999).

## 5. Discussions

The findings confirm literature by Awuah-Nyamekye (2013) and Tuhiwai-Smith (2002) that proposes that colonialism has eroded indigenous practices of the past using perceived Christian connotations. It was also evident that over time, reasons or symbolism from human actions have been lost. The reasoning is that we are socialised into copying and practicing without finding out the rationale and therefore the meanings or symbolism to our actions are lost.

It was evident that policy formulation and implementation is devoid of the community's cognitive views hence indigenous knowledge and practices which show how to protect the Lake are not in force. This means that knowledge which have been handed over from generation to generation through historical experiences of the locals and their interaction with the Lake are dwindling if not dwindled due to the interrupted perception, learning and reasoning process within the resource's environment. The sudden introduction of a new system has interrupted recognition, understanding and interpretation of the improvised symbols in relation to the original symbols and meanings native to the people. That confirmed the symbolic interactionist theory that affirms that there is a meaning behind every word or sentence which is based on one's interaction with the environment.

## 6. Conclusion and Recommendation

Because of the extent of changes in the system of governance, challenges in socio-economic activities and unregulated human wants as well as lack of leadership and control in enforcing rules and regulations, it was evident that local practices as well as government rules are not helping in the conservation of the Lake. Although IK in freshwater governance is acceptable to almost all the local communities its understanding, and implications to freshwater conservation are dwindling due to the imposition of a different system of governance.

It was clear that participation in policy formulation, was not transparent enough to understand and include the views of the local communities. The transfer of power from the traditional authority to the government has left the vacuum in supervision in the adherence to rule and regulations.

The implications of the traditional practices, its benefits to resources conservation and the reverence given to water resources are disregarded and become irrelevant in policy formulation because of the importance it detached from research work or scientific issues. Consequently, importance to water conservation is lost to the local and larger communities.

Recommendations are that freshwater policy formulation and implementation using management principles, should be structured in a way that takes into con-

sideration the traditional structure or local systems of governance such as the hierarchically ordered arrangements of human interaction with the Lake Bosomtwe area, which has helped to ensure control of society's access to freshwater and its conservation.

Such conservation structures should use informed data or knowledge generated from the local communities successively to the highest hierarchy, after which it is resent to the communities. These arrangements take into consideration the semiotics of IK and other available knowledge, after which a more critical inquiry, discussion, classification and interpretation of information are put together or structure to draw meaningful conclusions in response to freshwater resources intervention. It is expected that these solutions, would help to situate the concerns of the local communities in solving their day to day issues in freshwater conservation towards livelihood empowerment.

It is expected that values of local communities towards resources conservation, especially the reverence for water resources should be understood with reference to the conservation of the resources and benefit to human life based on the long-term benefits. Thus, it is important to ensure proper integration of knowledge and participation in freshwater resources policy, and not regard such knowledge as irrelevant while dismissing them as useless, archaic or out-dated.

Additionally, local participation in freshwater governance policy should be based on giving and receiving informed or workable data through improved interaction with government officials and local stakeholders. Participation should not only be a represented at durbars or meetings but they should be supported to give meaningful ideas based on their interaction with the resources in the past and present in support of their livelihood and conservation of the resource.

It is suggested that freshwater resources and of that matter, all natural resources should be socially (social or recreational, economic, religious, educational, political) sustained through spirituality, power, belief system and interrelatedness of the system taking into consideration stakeholders' motivation, emotions, spirituality, global intrusion, goals or intentions. Additionally, the needs, desires, livelihood aspirations and health implications of the local people and other beneficiaries of the resource should be considered to provide compatible, meaningful, and easy to understand symbolism and rules for freshwater governance. It is expected that this initiative would lead to a positive relationship and behavioural response towards the protection of Lake Bosomtwe. Inadvertently it would also help both leadership in government and local authorities as well as the local communities around the lake to make a rational choice in their control and use of Lake Bosomtwe. It is also expected to reduce the problem of separation of powers to ownership, control and use of the resources headed for a better participatory freshwater governance.

## Ethical Clearance

First, ethical clearance was taken from the Institutional Review Board of the

University of Cape Coast. Then permission for field work was granted by the Department of Geography and Regional Planning of the Social Science Department, University of Cape Coast. Permission was finally granted by the chiefs and other responsible authorities where the study was undertaken. The purpose of the study was explained ensuring that the study is voluntary and no harm shall be caused to the respondents.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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