Design and Assessment of water-energy-food-environment Mega-Systems

The context and politics of decision making on large dams in Ghana: an overview

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Abstract

Large dams were central to policy making in Ghana and the rest of Africa in the early postcolonial period as part of the quest for development, framed in terms of the socioeconomic and cultural modernisation that pertained in advanced industrialised countries. Ghana has constructed three large dams, primarily for the provision of hydroelectricity, to catalyse industrialisation. There are plans for other dams in the future. Against the background of debates about large dams and their implications for the environment and human wellbeing, and the continuing global interest in dam construction, particularly in developing countries, this paper provides a retrospective overview of large dams in Ghana, with a specific focus on the Akosombo, Kpong and Bui dams. It notes that decisions and processes leading to dam construction often involve a diverse array of actors operating at different levels, with multiple interests. This potentially leads to indeterminate consequences; therefore, understanding the dialectics of decision making is helpful to avoid binary dichotomies such as macro–micro and local–global. Thus, our understanding of the interface between water politics and large dams, on the one hand, and the quest for socioeconomic development, on the other, would be enhanced by an expansion of the analytical gaze to capture the nuances and complexities resulting from a diversity of actors and power relations. Ghana's experiences with the construction of large dams also show that, while broader narratives about socioeconomic development play a major role, especially in terms of openness or otherwise of the domestic decision-making process, the source of funds has also proved to be a deciding factor: it shapes (1) the access of transnational actors to decision-making processes; and (2) the design and execution of dam projects. Furthermore, energy, economic and development considerations have outweighed ecological and environmental concerns regarding dams, with implications for those living near them. This is partly because decision-making processes have been largely elitist and technocratic, with limited consultations on potential environmental impacts.

Keywords

Dam, dam decision, Ghana, hydroelectric plant, resettlement

1 Introduction

Water plays a key role in the socioeconomic development of every nation in terms of energy, water supply, irrigation, flood control and navigation. Ghana is sufficiently watered, with annual rainfall ranging between 950 mm and 2,000 mm (Logah et al, 2013) but the pattern of distribution is uneven. The availability of and access to fresh water resources is a significant determinant of patterns of socioeconomic development in the country, since the livelihoods of much of the population are heavily dependent on water resources (Odada, 2006). Demand for water is steadily increasing through population growth, economic development, urbanisation and lifestyle changes.

Major water projects such as dams have often been seen as an effective way of meeting water demands by storing water in times of plenty and releasing it when there are deficits. Despite the huge potential benefits of dams, the development of rivers has often come at a high cost in terms

of riverine livelihoods and ecosystems degradation (Nukpezah et al, 2017; Ofosu et al, 2017; Abodzo, 2013; Tsikata, 2006; Hart, 1980). Furthermore, the adverse social and environmental impacts of dam construction are either underestimated or not considered during the design, planning and execution of dam projects (Gyau-Boakye, 2001; Hart, 1980).

In Ghana, major dams varying in sizes have been constructed to create impoundments for different uses. The most important is the Akosombo hydroelectric project, which created Lake Volta, the largest man-made reservoir in the world by surface area (~8,500 km^2), and third largest in the world by volume (~148 km^3). Subsequently the Kpong Dam (1982) and the Bui Dam (2013) became Ghana's other large hydroelectric dams. The Akosombo hydroelectric project (HEP) was considered as the largest single investment (£230 million in 1960s prices) in Ghana's economic development plans (Hilton, 1966) and was seen as the gateway to Ghana's industrial evolution (Gyau-Boakye, 2001; Moxon, 1969). The development of the Akosombo HEP came with many benefits but also with long-term adverse socioeconomic, environmental and health impacts on riparian communities: the relocation of some 80,000 people into 52 resettlement villages; higher rates of endemic water-borne diseases such as schistosomiasis (bilharzia), onchocerciasis and malaria; and proliferation of aquatic weeds. Like many dam and water projects in developing countries in the era of Independence, the execution of these projects was dominated by technical and economic considerations (Gyau-Boakye, 2001). Once a dam project was viewed as economically feasible and technically sound, government or its agent (department or agency) became the driver of the project (Gyau-Boakye, 2001).

A number of studies has been conducted to consider how to re-operate and re-optimise the Akosombo dam and the downstream Kpong dam, to recover some of the ecological and social benefits lost through damming the Volta River (Ayivor & Ofori, 2017; Dankwa et al, 2017; Nukpezah et al, 2017; Obuobie et al, 2017; Ofosu et al, 2017). These efforts appear to be only of heuristic value rather than of practical value. The impediments facing the proposed re-operation and re-optimisation of the Akosombo and Kpong dams include: huge investments in alternative power supply; potential reduction of current economic gains; and potential reluctance of the Volta River Authority (VRA), the institution that manages the Akosombo and Kpong HEPs, to change the operation of the dam from the present flow regime to the proposed re-operation and re-optimisation framework (Ofosu et al, 2017).

From the initial days of their identification for power generation, these dams were prioritised above the restoration of the downstream ecosystem services provided by the seasonal interactions between the rivers and their floodplains, wetlands, deltas and estuaries. Ofosu et al (2017) suggest that the re-operation and re-optimisation of these dams may not be politically feasible; rather, the proposed framework may be applicable to new dams with low priority for power generation. To change the old HEP narrative to a genuine multi-purpose paradigm calls for a better understanding of the human nexus (water–energy–food–environment) system. Intended to provide a background to rethinking the design and implementation of dams in Ghana for water–energy–food–environment security, this review paper provides an overview of hydroelectric dam development in the country, highlighting the major drivers that influenced the selection, design and execution of past dam projects and their operations. Based on the available information on the three HEP dams, we argue that decision making on dams involves a diverse array of actors with multiple interests that manifest in indeterminate consequences. It is therefore essential to understand the power play among these actors in the prioritisation of the core components of dams. More

important still is the need to understand why and how dam construction has captured overriding policy attention, unlike resettlement and environmental components. The characteristics of the diverse actors, notably their interests, ideological leanings and the institutional cultures that have defined and shaped decision making and implementation are also examined.

2 Geographical background

2.1 Location

Ghana is located on the west coast of Africa (latitudes 4º 44' N–11º 15' N and longitudes 3º 15' W–1º 12' E), bordered by Côte d'Ivoire (Ivory Coast), Republic of Togo, Burkina Faso and the Gulf of Guinea (Atlantic Ocean) on the west, east, north and south, respectively. The country is divided into ten administrative regions: three in the north (Northern, Upper East and Upper West), three in the middle zone (Brong-Ahafo, Ashanti and Eastern) and four in the south (Western, Central, Greater Accra and Volta).[1]

The Akosombo and Kpong dams are located in the southeast (Eastern Region) of Ghana but the inundated areas extend from the middle belt of the country (Volta, Brong-Ahafo Regions) to the north (Northern Region). The Bui dam is located in the northwest of Ghana (Brong-Ahafo Region), with the flood area covering portions of the north (Northern Region).

Figure 1: Map of Ghana within West Africa

Source: wellmake.co/editor, 2016.

2.2 Physiography and drainage

The topography of Ghana is generally of low relief, characterised by a predominantly flat and gently undulating terrain with slopes less than 5% (Quansah, 2000). The local relief is typically below 500 m, with a mean altitude of less than 150 m above mean sea level (amsl) in most parts of the country (Obuobie & Barry, 2012). Northwest of the dam at Akosombo lies the Kwahu Plateau, while the Akwapim mountain ranges begin at the sea and extend in a southwest–northeast direction into Togo, continuing as the Togo Mountains, and as the Fazao and Atakora Mountains in

[1] The outcome of a recent referendum is the carving out of six additional administrative regions from some of the existing ten, thus bringing the administrative regions in the country to 16.

Benin. The narrow river gorges created by the mountain ranges and hills at Bui and Akosombo, were considered ideal for construction of the respective dams.

The country is drained by three main river systems, namely the Volta, South-Western and Coastal River Systems. The Volta River System comprises the Black Volta, White Volta, Oti and Lower Volta rivers. The Black Volta originates as Sourou River in Mali and as the Mouhoun River in Burkina Faso and drains part of Côte d'Ivoire. The White Volta originates as Nakambe River in Burkina Faso, while the Oti originates as Pendjari River in Benin and flows through Togo. The Lower Volta refers to the river downstream of the confluence of the Black Volta and White Volta. Forty-two percent of the Volta Basin System lies in Ghana with the rest in Côte d'Ivoire, Burkina Faso, Togo, Benin and Mali (van de Giesen et al, 2001). The Volta River System covers about 70% of the country and contributes about 65% of the annual runoff from Ghana.

The South-Western River System comprises the Bia, Tano, Ankobra and Pra rivers. The Tordzie/Belikpa-Aka, Densu, Ayensu, Kakum, Butre, Ochi-Nakwa and Ochi-Amissah rivers form the Coastal River System. The South-Western River System covers about 22% of Ghana and contributes about 29% of the runoff; the Coastal River System covers about 8% of the country and contributes about 6% of the runoff generated in Ghana (Ministry of Water Resources Works and Housing (MWRWH), 2007). The total annual runoff generated is about 54.4 billion m^3, of which about 53% is generated within the country, while the remaining 47% comes mainly from Burkina Faso via the Volta River System (Gyau-Boakye & Kankam-Yeboah, 2016a).

2.3 Climate

The climate of West Africa is influenced by the Inter-tropical Convergence Zone (ITCZ), (Ojo, 1977). The ITCZ moves over northern Ghana once and southern Ghana twice each year, causing a shift between the two opposing prevailing wind directions (ie the Harmattan and the Southwest Monsoon), resulting in a mono-modal rainfall pattern in the northern parts and a bi-modal pattern in the southern parts of the country. The bi-modal rainfall regime occurs from April to July and from September to November; the mono-modal rainfall regime starts in April/May and lasts until September. Rainfall in the northern parts of the country is unevenly distributed and skewed towards the months of June to September, during which over 70% of the total annual rainfall occurs (UNEP-GEF Volta Project, 2013; Amisigo, 2005). Meanwhile, the Volta River System responds to the rainfall seasonality mostly in the north of the country, ie the river is at its lowest in March and at its peak at the end of September or early October. Thus, the dams built on the Volta River System fill from August, which often results in the harnessing of water resources of the river system for all year-round multi-uses and the provision of ecosystem services.

Ghana's climate regime is characterised by strong meridional gradients. Rainfall generally decreases from the southwest towards the north and southeast. The movement of the ITCZ is associated with vigorous frontal activities that influence the amount and duration of rainfall over the country (Andah et al, 2003). The mean annual rainfall varies from 2,200 mm in the extreme southwest along the coast in Axim to about 600 mm along the southeast coastal plains (FAO, 2005). The mean annual temperature is about 30^{o}C. For most parts of the country, temperatures are highest in March and lowest in August. Humidity is high in the south, particularly at the coast, where relative humidity may be 95%–100% in the morning and about 75% in the afternoon (Andah et al, 2003). The north experiences low humidity with relative humidity values of 20%–30% during the Harmattan period and 70%-80% in the rainy season. Annual potential open water evaporation

has been estimated as ranging from about 1,500 mm in the south to more than 2,500 mm in the north (Obuobie & Barry, 2012).

2.4 Population

The population of Ghana in 2018 was estimated at 29.6 million, with an annual growth rate of 2.17% (GSS, 2019). Males constituted about 49.1% and females 50.9% of the population. The population is largely urban (55.41%) as of 2017 (World Bank & UNDP, 2018). Much of the population is concentrated in the southern half of the country, with the highest concentrations being on or near the Atlantic coast.

As of mid-2016, about 38.8% of the population was under the age of 15, while persons 60 years and older accounted for about 7.1% (UNDESA, 2015). The total fertility rate fell significantly from 5.6 in 1990 to 4.0 in 2017 (World Bank, 2019). Life expectancy at birth for the total population as of 2017 was 63 years (World Bank, 2019). This is a slight increase over the 2010 figure (61.3 years) reported from the 2010 population and housing census (GSS, 2016). The increase in life expectancy may be attributed to better health care, nutrition and hygiene, and to reduced fertility.

