LARGE DAMS IN CONTEMPORARY AFRICA: A DEVELOPMENT IMPERATIVE, "THE TYRANNY OF TECHNOLOGY", OR A SUBVERSION OF SOUTHERN COUNTRIES' DEVELOPMENT?

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ABSTRACT

Most contemporary literature on large dams is critical of their performance particularly regarding their negative impacts on society and the ecosystem. This has led to suggestions of more benign alternatives which could provide the same if not more benefits and fewer negative social and environmental stresses. Consequently, large dams are caught in an ideological contest of why, what and how development should be pursued. This thesis examines the impacts of large dams to analyse some aspects of development theory in the context of the links between dam-building, sustainable development and neo-liberalism/modernisation in Africa's socio-economic development trajectory. Using an interdisciplinary approach and multiple methods including actor-oriented research, historical research processes and case studies and a review of large dams in Africa, this thesis examines and analyses the perceptions and experiences of communities resettled following the construction of the Akosombo Dam, and communities likely to be affected by the proposed Bui Dam Project in Ghana, and of other national, local and international actors and their organisations.

Contextualised within contemporary African development, the thesis finds that the construction of large dams is temporally and spatially mediated by geophysical conditions and prevailing international, national and local socio-economic and political circumstances. Although some large dams built to maximise water resources use for development have realised their objectives, others have demonstrably failed, and this failure is especially acute viewed in the context of their additional social and environmental costs. The thesis finds that although large dams have variable outcomes, they are associated with problems of equity in benefit distribution, social and environmental costs. Despite these problems the alternatives proposed to replace large dams lack adequate capacity to deal with Africa's water, energy and food problems, though they could complement large dams. Participation in the development of some large African dams is an established process. The thesis also finds that some Western nations, institutions, and NGOs' opposition to large dams appears to be undermining Africa's socio-economic development.

The results of the case studies suggest that actors think large dams offer significant benefits particularly for national socio-economic development and could generate local gains if properly executed and managed. The positive perception of large dams is informed by the understanding that they are technologies that deliver recognisable positive benefits with identifiable negative socio-economic and environmental impacts which can be mitigated; in contrast to potential alternatives whose impacts are as yet unproven. The policy implication of the thesis' overarching conclusions is that large dams should continue as an important technology tool in Africa's socio-economic development.

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DEDICATION

This thesis is dedicated to my family for their great sacrifices during the course of my studies.

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AAF-SAP	African Alternative Framework to Structural Adjustment Programme
ACP-EU	African Caribbean and European Union Partnership Agreements
ADB	Asian Development Bank
AfDB	African Development Bank
AHD	Aswan High Dam
APPER	Africa's Priority Position on Economic Recovery
AU	African Union
AWV	Africa Water Vision
BBC	British Broadcasting Corporation
BDS	Bui Development Secretariat
BHP	Bui Hydropower Project
BNP	Bui National Park
BOOT	Build-Own-Operate-Transfer
CPP	Convention Peoples' Party
CSD	Commission for Sustainable Development
CSIR	Council for Scientific and Industrial Research
DDP	Dams and development Project
DfID	Department for International Development
DMC	Developing Countries Members
DNP	Dwidja National Park
DOE	Department of Energy (USA)
EBRD	European Bank for Reconstruction and Development
EFG	Energy Foundation of Ghana
EIA	Environmental Impact Assessments
EIA	Energy Information Administration
EIB	European Investment Bank
EMMP	Environmental Management and Monitoring Plans
EPA	Environmental Protection Agency
EPFI/EF	Equator Principles for Financial Institutions/Equator Principle
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment

ESMP	Environmental and Social Management Plan
FAO	Food and Agricultural Organisation
FOE	Friends of the Earth
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIS	Ghana Information Services
GNA	Ghana News Agency
GNP	Gross National Product
GOG	Government of Ghana
GPF	Global Policy Forum
HIPC	Heavily Indebted Poor Countries
HSBC	Hong Kong Shanghai Bank Corporation
IAEA	International Atomic Energy Agency
ICID	International Commission on Irrigation and Drainage
ICOLD	International Commission on Large Dams
IDAF	Integrated Development of Artisanal Fisheries
IEA	International Energy Agency
IFAD	International Fund for Agriculture Development
IHA	International Hydropower Association
IJHD	International Journal of Hydropower and Dams
IMF	International Monitoring Fund
IRN	International Rivers Network
IUCN	International Union for the Conservation of Nature
IWPAC	Integrated Water Planning Advisory Committee
JIBC	Japan Bank for International Cooperation
LCCE	Land Compensation Commission of Enquiry
LHWP	Lesotho Highlands Water Project
LPA	Lagos Plan of Action
MDG	Millennium Development Goals
MHA	Major Hazards Assessment
MWH	Ministry Works and Housing
NAS-NRC	US National Academic of Sciences - National Research Council
NBI	Nile Basin Initiative
NDC	National Democratic Congress
NEPAD	New Economic Partnership for Africa Development
NGO	Non – Governmental Organisation
NIRS/WISE	World Information Service on Energy and the Nuclear Information & Resource Service
NPP	New Patriotic Party
OAU	Organisation of African Unity
ODI	Overseas Development Institute
OECD	Organisation for Economic Cooperation and Development
OPIC	Overseas Private Investment Corporation
PANOS	Pan African News Organisation
PEA	People Education Associations
PNDC	Provisional National Defence Council
PNP	People National Party
PRSP	Poverty Reduction Strategy Plans
RIS	Reservoir Induced Seismicity
RPF	Resettlement Planning Framework

SAP	Structural Adjustment Programmes
SBC	Save Bujagali Crusade
SIA	Social Impact Assessment
SMC	Supreme Military Council
SMEC	Snowy Mountain Engineering Company
TDA	Thirlmere Defence Association
UNCTAD	United Nations Conference of Trade
UNDESA	United Nations department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, scientific and Cultural Organisation
UNICEF	United Nations Children Fund
UNIDO	United Nations Industrial Development Organisation
UN-PAAERD	Programme of Action for African Economic Recovery and Development
US-AGOA	US African Growth and Opportunity Act
VALCO	Volta Aluminium Company
VLTC	Volta Lake Transport Company
VRA	Volta River Authority
VRP	Volta River Project
WAFAL	West African Aluminium Company
WAGP	West Africa Gas Pipeline
WB	World Bank
WCD	World Commission on Dam
WCED	World Conference on Environment and Development
WEC	World Energy Council
WFS	World Food Summit
WHO	World Health Organisation
WMO	World Meteorological Organisation
WMP	Watershed Management Plan
WPDC	Water Power and Dams Construction
WRI	World Resources Institute
WRSS	Water Resources Sector Strategy
WTO	World Trade Organisation
WWAP	World Water Assessment Programme
WWC	World Water Council
WWDP	World Water Development Report
WWF	World Wide Fund for Nature
WWP	World Water Partnership

CHAPTER 1
DAMS AND DEVELOPMENT

1.1 Research purpose, objective and questions

The current acute need for improved water resources and energy management in the contemporary development of Africa has recently generated renewed interest in large dams. This is especially the case in the energy sector because of the high-profile debate and concern about climate change, the Millennium Development Goals (MDG), the increase in crude oil prices and alternative sources of funding for large dams.

For instance, alternative funding sources with concessionary/low-interest loans from China's growing financial reserve of about $1.3 trillion a year significantly revived large dam construction, which had hitherto been unable to proceed for more than a decade in Africa and the global South (Wild and Mepham, 2006a; Kaplinsky et. al., 2007; Hilton, 2008).

The desire to achieve the MDGs and other socio-economic development objectives led to the reengagement of the World Bank and other regional banks in financing large water infrastructure (World Bank, 2004; Grey and Sadoff, 2007) in the last few years. This supports the need for the services which large dams provide in socio-economic development and poverty reduction.

Climate change and increasing crude oil prices have led to reconsideration about large dams as a means of reducing global carbon emissions. For instance, the use of thermal energy for electricity generation is said to be expensive in terms of both financial and ecological cost. For the reason that increases in the cost of crude oil and environmental damage via gas emissions are worsened by the increasing shift to coal use. So the reconsideration of large dams as an energy source is based on the quest for cheaper and renewable sources of electricity.

However, the credentials of large dams regarding their provision of renewable energy and their consistence with principles of sustainable development are disputed. While IRN (2007, WWF (2007), REN21 (2008)) do not perceive large dams as a renewable source of energy, the WEC (2003; 2004; 2005) and IEA (2000a, 2002 and 2007) argue to the contrary. Thus the dispute surrounding the sustainability of large dams and whether they are a renewable energy source is at the centre of the debate about large dams and development.

To understand this debate, the thesis situates it within the wider context of post-Second World War paradigmatic shifts and debates around development theories and policies. Long (1992: 18) refers to paradigmatic shifts in development theories and policies as a 'crisis of theory' which occurs for two reasons. Firstly, 'the sheer variety and complexity of social phenomena simply invite alternative visions'; and secondly 'the difficulty of establishing a common epistemology for grounding research methods and findings' (ibid: 38,39). For example, a wide range of development paradigms have been proffered since the Second World War. These include: 'reconstruction and development'; 'economic development'; 'the growth theory; 'modernisation' and its new variant 'neo-liberal development'; 'post-modern development, and sustainable development (Long, 1992: 16; Preston, 1996; Simon, 1997:184,185). These different development paradigms are believed by Simon (1997: 184) to be 'contextual and contingent upon the ideological, epistemological and methodological orientations of their purveyors' and are usually 'vague, reflective and reflexive' (ibid). In this regard

> *'the existence of multiple paradigms does not exclude the possibility of certain of them becoming prominent at particular historical junctures and being promoted by particular groups of scholars or institutions' (Long, 1992: 39).*

This suggests that the perception of large dams and development is dependent on which of these development paradigms dominates the theoretical and policy process in a particular historical time frame.

This thesis views the dispute through the lens of the development policies of modernisation/neo-liberalism and sustainable development.

Modernisation/neo-liberalism is a development paradigm which has proved resilient over the years in spite of challenges posed by other development paradigms. It is perceived as the basis from which the health of the global economy can be determined (Rostow, 1960; Stiglitz, 1998; Kuczysnki and Williamson, 2003; Williamson, 2004; Maxwell, 2005) due to the resilience of the 'development thinking that underlay the Washington Consensus – recognition of the importance of macroeconomic discipline, trade liberalization rather than import-substituting industrialisation, development of the market economy rather than reliance on the leading role of the state – were as valid in developing countries as they had long been regarded in the OECD' (Williamson, 2004). This means that modernisation/neo-liberalisation as a development paradigm has a global reach and usage which can employ tools such as the construction of large dams to achieve its development goals.

In contrast, the sustainable development paradigm has emerged as a strong counterbalance to the dominance of modernisation/neo-liberalism theories of development. It is therefore suggested that the

appeal of sustainable development as a paradigm stemmed from its advocacy of equal consideration of social and environmental aspects of development rather than the exclusive focus on the economic aspect that the modernisation/neo-liberalism paradigm is thought to have. This agrees with the criticism of large dams' negative social and environmental impacts.

The thesis' overarching objective is to examine the political, environmental, and socio-economic conditions that inform the development of large dams in contemporary Africa in the context of modernisation/neo-liberalism theory and the concept of sustainable development, because both now occupy centre stage in global development discourse. I examine how the modernisation/neo-liberal approach to development has continued to reinforce the development of large dams in some parts of the world, and how the concept of sustainable development is being used to countermand their impact.

Consequently, in the broader context of the large dams debate I also examine whether large dams have contributed positively or negatively; which I respectively consider as a development imperative or 'tyranny of technology' (Loose, 2001; Goodman and Chant, 1999) which either boost or undermine the socio-economic aspirations of Southern countries.

Large dam technologies like other technologies "may operate to infiltrate, to stiffen, to reorganise, or to dissolve … social relations" based on "distribution and power" which is "recursively woven into the intricate dance that unites the social and the technical" (Law, 1991: 18). The unity of the social and the technical leads to "distributed costs and overheads [like the financial, social and environmental] associated with the ways in which individuals and … technologies [such as large dams] meet" (Star, 1991: 34). Lafollette and Stine (1991: 1) seem to agree with Star (1991) when they also argued that the application of new technologies sometimes "presents society with new capabilities accompanied by new moral dilemmas; sometimes society's desires and dissatisfactions stimulate development of a technical solution; at other times, technologies may be rejected or remaindered." Consequently, "technological developments [like the construction of large dams] represent neither automatically reliable nor necessarily positive outcomes" (ibid). It is in this context that the 'tyranny of technology' of large dams is used in this thesis.

In contrast, it should be recognised that large dam "technology is a human activity" (Goldhaber, 1986: 4) and "the means by which man extends his power over his surroundings" (Hamilton, 1973: 17). In addition large dams "technology helps man in his eternal struggle for survival" … by arranging his "environment to suit his needs" (Hamilton, 1973: 20) by extending "variety, alternatives, and flexibility to social systems" Lafollette and Stine (1991: 2) … which sometimes "conflict with nature" (Hamilton, 1973: 20),

though large dam technology contributes to the provision for the "wise husbandry of the environment – more nutritious and more varied foods, better housing and urban conditions, better facilities for medical care, education and welfare, and other amenities" (ibid: 41) to boost the existence and living standards of humans. In this context large dam technology is regarded as a development imperative.

However, Feengerg (2002: 3) argued that "the real issue is not technology or progress per se but the variety of possible technologies and the paths of progress among which we must choose." But Lafollette and Stine (1991: 17) pointed out that "each technology carries with it human values, biases, and flaws" and the choice of technology "depends on human wisdom, in all its depth and all its failings" (ibid: 2) because technology that gets developed is a direct result of political choices with political implications (Goldhaber, 1986; Feengerg, 2002). Goldhaber (1986: 5) added that "the choices we make depend on what we hold most central" and "shaped by definite values, aim towards definite goals, and are favour by specific social groups along with specific social arrangements." Consequently, "technology shapes what is possible economically and socially. It affects patterns of work, community life, home life, power relations, modes of thought, and any much else that is central to prohuman politics" (ibid: 5).

Invariably, the human or specifically the political choice of a technology like large dams from other options imposes a burden over the environment; in fact all technologies do. Man's application of technology and its "power over the environment can be a dangerous thing, and some of the changes … - sometimes unwittingly – are positively harmful" (Hamilton, 1973: 20). But Feengerg (2002: 3) thinks "the degradation of … the environment is rooted not in technology per se but in the antidemocratic values that govern technological development." He further contended that *"What human beings are and will become is decided in the shape of our tools no less than in the action of statesmen and political movement" [emphases in the original]* (ibid). Therefore "what matters … is the scale, pace, and sometimes irreversible nature of these modifications" (Hamilton, 1973: 20) and how the exclusion or inclusion of the majority in participating in the choice and implementation of technology such as large dams is what determines whether it is a technological tyranny or a development imperative. Consequently, the type and design of technology which might contain the seeds of happiness and health, or chaos and destruction is thus an ontological decision fraught with political consequences that man must choose and decide how to use them (Hamilton, 1973; Feengerg, 2002).

Also, I examined whether the suggestions that large dam construction should cease in favour of alternatives perceived as benign and sustainable is a subversion of Southern countries' development due to

perceived uncertainty about the costs and capacity of alternatives to deliver the services provided by dams now and in the near future.

In furtherance of the objective of this study a review of some dams in Africa was undertaken. This includes a detailed case-study analysis of Ghana's Akosombo Dam and the Bui Dam project which are used to draw out the political and conceptual links between large dams and development theory and practice. In addition, the African and Ghanaian case studies are used to critically examine how lessons from past dam controversies have influenced current attempts to reconcile the environmental, social, economic and political trade-offs that are present in any development undertaking.

The thesis' case studies of African dams consider how the current neo-liberal development consensus in Africa and other international conditionalities might imply a return to emphasis on large infrastructure-based projects such as dams as part of a programme to develop a viable environment for the attraction of foreign direct investment (FDI) in support of pro-poor economic growth. Africa's lack of infrastructure has been identified as one of the key reasons why the continent has not been able to attract much FDI and a major cause of the present low socio-economic development in Africa.

The global emergence of China as a significant funding source for tackling Africa's infrastructure deficit – roads, railways, communications, water and energy, including large dams – and how it affects global infrastructure financing dynamics are also analysed. The availability of low-interest loans, grants and aid from China to some African countries in exchange for trade, resources and to some extent geo-political influence has brought to life some projects that were hitherto deemed unattractive by the World Bank, International Monetary Fund (IMF), European Development Bank (EDB), other multi- and bilateral institutions of the Organisation for Economic Cooperation and Development (OECD) member countries and Russia, who have traditionally funded infrastructure development in Africa. Thus the financial clout of China makes it a global force in the recent surge in Africa's infrastructure development.

This thesis therefore examines the ideas and ideology behind contestations around large dams and their future role in Africa's development. The research uses case studies to investigate how people perceive the benefits or otherwise of dams, based on interviews and the administration of questionnaires to various actors in Ghana, and other secondary sources.

In addressing the thesis' objective the following three broad questions guide this study:

1. What has been the ideological and economic justification for large dams, and what role have they played in meeting Africa's development objectives?

2. What are the alternatives to large dams, and how credible and competitive are these alternatives in the present and immediate future?

3. Can large dam projects proceed in an era of devolved, participatory governance and inclusive decision-making when such projects are invariably centrally conceived and implemented?

The thesis addresses these research questions in six chapters as summarised in subsection 1.4 of this chapter.

1.2 The contestations of development

The interrelationship between large dams and development is a complex one and reflects an increased diversity of opinion in recent years. This complexity is based on the myriad interpretations of development, the process of attaining it and its ultimate goals over past decades.

Development paradigms borrow from each other, and the paradigm of modernisation has borrowed heavily from growth theory, which dominated development thinking and practice after the Second World War (Preston, 1996: 154) and involved investment in infrastructures such as large dams for irrigation flood control and hydroelectric power generation. In the context of Africa's development trajectory, growth theory and modernisation served as the basis of post-colonial development agendas.

Four key elements based on such easily quantifiable indicators as gross national product (GNP) and per capita income are said to have influenced the establishment of growth theory as a dominant economic discourse. These four elements are: the intellectual influence of the work of the economist John Maynard Keynes; the political agenda of the USA as it moved to a position of dominance; the Marshall Aid programme for the reconstruction of Western Europe; and the demand for nationalist developmentalism as an ideology of emergent new nations (ibid). This last point is illustrated by Arthur Lewis'[1] advice through the United Nations to emerging nations' planning agencies on how to pursue socio-economic development with an emphasis on infrastructure and the use of technology (Preston, 1996:163).

[1] Arthur Lewis contributed to the United Nations' 1951 report, *Measures for the Economic Development of Underdeveloped Countries; Economic Development with Unlimited Supplies of Labour* and the monograph, *The Theory of Economic Growth* (Preston, 1996: 163).

However, modernisation has overtaken growth theory as the paradigm of choice in development discourse, particularly in Africa and the global South. The appeal of modernisation is based on visualising development as a process whereby less developed countries would shift from traditional patterns of life to become developed. The shift from traditional to modern could be achieved by utilising science and technology – such as large dams for electricity and irrigation – to improve on the production base of the economy.

In this context growth theory has been the antecedent of the modernisation paradigm of development. Many of the features of growth theory can be found in the paradigm of modernisation. For instance, the basic proposition underpinning growth theory – and a major component of modernisation/neo-liberalism as propounded by Harrod (1939) – underwrote the rapid post-war growth in infrastructure and technology as 'the necessary conditions for equilibrium between aggregate savings and investment in a dynamic economy' (cited in Jones, 1975: 44). So as an approach within development studies, growth theory became integrated into the paradigm of modernisation (ibid: 161) and the continuation of the perceived imperative to develop large scale infrastructure such as dams.

The development of such large infrastructure became an integral part of the modernisation model of development because the financial and technical costs of investment in dams could be quantified and their benefits projected. On this basis, large dam development in Southern countries received a huge influx of both domestic and foreign investment as a means of attaining modernity and economic growth. Thus a possible correlation between modernisation and the construction of large dams as modernising tools can be said to be the perceived modern transformation of society from traditional to industrial.

Industrial society, with the aid of facilities like irrigation and hydroelectricity from large dams, was presented as the goal of modernisation, and societies across the world were driven by the demanding logic of industrialism (Preston, 1996: 172). It was thought that this logic would lead to the convergence of political and economic systems (in particular those of the East and the West), and that the achievement of prosperity such as that of the USA in the 1960s would mean that ideological debate occasioned by conflict over scarce resources would wither away (ibid). Modernisation therefore assumed a dichotomy between the traditional and the modern based on the transformative power of science and technology displayed in the form of large-scale infrastructure such as large dams, measurable economic indicators and identified points of intervention.

Consequently, development as envisioned by modernisation emphasises and is synonymous with industrialisation, capital-intensive technology and urbanisation. In this regard large dams played a significant role because they were capital-intensive technological instruments which aided urbanisation as sources of electricity and portable water and encouraged industrialisation by producing large quantities of comparatively cheap electricity. Rostow's (1960: 4) five lineal stages of achieving development – traditional society, preconditions for take-off, take-off, the claim to maturity and the age of high mass consumption – became the path through which modernisation could be attained. According to Preston (1996: 175), Rostow's five stages of economic growth 'represent the apogee of the modernisation theory', and large dams as a development imperative became an integral part of this.

However, modernisation as a development paradigm and the instruments – such as large dams – deployed to achieve its goals caused the underdevelopment of the global South. Modernisation is perceived in large part as the historical product of past and continuing economic and other relations between satellite and metropolitan countries based on centre-periphery dependency relationships, which are an essential part of the structure and development of the capitalist system (Frank, 1972: 3). This relationship is said to be the continuum of the colonial capitalist system where the peripheries supplied primary products and low-tech manufactured goods to the First World in exchange for high-tech goods (Preston, 1996:195). It is further argued that the centre-periphery capitalist system is dominated by North based multinationals which derive the greater benefit from the relationship with little benefit to the global South, thus deepening the economic imbalance between the centre and peripheries.

It is argued that the purpose of modernisation and its instruments is to entrench and guarantee the smooth functioning and survival of the capitalist system while further ensuring that the process of modernisation strengthens the bond between the periphery and the centre by use of advanced technology. In this context the role of large dam technology in modernisation can be said to be perceptibly tyrannical.

The solution to the dependency of the peripheries on technology-driven modernisation is to weaken the grip of the global system. The tools suggested for achieving this are trade barriers, controls on multinationals and the formation of regional trading blocks to permit nationalist governments to pursue goals of national development (Preston, 1996:195) that reflect the interests of the peripheries and meets their socio-economic development objectives.

This critique of the development paradigm of modernisation was an attempt to negate its impact and curtail its influence and provided the grounds from which alternative development paradigms emerged.

Past attempts at providing global alternative development paradigms on the scale of the growth theory and modernisation have been unsuccessful because modernisation changed into a new variant, neo-liberalism, which has continued to enjoy long-standing domination as a powerful global narrative on capitalism and development in development discourses and practices (Sen, 1984; Klaren, 1986; Preston, 1996; Simon, 1997; Gray, 1999; Leftwich, 2000; Hoogvelt, 2001; Berger, 2001). A major reason advanced by Hoogvelt (2001: 35) for the hegemony of neo-liberal development discourses is that 'modernisation theories were problem solving and policy-oriented theories of social change and economic development' because they provided avenues for economic assistance and technological aid which were necessary for the attainment of socio-economic development goals.

To liberate the potential of developing countries, the application of technology like the building of large dams have made an 'important and significant contribution to human development' (WCD, 2000: xxviii) with considerable benefits derived from them. Coupled with a free market economy, large dams were perceived as imperative to the dynamic socio-economy espoused by the modernisation/neo-liberal paradigm because they aided both industrial growth and agricultural development by providing energy and raw materials.

The central role of the nation-state in the paradigm of modernisation – such as in determining its development priorities – was curtailed by neo-liberalism. The modernisation paradigm used the machinery and agents of the nation-states to plan and at times execute the projects needed on the developmental path towards modernisation. The planning of large dams and other infrastructures emanated from state bureaucracies. However, neo-liberalism envisaged the state's role/function in development as enabling and minimally regulating. So while modernisation viewed the state as the engine for attaining development, neo-liberalism assigned the same role to the free market.

As a result it is suggested that neo-liberal economic and governance policies effectively 'rolled back' or caused the 'death' of the State's role in development (Gray, 1999: 68; Berger, 2001: 891), but this did not change the emphasis on and importance of technology and infrastructure such as large dams in socio-economic development. Therefore neo-liberal reforms such as the structural adjustment programmes (SAPs) associated with multilateral institutions like the World Bank and IMF were undertaken as part of a general policy of economic reform in developing countries. The aim of restructuring the development process is based on the need to enhance efficiency and the effective allocation of resources for achieving development goals that in some instances have been elusive under the paradigm of modernisation.

It is said that the de-emphasis of the state's role in socio-economic development activities particularly affected countries both under dictatorship/tyrannical leadership (Scott, 1998) and democratically elected in the global South. The IMF and World Bank's implementation of SAPs have been more damaging than helpful to poorer people and countries (Dadzie, 1993, cited in Leftwich, 2000). In this regard neo-liberalism-inspired SAP may not have brought about the anticipated socio-economic development because poverty and inequity have increased with the widening development gulf between the global North and South as the South is drawn deeper into the global economy.

Globalisation based on the free market economy has encouraged the imperatives of large scale infrastructure such as large dams by providing the base for their continued expansion. According to Gray (1999: 55) 'globalization implies that nearly all economies are networked with other economies throughout the world'. Globalisation, he added, is the 'worldwide spread of modern technologies of industrial production and communication of all kinds across frontiers – in trade, capital, production and information' (ibid). But Pender (2001) notices that the free market – espoused by neo-liberalism and globalisation – left to itself would not always result in the most efficient and effective outcome, especially in the allocation of public goods. This suggests that the state could still be relevant in charting the course of development, particularly in large projects like dams with huge socio-economic and environmental implications.

The minimal role accorded to the state in the neo-liberal globalised development economy is thought to be counterproductive because it denies states some tools such as large dams which might be needed for development. Gray (1999: 69/70), for instance, posits that, 'the model of hyper globalisation errs badly in writing off sovereign states as marginal institutions, since they remain the key arena of influence-seeking by corporations' at all levels from the local to the international. He aptly observes that for multinationals, sovereign states are not marginal actors in the world economy whose development policies are easily circumvented; therefore states are key players in development whose power is well worth courting (ibid). 'The leverage of sovereign states over business may actually be greater in some respects today than it has been in the past', he adds (Gray, 1999: 70). This leverage might enable states to construct large dams in pursuit of their development agenda. Consequently sovereign states are not obsolete because they remain decisive mediating structures of development which multinationals will compete to control or curry favour from in order to effectively execute their interests (ibid). Changing global markets for new technologies also means that both nation-states and multinationals will need each other in a mutating and evanescing way to maintain their legitimacy and identity (ibid).

A symbiotic relationship between nation-states and corporations in the face of challenges such as climate change could enable them to survive and prosper. Since both have the capacity to effectively and profitably generate and deploy technologies, including large dams, to achieve a competitive edge over their rivals (Leftwich, 2000). The World Bank's 1997 World Development Report recognises that 'the state is central to economic and social development, not as a direct provider of growth but as a partner, catalyst and facilitator (World Bank, 1997). Hence the state's capability, defined as the 'ability to undertake and promote collective actions efficiently', needs to be enhanced if 'sustainable development, both economic and social' is to be achieved (ibid). This implies that the state is well equipped to decide when a technology is an imperative or otherwise for sustainable development.