Similar to global trends, the growing population in Ghana is placing higher demands on water, food, energy and the environment. In relation to energy in particular, Ghana has experienced a huge growth in peak load of electricity consumption from 1,393 MW in 2006 to 2,087 MW in 2016 (VRA, 2015; Energy Commission of Ghana, 2017), representing an increment of 49.8% over the past 10 years and an annual increase of 4.29% (Kumi, 2017). This is driven mostly by population growth, as residential consumers in both rural and urban areas of the country have been identified as one of the top three consumers of electricity in Ghana (Kumi, 2017).

2.5 Economy

Ghana has a lower middle-income-based economy. The nominal gross domestic product (GDP) of the country in 2017 was estimated at $47,269 million (GSS, 2018). Services make up the largest sector of the economy and accounted for about 56.2% of GDP in 2017, employing about 41% of the Ghanaian workforce. Industry is the second largest contributor to national GDP, with a share of 25.5% in 2017, but employing only about 14% of the total workforce. The agriculture sector is presently the smallest contributor to national GDP but employs the highest proportion of the workforce (45%), compared to services and industry. Its share of GDP in 2017 was estimated at 18.3% (GSS, 2018). In 2015, Ghana’s unemployment rate was estimated at 12%, with about 24% of the population having incomes below the national poverty line and engaged in precarious employment and self-employment in agriculture and services (GSS, 2018).

Cocoa, gold, oil, timber, bauxite and horticultural products are the main exports. Production at Jubilee, Ghana's first commercial offshore oilfield, began in mid-December 2010 and from the Tweneboa-Enyenra-Ntomme (TEN) and Sankofa fields in 2016 and 2017, respectively. The country’s first gas processing plant at Atuabo uses natural gas from the Jubilee field for the production of thermal power for VRA-owned generation plants. The expansion of Ghana’s nascent oil industry has boosted economic growth. However, the fall in oil prices since 2015 has reduced oil revenue by half (GSS, 2018). The dominance of the economy by agriculture and micro-enterprises and the needs of the extractive sectors, as well as population growth and urbanisation have implications for the current energy needs of the country, while the drive for industrialisation has framed estimates of future energy needs.

3 The context and policy decision-making processes around large dams in Ghana

3.1. Ghana's large hydroelectric dams

Ghana has three large hydroelectric dams, Akosombo, Kpong and Bui. Akosombo, built in 1965, dominates the country's engineered water infrastructure. The Akosombo dam is constructed across the gorge at Akosombo on the Volta River (Figure 1). It is a rock-fill dam with a thin vertical impervious clay core protected by fine and coarse filters (Kaiser Engineering and Contractors, 1966). The dam is 113 m high, with a length of 640 m and total volume of 7.92 million m^3 (VRA, 2018a). The Volta Lake created from the construction of the dam has a capacity of 148 km^3 (surface area of about 8,500 km^2, roughly 4% of Ghana's land area) at full supply level (84 m amsl) and has a length of 400 km with a shoreline of 5,500 km (VRA, 2018a). The Akosombo dam is multi-purpose. It is used for generating hydroelectric power and domestic water supply, while the lake supports fish production. The power generation plant has six generation units, with original installed capacity of 912 MW. The generation capacity was upgraded to 1,020 MW by 2006, in a retrofit project (VRA, 2018a).

Figure 2: Akosombo Dam

Source: Taken from Hayat (2017).

The Kpong dam was constructed between 1976 and 1982 at Akuse, 24 km downstream of the Akosombo Dam. The Kpong dam operates in tandem with the Akosombo dam as a run-of-the-river plant. It is used for energy production, irrigation and domestic water supply. The energy plant has four generating units (each with a capacity of 40 MW) and has a total installed capacity of 160 MW (VRA, 2018b). The designed average flow through the plant is 1,160 m^3/s, with a corresponding designed annual energy of 1,000 GWh (Ackah et al, 2014).

The created reservoir has an area of about 38 km^2 and a volume of 0.194 km^3 (Gyau-Boakye, 2001). The normal headwater is 14.75 m, with maximum and minimum headwater of 17.68 m and 14.75 m, respectively (VRA, 2018b). The Kpong headwater level is about the tailwater level (15 m

amsl) of the Akosombo. There is minimal daily head-pond variation since the Kpong flows are balanced with the daily Akosombo discharge.

Figure 3: Kpong Dam

Source: Taken from Adogla-Bessa (2018).

The Bui dam was constructed at the Bui Gorge on the Black Volta, which is located on the borders of the Northern and Brong-Ahafo regions. Its reservoir has a surface area of 444km^2 (at maximum operating level: 185 m amsl) and at its minimum operating level (167 m amsl), it has a surface area of 288 km^2 (Gyau-Boakye, 2001). The Bui HEP is the second largest hydroelectric plant after the Akosombo HEP and has an installed capacity of 400 MW. It was designed primarily for hydropower generation. However, the design includes the development of a 30,000-ha irrigation scheme for agricultural development, providing opportunities for enhanced ecotourism and fisheries (Hensengerth, 2011).

Figure 4: Bui Dam

Source: Taken from Owusu-Abedi (2015).

The proliferation of large dam projects in the 1950s to 1980s was underpinned by the need for irrigation, flood management and, notably, hydropower (Tsikata, 2012; Alhassan, 2009). During

these periods, decisions on dam projects were based on top-down approaches, reflecting a modernist perspective that prioritised the economy over other dimensions of development (Johnson et al, 2015). During most of Africa's independence struggle, large dams were seen as symbols of self-reliance, economic liberation and social progress. In the postcolonial period, between the 1960s and 1980s, large dams for energy supply were symbolic of modernisation, industrialisation, statehood and elite political authority (Hausermann, 2018). Despite later concerns about the negative implications of dam construction for the environment and communities near the dams, an acute quest for more energy and water resources since the 1990s has renewed interest in large dams (Mosello et al, 2017).

Obour et al (2016) have identified three national-level components of importance for dam construction: elite politics, bureaucratic capacity and finance source (international funding). They argue that national processes are increasingly being shaped and reshaped by local actors, civil society organisations and elites' perceptions of political mobilisation. The next section of this paper will focus on the politics of decision making, resettlement and the ecological impacts of the aforementioned three main large dams in Ghana.

3.2. The politics of the dams

Akosombo Dam

Described in the late 1960s as the "greatest single project that has so far been undertaken in tropical Africa", the Akosombo dam was expected to "put Ghana in the forefront of the industrialised parts of tropical Africa and thereby minimise the country's [dependence] upon the production of a single crop, cocoa" (Steel, 1968, p 63). Although the idea of the Akosombo dam dated back to the early part of the 20th century, it was not until Ghana attained independence, under the leadership of Dr Kwame Nkrumah and the Convention Peoples' Party (CPP), that the project was given the needed push. The campaign against colonial rule framed colonisation as deliberate underdevelopment strategy orchestrated by the British Empire to keep Ghana – and for that matter Africa – poor. Kwame Nkrumah's government therefore opted for industrialisation based on value addition as the appropriate remedy for Ghana's socioeconomic and welfare needs. The CPP was a socialist party and its attitude towards the country's transformation was informed by this ideology. As such the state was positioned as the primary instrument for engineering and delivering the transformations and improvements in the welfare of the citizenry promised during the independence struggle. By 1951, when Ghana attained limited self-rule, the idea of a major dam on the Volta had been the subject of several studies, and the importance of the project was also highlighted by the Watson Commission mandated to conduct an enquiry into the 1948 riots in the Gold Coast (Hart, 1980).

The decision-making processes around the construction of Akosombo took place at both the national and international levels. The national-level policy process, which took place mainly within the legislature, was inspired by a collective desire among the domestic political elites for modernisation through industrialisation. The international dimensions of the policy process were shaped by the lack of domestic financial resources to undertake the project and the need to raise funds from interested international actors. Nevertheless, there was considerable apprehension among members of the opposition parties in the legislature about the neocolonial implications of external involvement in the construction of the dam (Apter, 1972). In other words, although across Ghana's political divide there was agreement on the need for the Akosombo dam in the country's pursuit of socioeconomic transformation, there were heated disagreements about "political and

economic control, financing, labour, timing, and particularly about the relationship with the United Kingdom" (Miescher, 2014). Members of the opposition and some members of the CPP were sceptical about the dominance of foreign companies and expatriates in the preparatory work on the dam, and accused Nkrumah of drifting favourably towards imperialism.[2] Dr JB Danquah, one of the prominent opposition members, proposed not only the use of funds from "Cocoa Marketing Board reserves to finance the scheme", but also the establishment of an "independent commission, not dominated by foreigners". The leader of the Ghana Congress Party, Dr Kofi Abrefa Busia, noted, "it is against our interest as a nation to mortgage our entire economic future between the benevolence of the British and the restraint of the Aluminum Company" (Apter, 1972, p 237). He further warned about the "sociological implications of the scheme", especially given that it had the potential to culminate in "the breaking down of traditional sanctions, the movement of populations, submergence of old towns on the Volta, the creation of a great lake". On the basis of their scepticism, the opposition sponsored amendments to the original motion to accommodate local financing and local control of the scheme but, when it was put to a vote, the opposition motion was defeated by 51 to 14, and "the government motion seeking approval of the ongoing negotiation and the establishment of the preparatory Commission passed 50:13 with two abstentions" (Miescher, 2014).

The main external actors interested in the dam project, especially from the 1950s, were the British government, whose interest was the "assured supply of this scarce metal [ie aluminium] from a soft-currency source" (Birmingham et al, 1966) and, later, the government of the US, whose interest in the project was also shaped by the dynamics of cold war politics. Eventually the World Bank also became interested after it became obvious that the British and aluminium companies had lost interest in the project. Originally, the British government published a White Paper in 1952 that estimated the project would cost £140 million, which was to be shared between the Ghanaian and British governments, as well as British aluminium companies. At this early stage, the British government's interest was informed by the opportunity for aluminium buyers from that country to be able for "the first thirty years to have an option at the ruling market prices for 75 per cent of the total aluminum output" (Birmingham et al, p 392). It is instructive note that, at the time, the world was experiencing an acute shortage of aluminium, and therefore, while the Ghanaian government saw the Akosombo Dam as a means to actualise the dream of industrialisation, the British government's interest was driven by access to and possible monopoly over a cheap source of the precious metal. However, with the increase in production of aluminium by about 60% in the period between 1952 and 1956, there was a sharp decline in its price on the world market which adversely affected the interest of the British government and aluminium companies in the project.