The pursuit of sustainable development by the private sector in partnership with the state is believed by the World Bank to be important. The nation-states control and in most cases are the custodians of their natural resources – such as the rivers across which large dams are built – that are necessary for economic growth (World Bank, 1997). Leftwich, 2000 also argues that states determine how the natural resources within their territorial boundaries are used to deal with poverty reduction, inequality and the expansion of employment.

But the recognition that some large infrastructures including dams are not serving their purposes seems to have provided some impetus for the promotion of sustainable development as an alternate development paradigm in Africa and the global South. For instance, the World Commission on Dams (WCD) (2000a) observes that 'in too many cases, an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment' and that 'lack of equity in the distribution of benefits has called into question the value of many dams in meeting water and energy development needs when compared with the alternatives' (ibid: xxviii). This exposes some of the socio-economic and environmental shortcomings of technology-driven large-scale infrastructures such as dams.

Sustainable development therefore stresses that retaining the flexibility to respond to future shocks to development, even when the probability, size and location of their effects cannot be assessed with certainty, is important (OECD, 2001). This flexibility could maximise human well-being for today's generations without leading to a decline in future well-being (OECD, 2001), based on structural changes in natural and man-made capital stock, including human capital and technological capabilities, which ensure the feasibility of at least a minimum socially-desired rate of growth in the long run (Keshna, 1994).

In this regard sustainable development is 'meeting today's true needs and opportunities without jeopardizing the integrity of the planetary life-support base – the environment – and diminishing its ability to provide for needs, opportunities, and the quality of life in the future' (Caldwell, 1996: 243). Thus sustainable development as a paradigm seeks to counterbalance the dominance of the neo-liberal paradigm and globalisation and their heavy reliance on technologies such as large dams, which in some instances are seen as tyrannical and not necessary.

Attaining the goals of sustainable development requires the elimination of the negative externalities responsible for natural resource depletion and environmental degradation – particularly those associated with large infrastructures like dams. The elimination of the negative externalities of development and technologies requires the securing of a well-functioning ecosystem and cohesive society, which are public goods essential for economic development to last (OECD, 2001). So as a policy, the objective of sustainable development is to prevent developmental or demographic overshoot that could result in social and ecological collapse or irreversible impoverishment – the 'tyranny of technology' – which the neo-liberal development paradigm seems not to account for in the pursuit of technologically-influenced large infrastructure, such as dam building, which it perceives as imperative to development. Therefore sustainable development has emerged as a counterweight to the neo-liberal globalised development paradigm.

Sustainable socio-economic development has gained wider usage in development discourse and practice in Africa and the global South because it is perceived as embodying a broader concern for human welfare by balancing the goals of economic efficiency, social development and environmental protection. Hence the sustainable development paradigm is said to underscore the importance of taking a longer-term perspective on the consequences of today's development activities and encouraging cooperation among countries, institutions and actors in order to reach viable solutions (OECD, 2001). A longer-term perspective and cooperation in resolving problems are key elements of domestic policy formulation or goal-setting objectives (Caldwell, 1996; OECD, 2001); it is argued that their principal merit is the modification of the previously unqualified modernisation/neo-liberalism development paradigm with its heavy reliance on gross net product (GNP) and gross domestic product (GDP) as measures of national performance (Caldwell, 1996; Barrow, 1999) and technology as imperative to development.

In a nutshell, sustainable development posits that socio-economic development and environmental protection are not mutually exclusive; the underlying reason being that economic growth through the use of technologies such as large dams can be environmentally efficient and generate an apparent win-win

situation. In this case the benefits of contemporary industrial societies, possibly driven by large dam technology, are retained, while the burdens, or externalities, of the industrial society on the environment are progressively dispelled (Connelly and Smith, 2003). This suggests that sustainable development could enhance the imperative of large dam infrastructure whilst minimising its 'tyranny of technology' aspect.

Jacobs' (1999) six core aims of the sustainable development paradigm are relevant to how the imperative of large dams could be sustained in the long run. The six core aims are environment-economy integration, futurity, environmental protection, equity, quality of life, and participation (ibid). There is the belief that capturing these core aims of sustainable development in the planning, building and operation of large dams in Africa and the global South could aid in meeting the challenges of climate change and accelerate the achievement of the MDGs. It is in this regard that O'Riordan et. al. (2002) argue that sustainable development is best considered as a constant process of societal and economic transformation which act as trustees for future generations and might be applicable to large dams.

The WCD (2000a) proposes two ways of dealing with divergent views in the large dams debate which could be applicable to other large scale infrastructure. It suggests firstly that 'by bringing to the table all those whose rights are involved and who bear the risks associated with different options for water and energy resources development, the conditions for a positive resolution of competing interests and conflicts are created'; and secondly, that 'negotiating outcomes will greatly improve the development effectiveness of water and energy projects by eliminating unfavourable projects at an early stage and by offering as a choice only those options that key stakeholders agree represent the best ones to meet the needs in question' (WCD, 2000a: xxviii).

However, the sustainable development paradigm contains a number of shortcomings which generate some internal inconsistencies. These shortcomings make it difficult to determine how to deploy technologies such as large dams as an effective development framework to deal with the global challenge of climate variability and the MDGs. The two major identified shortcomings of sustainable development are its inability to provide an indication of development goals and to prioritise them, or to provide an indication of the level of quality of life to be used as a benchmark for sustainability (Connelly and Smith, 2003). These two shortcomings expose the ideas and concepts implicit within sustainable development to different interpretations (ibid), and by extension, large dams as a development imperative.

The shortcomings of sustainable development also provide scope for fundamental contradictions (O'Riordan et al, 2002) including conflicts of interest and conflicting values and ideologies (Holland,

2000). Thus, based on the values, ideologically-inspired conflicts and contradictions of the sustainable development paradigm it is possible that large dams might be caught in this conflict instead of being objectively assessed for their merits or otherwise regarding meeting the challenges facing Africa of climate variability and MDGs.

Other conflicts at the core of the sustainable development paradigm which might influence how large dams are perceived in their role of addressing development needs revolve around the interests of present verses future generations, human well-being verses environmental protection, rich verses poor, and local versus global forces (de-Shalit, 2000; Dobson, 2000; McNeill, 2000). This means that the perception of large dams could be held hostage to different competing interest groups.

To Leftwich (2000), the perceived shortcomings, conflicts and internal inconsistencies of the sustainable development concept 'have made it acceptable to so many public institutions and private interests around the world', which include advocates of large dams and other large infrastructures. Leftwich also argued that sustainable development has failed to 'threaten the urge to growth but rather legitimated development afresh' (ibid: 58). This refers to the neo-liberalism/modernisation paradigm of development which is seen as the vanguard of technology and large-scale infrastructure deployment.

The perceived legitimisation of the modernisation/neo-liberal development paradigm, which is generally supportive of large infrastructures and technologies, e.g. dams, has led some political ecologists to be 'highly sceptical of the merits of the concept of sustainable development' (Bryant and Bailey, 1997: 4). This scepticism is due to their understanding that sustainable development still retains some aspect of the neo-liberal development theory of the private dominance of economic activities and the ambiguity of the role of the state as both facilitator of the capitalist system and protector of the environment, as implicit in the concept of sustainable development (Bryant and Bailey, 1997). Given such scepticism it appears difficult for any large dams built to deal with issues such as climate variability and the MDGs to pass as a development imperative.

The subversion of the development interests of Africa and the global South is a major concern for African policymakers and development planners in the midst of changing development paradigms. This is exemplified by the internal contradictions, shortcomings and conflicts identified in the sustainable development paradigm; particularly the lack of clear and measurable development benchmarks and indicators and its implication for infrastructure development and use of technology e.g. large dams.

The lack of measurable benchmarks and clarity surrounding the sustainable development of large infrastructure seem to have created some perception in Africa and other parts of the global South that sustainable development is a 'late "colonialist conspiracy" to hinder third-world development and impose on it constraints that developed countries had not faced when they went through their "pollution-generating, resource-consuming industrial revolution"' (Birnie, 1993: 338, cited in Leftwich, 2000: 56). So by imposing conditions that affect the use of certain technologies in Africa's socio-economic development, the sustainable development paradigm appears as 'a device, whether internationally or not, for blocking "Southern" development' (Holland, 2000: 3) which subverts the legitimate desire for socio-economic progress in Africa and the global South.

At the centre of the past and present discourses of development is the political nature of development and efforts to control resources, and by extension the livelihood of people in Africa and the global South. The 'highly political nature of both the ideas and practices of development' (Leftwich, 2000) evident in the various theories of development propounded and dominated by Northern authors and international organisations controlled by the North seem to have coincided with different epochs of global politics. So depending on the development paradigm and political epoch of the time, construction of large dams in Africa and the global South has either risen or fallen based on whether they are perceived as a development imperative or the tyranny of technology.

It also appears that the politics manifested in development generally and infrastructures such as large dams in particular are also associated with global geo-politic power relationships. This is apparent in the dichotomy of the North-South, developed-developing, and first, second and third world countries. In this case the agenda of development paradigms such as sustainable development and neo-liberalism/modernisation is the further 'incorporation of third-world people and environment piecemeal into globalising capitalist markets in keeping with the needs and interests of capitalist enterprises' (Holland, 2000: 104). The success of such incorporation of third-world countries into the global geo-political and economic systems is contingent on the success and dominance of the development paradigm and the role infrastructures such as large dams play in them.

However, despite its rapid integration into the capitalist markets of globalisation, Africa is ill-prepared to effectively participate in the global economy and derive benefits accruing therefrom, apparently because the continent lacks the infrastructure and knowledge of how to adapt to a continuously-changing world production system brought about by sustainable development and neo-liberal/modernisation and spurred on partly by advances in technology (Bryant and Bailey, 1997). Changes in world production systems

have led to intensified global competition; international trade is now predatory and adversarial instead of complementary (Peter Drucker cited in Bryant and Bailey, 1997) and based on competitive instead of comparative advantage. Thus the development paradigms of neo-liberal/modernisation and sustainable development in a globalised world, the role of the state in development and water resources infrastructure development provide the framework for this thesis' investigation of the economic viability, environmental performance, inclusive decision making and political dimensions of large dam construction in contemporary African development.

The thesis about large dams and development is conducted in the context of two broad areas: 1) a liberal democratic political system and 2) a flexible and consistent monitoring and evaluation regime. The use of large dams to modernise African economies and bring about social transformation are in themselves not a bad idea, but such projects are said to be more effective if they take place within a liberal democratic political system where planners 'negotiate with organised citizens' (Scott, 1998: 5) and the development programmes of governments are subject to scrutiny in the legislature and among civil society groups to 'spur reform' (ibid). In this regard two requirements are necessary. Firstly, democratic institutions need to be firmly grounded in Africa, a process that has gained momentum in the past decade. Secondly, the growth of vibrant and independent indigenous civil society groups and NGOs is necessary to ensure that development priorities are not driven by outside interests. However, the influence of NGOs and civil society groups are uneven, based on a North/South divide and availability of resources such as funding, expertise, and different environmental and development priorities, particularly those concerning Southern environmental and development needs. Thus a liberal democratic political system might to some extent help in reducing the tensions in the large dam and development debate in contemporary Africa.

The monitoring and evaluation of large dams is generally not adaptive enough to capture both unintended loses and unexpected gains, thus making it difficult to analyse their overall impact. Therefore it is suggested that a consistent yet flexible monitoring and evaluation regime of large dam performance is required to take on board both positive and negative issues not anticipated in their project design, cost-benefit analysis (CBA) and environmental and social impacts assessments (ESIA). It is also assumed that an adaptive monitoring and evaluation system enhances the institution of swift remedial action to ameliorate undesirable consequences of large dam projects because experience and insight make allowances for surprises (Scott, 1998). Adaptive performance appraisal includes efficiency (economic performance and delivery of expected benefits in aggregate), equity (appropriate conflict resolution, resettlement, compensation, access to benefits, and opportunities for the disadvantaged), sustainability (evaluation of benefits relative to environment and social impacts, capacity of the state to maintain

infrastructure and maximise delivery of benefits) and the global trade regime (trade barriers, tariffs, and subsidies which militate against the comparative advantage of products and services generated either directly or indirectly from large dams in Africa) (Scott, 1998). All of the above issues are considered in this thesis when analysing the socio-economic viability of large dams and development in contemporary Africa's political economy as envisaged by NEPAD.

1.3 Large dams as a development strategy

Dams have been used as part of some nations' development strategy for centuries. But the advent of large dams, estimated as about 45,000 to 50,000 of the total of 800,000 dams (Nilsson and Reidy, 2006; ICOLD, 1997) became possible with advances in science and technology. This figure is however deemed 'a partial list'[2] (WCD, 2000a: 370). Notwithstanding the uncertainty about the number of large dams in the world, their huge number underscores their importance to the development strategies of several countries, hence the perception that they are desirable and therefore imperative.

According to ICOLD (1985 and 2003a) large dams are 'those having a height of 15 meters from the foundation or, if the height is between 5 to 15 meters, having a reservoir capacity of more than 3 million cubic meters'. World Bank (2001) defines 'large dams are 15 meters or more in height' but those 'between 10 and 15 meters in height are treated as large dams if they present special design complexities - for example, an unusually large flood-handling requirement, location in a zone of high seismicity, foundations that are complex and difficult to prepare, or retention of toxic materials.' Also 'dams under 10 meters in height are treated as large dams if they are expected to become large dams during the operation of the facility.' The Report of the World Commission on Dams (WCD) (2000) used the ICOLD definition in its deliberations and report about large dams worldwide. For the purpose of this thesis the definition of large dams proffered by ICOLD and adopted by the WCD will suffice.