Desirous to see the project through, Ghana's government approached the US government in October 1957. Against the background of the Cold War, the latter saw this as an opportunity to contain the former, which was obviously drifting towards the USSR, both in thought and in development rhetoric. The entry of the US resulted in a reassessment of the project, and significant changes in the actual scheme. Occurring simultaneously were negotiations between the Ghanaian government and major America players in the aluminium industry and, in 1959, a letter of intent was signed between the Ghanaian government and Volta Aluminum Company (VALCO) – a new

[2] This argument of the opposition is interesting given the normal congruence between the opposition and Western governments in their critique of Ghana's growing closeness to socialist countries and the non-aligned movement, and Nkrumah's consistent and more explicit anti-imperialist stance on a range of economic and political issues.

company resulting from a partnership headed by Kaiser Aluminum and Chemical Corporation. The Ghanaian government was able to secure a World Bank loan of £17 million in early 1960. In addition to their cold war strategic interest, the report from the Bank's team was instrumental in influencing the British and US governments to make loans to the project (Birmingham et al, 1966). As Tsikata (2006) has noted, the World Bank's intervention was decisive and significant for the project thanks to its role as both lender and referee. With the negotiations spanning almost a decade by the 1960s, if an agreement was not reached with the VALCO companies, there would have been little chance of getting the smelter; without the smelter, the whole scheme would not have been viable ((Birmingham et al, 1966). Yet in Ghana all hopes for modernisation, especially through industrial development, were hinged on the project (Birmingham et al, 1966)

The decision-making processes for the Akosombo dam were shaped by a development discourse and practice that highly prioritised state-led modernisation, broadly defined to include industrialisation, as the dominant reference point for socioeconomic transformation (Huntington, 1968; Apter, 1972). Consequently, modernisation conferred significant authority and legitimacy on the political elites to transform their heavily traditional and agrarian societies into modern industrial societies. Modernisation advocates argued that the processes of nation building and socioeconomic transformation resulted not only in shifts in power "from regional, aristocratic and religious groups to central secular natural institutions but also the concentration of authority in a single individual within those institutions". They also led to the ability of the institution to assert its interest over all other interests (Huntington, 1968). This is a top-down model of decision making, which organises society into two main categories: 1) ordinary people who lack access to the knowledge and expertise to understand the complexities of decision making; and 2) the elites who, by virtue of access to training, skills and knowledge, are not only deemed more capable, but are also entrusted with the responsibilities for decision making. The combined effects of the elite model and the logic of modernisation were reflected in development planning as the appropriate strategy for executing socioeconomic transformation. Overall, the intellectual disposition towards policy making in the early postcolonial period favoured exclusionary tendencies. Thus, civil society organisations and other stakeholders whose livelihoods were affected by the dams were only informed of decisions taken on their behalf and not consulted for their input nor allowed to participate in the process. As far as the engagement or participation of the larger Ghanaian public was concerned, the government opted for public education through mass media campaigns, film-shows and exhibitions to showcase the potential of the project to transform the country (Miescher, 2014).

It is worth noting that technocratic decision making was instrumental in the processes leading to the construction of Akosombo dam. Leaving aside the fact that the dam was a subject of several expert analyses, beginning with the first written article by Sir Albert Kitson, entitled 'The Possible Sources of Power for Industrial Purposes in the Gold Coast, British West Africa' presented at the First World Power Conference in 1924 in London, and later published in the Bulletin of Gold Coast Geological Survey in 1925, the final decision to proceed with the dam was significantly shaped by technocratic decisions involving the use of independent experts to research and advise on all aspects of the dam, including matters relating to the social impact on affected downstream communities, and possible remedies. For instance, the Preparatory Commission established by the government produced three large volumes of reports on various aspects of the proposed dam. In addition, Professor Arthur Lewis, later an advisor to Kwame Nkrumah, who was then at The University of Manchester, also produced "an independent government commissioned report"

(Steel, 1968, p 64). These reports later served as the foundational studies upon which the US Kaiser Corporation conducted its own analysis and revised the original project to reduce the budgeted cost, which was “eventually accepted by all the different interests concerned – including the governments of the USA, United Kingdom and Ghana, and the International Bank for Reconstruction and Development and the Aluminium concerns that combined to form the Volta Aluminium Company Ltd” (Steel, 1968, pp 64–65). The independent commission was succeeded by the Volta Basin Research Project, which came to be institutionalised at the University of Ghana, thus illustrating the enduring significance of technocrats in the policy-making processes surrounding the Akosombo dam.

Among the significant decisions relating to the dam was the establishment of VALCO in 1959. A joint venture between Kaiser Aluminum and Reynolds Metals, VALCO’s primary role was to establish and operate an alumina smelter, which would use the electric power generated from Akosombo to process bauxite in Ghana. Second, in anticipation of the completion and operation of the dam, the government, through an Act of Parliament in April 1961, established the Volta River Authority as an independent state agency with the mandate to generate, transmit and distribute electricity (Volta River Development Act, 1961). As Steel (1968, p 76) has noted, the VRA “is responsible for the construction of the dam, the provision of transmission lines, the building and maintenance of the hydro-electric station, and various other things like compensation of these whose homes and land have been flooded by the new lake”. Tsikata (2006, p 53) observed that “since the 1960s, the VRA has successfully implemented its mandate of producing reliable electricity for the alumina smelter and for local commercial and domestic consumers”. The terms on which VRA was to supply power to VALCO were stipulated in an agreement between the government of Ghana and VALCO which identified the latter as a preferential consumer of Akosombo power at a fixed price, impervious to market conditions (Tsikata, 2006).

Barely a month after Nkrumah commissioned the Akosombo dam, he was removed from office through a military coup d’état in February 1966, plunging Ghana into a period of political instability. Between 1966 and 1981, the country experienced about seven different political administrations consisting of two democratically elected governments and two military regimes. The first two of these regimes, the National Liberation Council (NLC) from 1966–69 and the Progress Party (PP) led by Dr Kofi Abrefa Busia (1969–72) were very hostile to Nkrumah’s ideology and development policies and so did not demonstrate an interest in policy continuity. The Busia administration’s overthrow in 1972 by another military coup led by General Ignatius Kutu Acheampong culminated in two administrations between 1972 and 1979, the National Redemption Council (NRC) and the Supreme Military Council (SMC). Acheampong’s emergence as head of state paved the way for the return of some of Nkrumah’s ideas to the policy agenda. It was thus under the Acheampong administration that the VRA, observing the favourable posturing of the new military government, revived discussions over the construction of the Kpong Dam.

The construction of the Kpong Dam was based on a recommendation adopted from the 1959 Kaiser Re-assessment Report, which suggested the construction of an additional low head power plant at that location. The dam’s conception was shaped by the same developmental discourse of state-led modernisation and the elite model of decision making. Unlike in the case of Akosombo, the decisions that culminated in the construction of the Kpong Dam were taken primarily by the VRA as the institution of state mandated to further explore issues relating to the development of the Volta Lake (VRA Act, 1961). To this extent, the Kpong dam was arguably removed from the

domain of high politics and located within the arena of technocratic decision making under the VRA. Thus, notwithstanding the political instability of the period, the government of Ghana approached a number of agencies through the VRA with a request to finance the foreign exchange component of the costs associated with the Kpong dam. A total of $185,383,000 (out of $196,867,000), comprised of loans in five foreign currencies was provided by eight participating funding agencies. The VRA shouldered the local currency component of 178, 541,000 cedis plus the foreign currency deficit of $11,484,000 (VRA, 1984) The Kpong Dam was situated 24 km downstream from Akosombo, with four generating units and related infrastructure. The project was implemented over a period of five years, covering five political administrations consisting of the SMC I (led by Acheampong), SMC II (led by General FWK Akuffo), the Armed Forces Revolutionary Council (AFRC) led by Jerry John Rawlings, the People's National Party (PNP) led by Dr Hilla Limann, and the Provisional National Defence Council (PNDC) led again by Jerry Rawlings. According to the World Bank (1993), the success of the project, in spite of the deteriorating economy and political turmoil at the time, was to the credit of the VRA. Unlike the case of the Akosombo Dam, where the government opted for public education to inform its people about the dam and its socioeconomic implications for nearby communities and the country as a whole, the Kpong dam project was undertaken without much public discussion, although some communities were resettled under a plan that was expected to avoid the mistakes of the Akosombo resettlement.

Arguably, nothing in the negotiations for the Akosombo dam illustrates more the dangers inherent in unequal power relations for decision making than the Master Agreement between VALCO and the government of Ghana (see Tsikata, 2006). In 1985, the PNDC government successfully renegotiated the terms of the agreement with VALCO. That agreement had been the subject of agitation by Ghana's student movement and other civil society organisations over several years. The PNDC, a military regime that encouraged popular participation in the political life of the country, provided the impetus for the renegotiation that VALCO initially rejected on the grounds that the agreement had not expired. A serious drought that had resulted in the levels of the Volta Lake becoming dangerously low, thereby compromising power production, strengthened the government's position that the needs of other consumers of Akosombo's power be considered in the distribution of power (Tsikata, 1986a, 1986b). The Ghana team, with technical support from the Commonwealth Secretariat and the erstwhile UN Centre for Transnational Corporations, as well as the staunch support of the PNDC, successfully negotiated a compromise deal that also recalibrated the power dynamic with VALCO. The renegotiation was aimed at deriving more benefits from Ghana's hydropower resources and ensuring that national priorities were satisfied. The outcomes of the renegotiations, coupled with the completion of the Kpong Dam, made it possible for the PNDC government to embark on a massive rural electrification programme that provided power to local communities which had previously not enjoyed power from the Volta River Project grid.

The renegotiation focused principally on the pricing and availability of power for VALCO (Sims and Casely-Hayford, 1986). As part of the renegotiation, VALCO maintained the right to continue its operations in Ghana, slightly expanded its privilege of holding foreign currency in an external account and received an undertaking from the government that it would not expropriate its assets. Ghana managed to get some favourable terms from the renegotiation, including a 20% reduction in the amount of energy VALCO was entitled to receive from the Akosombo dam (Sims and Casely-Hayford, 1986), and an increase in the base power rate from 5 to 17 UDS mills/kwh. Initially, power

was guaranteed to VALCO at a very cheap rate of 2.625 mills/kwh for 30 years from the commencement of the operations of the smelter (Tsikata, 1986a, 1986b). While this was 40% lower than the terms agreed with the World Bank, the Ghana government had agreed to these terms to facilitate the constructions of the dam. Additionally, as part of the renegotiation, VALCO's income tax rate increased from 40% to 60% (Sims and Casely-Hayford, 1986) and Ghana also secured the right to tax dividends distributed to shareholders and interest paid to creditors. These changes were an improvement on the original agreement, where VALCO was allowed to import all its raw materials duty-free. As Tsikata (1986a) has noted, there are often complex relations between transnational corporations and governments in the developing world. On one hand, there is pressure on such companies to comply with national objectives, while at the same time working in their own interests. This has often required the provision of incentives for such companies.

The Bui Dam

The Bui dam was revived and constructed during the administration of the New Patriotic Party (NPP) under the leadership of President John Agyekum Kufuor. The NPP traces its political tradition to the politics of JB Danquah and Busia, and lays claim to a free market ideology. In contrast to the decision making on the Akosombo and Kpong dams, the decision that ultimately led to the construction of the Bui Dam occurred in a policy environment that favoured participatory policy making (at least in rhetoric), and a market approach to development. Starting from the 1970s, the intellectual context of public policy making in Ghana, as in much of the developing world, began to change in favour of citizen participation in decision making (Chambers, 1970). By the 1990s, this approach came to be linked to neoliberal economic policies and multiparty constitutional rule. In departing from the elite model of policy making, the participatory approach gave priority to the involvement and participation of ordinary people in the policy making processes (Peters and Pierre, 2000). Interest in participatory policy making was influenced by the World Bank and other multilateral institutions in their demands that aid-recipient countries undertake reforms that allow public engagement in their policy processes (Williams, 2008). This approach assumes that policy making stands to benefit from the experiences and expectations of the broader society by tapping into the knowledge and aspirations of ordinary people (Ackerman & Fishkin 2004). The prioritisation of good governance in the 1990s provided inspiration for the shift to a participatory approach that enabled decisions about the Bui Dam to involve multiple actors.

The decisions leading to the construction of the Bui Dam in first decade of the 2000s witnessed the involvement of several actors, both domestic and transnational. Before 2000, the dam had been the subject of feasibility studies by JS Zhuk Hydroprojeckt of the USSR and Snowy Mountains Eng Corp (SMEC) of Australia in 1976, and by Coyne et Bellier of France in 1995, and again in October 2006 (Odoom, 2017; Abrampah et al, 2015). As with Akosombo, the decisions about the Bui Dam occurred at two levels – domestic national politics and international politics; and involved matters relating to the establishment of the Bui Power Authority, funding arrangements and compensation for affected communities. Following the decision to revive the Bui project, the government set the policy agenda by introducing a Bill in parliament, passed by the legislature in 2007, to establish the Bui Power Authority (BPA) with oversight responsibility to develop a hydroelectric power plant on the Black Volta at Bui, as well as other potential hydroelectric power sites on the same river.

The establishment of the BPA brought to an end the monopoly of the VRA on matters relating to the development of hydroelectric power in Ghana. This appeared to be the culmination of a process that began with the establishment of NEDCO in 2005 and GRIDCO in 2006, with specific

mandates to participate in aspects of the production and transmission of power in Ghana. The circumstances under which Bui resurfaced on the domestic policy agenda showed quite clearly that funding and economic considerations were the primary reasons why its construction had been delayed. For instance, it was only after the government was assured of funding for the project during the 2006 China–Africa Cooperation Summit in Beijing (Hensengerth, 2011) that domestic efforts were initiated towards the realisation of the dam.

3 Governance of water and dams in Ghana

There is no single institution or government agency responsible for the planning, regulation, operation and management of dams in Ghana. Different government agencies have specific mandates or roles that relate to different aspects of dam development and management, depending on the purpose for which the dam is intended. Water governance in general has undergone a number of reforms in the country. In the pre-colonial era, before Ghana came under colonial rule in 1844, individuals, small communities, trading, mining and timber companies were responsible for their own water supplies for different uses. From about 1900, the colonial government assumed some responsibility for public water supply in urban and rural areas as a result of periodic droughts, population growth, concentration into larger communities and pollution of water sources. A number of legislative instruments (LIs) were enacted in the early 1900s for the regulation of water use, for catchment protection, control of water abstraction in forest reserves, soil erosion and water courses control. These LIs included the Rivers Ordinance, CAP 226 of 1903; the Forests Ordinance of 1927; and the Land Planning and Soil Conservation Ordinance of 1953. However, all these LIs were vague and ambiguous on the ownership of water resources in the country.

Post-independence in 1957, agencies and institutions with defined roles for water supply, irrigation, water transport services and environmental protection and management were established. Each institution coordinated its own mandates with little or no collaboration in water management and governance. Before the 1990s, there were no clear-cut water governance policies in Ghana. Governance and management of its water resources were fragmented under various ministries and institutions. As a result, individuals and communities had a sense of ownership of their water resources. During this period, administrative and political reforms were undertaken to decentralise power from the central government to the district assemblies and lower levels of governance (Ampomah, 2016). These political reforms culminated in reforms in the water sector to improve efficiency in urban, rural and irrigation water supply, as well as to attain some measure of environmental protection and conservation.

In the early 1990s, the government of Ghana concluded that, although the water sector was being reformed, there were no arrangements for the overall regulation, management and coordination of water resources in the country. A comprehensive Water Resources Management Study (WARMS), which concluded that water is a scarce commodity with dimensions of social equity, economic efficiency and environmental sustainability, recommended that Ghana adopt an integrated, multisectoral and basin-level (decentralised) approach to water management, based on Integrated Water Resources Management (IWRM) principles.
Based on these recommendations, the Water Resources Commission (WRC) was established by an Act of Parliament, Act 522 of 1996, to regulate and manage the utilisation of water resources and coordinate related government policies. The WRC is an interagency Commission with

membership drawn from the following entities: National Development Planning Commission (NDPC), Hydrological Services Department (HSD), Water Research Institute of the Council for Scientific and Industrial Research (WRI), Ghana Meteorological Agency (GMet), Ghana Irrigation Development Authority (GIDA), Community Water and Sanitation Agency (CWSA), Ghana Water Company Limited (GWCL), VRA, Environmental Protection Agency (EPA), Forestry Commission (FC), and Minerals Commission (MC). Other members represent women, NGOs and traditional authorities (chiefs). The WRC acts as the body responsible for all water resource-related development and management matters in the country. Therefore, projects involving the utilisation, exploitation, development, and conservation of Ghana's water resources require permits from WRC.

Developing a hydroelectric power dam requires separate permits from the Energy Commission (EC), representing the energy sector; the WRC (representing the water sector) and EPA (representing the environmental sector). Consequently, hydroelectric power dams are affected by the governance arrangement and licensing processes stipulated by the various agencies. The EPA was established by Act 490 of 1994 and has the mandate to regulate the environment and to ensure the implementation of government policies on the environment. The EC was established by Act 541 of 1997 and has the responsibility of regulating and managing the development and utilisation of energy resources, as well as providing the legal, regulatory and supervisory framework for all energy providers, granting licences for the transmission, wholesale, supply, distribution and sale of electricity and natural gas, among other matters.

When the uses of a dam include the generation of hydroelectric power, the overall licensing process is led by the EC and the licences issued by the WRC and EPA are considered to be part of the energy licensing process.[3] Any intent to develop a hydroelectric dam (eg the Bui Power Authority – BPA) would first of all require the submission of an application to the EC. The energy licensing process is in two stages, the first being the issuance of a Provisional Licence upon receipt of an application and the second being the issuance of an Operational Licence (final licence). In between comes the issuance of siting and construction permits by the EC; the issuance of an environmental permit by the EPA; and the issuance of a diversion, construction and water use permit by the WRC.

Upon issuing a provisional license, the EC constitutes a committee that comprises EPA, WRC, GRIDCo, the Lands Commission, Town and Country Planning, the Forestry Commission and other relevant stakeholder institutions under whose jurisdiction the planning and development of the project will fall or will be affected. The committee then reviews documents submitted with the application, including those on the proposed site for the project. The committee reviews documents submitted by the applicant for the energy licence, undertakes site visits to inspect the proposed location of the project and makes recommendations to the EC on the issuance of a siting permit. The issuance of the siting permit is contingent upon approval by all stakeholder institutions on the committee. Following the issuance of a siting permit, applicants may undertake feasibility studies, environmental and social impact assessment (ESIA), and may apply for permits (eg an environmental permit from the EPA) from relevant stakeholder institutions and secure off-taker/power purchasing agreements.

[3] Interview with representative of the Energy Commission conducted via phone in Accra, February 2019

The EPA issues an environmental permit after an ESIA has been conducted by project proponents. The construction process involves blocking the flow of the river and diverting the water. Before a river can be diverted, a diversion permit is required from the WRC and, subsequently, construction and water use permits also have to be obtained from the WRC before actual constructions commences. The EC issues a construction permit as the next step in the licensing process, after issuing a siting permit to proponents. The construction permit is issued after proponents have acquired an environmental permit, a water use permit and off-taker agreements, among other things. Once construction of the hydroelectric project is completed, tested and commissioned, the EC issues the operational licence, which is the final licence required for any hydroelectric project in Ghana.

Individual stakeholder institutions do not interfere with permitting and licensing processes. However, in the issuance of the environmental permit, WRC is invited by the EPA to form part of the technical review team for the ESIA (Hensengerth, 2017). The EPA is also represented on the technical committee of WRC as a member of the Commission. However, the EC is not part of the licensing processes by the EPA and WRC unless project proponents invite the EC to be part of the public hearing proceedings, as part of the ESIA process.

As EC, EPA and WRC were established in the 1990s, the construction of the Akosombo and Kpong Dams did not go through the permitting and licensing processes now required by these regulators. For the BHP, the BPA did go through the permitting and licensing processes. However, the sequence of the processes was not followed strictly. For example, the ESIA process preceded approval and permitting processes by the three regulators, as this was a requirement for the loan agreement between the Ghanaian and Chinese governments (Hensengerth, 2017).

Hensengerth (2017) suggests that the licensing and permitting processes were a formality, since the planning process for the BHP had been in place since the 1960s, when the Bui Gorge was certified as a site for power generation and Ghana's parliament had already approved the contract and loan agreement for the development of the dam. Consequently, the WRC, for example, addressed environmental concerns with a mitigation requirement (ie a specific daily downstream flow to be recorded and reported and mitigation measures for sedimentation) in the issuance of the permits. Currently, the WRC has established the National Dams Safety Unit to ensure that dams operate according to stipulated standards. The National Dams Safety Unit includes representatives of all the agencies responsible for the dam planning, namely the BPA, VRA, WRC, EPA, GWCL, GIDA, and the Ministries of Justice, Local Government and Water Resources and Sanitation.

5 Decision making on ecological/environmental impacts and dam-affected communities

Dams often have adverse ecological/environmental and socioeconomic effects on local and downstream communities. In some cases, dam-affected communities have had to be resettled, with attendant challenges. This section discusses the environmental and socioeconomic impacts of the three large dams in Ghana, including the implications of resettlement for certain dam-affected communities.

5.1 Environmental impacts of and decisions on Akosombo, Kpong and Bui Dams

Decisions on dams and water resources management have often prioritised hydropower generation and irrigation projects (Mosello et al, 2017). However, dam construction comes with challenges, including socioeconomic and ecological problems for local communities. Problems associated with Akosombo and Kpong dams were caused by the lack of adequate environmental impact assessments. Ecological concerns were an afterthought, only taken seriously when they started to manifest in affected communities. This approach to resettlement was expected to change with the more recently constructed Bui dam, which saw efforts to promote broader energy sustainability (Hensengerth, 2017).

This section discusses the ecological decisions and implications of Akosombo, Kpong and Bui. It is divided into four sub-sections. The first two outline the environmental challenges associated with Akosombo and Kpong. The third discusses the ecological issues linked with the Bui project. Finally, sub-section four outlines the ecological challenges faced by communities in the Lower Volta Basin, whose concerns were largely ignored before the 1990s.

Ecological challenges with Akosombo dam

Akosombo and Kpong dams were constructed during a period where there was limited pressure from national and international actors over the need for environmental and social impact assessments before the commencement of dam projects (Obour et al, 2016). Decisions regarding ecological matters were made as an integral part of the technical decisions made by the VRA and the political elites, with limited consultation of local communities. This is in spite of the significant ecological impacts attending the two dams.

The creation of the reservoir resulted in the loss of habitat from direct inundation and in changes in hydrological conditions and river habitat, with the dam acting as a barrier to migratory fish and other aquatic species (Mosello et al, 2017). In addition, there were changes in water quality and sediment releases (Volta Basin Research Project, 1999). Further, the Volta Lake spurred changes in local climatic conditions, including changes in precipitation patterns and storms), reservoir-induced seismicity and a proliferation of aquatic weeds linked to health risks and impediment of economic activities, especially fishing (Johnson et al, 2015; Gyau-Boakye, 2001). Indeed, it was earlier reported by Hall & Pople (1968) that the creation of the lake provided conditions for aquatic plants and weeds to flourish, leading to a dramatic and explosive development of such weeds in the river. Greenhouse gas emissions were caused by the decay of vegetation in flooded areas and the extensive use of cement in dam construction (Mosello et al, 2017). These changes had implications for local livelihoods and health.

Water-borne diseases such as bilharzia and malaria became public health concerns as they became endemic among the inhabitants of surrounding villages near the Akosombo Dam (Alhassan, 2009; Gorman and Werhane, 2008; Rahaman et al, 2004). Before the construction of Akosombo, it was reported that bilharzia affected 1% to 5% of the population but, by 1979, the prevalence rates in the area had increased to 75% among lakeside residents (Alhassan, 2009; Gorman and Werhane, 2008). However, river blindness which was noted to be prevalent before the dam was built declined after its construction (Tsikata, 2006). Ironically, most of the environmental issues were considered secondary because of the contemporary prevailing development discourse and the political elites' desire to consolidate their power and rapidly implement the dam for newly independent Ghana's development. Thus, as expected, the environmental implications (both downstream and reservoir assessments) were only examined

from the 1990s onwards, after the negative impacts of the dams on their surrounding environment and communities became evident, and when more awareness and guidelines for safeguarding environmental quality became prominent at the international and national levels (Mosello et al, 2017).

Environmental challenges of Kpong dam

Similarly to Akosombo, the environmental decisions concerning the Kpong dam were taken by bureaucrats (VRA), aided by the military. The environmental and resettlement issues were supposed to be managed by VRA, but this was not fully appreciated at the time, as VRA tried to separate the energy component from environmental issues (Futa, 1983). These environmental issues were based on *ad hoc* approaches, with little input from the locals.

The Kpong Dam provided additional energy for the industrial and mining sectors and cheap electricity for domestic and commercial consumers. However, its environmental impacts were significant. They are difficult to isolate because of Kpong's proximity to Akosombo, as well as the fact that several of the problems had begun with Akosombo. Fishing benefited positively from the dam. However, it negatively impacted 7,000 resettled people, increasing health problems such as malaria, socioeconomic deprivation and the destruction of the ecosystem. The construction of the Kpong dam, powerhouse and head pond covering about 3,500 hectares led to the submerging of a large land area except for some islands and rock outcrops.