The importance of large dams, which varies regionally and proliferated in the 1950s and 1980s, is based on the provision of irrigation, water supply, flood control, and hydropower generation services. The ability

[2] The WCD point out that the registering of large dams is voluntary and therefore faces five constraints: a) the dams provide information on a limited set of parameters for each large dam such as location, commissioning date, purpose, height, reservoir size, spillway, etc.; b) it is incomplete for certain countries, the most significant being China, with only 1855 of its estimated 22,000 large dams registered; c) gaps left by other countries such as the Russian Federation are likely to bias the sample in similar ways; d) data for the 1990s are underreported to an unknown extent and also contain dams which are uncompleted; e) entries are for dams and not reservoirs, therefore care must be taken in finding average reservoir capacity and surface area where more than one dam is associated with a particular reservoir (not clear to me) (WCD, 2000a: 370). Consequently, the WCD (ibid) brought out different estimates for the numbers of large dams in each country, one from the ICOLD register of large dams and the other from what they termed 'other sources'

of countries to provide the above services to further their national goals, among others, demonstrates self-reliance, independence and economic and social progression. For instance, the transfer of water to drier areas, as exemplified in the western United States where there are huge water transfer facilities and large dams, have provided a stable water supply to dry states such as California and made them habitable. The sophisticated development brought about by the Tennessee Valley Project in the USA have significantly transformed huge swathes of land susceptible to devastating floods into an industrial hub (van Robbroeck, 1999; Gupta, 1998). The considerable development of the countries in Western Europe, particularly Sweden, Norway, and Switzerland, can also be partly traced to hydroelectric power and flood control dams (ibid). Again, the recent emergence of Spain as a major producer of irrigated horticultural produce is attributed to the large dams located around the country (ibid). Therefore the role of large dams in modernising the economies of some states in the USA plus Norway, Sweden, Spain, Switzerland and other countries demonstrates their socio-economic imperative and how different nations have used them over several decades to meet their development objectives.

So from the perspective of the socio-economic imperative of large dams and in the context of perceived minimal substitutability by other infrastructures that could provide services in the same quantity and efficiency that large dams development should not be shackled with or constraint by the limitations of development theories of either modernisation/neo-liberalism or sustainable development but should rather be pursued where practically and financially feasible to satisfy the common good of society.

However, the importance of large dams is challenged by a paradigmatic shift in water resources development from a supply-led and control-based approach – the 'hydraulic mission of industrial modernity' (Allan, 2003: 2), - to increased concern for environmental and ecological impacts and the economic and social costs of large dam construction (Gleick, 2000; ODI. 2002). In this context large dams are perceived as part of the 'tyranny of technology' (Goodman and Chant, 1999; Loose, 2001).

The 'tyranny of technology' emanates from the unrestricted use of inappropriate and unsuitable technology without due and careful consideration of the medium- to long-term implications of the said technology (ibid). Technology is assumed to be one of the key solutions to underdevelopment, especially of the global South. Though it is assumed that technology may bring about huge benefits to the people of the global South just as it has done in the North, technological application through undemocratic top-down procedures is said to enhance its tyrannical status.

The argument about the 'tyranny of technology' of large dams is based on concerns about how large dams disrupt the flow of rivers, dislocate entire communities, fracture social cohesion and damage the self dignity and mental psyche of those affected, leading to untold and irreparable hardship, yet without corresponding benefits (Goldsmith and Hildyard, 1984; Rich, 1984; Pearce, 1992; McCully, 1996; Ursher, 1997; Gleick, 1998). These problems are especially acute in semi-arid and arid areas of developing countries where the 'hydraulic mission proved to be readily exportable […] in the second half of the twentieth century' (Allan, 2003: 10).

The criticism of large dams as technological tyrants because of their social and environmental costs coincides with a surge in nongovernmental environmental activism, some resistance from local people affected by dam construction and the notion that most ideal dam sites in Northern countries have been exhausted. This has contributed to a policy shift away from supporting such large infrastructure development in the global South, especially in Africa, and a significant decline in large dam development in the late 1980s. This created the perception among some Africans of a deliberate attempt to subvert their developmental aspirations because the continent is denied the infrastructure needed for nation building and development and the ability to participate effectively in the global economy, thus limiting them to the economic periphery as 'drawers of water and hewers of wood' and the raw materials basket of the global North.

The notions of the subversion of Southern countries' development have been reinforced by the high consumerism of the North. According to Giulianom (2006), the average US citizen uses 50 times more steel, 56 times more energy, 170 times more synthetic rubber and newsprint, 250 times more motor fuel and 300 times more plastics than the average citizen of India. Van Robbroeck (1999) asks whether the 'poor South should stop developing' and not be ambitious in aspiring to attain a comparative level of living standard, but resign itself to being the suppliers of raw materials for the extravagant lifestyle enjoyed by the rich North, partly enabled by decades of large dam construction and which they continue to profit from. He adds that their development and progress no longer depends on the construction of new dams (ibid).

The debate over whether large dams are good or bad and their future role in different societies is complex and provides a paradigmatic case of the contemporary debates over sustainable development in general. Unfortunately, the big dam debate has become increasingly polarised and at times conflictual in recent years. It has become more a reflection of the frustrations of one side with the other than a constructive engagement between different stakeholders over the difficult choices associated with managing water

resources (Asmal, 1999). The capacity of large dams to generate controversy has taken centre stage in the drama of 'hydro-politics' (Gupta, 1998). As a result, the debate is caught between the imperative need to assure flood control and supply water and electricity to domestic, agricultural, and industrial users, and the desire to ensure that human conditions and environmental considerations are not ignored in the process.

Large dams therefore encapsulate the choices and dilemmas faced by every society (Asmal, 1999). Consequently, the debate about them is a debate about the very meaning, purpose, and pathways for achieving development. In any case, all development choices and decisions about dams and their alternatives must respond to a wide range of expectations, objectives, and constraints (WCD, 2000b). It is against this contested background and context that this research is executed.

The discussions in the last few paragraphs of this subsection outline the basis upon which the validity of and inter-relationship between the three themes – the development imperative, the tyranny of technology and the subversion of Southern countries' development – are explored in this thesis.

1.4 Theoretical framework

Despite significant technological achievements and its usefulness, protest against their impacts has been present since the advent of technology. Though some of the basis for opposing technology is baseless, the protests against technology gained roots in the 1960s because of failures in supposed fool-proof safety measures of technology (Harremoes, et. al. 2001 cited in Renn, 2008; Sjoberg, 2002). Gellert and Lynch (2003) argued that faith in technology and domination of nature which is central to modernisation was specifically bias toward larger scale projects which displaces more earth and increased the potential severity of secondary displacements but then favours international lending institutions, construction firms, and monumentalist states because of their association with bigger equipment, 'what Linder (1994) calls "mobile fixed capital" (cited in Gellert and Lynch, 2003: 22). Furthermore, the bias toward large scale projects is said to create a vicious cycle of capital accumulation and the logic of advancing large loans for projects which are amenable to international bidding by multinational firms, despite environmental, displacement, human rights, and project utility concerns (Gellert and Lynch, 2003).

This leads to a distinction between reality and possibility in that an undesirable state of reality (adverse effect) will occur as a result of natural events or human activities base on causal connections between actions (or events) and effects (Cardona, 2008). This ties the impacts of large dams to "human agency in that it involves choices among various possibilities … the consequences of alternative possibilities, evaluating their desirability, and choosing the most desirable option" (Renn et. al., 2001: 18).

This is partly in the eyes of the beholder and though it is a representation of reality about human concerns and interests, it is also socially constructed (Reddy, 1996; Rosa, 1998; Klinke and Renn, 2002) and a "culturally determined affair" (Reddy, 1996: 223). For instance, Fishhoff et. al., (1984) argued that "the relative 'riskiness' of energy technologies depends upon the definition used" (ibid: 124) and that "the choice of definition is a political one, expressing someone's views regarding the importance of different adverse effects in a particular situation" (ibid). This implies that the selection of "issues of concern and how they model likelihood may indeed be a result of cultural conventions and rules" (Klinke and Renn, 2002: 1076) which are "socially and culturally framed" (Rippl, 2002: 149). Consequently, the impacts of large dams is both real and socially constructed and thus the epistemology of critical realism should frame the approach to analysing large dams because it combines statistical/technical knowledge with a constructivist approach as there is a world 'out there' with limited direct access (Zinn, 2005).

However, the constructionist perspective is criticised as 'subjective processes affected by the experiences and cultural context' (Bradshaw and Bekoff, 2001: 460) which denies "harmful existence of serious real-life problems" (Hannigan, 1995) such as droughts, floods, seasonality of rainfall, resettlement, compensation, food security, energy requirements, environmental degradation and equity.

But the limited access to the world out there led Nelkin (1989) to argue that "scientific judgments … are often constrained by inadequate evidence." Rosa (1998) added that limitations to human knowledge makes it difficult to either generate a perfect knowledge about the world or create a 'true' understanding of our physical and social environments, therefore our claims to knowledge about our worlds are always subjective and fallible.

Furthermore impacts of large dams exists "when humans have a stake in outcomes" (Renn et al., 2001: 17) as they "affect the economic interests and political values of different social or cultural groups" (Nelkin, 1989) because it presents either danger or opportunity – a potential for loss or gain – in relation to present actions and future outcomes and thus involves evaluative judgment about the desirability of outcomes (Renn et al., 2001: 18). Therefore there are a variety of actors: scientists, public health professionals, environmental activists, lawyers, agency administrators, and journalists who have a stake in defining the impacts, risks and benefits of technologies as "their economic stakes, professional ideologies, administrative responsibilities, career pressures, and political beliefs all may influence their perceptions of technology and interpretation of evidence" (Nelkin, 1989: 96) because they operate from very different frames of reference (ibid). Thus Ellis and Thompson (1997) cited in Rippl (2002: 149) "argued that

concern (e.g., for environmental and social issues) is embedded in broader socio-cultural orientations and is not merely a function of information about the safety of particular technologies."

For instance, Cohen (1997) referred to the widespread of technology including large dams in modern times as an "inadequately-controlled" process in which "societies are forced to confront acute and chronic threats" (ibid) based on the 'rhetoric of purity and pollution'(Douglas, 1986, 1992 cited in Elliott, 2002) is the advanced industrial countries construction.

In the broader context humans by the use of technology transform the natural into a cultural environment with the aim of improving living conditions and serving human wants and needs (Turner, et. al. 1990 cited in Renn, 2008). Such transformations are performed with a specific purpose in mind (normally a benefit to those who initiate them) (Renn, 2008). Implementing these changes leads to intended (or tolerated) and unintended consequences which may meet or violate other dimensions of what humans' value. These changes are not taken for their own sake but they are rather incurred, actively or passively, and integral to a specific activity (Renn, 2008: 5). An example is the neglect of equity issues in relation to time (future generations) and the adequacy of institutional arrangements to control or manage undesirable impacts (ibid). Rayner and Cantor (1987: 4) therefore outlined three issues that should be considered in addressing equity. These are firstly to ensure that collective consent is obtained from those who must bear its consequences. Secondly, the principles that will be used to apportion liabilities for an undesired consequence are acceptable to those affected. And thirdly, ensure that the institutions that make the decisions that manage and regulate the technology are worthy of fiduciary trust. In this regard, a definition of equity to which would open new approaches to large-scale technology choice should not be "How safe is safe enough?," but "How fair is safe enough?" (Rayner and Cantor, 1987: 5).

In the case of technology risk, these are choices among options which signify that, adopting a particular technology such as large dams means accepting its entire package of impacts which are some times not immediately known (Fishhoff et al., 1984; Sjoberg, 2002). This is because engineers and inventors face different possibilities and competing solutions which is based on the ability to solve a particular problem and determined by technological criteria, costs, cultural values, and life style (Hughes, 1983; Vicenti, 1990 cited in Rammela et al., 2003). Consequently, technological development - like large dams - is an evolving, complex, multi-dimensional, and culturally dependent process (Rammela et al., 2003: 125). Therefore Jamison and Hård (2003: 89/90) argued that "technologies are appropriated not just on a global, or general level, but rather, and for the most part, they are filtered into national traditions and languages, as well as into regional and locally distinctive organizational and institutional cultures."

1.4.1 My Epistemological approach

All sides of the dam debate have one thing in common which is their desire to improve the human condition yet they are so strongly opposed to each other's viewpoint. The approach of the major conflicting actors in the dam debate seems to be epistemologically similar as it is rooted in empiricism, while using deconstructs to discredit each other. The differences being that while those for the building of dams are highly structuralist, those against seem to be less so and want to cite agency in local people and communities. For instance, Adams (1992: 24) argued that:

> *"The future of Africa rural people must be based on the informal skills of local people, organised and directed in concerned political and practical action by those people themselves. Development is what those people will do with the resources and ideas at their disposal. Development planning must be something they control. Outsiders must come as equals to meet with local people face to face, and must seek to facilitate and not to dominate."*

Adams (1992) posits and privileges an ecologically governed imperative of development – based on the natural functions of rivers and wetlands in Africa - which he believed was more appropriate for improved livelihood of local people based on a combination of "integrated natural resources management with realistic socio-economic goals" (ibid: 16) over an emphasis on technological induced socio-economic development imperative of large dams.

This difference has led to a development stalemate, which has had a significant impact on the very people for whom the large dams and development protagonists are desirous to assist. Accordingly, specific "actors" such as NGOs, state agencies or transnational companies may not act autonomously to create ecological oppression or liberation, but may themselves – as are their critics – be acting within structures defined by environmental discourses or storylines (Forsyth, 2003: 272).

The epistemological approach to this research will be a combination of critical realism and pragmatism in the context of political ecology. The reason for these approaches is to enable me to be eclectic and show reflexivity. Critical realism is the attempt to 'understand "real" structures of society and the world while acknowledging that any model of such structure will reflect only partial experiences of them, and social and political framings within the research process' (Forsyth, 2003: 16). My choice of critical realism rejects positivism and its narrowly empirical philosophy (Proctor 1998: 360) which has an ontological proposition that reality exists independently of our ideas of it and is knowable to some significant extent (ibid). My own ontological position is that reality exists, yet acknowledges that its content and context

changes in time and space and the knowledge construction of that reality is mediated by experience, training and culture. In this regard, I reject scientific determinism but accept its importance and relevance to knowledge creation for addressing the needs of the human condition. As Proctor (1998) observed, knowledge, to critical realists, is neither wholly objective nor subjective but is in fact the result of interaction between subject and object. These negate the cornerstone of empiricism: objectivity, value neutrality, and independence from social and cultural contexts (Bradshaw and Bekoff, 2001: 461), leading to the view that modelling, analysis and explanations are subjective processes affected by the experience of the individual (ibid). For the critical realist the truth content of different ideas can be compared on a relative basis: some [social] explanations are more adequate representations of reality than others, though all are, by virtue of the dialectic (subject-object) nature of knowledge, always "partial truths" (Proctor 1998:361).