There was little anticipation of weeds invading the submerged area to change its ecology, apart from specialised flora that formed patches over the higher sandbanks exposed during the dry season (Futa, 1983). Apart from the weeds serving as breeding grounds for some diseases, they also restricted and, in some cases, disrupted the fishing activities of locals. The disruption of the annual floods, which began with Akosombo, was responsible for an increase in aquatic vegetation as the water became stable, with no seasonal changes. Submerged weeds developed continuously, instead of having to start anew each year from surviving the high rainy season floods or low dry season flows (Hall & Pople, 1968).

Bilharzia was anticipated at the Kpong dam area as aquatic weeds developed and snails that act as hosts for the disease became numerous, as at Akosombo (Futa, 1983). Among the other medical problems found in the area were worm infections, particularly round and hookworms (VRA, 1999). To control these diseases, efforts were made by the VRA, such as ensuring good sanitary conditions and potable water provision for the locals. The issues were, however, more complex than the VRA, which was purposely established to produce power, was able to address comprehensively.

Environmental problems with Bui Hydropower Project

The construction of the BHP, like that of the earlier dams, resulted in both positive and negative impacts. The BHP was designed to include a 30,000-ha irrigation scheme and opportunities for fisheries and eco-tourism (ERM, 2007). Even though the reservoir currently supports fisheries, the status of irrigation is unclear (Ferdinand, 2015). The proposed irrigation project is still at the preparatory stages. According to the BHP, Royal Haskoning BV, a consulting firm from The Netherlands is currently conducting feasibility studies of the proposed irrigation area and is to provide detailed designs for the development of 5,000 hectares as the first phase of development.[4]

[4] https://www.buipower.com/node/134, accessed 20 March 2019.

The adverse impacts, which are not very different from those of Akosombo and Kpong, included the displacement and resettlement of 1,216 people, poor resettlement housing, breakdown of cultural practices, livelihood loss and inadequate alternatives, limited fertile lands, the proliferation of aquatic weeds, water-borne diseases (bilharzia) and the flooding of about 20% of the Bui National Park (BNP), which destroyed habitats and biodiversity (Gyau-Boakye & Kankam-Yeboah, 2016).

In order not to repeat the challenges of having to chase after environmental issues after they had occurred, as happened with Akosombo and Kpong, the VRA prepared the design of Bui Dam with assistance from the World Bank in 1999 (Han, 2018). Since the 1990s, Ghana's parliament has passed various pieces of legislation and established institutions to comprehensively assess new dams and water projects. Global initiatives, including the World Commission on Dams and the Equator Principles, have also pushed the environment sustainability agenda with respect to dams to the fore. Financing for BHP came from China, a new player in the dam construction and financing space, whose approach is also influenced by its internal environmental norms, international guidelines, bilateral agreements and national politics. Sinohydro, the company that built the dam, has an environmental policy that is informed by Chinese government standards. Chinese national political elites and bureaucrats have a responsibility to develop frameworks that do not maintain or (re)produce inequalities whereby locals suffer ecological consequences.

Environmental and social concerns initially raised by the Bui report centred on land loss, species protection and health (disease risk). Earlier in 1997, British researchers undertook ecological studies in the BNP to assess potential dam construction impacts. In 2001, Daniel Bennett, a British scholar was banned from the area by the government 'politically sensitive' and national interest concerns (Han, 2018; Miescher & Tsikata, 2009–10).

The preparation of the BHP ESIA and Resettlement Action Plan (RAP) were supervised by the Bui Development Committee (BDC) under the Ministry of Energy (Hensengerth, 2014, 2013, 2011). Based on the ESIA, it was anticipated that a large area of land would be submerged as a consequence of the project, resulting in the loss of terrestrial habitats and associated disruption in the ecological integrity of various areas, including the BNP (ERM, 2007, p 102). Environmental concerns raised were wildlife and habitat loss within the BNP as a result of the flooding of 21% of the park, erosion and sedimentation of the river and its banks, changes in river flow and effects on fisheries, and sociocultural and economic impacts of resettling 2,500 people (Han, 2018; Alhassan, 2009; ERM, 2007).

Basically, inundation of the area by the reservoir altered the ecology (Asiama et al, 2017; Hensengerth, 2017). This led to the loss of the riverine forest ecosystem, terrestrial and aquatic habitats, and displacement of wildlife and aquatic communities (Hensengerth, 2013). Reservoir filling after construction restricted downstream flow releases for extended periods, altering and affecting downstream surface water resources, river habitats and users. Even before the BHP was constructed, there was a report that species that prefer a shallow habitat would colonise the periphery of the reservoir, while those that require moving water would disappear or persist as relic populations in the headwaters of the reservoir (ERM, 2007, pp 99–100). The presence of the reservoir has further caused a shift in the terrestrial wildlife species, with both adverse and beneficial effects.

Through the filling of the reservoir, the remaining vegetation decomposed, and this has affected water quality (Appiah et al, 2017). Organic decomposition under anaerobic conditions at the bottom of the reservoir also leads to anoxic conditions and the production of hydrogen sulphide, giving rise to odours and damage to aquatic organisms in the reservoir and downstream. Humidity levels around the reservoir also increased as a result of its surface area (Appiah et al, 2017).

Inundation of the reservoir has resulted in the drowning of some terrestrial fauna (Appiah et al, 2017). Wildlife and habitat were lost because of flooding. It is reported that some rare species of flora and fauna were destroyed (Han, 2018). Concerns have been expressed about the possible extinction of the hippopotamus because parts of their habitats closest to the Bui Gorge and the BNP have been flooded (Miescher & Tsikata, 2009–2010). These unquantifiable impacts of the Bui Dam on the local ecology and biodiversity constitute a 'tyranny of technology' (Alhassan, 2009). The tyranny of technology refers to the way technologies dismember rivers, dislocate communities, fracture social cohesion, and damage the dignity and mental psyche of those affected, resulting in hardships without corresponding benefits. It hinges on the inability of large dams to deliver on anticipated benefits and social and environmental impacts (Alhassan, 2009). Vegetation loss and disturbances to remaining plant life within the landscape alter the floral and faunal species composition and render the fragmented ecosystems unable to support species assemblages (ERM, 2007). The BNP has diverse wildlife species, including hippopotamus, buffalo and leopard. Displaced animals face increased hunting. Thanks to the International Union of Conservation and Nature's (IUCN) global conservation designation of the hippopotamus as either stable or decreasing, but vulnerable,[5] concerns have been raised about BNP, since the area contains Ghana's largest hippopotamus population (ERM, 2007). The pygmy hippopotamus is even classified as endangered by the IUCN.[6] BHP construction thus has implications for altering the ecosystem and exposing the hippopotamus to further risk.

Health hazards such as bilharzia were also raised in relation to Bui, and some referred to the area as an ecological disaster (Miescher & Tsikata, 2009–10). A permanent change in water flows in the river and the creation of the reservoir were thought to have significantly affected the incidence of diseases such as bilharzia, trypanosomiasis, guinea and intestinal worms in the local region (Appiah et al, 2017; ERM, 2007). The loss of land and forest resources has resulted in the destruction of medicinal plants for locals. The proliferation of water-borne diseases and aquatic weeds are also having an impact on resettled areas (Han, 2018).

Within the BHP, decentralisation as a factor in decision making was a major part of the environmental decision processes. Participation of the key actors in decision making was dependent on their expertise and interest in the project. Political elite engagement with transnational funding agencies was key in securing funding for the BHP. The BPA also replaced VRA as the body overseeing the BHP. The BPA was assisted by the Lands Commission, EPA, Town and Country Planning, Ghana Health Service, the District Assemblies, traditional authorities, and civil society organisations (CSOs) like the Ghana Dams Dialogue (GDD) on the planning and implementation of the dam and the mitigation of its impacts (Asiama et al, 2017). As Hausermann (2018) observed, the construction of the BHP reinvigorated historic discourses on dams and modernisation in rural Ghana, but this time in a neoliberal and constitutional-rule era that

[5] https://www.iucnredlist.org/species/10103/18567364, accessed 27February 2019.
[6] https://www.iucnredlist.org/species/10032/18567171, accessed 27 February 2019.

simultaneously framed the dam as a national project, with rural communities responsible for accessing its trickle-down effects.

China and navigating the environmental challenges of BHP

Environmental decisions concerning BHP were influenced by globalised actors and structures – international funding agencies, China, state political elites and technocrats led by the EPA,[7] CSOs and local actors. There were multi-stakeholders involved in BHP environmental issues, including China, which funded the project when Western funding agencies were reluctant to do so because of environmental sustainability and climate change discourses that raised concerns about the effects of the BHP on biodiversity and local communities.[8] China made funds available for the BHP at the request of the Ghana government. Ghana offered cocoa as payment for the loan. China's involvement facilitated the decision-making process, but also raised environmental questions, since China has been criticised for not abiding by the strict environmental standards of the West. Hensengerth (2011) has observed that Chinese actors abide by the host country's low standards, ignoring environmental standards set by the OECD's Common Approaches. Recently, however, China has strengthened and improved its domestic environmental regulations following internal criticisms. Chinese companies and banks are now required to apply domestic environmental standards to overseas projects (Hensengerth, 2011; Bosshard, 2010).

During the 2006 China–Africa Cooperation Summit in Beijing, Hu Jintao announced China's readiness to fund Bui (Hensengerth, 2011). Based on the events leading to the construction of BHP it can be argued that, because the Ghana government was determined to get the project executed, stakeholder engagement on matters including environmental impacts were more about information sharing than about seeking actual inputs. In other words, they were more informative than consultative (Mosello et al, 2017). The rising interest in sustainability affected the discourses around the BHP. The government meanwhile invoked the modernisation discourse, but the media and CSOs shifted the debate to ecological concerns, focusing even more on biodiversity than on the question of dam-affected communities, although the experiences with Akosombo's affected communities featured in discussions (Miescher & Tsikata, 2009–10).

While Chinese companies are required to apply international standards to their World Bank-financed construction projects (Hensengerth, 2011; Chen et al, 2009), Sinohydro and the China Exim Bank were not involved in the environmental decisions on BHP. The firm honoured the terms outlined by Ghana's EPA (Hensengerth, 2011). The environmental approval documents were part of the loan application reviewed by the China Exim Bank (China Exim Bank, 2007). The role of international norms in Chinese investment compliance with environmental guidelines is dependent on the contractual arrangements, and the political institutions of host countries (Hensengerth, 2013). It is instructive to note that international norms informed Ghana's EIA (Hensengerth, 2014) and the EPA's regulations are based on international standards – those of the World Bank, International Finance Corporation, International Organisation for Standardisation (ISO), and International Hydropower Association (IHA) (Hensengerth, 2013, 2011). The environmental guides that informed BHP are a product of transnational actors. They have, however, been implemented haphazardly, and political and technological necessities override ecological issues.

[7] The EPA had not been established during the constructions of the dams before Bui.

[8] A feasibility study had been undertaken by the French consulting company Coyne et Bellier (1995) and the ESIA by UK firm, Environmental Resources Management (Hensengerth, 2014).

Using the literature on BHP, it seems that a techno-political approach is helpful in disentangling the historical, technical, political, social and environmental complexities of dams in Africa (Han, 2018). Han argues that Chinese activities overseas are affected and challenged by the interplay between external technocratic and political influences. China is not following international norms fully, but, with insufficient local participation, it creates a situation where recipient countries seem to lack the needed agency or power to resist China's influence because of its money and technology offerings (Han, 2018). As a new global player in the development space, China could champion environmental concerns. However, for this to happen, bilateral contracts and African institutions need to crystallise China's environmental responsibilities.