Critical realists recognize that direct access to a reordered reality is impossible and that knowledge is always fallible and incomplete; coupled with optimism that this admission need pose no fatal blow to the project of finding better explanations for reality (ibid). Consequently, it is an acknowledgement that 'sciencetification' functions as part of a larger system of knowledge, nature and society (Cillers, 1998). In spite of the differences with empiricism, critical realism cannot interpret divergent truths since it only seeks to explain reality in terms of structures. It is the acknowledgement of the limitation of critical realism that leads me to draw on pragmatism.

Hawkings (1988: 392) defined pragmatic as "treating things from the practical point of view". Hospers (1997:46) refers to pragmatism, as "the truth is what works". The term "pragmatic" is thus widely used in the lay sense to mean a focus on practical issues or practical, workable means to accomplish a desired end (Proctor, 1998:363), and showing that the essence of knowledge is problem-solving capability [it is however, recognized that pragmatism is subject to various definitions] (Lovejoy, 1963). In this regard:

> *Pragmatism may be seen to refer to three key tenets: the rejections of essentialist concepts of truth; the perception of no epistemological difference between facts, values, morality, and science; and a belief that social networks or solidarities determine scientific inquiry. For pragmatists, 'truth' is just the name of a property that all true statements share. The term pragmatism refers to the necessary limitations such social solidarities place on the extent to which scientists – or the networks to which they belong – can produce explanations that go further than their own experience and objectives. In this sense, pragmatists seek to understand how social networks (or institutions, or solidarities) may be the determining factor in*

understanding complex reality, rather than placing innate faith in the predictive power of science itself. (Forsyth, 2003: 92).

This has important implications for my research topic; as the issues involved are central to the livelihood of people in several continents especially the developing world. The proposition is whether the solutions being offered are workable and can make significant contribution to the development of the society in general. Proctor (1998: 368) citing a rubric presented by Anne Buttimer (1993) argues that pragmatist and critical realist look at the word in different ways.

I also intend to draw on the concept of political ecology. Political ecology is premised on the fact that society - from individuals, households' local communities, nation-states and the global - is political. The development continuum in my research is a political issue, and every development has an ecological implications. Blaikie (1999:132-3) identifies two narrower foci of political ecology. "The first is the interaction between changing environmental and the socio-economic, in which landscapes and physiographic processes acting upon them are seen to have a dialectical, historically derived and iterative relation with resource use and the socio-economic and political sets of relations which shapes them. The second being the examination of different states of nature, their change through time and their contested representations under conditions of unequal power." Given that development is a negotiated and contested process, political ecology as an epistemological approach will sit comfortably within my research by linking it up with critical realism and pragmatism; I believe their interface will enhance my research.

The issue of power relations (Blaikie 1999:138) is clearly embedded in the dam debate, where agency is rooted in the authoritative (privileged) speech of technocrats and bureaucrats (Woolgar 1988:101), while less visible, yet present, are those who oppose large dams development – NGOs, for example. There is therefore a contest between approaches that put human conscious agency at the centre of the analysis, and those that focus attention on the social - structural conditions for, and constraint on, action (Benton and Redclift, 1994:7). This leads to a struggle which either seeks to stress the supremacy of social law and determinacy or to celebrate human agency and freewill (Chapman and Driver, 1996:19). This recognises that the power to make a significant difference is immensely unevenly distributed (Benton & Redclift 1994:8) even though people have free will and do face choices (Chapman and Driver, 1996:22). I intend to attempt to strike a balance between power relation and agency, thereby examining what Benton & Redclift (1994:8) refers to as "collective agency" and collective decision-making in the pursuit of development and improved living standards for Africa.

My approach seeks to straddle both logical positivism and post-structuralism by attempting to blend three different epistemologies: critical realism, pragmatism and political ecology. This reflects my desire not to be constrained and confined by any epistemology straitjacket in attempting to address one of the most contentious and divisive if not insidious controversies to afflict humanity - the use of water resources for development, particularly in Africa. This, I believe, will lead to the production of knowledge that is fluid and dynamic enough to address a pluralistic audience, in languages they recognize, to identify real and feasible choices (Blaikie 1999:144), and accepting that all knowledge is provisional as variables changes over time and space. This is what I think Blaikie (1996:84) refers to as "the case for swimming".

1.5 Organisation of chapters

This chapter introduces the thesis by presenting the research goal, purpose, objectives, questions and chapter outlines. It unpacks the thesis title in the context of contemporary development theory and water resources/dam strategy.

Chapter 2 outlines the research design, methodology and approaches used for this study. The research design and methodology were based on interviews with actors interested in dams of all sizes, case studies and analyses of historical data to gain evidence and insights into the perception of respondents about large dams and their alternatives. It justifies the choice of the Akosombo Dam and the Bui Dam Project as case study sites and their significance to this study of large dams and development in contemporary Africa. The chapter also discusses how the available literature was used to examine and contextualise the large dam debate as a global development strategy. An actor-oriented research approach was used to understand why actors' interests in the large dam debate either converge or clash, and why and how the articulated positions of actors in the debate are negotiated, managed or contained. The historical process used in the research contributed to a better understanding of past sequences of events; aided in understanding the nature of change in society; and possibly predicts the likely course of future events, because the sequence of historical events usually draws out patterns and trends that are useful. Key informants and institutions were identified for the purpose of administering a questionnaire based on their present and past engagement with large dams in Ghana. The chapter discusses some shortcomings of the research methods with regard to the applicability of the different processes. Finally the research process and field procedures are presented and a retrospective evaluation of these is undertaken to safeguard the validity and integrity of the field and data-gathering methods.

This thesis is not an economic analysis of performance of countries with and without dams, or a before-and-after costs-benefits analysis of countries with large dams but rather an analysis of the perceptions of people about large dams in the development of Africa.

The main thrust of the third chapter of the thesis examines the ideological contestations about large dams and development. Here the key players and their evolving positions in the large dam debate at global level are identified and outlined, and articulation of the discourse of development and a review of the large dam debate are presented. This chapter analyses the large dam debate by examining the ideological basis for and against their construction, based on review and analysis of secondary literature about sustainable development, development theory and large dams. This seeks to address the first part of the first research question of the thesis which is; what are the ideological and economic justifications for large dams?

The fourth chapter provides answers to the second research question which is; what are the alternatives to large dams, and how credible and competitive are these alternatives in the present and immediate future through an analysis of the technological issues around large dams and their alternatives. The chapter analyses what dams can do technically versus what their alternatives can or cannot do. It relates more to the function of dams than to the ideologically contested views about them discussed in the previous chapter. This chapter assesses the key factors of water, energy, flood control and food that have historically been assumed to be the bases for constructing large dams. It also examines new factors such as climate change and increasing climate variability, efforts to meet the MDGs, historical increases in the price of crude oil and other factors that were not dominant prior to the WCD report about large dams but which now contribute to the debate.

The fifth chapter explores the second part of the first research question; what role have they played in meeting Africa's development objectives? The third research question; can large dam projects proceed in an era of devolved, participatory governance and inclusive decision-making when such projects are invariably centrally conceived and implemented? based on analyses of the changing development paradigms in the social, economic, and political arenas of Sub-Saharan Africa since the attainment of dependence from the 1950s and the role of large dams in the process. In contemporary African development, development thinking engendered by NEPAD is analysed against the background of Sub-Saharan African development and large dams. A key aspect of this chapter is the articulation of current African development needs in the areas of potable water, energy, and food security, – as captured by climate change/variability and the MDGs – and how these needs can be met using the continent's available resources. Another aspect of the chapter is concerned with how current large dam construction is

influenced by climate variability, climate change and the need to achieve the MDGs. The place of large dams and how they were and are construed in African development planning is examined in the context of their antecedents', achievements and failures. The current state of large dam development within the changing debate about whether their role is crucial in contemporary African development is also analysed using case studies of large dams in selected African countries.

Chapter 6 examines the contemporary development of large dams in Africa, which is dependent on a confluence of several factors. The three key factors identified in this chapter are sources of large dam funding, governance and cooperation in and among African states, and the viability of alternatives to large dams in Africa. The influence of geopolitics and financial regimes, environmental and development politics and the social and environmental movements at global level is also analysed. This further addresses the first and third research question at the global level.

In Chapter 7 the findings of the field data, which consist of personal interviews, questionnaires, unpublished reports and documents related to the research are presented and analysed. The chapter tackles the debate and perceptions about the role of large dams in Ghana's national development, based on analysis of the responses of actors engaged in the process of developing the Akosombo Dam and the current attempt to develop the Bui Dam project in the context of the present developmental needs of the country and current development thinking. Available alternatives to the development of Akosombo Dam, the Bui project and the general development of large dams in Ghana are assessed based on Ghana's resources and development interests. The arguments for and against large dams are evaluated and analysed in the Ghanaian situation using evidence deduced from the two case studies. In this chapter all the four research questions are examined in the context of the case studies.

Chapter 8 discusses the evidence from Chapters 3 to 7 and presents the theoretical and policy implications of large dams and development in general and the contemporary development of Africa in particular. Recommendations for further research are presented. The chapter sums up the thesis by reiterating the key themes, findings and the theoretical expositions generated by the findings from the field study and literature review.

1.6 Conclusion

Large dams and development are contested issues, partly because of differing perceptions of development and how to achieve it. This introduction has set out the main contentions in the large dam and development debates in the light of emerging global challenges such as climate change/variability, MDGs

and the increasing cost of crude oil and its derivatives. The introduction sets out the research goals and objectives and maps out how these will be achieved by outlining clearly defined questions. The answers to the research questions are logically presented in six chapters, as summarised above. The next chapter presents the research design and methodology of the thesis.

CHAPTER 2
RESEARCH DESIGN AND METHODOLOGY

This thesis uses a mixture of qualitative social science research methods – discourse analysis, an actor-oriented research approach, historical analysis and case studies – to explore contested views of the role of large dams in development in Africa. The specific research methods are discussed in sub-sections 2.1.2 to 2.1.4.

2.1 Case studies and site selection

The Akosombo Dam and the Bui Hydroelectric Project (BHP) are the two field case studies used in this research about large dams in contemporary African development. The main reason for selecting these cases is that they provide an opportunity to historically examine the large dam debate in the context of national development; pre- (Akosombo Dam) and post- (BHP) WCD, to provide insight into the debate about large dam construction.

Both the Akosombo Dam and the location of the BHP were identified among others as possible sites for hydropower and irrigation development on the Volta River Basin in Ghana by Kitson (1925) and subsequently prioritised for construction by the Volta River Project Preparatory Commission in 1956 as a development imperative for Ghana.

While the Akosombo Dam was commissioned in 1964, the BHP is now being constructed by Sino Hydro, a Chinese construction firm, more than 40 years after the building of the Akosombo Dam. The delay in constructing the BHP was because preparations towards its execution were suspended in 1966 by the military/police regime which overthrew Nkrumah's government; this is discussed in detail in Chapter 5. Since then the prospect of constructing the BHP has gone through a process of fits and starts and through different political administrations.

However, consistent efforts made by two different governments – the New Patriotic Party (NPP) and before it the National Democratic Congress (NDC) to construct the BHP in the past eight years have come to fruition as work on the BHP commenced in late 2007 (see Chapter 5 for more discussion about the Akosombo Dam and the BHP).

The historical records of about 40 years of planning, building and operating dams that the case studies present chronicle the role of dams in Ghana's socio-economic development processes. The historical information about the two case studies also offers the chance to contrast the vision, significance and role

of dams over a 40-year time span in the same country and river basin, but in otherwise changing global and national political, economic, social, and environmental circumstances. These changing global and national circumstances involved greater opposition to large dam construction, particularly in the global North, due to increased concerns about the environment and the interests of people affected by large dams. This opposition, dominated by the global North, suggests the subversion of the development interests and needs of the global South.

Another factor in the choice of the two case studies is geography. The geographical factor has significance for both research and production. With regard to research, the two case study sites are in the same river basin, with the Akosombo Dam sited downstream in the south-eastern portion of the country and the BHP site on one of the main tributaries – Black Volta – in the north-west of Ghana, draining into the main Volta River on which the Akosombo is sited. The production significance of the geographical locations of the case study sites covers both economic development and the distribution of electricity. Regarding economic development, the idea was to use the BHP to spur and aid the economic development of the northern part of Ghana with the Akosombo Dam doing the same for the south (VRP, 1956; and Kitson, 1925), to ensure that Ghana's socio-economic development was regionally balanced between its northern and southern sectors.

The two dams could be interconnected to ensure that in the event of any mishap to the main pylons linking the north to the south the electricity supply to either of the electricity-generating sites was not disrupted (Int/19, 2005). It was thought that electricity from the BHP and Akosombo Dam could secure the electricity needs of Ghana and other neighbouring riparian countries of the Volta Basin (Benin, Togo, Burkina Faso, Cote d'Ivoire and Mali) for several decades. With interconnectivity with these neighbouring countries, the electricity produced from Akosombo Dam and the BHP could also be supplied to Ghana's riparian neighbours to the east, Benin and Togo, and to the west, Cote d'Ivoire, while the BHP supplied electricity to those to the north, Burkina Faso and Mali (Preparatory Commission on the Volta River Project (VRP), 1956) and assist the socio-economic development of all the Volta Basin riparian countries.

2.1.1 The Akosombo Dam

The Akosombo Dam is a single-purpose rock-filled hydroelectric power generation dam. The power plant had an initial installed capacity of 768 MW on completion in 1964 at an estimated cost of £230 million – now approximately GBP 700 million at the 2006 exchange rate[3]. As of the middle of 2005, the turbines were retrofitted thereby increasing its power generation capacity to 2010 MW. The Akosombo was the

[3] Exchange rate by Antweiler (2006), Pacific Exchange Rate Service. http://fx.saunder.ubc.ca (accessed, 08/01/08).

first dam constructed in Ghana and is so far the largest, covering a surface area of about 8,515 km^2, and led to the resettlement of 80,000 people in 52 communities. It main purpose is to support the industrialisation and general development of Ghana, while some of the power it generates is exported to neighbouring countries (Kalitsi, 1999). The dam has been in operation for about 44 years and is still the main source of electricity supply for Ghana.

2.1.2 Bui Dam Project (BHP)

The BHP is estimated to cost about $600 million and will comprise a 110 m high roller-compacted concrete (RCC) straight gravity dam which will create a 12,350 million m^3 reservoir with a total surface area of 440km^2 (VRA, 2001; ERM, 2007a). The BHP reservoir's active storage is estimated to be about 5,620 million m^3 and the powerhouse will be equipped with 3 units generating 133 MW, with a total generation capacity of about 400 MW (ibid). As a multipurpose dam it is expected to produce hydroelectric power, support irrigation agriculture and enhance the tourism potential of the Bui National Park (BNP) area.

The BHP is located in the BNP and could occupy about 21 percent of its total area of 1,820 km^2 (VRA, 2001; ERM 2007b). A preliminary environmental impact assessment (EIA) predicts that about 383km^2 out of the total reservoir surface of 440km^2 of the dam will be located within the BNP (VRA, 2001; ERM, 2007a). The general area is sparsely populated with the required resettlement of an estimated 2500 people (VRA, 2001; ERM, 2007c). Consequently, there is concern for the biodiversity of the park, in particular the 140–150 hippopotami (Kalitsi, 1999; VRA, 2001).

2.2 Methodology

The methodological approach of this study comprises a cross-country comparative analysis of historical data and the contemporary application of an actor-oriented research approach; these are applied to a case study of both a completed and a planned dam in Ghana. The historical data analysed were: the determinants of dam building; their interrelationship with national development priorities; and the processes involved in large dam construction in Ghana.

The purpose of undertaking the cross-country comparative analysis of historical data was to look for either the presence or absence of trends and variations in dam-building determinants, development priorities and processes from the conception of the VRP to the present. The historical data used included relevant unpublished official documents on the Akosombo and Bui Dams to give insight into the two case studies in particular and large dams in the development history of Ghana in general.

Some of the specific data analysed in the historical and contemporary context of dam building in Ghana and discussed in detail in Chapter 5 of this thesis are the hydro-geophysical characteristics of the country; large dams and socio-economic development; the politics of large dams in Ghana; large dam alternatives; equity in dam benefit sharing; and participation in decision making about large dam construction in Ghana. These are among some of the issues prominently featured in the WCD (2000a) report and whose relevance is said to continue to dominate the development, environment and large dam discourse.

The contemporary application of an actor-oriented approach was carried out through interviews and the administration of semi-structured questionnaires to identified actors in the dam debate. Ghana has representatives of all the major international NGOs and local social and environmental NGOs; a well-organised and independent civil society; a democratic representative government; country offices of most of the multi- and bilateral financial, development and aid agencies; a decentralised system of local government and a vibrant mass media. These features and institutions are necessary for a country which needs to make significant progress through the cross-fertilisation of ideas and for an open and frank discussion of the research topic.

2.2.1 Collection and review of secondary literature

The secondary literature reviewed for this thesis is an important aspect of the research, because it helped to set out the parameters of the study and established the perspectives and direction that the research took. To further this aim, the first step I took was an examination and contextualisation of the large dam debate as a global development strategy within the framework of historical/contemporary development theories. The review of the development theories led me to choose modernisation and neo-liberalism as those from whose perspectives I would examine the debate about large dams and development. The contextualisation of the debate entailed a review of the available literature, which gave me a better appreciation and understanding of the past events and trends of dam construction and their interrelation with development as a whole.

The whole gamut of literature about large dams and development theories enabled me to suggest answers to whether the support for large dam construction was based on the necessity of development or the misuse and abuse of existing technologies, which constitute the first two parts of the research title. The literature also helped me to answer the third part of the research title; whether those who oppose large dams irrespective of the purpose they serve are deliberately undermining the development needs of

countries – particularly those in the global South – which desire to build them for socio-economic development.

The wide array of literature available on the large dam debate and the different approaches to theories of development either criticised large dams' negative impacts on society or applauded their positive contribution to development. The reason for the continued critique and support for large dams is because the argument about what development is actually about and the role of large dams in achieving it is far from settled.

Notwithstanding the different perspectives of critics and supporters, an attempt was made by the WCD (2000a) to encapsulate the debate in the late 1990s. It brought together all sides of the large dam spectrum (proponents and opponents of their construction) to deliberate on the pros and cons of large dams in order to chart a new paradigm for their development.

In the review process adopted for this research, although all available literature on the topic was considered, particular attention and emphasis was given to literature relating to developing countries, especially those involving Africa's development and large dam construction. The main reason for the emphasis on Africa is that the continent has great potential for the utilisation of its natural resources – including constructing large dams on undeveloped, technically and financially feasible sites – but still lags behind in development in all its implications as compared to other continents.

To contextualise Africa's development and its large dams, a general review and analysis of some major dam benefits, critiques, alternatives and lessons are presented in this thesis. This aspect of the literature review was made difficult by the paucity of primary information on the post-construction performance of most of the existing large dams in Africa. The greater part of the available information was skewed in favour of those pointing out the negative social and environmental impacts of large dams in Africa.

Background historical information/data were also collected on the two Ghanaian case studies – the Akosombo Dam and the BHP – used in this thesis. The literature associated with historical data is found in technical reports and briefs, consultants' reports, parliamentary proceedings, government policy documents, reports of commissions, the mass media, NGO publications and studies by researchers and individuals, some of which date back to the period when Ghana was under British colonial rule. Together, the historical literature helps to tell the evolving story of large dam construction and its links to the socio-economic development – or otherwise – of Ghana.

The historical data, the case study on the Akosombo Dam and the review of major dams in Africa were among the input used to analyse the second case study; the BHP. The feasibility of alternatives to large dams being proposed was also assessed in the Ghanaian case-studies, particularly with regard to the BHP.

2.2.2 Actor-oriented research

One of the methodological frameworks adopted in this complex debate regarding the role of large dams in present-day development thinking is an actor-oriented perspective, 'informed by the concrete experiences of the particular actor involved in and who stands to gain directly [from it]' (Nyamu-Musembi, 2002: 1), as also to lose from such an undertaking. This involves the actors negotiating their way through a 'complex landscape which continually alters shape as a result not just of their own actions but those of others as well' (Gough and Wood, 2004:64).

Villarreal (1992: 248) posits that society is composed of actors who are 'thinking agents, capable of strategising and finding space for manoeuvre in situations they face and manipulate resources and constraints'. Their manoeuvres may sometimes generate an appearance of 'chaos' which Long (1989b: 222), cited in Villareal (1992: 248), argues is 'in great measure the outcome of different ways in which actors deal, organisationally and cognitively, with problematic situations and accommodate themselves to other's interests and design for living'.

'Economic and political considerations, as well as life experiences and particular every day circumstances are relevant to the way actors tie together, act upon, attribute meaning to, and recreate different elements' (Long, 1992: 20). In this regard, all forms of intervention – including those related to large dams and development – necessarily enter the life-worlds of individuals and social groups affected, and in this way are mediated and transformed by these same actors and structures. Therefore interventions (both large and small) are on-going processes that are constantly reshaped by the political dynamics and the specific conditions the encounter itself creates, including the responses and strategies of local and regional groups who may struggle to define and defend their own social spaces, cultural boundaries and positions within the wider power fields (ibid).

Accordingly, development interventions such as the construction of large dams are 'an ongoing socially constructed and negotiated process, not simply an execution of an already-specified plan of action with expected outcomes' (Long. 1992: 35). Long (ibid) further posits that one should not assume a top-down process, as is usually implied, since initiatives may come from 'below' as much as from 'above' (ibid).

Consequently, it is better to focus on intervention practices as shaped by the interactions among the various participants, rather than simply on intervention models. This allows one to focus on the emergent forms of interaction, procedures, practical strategies, and the type of discourse and cultural categories present in specific contexts (Long 1992). Focusing on intervention practices rather than models leads to a paradigm centred on actors and a method centred on networks, power flow and strategies (Villareal, 1992). Villareal (ibid: 265) further argues that 'an actor-oriented approach makes a plea for a decisive unpacking of our concepts, a focus on the complexity of power process, and a modest evaluation of 'external' change agent's contributions'.

The actor-oriented approach as outlined provided the broad basis and context within which this research was carried out. The actor-oriented research involved local people, government officials representing their various institutions, NGOs and the media, among others, and the power relations and complexities that exist among them. The constant interaction of the actors, particularly in a democratic environment, informed and gave direction to the development agenda – including large dam construction – of the state. By using this method I captured the interplay among the various groups in the dam debate in Ghana and gained an understanding of the issues in the dam debate that explain their positions by either bringing them together or dividing them.

The process of gaining information from the identified actors and key informants in the case study areas were through interviews and the administration of questionnaires and were undertaken in Ghana from January to September 2005. The informants and actors identified are shown in Table 2.1 and 2.2.

2.2.3 The historical process

I also applied an historical research approach to the gathering of primary data for this thesis. The historical process involved the evaluation, systematic analysis and synthesis of evidence (Burns, 2000). This is basically an act of reconstruction undertaken in a spirit of critical inquiry (ibid). The historical method helps to understand, explain or predict through the systematic collection, comparison, classification and the objective evaluation and interpretation of past data in order to find solutions to contemporary problems (Gottschalk, 1963; Burns, 2000). Historical research unravels the social and economic structures, their functional relationship, and social theories, through the combination of narratives and analysis, where narrative offers details of actual events while the analysis places those events in a broader social, economic and political context (McDowell, 2002: 16).

Having an appropriate historical perspective may enable us to see the significance of events which may not have been regarded as important to those who witnessed them at the moment they occurred. By developing a perspective on past events we may come to a different conclusion about what is historically significant, (McDowell 2002: 8). The understanding of past sequences of events will better position us to predict the likely course of future events or at least understand the nature of change in society, because the sequence of historical events usually draws out patterns and trends (ibid, 15). The historical analysis must, however, meet certain general standards and tests in the following: human behaviour, logical antecedents and consequences, and statistical or mass trends (Gottschalk, 1963).

The use of the historical approach in telling the story of large dam construction in Ghana and Africa, which was conducted partly in the UK and partly in Ghana and juxtaposed with African developmental needs within the context of the ever-changing global development theory enabled me to understand both the progressive and the deteriorating state of large dams and development in the continent without being what McDowell (2002: 15) calls 'deterministic'.

2.2.4 The case study method

Case study is a "research strategy which focuses on understanding the dynamics present within single settings" (Eisenhardt, 1989: 534) and provides a thorough analysis and 'development of detailed, intensive knowledge about a single case or a small number of related "cases"' useful for conceptualising a continuum of a bounded subject or unit that is either very representative or atypical (Kumar, 1999: 99; Burns, 2000: 460; Morris and Wood, 1991 cited in Saunders et al, 2000). Eisenhardt (1989: 534) said that "case studies typically combine data collection methods such as archives, interviews, questionnaires and observations". Archives, interviews and questionnaires are other data collection methods I have used to complement the case studies of this research about large dams and development. The evidence gathered from case studies may either be qualitative or quantitative or both (ibid). According to Bryman (2000) case study emphasis the intensive examination of a setting which may either be a community, location or organisation because the "aims is to provide and in-depth elucidation" of the "unique features of the case" (ibid: 50). "Case study research is concerned with the complexity and the particular nature of the case in question" (Stake, 1995 cited in Bryman, 2004) and tend to be inductive because of the relationship between theory and research if a qualitative approach is applied as it is employed in this research on large dams and development.

In using case study as a research method for this thesis, I was mindful of the argument of Stake (1978: 7) that; "the case need not be a person or enterprise", but "can be whatever 'bounded system' (to use Louis

Smith's term) is of interest. An institution, a program, a responsibility, a collection, or a population can be the case." This bounded system of interest is important as there are many stakeholders or actors in the large dams debate both globally and nationally in Ghana. Also it enabled me to draw extensive evidence on performance of large dams from different parts of Africa and the world in the research. The use of the Akosombo dam and BHP as case studies in this thesis offered an opportunity to test Stake's (1978: 7) postulation that the social science literature feature case studies as based on "descriptions that are complex, holistic, and involving a myriad of not highly isolated variables" where the narrative may includes "verbatim quotation, illustration, and even allusion and metaphor" and "comparisons are implicit rather than explicit." He further argued that though case studies "themes and hypotheses may be important, [---] they remain subordinate to the understanding of the case" which adds to "existing experience and humanistic understanding", with "the characteristics of the method are usually more suited to expansionist than reductionist pursuits" (ibid, 1978: 7).

Using the case study method to analyse the Akosombo Dam and the BHP discussed in Chapter 7, complemented with other dams such as the Kariba dam in Zambia and the Aswan dam in Egypt discussed in Chapter 5 of this thesis therefore satisfied the criteria of thorough analysis based on detailed and intensive knowledge about the Akosombo dam and the BHP. The Akosombo and BHP case studies will provide insights into what Stake (1978: 7) referred to as the "universality and importance of experiential understanding" of stakeholders especially those resettled by the construction of the Akosombo dam and the perception of others yet to be resettled by the BHP. The use of the case study also provides policy makers, academics and all those involved in the large dam debate with another prism through which to look at the possible relationships and dynamic trends between large dams and national development in an African country, Ghana, and their implications for the continent and large dam development as a whole. Consequently, the application of the case study method in this research is informed by its "epistemological advantage over other inquiry methods as a basis for naturalistic generalization" (Stake, 1978:7) of findings and conclusions of this thesis.