Although the BHP was supposed to have learned from Akosombo and Kpong, it can be argued that the institutional arrangements to mitigate its ecological impacts have been ineffective, allowing the political and technical elites to overlook an environmental sustainability agenda. Indeed, whereas official discourses framed Bui as a vital public good, its construction and operation created private property and reinforced the exclusion of locals from water resources and environment management. Compared to Akosombo's and Kpong's limited multi-stakeholder engagement, Bui had greater engagement, but it seems that the government's intentions were firmly made, undermining the influence of the environmental concerns of local communities on decision making.

5.2 Decisions concerning the altered ecosystem of the Lower Volta Basin

Communities located along the Lower Volta Basin were not a concern of the VRA in its consideration of the impact of the Akosombo Dam. This was despite the fact that the VRP Preparatory Commission had commissioned a study to examine the likely effects of the dam on the economic activities of the Lower Volta Basin (Lawson, 1968; 1972). Various studies had identified dam impacts on the Lower Volta. Those studies that preceded the dam's construction were followed by several that identified the early impacts of the Lower Volta Basin. These included the reduction of water flow which had altered the ecosystem of the Lower Volta Basin. Hall & Pople (1968) noted that, although aquatic weed problems were expected from the damming of the Volta, there was little anticipation of weeds invading the Lower Volta Basin. Aquatic weeds developed, however and this was attributed to the cessation of the annual floods that scoured the riverbed and prevented the spread of the weeds (Hall & Pople, 1968). Apart from the weeds serving as breeding grounds for diseases, they also restricted and disrupted local fishing.

The cessation of floods also altered the ecological balance between the Volta and its floodplain, significantly affecting the livelihoods of downstream communities (Alhassan, 2009), distorting local economies which were previously based on farming, fishing and small-scale trade (Miescher & Tsikata, 2009–10; Tsikata, 2012, 2006). Farming along the Volta was previously structured around the rise and fall of the river, a natural cycle that deposited nutrient-laden silts along the floodplains (Johnson et al, 2015). There was also a high saltwater intrusion in the lower Volta, rendering agriculture less productive and affecting lagoon fisheries, symptomatic of the 'tyranny of technology' of large dams (Alhassan, 2009). Tsikata (2012, 2006) and Alhassan (2009) noted that community losses were ignored in the initial years of the Akosombo, as economists did not include non-market and environmental losses in project accounting. Also, the adaptation of livelihoods of downstream communities predicted by the VRA did not happen (Miescher & Tsikata, 2009–10).

In the 1960s, the VRA maintained that, except for issues of flooding and salinity that were set out in the Volta River Development Act, it had no mandate to address challenges of the Lower Volta

Basin. While this position was informed by a government White Paper in 1996 that directed affected communities in the Lower Volta to the Ministries of Social Welfare and Agriculture, these ministries had neither the capacity nor the resources for this massive undertaking (Tsikata, 2012). The communities' demand for pipe-borne water, dredging the river, clearing of aquatic weeds and addressing livelihood difficulties were challenged by the VRA. Relations between Lower Volta Basin and VRA are the subject of petitions, politics, resistance and lawsuits (Tsikata, 2012). Community needs were not met because the VRA engaged with institutions and not local people.

Policy and practice towards the area changed as a result of the 1996 Lower Volta Studies. Commissioned by the VRA, the studies took an inventory of the pre-dam baseline data on the inundated areas from the Akosombo dam (VRA, 1999). They included a study of the ecological impacts of the catchment area of the lake after it filled in 1968. The aim of the Volta Basin Research Project, which undertook the studies, was "establishing a scientific information base through the generation of empirical data from a multi-disciplinary perspective, in order to promote sustainable utilization and effective management of the environment and resources in the Lower Volta Basin" (VRA, 1999, p 4). The studies reinforced the findings of earlier reoprts that the creation of Akosombo had had massive impacts on the Lower Volta Basin through the alteration of the ecology, of soil, vegetation, aquatic plant composition, water quality, fisheries and of the socioeconomy of the area (VRA, 1999). Furthermore, inadequate dredging of the Lower Volta Basin had worsened the aquatic weed problem. As noted, before the impoundment of the river, annual seasonal floods cleared out sandbanks at the estuary of the Volta. However, with the cessation of the annual floods, more sandbanks grew. Over the years, the estuary had become blocked, and the sea could not penetrate to alter the salinity, resulting in the growth of freshwater weeds (Tsikata, 2012; VRA, 1999).

The 1999 Lower Volta Studies led to a policy shift from an initial position that the Akosombo Dam had not significantly affected the Lower Volta and therefore that the VRA (and by implication the government) was not responsible to the downstream communities to one that espoused the need to address dam impacts on the Lower Volta (Tsikata, 2012). However, this shift, coming more than four decades after the construction of Akosombo, did not result in a fundamental change in decision making with respect to the Lower Volta.

In conclusion, it should be noted that, within the environmental debates, dam-affected communities are not docile. They have resisted and engaged national and transnational actors on dam impacts before and after dam projects. In the case of Akosombo, communities in the Lower Volta, though not consulted during the construction stages, petitioned the VRA through their leaders or chiefs to register their concerns about the environmental, economic and social impacts of the dam (Tsikata, 2006). Some families whose lands were submerged also sued the state (via the VRA) and had some compensation paid to them years later. This highlights the agency of dam-affected communities in a context of severe limits to their power, given the national and transnational interests in large dam projects. We now discuss decision making around the resettlement schemes of the three dams.

5.3 Resettlement dynamics of large dams in Ghana

From the vantage point of orthodox policy decision-making scholarship, decisions emanate from a normatively positivist practice. However, from our critical perspective, following Peck (2012), we conceptualise the policy-making field as a socially structured and discursively constituted spatial domain. Thus, the three resettlement schemes, akin to the dams that occasioned them, involved

diverse actors and institutions operating through diverse non-linear processes to arrive at core decisions.

From the outset it is vital to note that the resettlement schemes for the three large dams demonstrate a consistent pattern of decision making and outcomes. Common outcomes of resettlement include the significant levels of poverty among those displaced, which are manifest effects of problematic compensation and resettlement policies. Further, the questionable resettlement and compensation schemes emanate from the unequal power relations between what Pham et al (2013) call the 'iron triangle', which comprises government, financiers and construction engineering companies and the leadership of the heterogeneous population in the inundated communities.

Notably, the adverse consequences of dams and resettlement schemes are quite common in most developing nations (Hausermann, 2018). According to Hall & Branford (2012), the local population of the Belo Monte Hydro Dam Project on the Xingu River in Brazil battled the energy authorities about the negative effects of the top-down planning approach for over three decades. Wet (2003) also notes the chasm between the national development strategies and the relocation plan of the Lesotho Highlands project. The net effect was the sluggish provision of essential services and the impoverishment of the displaced citizens. Out of concern for these negative outcomes and other pertinent structural and institutional factors, the World Commission on Dams established guidelines that included both preventive and mitigating measures. This section on resettlement dynamics discusses the resettlement issues of each dam in turn, first to show the continuities and specificities of each resettlement experience; second to examine the nature of decision making accompanying such experiences.

The Akosombo Dam resettlement scheme

The Akosombo Dam and its reservoir displaced 80,000 citizens from over 740 villages from the Eastern, Volta, Northern and Brong-Ahafo regions who had to be resettled. Through a legislative act (Act 46, 1961), the Volta Resettlement Scheme was established by law. After the resettlement programme, studies found that the scheme had not delivered on its expectations and the promise by the government that no one would be made worse off as a result of resettlement. Some of the problems identified were high unemployment, food insecurity, insecure land titles, housing crises, identity crises among those displaced, gender inequalities, and ethnic tensions between the displaced people and host societies. In her study of New Mpamu Tamakloe (1968) identifies core problems of the resettled communities as: idleness among most men, overcrowding in most household units (15 people per unit), landlessness, apathy and demoralisation, and inadequate water supply. These unfortunate outcomes eventually led to the emigration of 40,000 displaced persons by 1964 in search of better livelihood options in other regions. There is unanimity in the literature that the Volta River Development Resettlement Scheme rather worsened the poor socioeconomic conditions of those displaced. In effect, the resettlement scheme failed to mitigate suffering, risk and vulnerabilities, and to protect the rights and wellbeing of the displaced. Schram (1967) and Lumsden (1973) note that the resettled population in some communities showed their unhappiness with the scheme by rejecting the housing units, and instead choosing to live along the Volta Lake. Further, some of the displaced population rejected Project 356, a World Food Program initiative, on the grounds that it was not an economically viable project (Lawson, 1968). Rather, some of these farmers secured lands elsewhere and cultivated crops likely to maximise their livelihood outcomes. Hence, the problematic resettlement outcomes were

characterised by understandable resistance from the displaced population (see Tsikata, 2006, for details).

These resettlement scheme outcomes were attributed to the scheme's problematic conception and execution. First, was the disproportionate attention paid to dam construction with the aim of achieving an elusive modernisation development agenda. Miescher & Tsikata (2010) explain that the 1959 Kaiser report initially ignored dam-affected communities. Thus, resettlement did not run alongside the construction from 1961. It was only later that Nkrumah's seven-year development plan made provision for the displacees. As noted by Miescher & Tsikata (2009–10), there was minimal attention devoted to resettlement by the VRA. As a matter of fact, the initial resettlement cost was pegged at £4 million in 1961 (Miescher, 2014). Clearly, given the 700 plus villages inundated for the dam reservoir, this meagre amount needs to be understood as a reflection of the overarching policy prioritisation of the dam as an industrialisation drive, with less concern for the human and ecological consequences for the displaced population. In particular, the initial resettlement was placed under the Ministry of Social Welfare, thus suggesting a gross underestimation of the risks and costs of displacement. The Ministry of Social Welfare essentially lacked the requisite staff levels to undertake such an arduous task of risk and asset valuation. With the inability of the Ministry of Welfare to handle its mandate, the VRA was authorised to discharge resettlement duties. This led to the appointment of a resettlement officer, a principal welfare officer and subsequently an agricultural officer (Miescher, 2014; Raschid-Sally et al, 2008; Tsikata, 2006). Afterwards, engineers, architects, lawyers, town planners, surveyors and public health specialists were recruited to carry out the resettlement scheme.

The Akosombo resettlement planning and execution reflects a top-down socio-technical engineering effort, which accorded very little consideration to the agential capabilities of the people displaced and their host populations. Furthermore, the complexities and magnitude of resettlement required a wide array of expertise and significant financial resource commitment, which was not forthcoming. The primary focus on physical resettlement, which neglected the human and social issues of resettlement, also proved damaging for the Akosombo resettlement experience. The voices of the representatives of the heterogeneous displacees were virtually absent, which makes the resettlement effectively expert-driven. In this sense, the people displaced had very limited input in terms of choice of location for resettlement, housing design, employment prospects, suitable agricultural production models, or health and educational amenities, to mention a few. The realisation of the objectives of development would require a significant shift in thinking by officialdom about the prioritisation of resettlement through progressive participatory intersubjective engagement. Also, there is a need to rethink the 'tokenistic' or 'invited' consultative participation that rarely addresses the fundamental structural, institutional and attitudinal factors involved in any transformational participation in future dam projects.