2.2.5 Key interview informants/institutions

Key interview informants and institutions make up the broad spectrum of actors involved in the large dam debate in Ghana, and the study attempted to capture the views of as many of these as possible. The key informants and institutions were local and international NGOs; international multilateral and bilateral organisations; local communities affected by dam construction; governmental and quasi-governmental bodies responsible for water resources planning, management and development; individual experts, and the private sector involved in the large dam industry.

A list of all those likely to be involved was developed prior to undertaking the fieldwork. The list was, however, given flexibility because it was continuously reviewed in order to add new actors or remove others as and when it was necessary to do so; a lists of actors who responded to questionnaires (the two questionnaires can be found in Appendix 2.1 and 2.2) and/or were interviewed are presented in Tables 2.1 and 2.2. In this way most of the listed multi- and bilateral organisations, international and local NGOs and civil society groups were revised and updated.

The perspectives and interactions of the key informants and institutions in the development discourse and the way the interactions and perspectives are negotiated usually have a bearing on development and aid in charting the path of Ghana's and Africa's development; this relates especially to large infrastructure, of which big dams are a part, in furthering the course of development. Most of the interviews with key informants and institutions were conducted in Ghana, and a few by telephone from the UK. The choice of the semi-structured questionnaire and interview method was basically informed by the need to elicit a wide range of information and perspectives on the research topic and questions posed.

To complement the use of interviews, a semi-structured questionnaire was administered in order to raise some of the main research issues in a more structured way. These issues included analysis of the general perception of large dams as a development strategy; their problems and benefits; the alternatives and their viability; the role of the Akosombo Dam in national development since its construction; the importance or otherwise of the Bui Dam project to the development interests of Ghana; and how the performance and role of Akosombo Dam, in possible conjunction with other large dams in the country is influencing and informing the development of the Bui project. All of the above questions were framed within the context of the analytical framework of neo-liberalism/modernisation, sustainable development and the WCD's five key recommendations to determine large dams' viability and decision-making processes and the political dimension of development discussed in sub-sections 1.2 and 1.3.

2.2.6 The research process and field procedures

Apart from the collection of secondary literature, reports, and other grey literature relating to the research topic, two semi-structured questionnaires were developed and administered to institutional and local actors respectively. With regard to the institutional actors, most of the questionnaires were hand delivered to identified institutional representatives; others were sent out by post because the organisations had their head offices outside the national capital. While some of the institutional actors agreed to fill out the questionnaire themselves and return it to the author by an agreed date, others opted to be interviewed

using the questionnaire as a guide. Some of those who chose to fill out the questionnaire also had informal discussions on some aspects of the topic with the author. These enabled further exploration of ideas of importance to the research that arose and required follow-up either with other institutions or with individuals.

The respondents in this category were from government institutions dealing with water and developmental issues, international and local NGOs, local people, bilateral and multilateral donor agencies and others in the private sector. In all 21 institutional actors were identified and these became part of the sample of this research as shown in Table 2.1 below. The identification of these actors was based on their functions in relationship with the research objectives of this thesis. Apart from presenting the institutional positions in either the questionnaires or through interview and discussion, respondents also gave their personal opinions, either to elaborate on issues they considered important and into which they had insights, or make clear their personal position on particular issues, especially where this diverged from their official position. Most of the institutional representatives also volunteered documents that in their view were of relevance to the topic, some of which the author was unaware of.

The local actors in this research were principally made up of communities and people who were either directly affected by the construction of the Akosombo Dam or are likely to be affected by development of the Bui dam project. Both these categories of actors are located in the Volta River Basin, which runs through six of the ten Ghanaian administrative regions; the Upper West, Upper East, Northern, Brong Ahafo, Volta and Eastern Regions, which stretch from the south-east and to the north-western part of the country and basin.

In the first case study, the Akosombo Dam, I first identified the 52 resettlement communities and people who were directly affected by the dam's construction. These 52 resettlement communities are basically those that have been resettled and are scattered around the basin and four of the six regions, the Northern, Brong Ahafo, Volta and Eastern Regions, and across 16 administrative districts and 18 political constituencies. To present a regional balance and representation of resettlement communities in the research I stratified the 52 communities into their respective administrative regions, namely; Northern, Brong Ahafo, Volta and Eastern. I then randomly picked a total of four communities, one community from each region; Yapei in the southern portion of Northern region; Yeji, located in the north-east of the Brong Ahafo region; Nkonya Tepo in the mid-western part of the Volta region; and Somanya in the southern section of the Eastern to administer the research questionnaires. This random sample process is based on the probability theory because they are representative (Bernard, 1994) of the 52 resettlement of

the Akosombo dam and thus “increase external validity in any study” (ibid: 73). Another reason for picking four communities out of 52 is because I had earlier in December 1998 - March 1999 visited the 52 communities as part of a research on “Challenges and Opportunities of the Volta Basin” (Shirazu, 1999) and had consistently interacted them ever since. Consequently, I am conversant with some of the similarities and differences in the communities and only desired a regional balance in my sample.

In the second case study, the Bui dam project, 12 communities were identified as likely to be affected by the dam. These were in two administrative districts and political constituencies, Bole and Tain districts in Northern and Brong Ahafo regions respectively. It has been established that six of these communities will be resettled before the project is executed, while the other six will be directly affected due to increased activity in the area (VRA, 2001; ERM, 2007a and c). All the communities likely to be resettled and three of those to be directly affected are in the Tain district of Brong Ahafo Region, while the remaining three communities that will be directly affected are in the Bole district of the Northern Region. For the purposes of regional balance and representation I randomly picked two communities that would be directly affected out of the six in the Bole district of the Northern region, namely Jama and Banda Nkwanta; and another two communities that were to be resettled from the other six, which are Bui and Battor Akanyakrom in the Tain district of the Brong Ahafo region.

I then administered questionnaires to all eight communities; four from the 52 resettlement communities of Akosombo dam and another four communities to be affected by the BHP construction for this study.

In conformity with customary and traditional protocol and before setting out to visit any community for the purpose of administering questionnaires, prior information was sent to the political and local authority and the police, as well as to the community to be visited. The reasons were to give advance notice of the purpose of the research to all interested parties, seek clarification on possible issues that might affect the outcome or make it impossible for me to go to the sample area, and for my own security. In spite of the open nature of Ghanaian society, ensuring that all the relevant bodies are aware of what you intend to do and where is important because local communities in remote areas are generally suspicious of outsiders who come into their villages and start asking questions. There might also be local tensions in an area due to chieftaincy or land disputes which could threaten my safety. Thankfully, there was no problem in the areas sampled and the interviews proceeded smoothly with the cooperation of all the sampled communities.

It was my initial intention to randomly sample the inhabitants of the eight communities chosen for the administration of the questionnaires, but this was abandoned in subsequent communities in favour of an open forum after pre-testing the random sampling in Somanya, the first community visited. In this community, I randomly sampled community inhabitants and administered the questionnaires as initially envisaged with the aid of an interpreter, because I could not communicate effectively in the language of the interviewees.

There were two main reasons for changing the approach from a random sampling of the population of communities to an open forum. The first was that the individual sessions either turned out to be family or group sessions or both, as other family members' opinions were either sought by the interviewee or the family members themselves were enthusiastic about making their own contributions to the discussion. Because the discussion was usually in an open space, friends and other passers-by stopped to enquire about the nature of the discussion and either deliberately or unwittingly stayed and contributed to the discussion. Others even asked me to come to their home to interview them, since they were also interested and had information on the topic under discussion.

The second reason was that the topic was of great interest to the whole community, because everyone had been or had relatives who had been or would be affected by the issues raised. As is usually the case with small, close-knit communities, the flow of information was very fast, and with the great interest shown in the topic of the research, continuous sampling could raise and possibly lead to what may be misconstrued as favouritism towards some community members over others. Hence the switch to the open forum format with either opinion leaders or the whole community in the subsequent sampled research communities. Since some members of the communities were more informed about certain issues than others due to various reasons, these persons were always mentioned, referred to and recommended to me.

Table 2.1: Summary list of institutional actors interviewed or who responded to questionnaires

Type of Actor	Name of Organisation	Organisation Type	Main Activities of Organisation
Institutional Actors	Ghana Atomic Energy Commission	Government	Policy development and Implementation, Nuclear Research and Development
	Energy Commission	Government	Policy development and Implementation, Economic, Social, and Environmental
	VRA	Government	Policy Development and Implementation, Electricity generation for Economic development, Social, and Environmental
	EPA	Government	Policy development, implementation, and Coordination of sectoral and institutional activities relating to the environment
	Water Research Institute of CSIR	Government	Policy implementation and Environmental
	West Africa Water Initiative	Civil Society/NGO International Organisation	Focussing on community water and sanitation program for health in selected rural communities in Ghana, Mali Niger
	Conservation International - Ghana	Civil Society/NGO International Organisation	Advocacy and Environmental
	Third World Network - Africa	Civil Society/NGO International Organisation	Research and Policy advocacy. Economic Development
	Green Earth Organization	Civil Society/NGO International Organisation	Environmental Conservation advocacy. Environmental
	Country Water Partnership - Ghana	Civil Society/NGO International Organisation	Advocacy and support. Environmental
	Ghana Wildlife Society	National Based Civil Society/NGO	Policy implementation, economic, social, environmental, and advocacy
	Adventist Development and Relief Agency (ADRA)	Civil Society/NGO International Organisations	Economic, social and environmental
	Earth Service	National Based NGO	Environmental Service delivery Environmental

	Ministry of Energy	Government	Policy development and implementation, Environmental and Energy
	Friends of the Earth - Ghana	National Based NGO	Social, environmental, and Economic
	Council for Scientific & Industrial Research (CSIR).	Government	Policy implementation, Economic/Environment
	Irrigation Development Authority	Government	Policy development and implementation; Economic/Social
	WWF	Civil Society/NGO International Organisation	Policy formulation and implementation, Environmental
	Water Resources Commission	Government	Policy development and implementation, Social, environmental, and natural resources.
	Energy Foundation	Civil Society/Partly Government	Renewable Energy, Policy and Advocacy, Environmental
	Bui Development Secretariat	Government	Source for funds, bidding and selection of contractors, and ensuring the construction of the BHP.

Table 2.2: Summary list of local communities (actors) selected for interviews and administering of questionnaires

Dam Site	**Name of Locality**	**Possible Dam Impacts**	**Region**
Akosombo Dam	New Somanya	Resettlement	Eastern Region
	Nkonya Tepo	Resettlement	Volta Region
	Yeji	Resettlement	Brong Ahafo
	Yapei	Resettlement	Northern Region
	*Ajena	Resettlement	Eastern Region
BHP	Banda Akenyakrom	To be Resettled	Brong Ahafo
	Bui	To be Resettled	Brong Ahafo
	Jama	To be impacted	Northern
	Banda Nkwanta	To be Impacted	Northern

*The secretary of the village is a key informant for this research because he and his community are taking the lead in pressurising government to improve the living conditions of resettlers and pay compensation for land flooded by the Akosombo dam.

The potential limitations of using a focus group approach to village questionnaires is the possibility of group 'take over' as group discussions can some times be difficult to steer and control, "possible problem of group effects" - because respondents express an opinion in line with the group due may be to peer pressure even if that opinion is at odd with their personal ones, "potential for causing discomfort among participants" (Bryman, 2004: 359). Consequently, Gibbs (1997: 4) argued that "it should not be assumed that the individuals in a focus group are expressing their own definitive individual view. They are speaking in a specific context, within a specific culture, and so sometimes it may be difficult for the researcher to clearly identify an individual message." Smithson (2000: 116) added that there is "the tendency for certain types of socially acceptable opinion to emerge, and for certain types of participant to dominate the research process." Also another potential limitation is how involved I as a moderator should be and how far I should seek to prompt and influence the group to deal with the set of explicit research questions in my questionnaires (Bryman, 2004). These issues are important because they affect the validity and accuracy of the research outcome.

Despite these constraints and limitations of focus group, Myers (1998: 107) suggested that "'the constraints on such talk do not invalidate focus group findings; in fact, it is these constraints that make them practicable and interpretable'" (cited in Smithson, 2000: 116). Consequently, "focus groups permit some insights into rhetorical processes, or 'practical ideologies': 'the often contradictory and fragmentary complexes of notions, norms and models which guide conduct and allow for its justification and rationalization'" (Wetherell et al. 1987 cited in Smithson, 2000: 116). In this regard, "a particular strength of the methodology is the possibility for research participants to develop ideas collectively, bringing forward their own priorities and perspectives, 'to create theory grounded in the actual experience and language of [the participants]'" (Du Bois 1983 cited in Smithson, 2000: 116). As a result, "participants themselves use the groups in ways not always anticipated by the researcher. This can be especially useful for highlighting issues for disadvantaged or minority groups by validating and publicizing their views, although this only works when these 'minorities' form the majority within a focus group" (Smithson, 2000: 116).

In this regard I initially had some reservations about the open forum format because of the possibility of it being dominated by a few outspoken members of the community. However, these fears were shown to be unfounded as questions were thoroughly debated by participants in the open forum before answers were given. The answers that were subsequently agreed on were the position of the community, arrived at through consensus as against that of individuals. Although the consensus answers were acceptable, they sometimes tended to alienate the few who held strong opposing views and were not still convinced about

the merit or otherwise of the answer given to a particular question. Where some individuals held strongly-opposing views these were also recorded and indicated as such in the questionnaire.

Individual comments that were deemed important and supportive of the consensus were also captured as part of the answers provided during the discussions. In some instances where there was disagreement on an answer to a question or an issue, the answer was deferred to a later stage while the discussions proceeded to other issues until such time that the respondents understood the issue well enough to return to it.