Furthermore, there was the problem of compensation. The State Property and Contracts Act, 1960, C6, gave expansive power to VRA to compulsorily acquire lands it deemed fit to inundate to fill the Lake. From the outset, massive tracts of land were acquired. Although compulsory state acquisition requires compensation, the Volta River Development Act 1961, 46, section 28 (a), undermined the terms and value of compensation. Section 28 (b) states: "compensation may be paid in money or in non-monetary assistance towards settlement or both. No person shall be entitled to dispute the compensation offered to him by reason only that it is not in money, whether whole or in part" (1961). This legislative provision constrained displaced communities and others

that had lost lands or livelihood activities from contesting or effectively negotiating the monetary compensation. It is therefore not surprising, as noted by Tsikata (2006), that there was significant undervaluation of the land and its endowments. This undervaluation of compulsorily acquired lands is a significant feature in compulsory land acquisitions and involuntary displacement situations in many developing countries, as noted by Cernea (1999, 2008). The approach to compensation rests on an implicit economic logic that the cost of land dispossession can be adequately compensated at the level of current market value. Kanbur (2003) and Cernea (2008) argue that compensation at the level of market value itself undermines the value of compensation because of market failures of incompleteness and uncertainty about future markets. Another vital shortcoming of the market value formula for the compensation of displaced persons is that it does not account for the cost of adjusting to the newly allocated land. Inundated lands are not equivalent to a consumable commodity that can easily be replaced. Arguably, it is the simplistic rhetorical Pareto optimal logic of compensation, which invariably undervalues the cost of adjustment, and ultimately results in low payments, as witnessed in many developing countries. This brings to the fore the nature of engagement between officials of the Lands Commission, the VRA and the chiefs who represented their communities in the Akosombo resettlement scheme. Beyond the constraining statutory legal provisions, the inequalities in power and influence between the officials and the communities had an adverse impact on communities' negotiating capacity. Except for the politicians of the leading opposition parties, it is striking that the groundswell of support by the people of Ghana, CPP government and the state media for the dam construction was not the same for issues of compensation for affected communities. In fact, this portrays a clear case of articulation of uneven narratives relative to the different components of the dam to suit diverse interests.

It is pertinent to note that poor compensation leads at best to livelihood restitution. However, it cannot transform the lives of displaced people. As found in the case of Akosombo, the poor compensation significantly undermined the asset base of the displacees and arguably inevitably rendered most of them impoverished. Additionally, these politics of compensation resulted in gender differentials in compensatory receipts because of the patriarchal nature of the land ownership rules and customs. The politics of compensation is imminent in the wake of the multi-layered nature of the local communities, whereby chiefs of resettled and host populations compete for the pursuit of idiosyncratic interests in the distribution of the compensation packages.

To address the significant shortcomings of the Akosombo resettlement scheme, the government established the Volta River Resettlement Trust Fund in 1996, 30 years after the commissioning of the Akosombo Dam. The primary focus of the Trust Fund is to provide basic amenities in the 52 resettled communities. The overarching rationale of the Trust Fund is to enhance the livelihood of the people displaced through the provision of a basic needs project.

However, the crucial question is the Fund's capacity to address the increasing demands of the communities. Raschid-Sally et al (2008) suggest that the Trust Deed of the VRA Resettlement Trust Fund enjoins the VRA to allocate a non-adjustable $500,000 annually to the Trust Fund, which would amount to $6 per household. This minuscule amount raises serious questions about whether the Fund represents a shift in the VRA's conservative stance towards the dam–affected people. Moreover, payment of this annual amount is contingent on VRA's annual profit. Given VRA's indebtedness over the past, it would be difficult to pay this annual requirement, the implication being that many projects will be underfunded. Thus, there is a crucial reason to

interrogate the processes that led to the determination of the annual commitment of $500,000, and to determine who the real beneficiaries have been. Furthermore, Skinner et al (2014) note that, out of the fixed $500,000, 25% of that amount is spent on running the Resettlement Secretariat, with 75% spent on projects in the approved communities through competitive application processes. The priority projects of the fund are sanitation and water, health facilities, schools and community infrastructure. It is critical to examine whether these investment projects have really enhanced the livelihoods of the displacees or created a dependency syndrome. Arguably, the primary focus of the Resettlement Fund on provision of basic needs for displaced persons attests to the failure of the original fulsome goal of modernisation of resettled populations and communities.

There is also a risk that the rural elite could be the major beneficiaries of the Fund. A cursory look at the composition of the Board of Trustees suggests an elite makeup. Indeed, the Trust Deed constitutes the Board of Trustees with the following officers: a chairman appointed by the Minister of Energy; ten Members of Parliament from affected constituencies in four regions; two representatives from the VRA; three representatives from the Ministry of Energy; and one Trustee appointed by the Energy Minister (Skinner et al, 2014, p 18). Significantly, in this age of questionable representative liberal democratic practice, decision making at the level of the Trust Fund is not open to the wider polity to engender broader deliberative processes that would ensure outcomes that benefit communities and their members.

Kpong resettlement

The Kpong dam displaced an estimated 6,000 citizens (Obour et al, 2016; Mettle, 2011). Differently from Akosombo, resettlement planning started early for the designated resettled communities. Thus, the provision of housing and electricity infrastructure started in earnest quite early. It bears noting that, as a corrective measure against the poor housing planning and design of Akosombo, the Kpong housing scheme was a hybrid between modern and traditional architectural design to suit the diverse population displaced by the dam. Additionally, there was a modest attempt to provide essential social and productive infrastructure such as roads, water, clinics and schools. This improvement in the infrastructure investment could be attributed to the lessons learnt from the Volta Resettlement Scheme. It would be viable to empirically interrogate these lessons and their instrumental articulation.

On the economic front, however, the agricultural and other development initiatives were not successful in terms of output and employment generation. For instance, in the agricultural sector, Raschid-Sally et al (2008) argue that, because of their small farm sizes and incompatible mechanised farming practices, most farmers were unable to continue agricultural livelihood activities. Even more worrying was the poor compensation scheme for the dispossessed lands and weak land title in the resettled communities. The net effect of poor compensation and resettlement approaches has been long-term ethnic tensions and conflicts between the host communities and the settlers in respect of land title and tenure security (Owusu et al, 2017).

As in the case of Akosombo, the dire consequences of the Kpong Dam for the non-resettled population requires us to interrogate the decision-making processes that underpinned the project. Said consequences include unemployment, poor sanitation, illiteracy, poverty and a heavy disease burden. This raises the need to expand the scope of the resettlement scheme, and augment the resources devoted to the resettlement compensation. Obour et al (2017) note how the non-resettled population complained bitterly about the zero-compensation paid to them, the loss of their assets and livelihood sustenance, and the precarious conditions that they have endured.

Bui resettlement

The Bui Dam was constructed in the era of the post-World Commission on Dams Report that highlighted and sought to address global concerns about the dire social and ecological impacts of hydropower dams. Interestingly, top officials of the Bui Power Authority have claimed that their resettlement initiative followed World Bank guidelines, which resulted from the recommendations of the World Commission on Dams Report. However, it is significant to note that, in actual practice, the resettlement planning and execution components reflect what Mitchell (2002) labels the rule of experts, akin to the Akosombo and Kpong schemes. Specifically, the resettlement processes involved consultation with selected chiefs of the displaced and host communities, but it was technical experts who were the drivers of the core decisions (Hausermann, 2018; Mettle, 2011).

Significantly, the architects and proponents of the Bui Dam replicated the symbolic and material ideals of modernisation of both Akosombo and Kpong. The Bui Dam displaced 2,000 persons from seven communities (Yankson et al, 2017). The compensation system was and still is undergirded by the Land Administration and Resettlement Policy (LARP). The major thrust of the LARP is to avoid resettlement or minimise its adverse outcomes. In addition, the LARP reiterates the need to maximise the wellbeing of project-affected people and foregrounds participatory processes with the project-affected people. Most importantly, the LARP has detailed and clear modalities and procedures to guide resettlement schemes, ostensibly to mitigate past problems and in keeping with the guiding principles of the WCD report.

However, it is vital to note that the LARP, which is similar to Act 46 of 1961, vested in statutory bodies like the Land Valuation Board the power to determine the valuation formulae and levels of compensation. Within the context of Bui, the complex traditional heterogeneous polities of the resettled communities played a vital intermediary role in the determination of the compensation level and distribution (Asiama et al, 2017). Various studies by Asiama et al (2017) and Yankson et al (2017) suggest that, in the main, some of the adverse resettlement consequences of Akosombo and Kpong have been replicated in Bui. These negative outcomes suggest a mismatch between the goals and means of the resettlement scheme and also the primacy of dam construction over the interests of dam-affected communities. Notably, the efforts to improve the lives of displacees have instead impoverished and predisposed them to serious livelihood challenges. These poor outcomes reflect Li's (2007) and Pritchett and Woolcock's (2004) problematisation of the development failures of expert-driven technical solutions.

This situation can be attributed to several factors, including the weak conceptualisation and haphazard planning of the resettlement scheme, and the marginalisation of dam-affected populations. Other causal factors are inadequate funding and power imbalances between officials and communities, with the decisive power vested in the dominant actors (officials of the state, donor countries, multilateral and bilateral institutions, technical experts and private capital.

The overwhelming detrimental repercussions of the three dams calls for new thinking about compensation, including the idea of continuous investment in resettled and other dam- affected communities. There are justifiable grounds for new thinking and an understanding of resettlement decision-making processes to avoid or mitigate historical mistakes. Further, there is a crucial need to create progressive multi-stakeholder engagement and equitable benefits-sharing mechanisms. Finally, it is imperative to examine the articulation of free prior informed consent in decision making

about future dams in Ghana to minimise risks, optimise benefits, and stimulate the active participation of the displaced population.

6 Ghana's planned dams

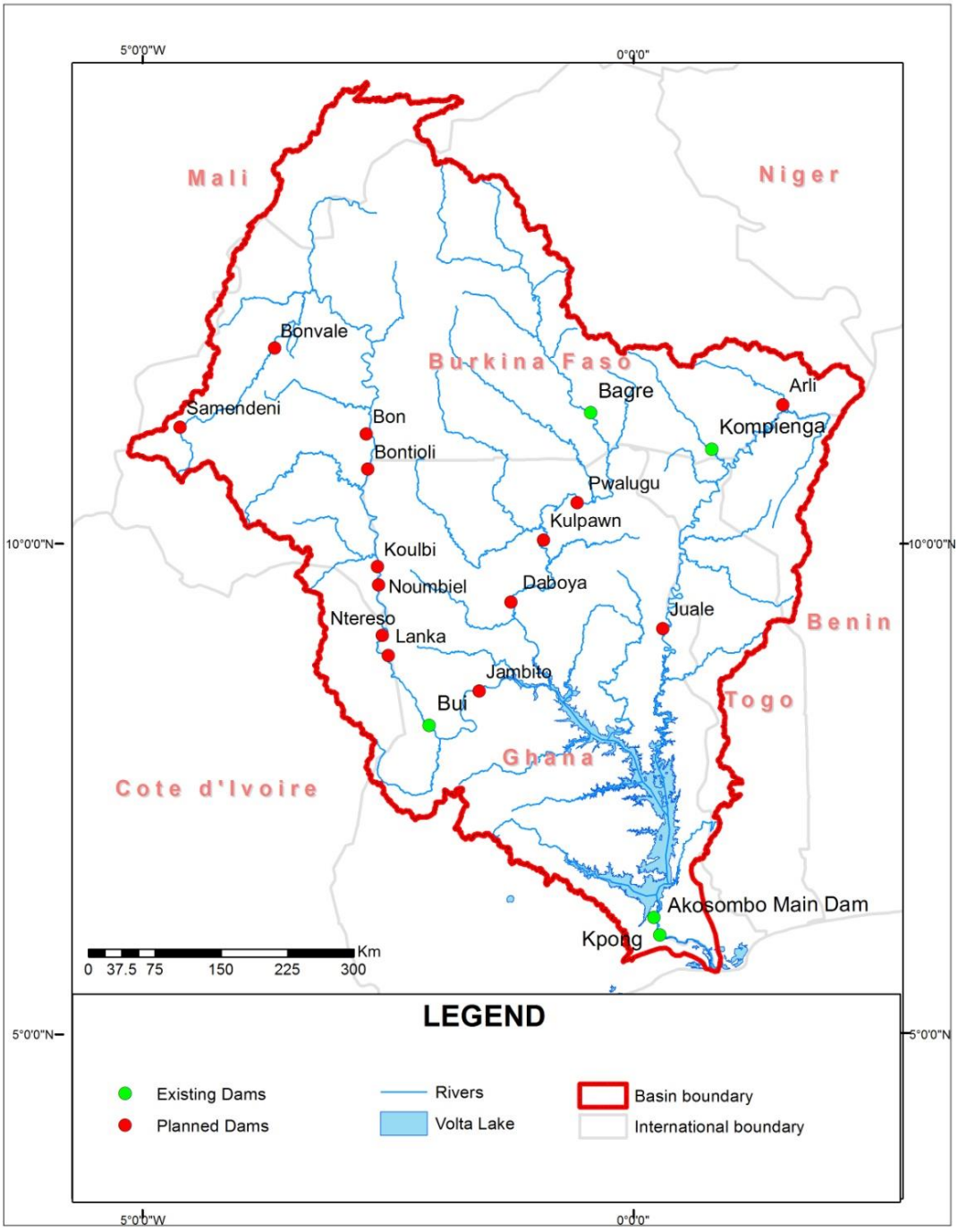
The Akosombo, Bui and Kpong dams have captured most of Ghana's hydroelectric power potential and some, including the IHA (2015) have argued that most of the planned large hydroelectric dams in the country, particularly those located in the Volta Basin (eg Juale on the Oti; Kulpawn on the White Volta; and Jambito on the Black Volta) are not viable and should be discarded. The reasons given for that argument include the following: (1) the negative impacts of planned dams on generation at Akosombo and Kpong, resulting in low or no net contribution; and (2) the flat topography of planned dam sites will lead to inundation of vast areas and cause massive displacement. The argument is contrary to what some national experts and successive governments in Ghana maintain. This is demonstrated by ongoing consideration of the large multi-purpose Pwalugu dam (proposed for hydropower, irrigation and flood control).

The sites identified for major new dams in Ghana, mostly for hydropower generation and irrigation are located in the Volta Basin (Figure 5). For irrigation, planned developments are meant to expand existing schemes and to create new schemes (McCartney et al, 2012). Table 1 gives an overview of Ghana's major planned dams, including those in various catchments of the Volta Basin. Based on Ghana's definition of small (< 1MW), medium (between 1MW and 10MW), and large (between 10MW and 100MW) hydropower, all the major planned dams can be described as large. In addition to the large hydroelectric dams, about 72% of Ghana's medium hydroelectric potential lies in the Volta Basin, specifically in the Black Volta (55%), White Volta (10%), and Oti (7%) basins (MoE, 2010). The rest of the country's medium hydroelectric potential is located in the Pra (18%) and Tano (10%) river basins.

Two of the large planned dams, Pwalugu on the White Volta and Juale on the Oti, are high priorities for the VRA and the government. In 2008, the government contracted a loan of US$525 million from Brazil for the construction of both dams but later abandoned these projects and reallocated the funds for the construction of the Eastern corridor road (Mosello et al, 2017). The Pwalugu dam in particular is still high on the national agenda for two important reasons: first, it is conceived by most government agencies, including the Northern Development Authority (formally Savannah Accelerated Development Authority) as a key initiative for the development of Northern Ghana (Mosello et al, 2017), which has very low levels of income and human development indicators; and second, it is considered a key structural intervention for addressing what has now become a perennial flooding problem in the White Volta Basin. The floods are largely a result of the high intensity of rainfall in short periods (three to four months) in northern Ghana, the generally low topography, and the low permeability of soils, compounded by spillage from the Bagre dam located upstream in Burkina Faso. Mosello et al (2017) have indicated that, even without any specific operational rule, about 70% of the annual floods downstream of Pwalugu can be controlled with the dam. It is estimated that the proposed dam at Pwalugu could produce a total power of 205GW/year at an installed capacity of about 56MW when energy is prioritised, with a full supply level set at 172m above mean sea level (EEMC et al, 2014). The irrigation potential of the dam is estimated at 95,000 ha if irrigation is prioritised and there is no hydropower production, but 47,000 ha if hydropower is a priority (EEMC et al, 2014). A summary of the benefits and impacts envisaged for the Pwalugu dam is detailed in Table 2 below.

A feasibility study of the dam was submitted in 2017 but supplemental studies have been commissioned to enable finalisation of the feasibility study. As part of the feasibility study process and the ESIA, Consultants held meetings with local government institutions such as the regional coordinating councils and traditional authorities in the project areas to discuss the project. However, these meetings were perceived to be more informative than consultative (Mosello et al, 2017), thereby marginalising the involvement of key stakeholders.

Figure 2: Location of existing and planned hydropower dams in the Volta Basin



Source: Mul et al, 2015.

Table 1: Potential/planned dam sites in Ghana's Volta Basin

Catchment	Name of dam/scheme	Total reservoir volume (Mm^3)	Irrigated area (ha)	Installed hydropower capacity (MW)
Black Volta				
	Bagri	**-**	**100**	**-**
	Duuli	**-**	**150**	**-**
	Gbari	**-**	**100**	**-**
	Koulbi	**2,950**	**-**	**68**
	Ntereso	**1,370**	**-**	**64**
	Lanka	**-**	**-**	**95**
	Jambito	**760**	**-**	**55**
White Volta				
	Daboya	**43**	**-**	**43**
	Pwalugu	**3,260**	**47,000**	**56**
	Kulpawn	**7,200**	**-**	**36**
	Dipala	**-**	**100**	**-**
	Sogo	**-**	**100**	**-**
	Tiego Yarugu	**-**	**200**	**-**
	Sambolekuliga	**-**	**200**	**-**
Oti River				
	Juale	**1200**	**-**	**87**
Lower Volta				
	Asentekwaa	**-**	**200**	**-**
	New Longoro	**-**	**200**	**-**
	Buipe	**-**	**200**	**-**
	Yapei	**-**	**200**	**-**

Sources: McCartney et al, 2012; EEMC et al, 2014.

Table 2: Potential impacts of the Pwalugu Multipurpose Dam

Nature of impact	Sector/impact area	Expected impacts
Positive impacts	Irrigation	- 95,000 ha irrigated if priority and no hydropower - 47,000 ha irrigated if hydropower is priority
	Flood control	Will help to maintain low water levels in rivers and other reservoirs in the White Volta in the event of a flood
	Hydropower generation	With energy as priority and full supply level set at 172m above sea level (asl), the total power generation could be 205GW/year, with an installed capacity of around 56MW, given a firm power output of around 24MW
	Capture fisheries and tourism	- fish catch - tourism
Negative impacts	Natural physical processes	- changes in the hydrological conditions of the transboundary river system;

	- effects from and for other dams, eg Bagré, Kpong and Akosombo; - noise from traffic during construction, blasting, drilling and excavation; - emissions and dust related to earthworks, traffic movements, loading and unloading of materials, stockpiling of spoil; - waste generation; and traffic to transport building materials, excavated materials, infrastructure components and plant items
Local communities in 4 districts (West Mamprusi, East Mamprusi, Bunkpurugu- Yunyoo, Mamprugu Moaduri) in the Northern Region and 7 districts (Telensi, Nabdam, Bawku West, Binduri, Bawku Municipality, Pusiga, Garu Tempane) in the Upper East region	- the loss of land and agricultural soils resulting in relocation and economic displacement; - occupational health and community health risks; immigration and induced development; - flooding of shrines, trees, wildlife habitats and rocks in the reservoir area; - change in tranquillity of the surrounding landscape
Local ecology	- the loss of habitat from direct inundation and induced development; - transformation of the river to a reservoir; - changes in the hydrological conditions and river habitat; - dam acting as a barrier to the migration of fish and other aquatic lives; - changes in water quality and sedimentation releases

Sources: Mosello et al, 2017; EEMC et al, 2014.

Like the planned dam at Pwalugu, the proposed dam at Juale is expected to provide multiple benefits, including HEP generation, fishery production and transport services. There is virtually no potential for irrigation as the dam site is located immediately upstream of the Volta Lake, and the soil conditions in the area are poor (Coyne et Bellier, 1993). The Juale dam is believed to be the only possible major water infrastructure that can be developed on the Ghanaian portion of the Oti tributary of the Volta River System (Coyne et Bellier, 1993). Based on pre-feasibility studies commissioned by VRA and conducted by Coyne et Bellier, the average energy that can be generated at Juale by the best plant alternative is 405 GWh/year, without considering the effects of the dam on the HEP generation from Akosombo. By considering the negative effects of the Juale dam on Akosombo (mainly the reduction of average flow into the Volta Lake as a result of increased evaporation and subsequently a reduction in average energy generation at Akosombo), the additional energy to be added by the same best plant alternative, as mentioned before, is 300 GWh/year (Coyne et Bellier, 1993). Fishery benefits from the reservoir that would be created when

the dam walls are built were estimated to be 7,000 tons/year, at a reservoir elevation of about 106 m NLD (Coyne et Bellier, 1993).

Foreseeable impacts of the Juale dam project include the displacement of an estimated 10,000 people within the reservoir area, flooding of a significant proportion of the most fertile agricultural lands in the upstream portions of the area, and increased potential for water-borne diseases such as schistosomiasis (Coyne et Bellier, 1993). Presently, it is unknown when the Juale project will be implemented, as the discussions and technical studies around this dam have not gone beyond the pre-feasibility stage.

A key issue of common interest to the implementation of both the Pwalugu and Juale dams is the issue of resettlement and of compensation for affected people. In the case of the Pwalugu dam, these issues were not discussed in detail in meetings between consultants who worked on the feasibility study and stakeholders, including traditional leaders of affected communities. Further, the feasibility study did not incorporate compensation, except for identifying communities to be displaced and the number of people to be affected. It is unclear why issues such as resettlement and compensation, which have proved to be very sensitive, have received scant attention so far. Future studies under the FutureDAMs project may examine the extent to which lessons learned from the Akosombo, Kpong and Bui resettlement programmes have or have not informed resettlement issues in the Pwalugu project, in particular.

7 Conclusion

Dams are important infrastructure in water–energy–food–environment mega systems that can help deliver economic growth and sustainable development. Ghana has three large multi-purpose dams (Akosombo, Kpong, and Bui) that serve the purposes of hydropower generation, domestic water supply, irrigation and fish production. These three dams have captured much of Ghana's hydropower potential but there is still significant potential that could be harnessed through a few planned large dams mainly in the Volta Basin, as well as through multiple planned medium- and mini-hydro dams spread across the country.

The development of dams in Ghana requires an environmental permit issued by the Environmental Protection Agency, as well as diversion, construction, a water use permit from the Water Resources Commission, and an energy permit from the Energy Commission, if hydropower is one of the uses of the dam. Presently, dam governance in Ghana is treated as part of water resources management and thus regulated by the Dams Safety Unit of the Water Resources Commission, to ensure that they meet national safety standards.

Initial decisions concerning the construction of dams in Ghana – as in most parts of the world – were informed by a development discourse and practice that strongly prioritised modernisation and industrialisation for socioeconomic transformation. This model is a top-down model of decision making, which organises society into two main categories: the ordinary people supposed to lack knowledge and expertise to understand the complexities of governance; and the elite and technocrats who, by virtue of training, skills and knowledge, are deemed the most capable and are entrusted with the responsibilities of decision making. Recent development discourses, however, including those concerning decision making about dams, champion a policy environment that

highlights participatory policy making. To some degree, this has re-shaped contemporary decision making.

Looking at the experiences of dam construction, it can be observed that decision making on dams elicits a diverse array of actors with multiple interests and this creates indeterminate consequences. Failures associated with most of the resettlement schemes and the adverse ecological and socioeconomic effects on the river basin and its inhabitants require renewed attention to understanding the decisions that undergird them. From an official perspective, such failures are reducible to capability and capital deficits. However, it can be observed that the problem is more complex and is significantly rooted in the minutiae of policy processes and institutional decision-making cultures. Understanding the dialectics of decision-making processes is helpful to avoid binary dichotomies such as macro–micro and local–global. It is imperative to expand the analytical gaze to understand the complexities of a diversity of actors and their power relations.

Further, environmental decisions concerning dams are influenced by global actors – international funding agencies, political elites, technocrats and local actors (although most of the views of the latter are not prioritised in decision making). The participation of the key actors in the dam discourse and processes of decision making is dependent on the expertise and interests in the project. Political elite engagement with international funding agencies has been key in securing funding, while engaging with locals may make the dam project more acceptable, despite the challenges that come with such large projects. A techno-political approach helps to disentangle the historical, technical, political, social and environmental complexity of dams.

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