The open forum format had some downsides, and an important one was the low level of participation by women, in terms of their number at the forum and even of those who spoke. But this seemingly low participation can be deceptive, because the women might have been consulted by their husbands or sons prior to the forum, since they had been informed about it earlier. This possibility was not ascertained because it is known to be customary practice that women are consulted before such gatherings since they do not normally speak in public.

After each open forum session the participants were allowed to ask me questions about issues on the topic under consideration. This approach enabled the communities to feel that they had got something in return and to give them some general and specifically vital information associated with the topic without compromising the confidentiality of other sources.

The responses at the open forum were basically to questions asked as per those in the semi-structured questionnaires developed. Notes were taken when it was determined that information given was of significance and relevant to the topic under consideration. This enabled me to pursue other sources of information as and when applicable in order to enrich the research findings.

2.3 Conclusion

The validity of the entire research process, and particularly the results, was of great concern to me, given the mainly qualitative approach adopted for the study. Different actors have different interests in relation to the research topic and might misrepresent certain facts. This was a challenge that was addressed by applying triangulation through cross-checking the answers and other information with each other and other sources after critical examination.

CHAPTER 3

THE CONTESTED VIEWS OF LARGE DAMS

3.1 The actors in the dam debate

This chapter analyses the large dam debate by examining the ideological basis for and against their construction on a review and analysis of secondary literature about sustainable development, development theory and large dams. The chapter identifies the key actors in the large dam debate and reviews their evolving positions regarding whether large dams are instruments of development or the tyranny of technology, and whether opposing their development subverts Southern countries' development. The positions of the various actors in the debate are analysed, along with how other actors may have influenced these positions, how those positions interlink in the debate, and why the actors' positions have either shifted over time or remained the same. What emerges by the end of chapter is a clearer understanding of the intricacies surrounding the debate and the implications for sustainable development and modernisation/neoliberalism.

The wide range of actors involved in the large dam debate appears to indicate the breadth and depth of the implications of large dams for society. These implications are mostly perceived as either positive or negative, depending on which side of the debate spectrum the actor belongs. There are also relatively few actors who do not subscribe to either position because they prefer to make their decisions about large dams on a case-by-case basis.

In general there were about seven main actors in the debate. These actors were identified based on their activities, role and functions in large dams development. The actors are: 1) civil society and advocacy groups such as international and local NGOs in the environment and social sector and human rights groups; 2) local communities affected by large dam construction because of resettlements and the economic and social impacts on their livelihood; 3) multi- and bilateral development agencies engaged in funding feasibility studies, design, and implementation of large dams projects; 4) private financial institutions who provide funding for large dams construction; 5) the large dam construction industry composed of the expertise required for implementing such complex projects, 6) manufacturers of large dam equipment, and finally 7) countries/states desirous of developing large dams. This large number of actors with varied interests in or concerns about large dams shows how complicated the nature of the debate is and the onerous task involved in trying to harmonise their different concerns and interests.

A review of the literature on the large dam debate shows that in general terms NGOs appear to oppose large dams, while some local people and communities displaced by large dams and civil groups have

mixed views, depending on their circumstances (Dubash et. al., 2001; Routledge, 2003; Scudder, 2005). Some of the NGO groups are unambiguous in stating their position because they believe that large dams always reconfigure the ecological and development balance against the environment and the livelihoods of communities of local and indigenous people, and thus are not favourable to the larger and long-term interests of society (Dubash et. al., 2001).

The NGOs and some civil society groups also believe that whatever large dams are meant to achieve in terms of the potential short-, medium- and long-term benefits to society – meeting MDG targets, mitigating climate change and adapting to climate variability, and reducing the use of fossil fuels – there are always better alternatives if only due diligence is applied to identifying and investing in them (WWF, 2001; McCully, 2001; Hathaway, 2005).

Despite their united opposition, some NGOs, civil society groups and resettled communities adopt different strategic approaches in responding to planned new large dams and problems caused by existing large dams. Overall, the unity of NGOs and some civil society groups is also perceived as scuttling the development needs of some countries in the world, particularly those in the global south.

Another significant group of actors in the debate is the multilateral and bilateral development agencies and institutions[4]. This group does not take a uniform position on large dam construction. For instance, some multilateral institutions such as the World Bank, IMF and regional development banks – the Asian Development Bank (ADB), Africa Development Bank (AfDB) and Inter-American Development Bank (IDB) are reengaged in funding large dam development, after a lull in the late 1990s and early 2000. This is obviously a tacit reflection of their support for large dams as a development imperative (Lagman and Aylward, 2000; ADB, 2002; World Bank, 2004; IWPAC, 2005).

The renewed focus on financing large dams and other large infrastructures by the World Bank and other multilateral institutions is a reflection of the changing dynamics in the broader debate about the role of

[4] These agencies and institutions are the International Bank for Reconstruction and Development (IBRD), better known as the World Bank, the International Monetary Fund (IMF), International Development Agency (IDA), and related regional banks like the Inter American Development Bank (IDA), African Development bank (AfDB), Asian Development Bank (ADB). Others are the United States Agency for International Development (USAID), the UK Department for International Development (DfID), and the Canadian International Development Agency (CIDA) the Swedish International development Agency (SIDA) and others. These also includes agencies of the United Nations (UN) like the United Nations Development Programme (UNDP), the United Nations Food and agricultural Organisation (UNFAO), the United Nations Environment Programme (UNEP) and the United Nations Industrial development Organisation (UNIDO), United Nations Department of Economic and Social Affairs (UNDESA) and the various continental Economic Commissions of the UN, among several others.

large infrastructures. According to Enskat and Liptow, (2008: 04): 'International donors are sending clear signals that after years of very little interest […] energy is back on the international development finance agenda' because 'power for economic growth is required in bulk quantities' (ibid). The support for large dams from some of the above multilateral institutions is also an acknowledgement that a sustainable energy supply at different scales is a 'precondition for economic and social development and achievement of the Millennium Development Goals' (Richter, 2008: 03).

Meanwhile, other multilateral institutions such as agencies of the UN find themselves pursuing conflicting and contradictory mandates and programmes in relation to large dams. For instance agencies like UNIDO, UNDESA and FAO are mandated to promote industrial and agricultural development and economic growth in less-developed countries and economies in transition (UNDESA, 2002 and 2004; FAO, 2006; UNIDO, 2006), and are likely to support large dam construction where such development is seen to be more beneficial than available alternatives. But the remit of UNEP, which focuses on environmental conservation, suggests that it is unlikely to be supportive of large dam construction (UNEP, 2006).

An example of areas of possible conflict between UN agencies is that UNEP unconditionally accepts the WCD findings on large dams and seeks to encourage its implementation (UNEP, 2000). In furtherance to this it has set up a secretariat to follow up on the WCD recommendations and promote continued dialogue among interested parties (UNEP, 2001). But FAO (2001) is critical of some aspects of the report, claiming that the WCD findings do not truly reflect the positive contribution of large irrigation dams to food security. The sometimes conflicting roles of the UN agencies have the potential to undermine and even undo each others' achievements and goals such as meeting the MDGs.

The possibility of conflict among UN agencies is also manifested in UNDESA's cooperation with the World Bank and the National Development and Reform Commission of China to highlight the development imperative of large dams by sponsoring a symposium on Hydropower and Sustainable Development in China in 2005. At this symposium the role of large dams in socio-economic development – particularly in connection with hydropower – was highly praised (ICOLD, 2005). The symposium recommended that multi- and bilateral institutions should reengage in large dam construction by offering financial and technical support to developing countries with strong socio-economic development and environmental challenges (ibid). Thus the conflicting mandates of UN agencies in providing direct or indirect financial and technical support for large dam construction and/or environmental protection makes it difficult for them to take a common position regarding the appropriateness or otherwise of large dams.

In the case of bilateral institutions' position on large dams, some country-led agencies like DfID, USAID and the Danish International Development Assistance (Danida) are unlikely to support large water infrastructural projects because of policy changes and budgetary constraints in America, Britain, and Denmark. In the area of budgetary constraints for instance, DfID's 2007/8 budget for water and sanitation for Sub-Saharan Africa to meet the MDGs only amounted to about £95 million (DfID, 2006), about US$188 million[5], DfID committed only £6 million for infrastructure and energy in Africa to the multi-donor Infrastructure Project Preparation Facility hosted by the African Development Bank, and £7.5 million to the EU Africa Infrastructure Trust Fund for the preparation and funding of regionally-agreed energy and infrastructure projects to promote integration in Africa (DfID, 2008). DfID's contribution seems inadequate when compared to the £1.8 billion investment needed to bring 7 of 23 regional infrastructure and energy projects identified by NEPAD to fruition (ibid). So the total DfID commitment of about £108 million for water, sanitation, energy and infrastructure (ibid) pales in significance compared to the amount needed to raise water, sanitation, energy and infrastructure levels in Africa to meet the MDGs.

Though the whole amount of £108 million is evidently not sufficient to construct one large dam, such an amount might be able to support preconstruction surveys, designs and plans, ESIAs and simulations. But the use of DfID money for large dam-related activities is unlikely because its current policy does not support large dam construction (ibid).

The professional bodies of the large dam industries – including the International Commission of Large Dams (ICOLD), the International Hydropower Association (IHA), and the International Commission for Irrigation and Drainage (ICID) – are a group that believes large dams to be necessary in addressing developmental issues (ICOLD, 2001; ICID, 2002; Schultz, 2002: IHA, 2003).

Closely identified with the arguments of the professional bodies of the large dam industries is the private sector's financial institutions group, including Barclays, HSBC, Morgan-Chase and others. With their huge investment portfolios, private financial institutions perceive large dams as investment opportunities as well as responding to specific human needs, which in certain circumstances are difficult to meet by the use of other existing means (Coface, 2003; Swiss Re, 2003; EIB, 2004).

It could be argued that the professional bodies of large dam industries and private sector financial institutions support large dam construction because they are sources of income.

[5] The conversion was done using x-rates.com. Accessed at http://www.x-rates.com/calculator.html# on 24/12/27

The final group identified in the large dam debate comprises independent self-governing nation-states, some of which have constructed, are in the process of constructing, or are interested in constructing large dams in the immediate or distant future. These nation-states do not espouse a uniform position as to whether large dams are beneficial or not. Their positions are dictated by four national interests; economic, social, environmental, and political. Outside the four national interests of nation-states, five other factors influence their position on large dams. These are: 1) level of socio-economic development; 2) availability of potentially feasible large dam sites; 3) level of technological innovation internally generated in the country; 4) the financial wherewithal to execute large dam projects; and 5) the availability of large dam substitutes.

Notwithstanding that the above factors might determine the position of a country with regard to large dam construction; countries in the global South seem generally to support large dam construction as a way of ensuring socio-economic growth and stability (Dubash et. al. 2001). The position of countries in the global North on large dams is more diverse because some Northern countries have placed a moratorium on building new large dams and others are decommissioning previously-built ones thought to have outlived their usefulness or decreed environmentally unfriendly. However, about 23 other countries in the North are building more dams (WCD, 2000; Bartle, 2002; Ausubel, 2005), which suggests that some countries in the global North perceive them favourably.

This diversity of actors and their positions regarding large dams shapes the direction and outcome of the large dam debate. However, given the huge disagreement among them about the development imperative or otherwise of large dams as analysed in this sub-section, the end of the large dam debate is unlikely to be reached in the immediate future.

3.2 Large dams and sustainable development

The main contention at the centre of the debate is whether large dams are consistent with sustainable development principles. The WCD outlines four 'most intractable' (WCD, 2000b:11) issues around the large dam debate: 1) 'the extent to which alternatives to dams are viable for achieving various development goals, and whether alternatives are complementary or mutually exclusive; 2) the extent to which adverse environmental and social impacts are acceptable; 3) the degree to which adverse environmental and social impacts can be avoided or mitigated; and 4) the extent to which local consent should govern development decisions in the future' (WCD, 2000b: 11). This section of the thesis analyses and discusses the large dam debate in the context of sustainable development.

Proponents of large dams have historically and contemporarily argued that large dams are consistent with sustainable development because they assist in and spur economic development, modernising the production and development process by providing a variety of services such as water supply, electricity and irrigation to the worlds' growing population (Biswas, 1997; WCD, 2000a; World Bank, 2004). Opponents of large dams, on the other hand, do not consider them consistent with sustainable development. They argue that they are socially, environmentally, and economically costly (WCD, 2000a; IRN, 2002a; McCully, 2004). This disagreement is at the centre of the large dam debate.

The argument in favour of the sustainability of large dams is based on using them to develop in a sustainable manner. For instance, while it is argued that large dams are used to transform, modernise and pursue socio-economic growth policies geared towards addressing specific societal problems (Hoogvelt, 2001), the growth of and benefit to society can only be sustainable if this is executed effectively and efficiently without placing an undue burden on the environment (Connelly and Smith, 2003). The neoliberalism/modernisation viewpoint emphasises socio-economic development through the unrestricted application of science and technology to aid industrial and agricultural development, while sustainable development is assumed to be about environmental and economic integration, futurity, environmental protection, equity, quality of life, and participation which focuses on an economic transformation of society that enables people to act as trustees for future generations (Jacobs, 1999; O'Riordan et. al., 2003). This implies that sustainable development seeks to prevent the perceived harm that the uses of technology such as large dams cause to the environment and society, privileging social and environmental issues equally with economic development.

The sustainable development of large dams therefore grants equal weight to and balances the social, economic and environmental needs of development based on economic vitality, environmental integrity and social equity as its governing foundations (Flint, 2004). In this context, the sustainable development of large dams becomes a principle that enables economic requirements which demands accountability to an ecological imperative to create equal access to resources and the minimisation of human suffering (ibid).

However, being accountable to an ecological imperative is only possible through the substitutability of resource capitals – natural, human, technological and social – conditioned on returns from the trade-off with substitute resource capital utilisation being higher than the original resource capital and offset by capital accumulation elsewhere in the economy to generate net capital and savings (Ikeme, 2000; Lopez

and Toman, 2006; Rogers et. al., 2006). This suggests that the operation of development projects and programmes such as large dams, if able to meet their stated objectives and cause minimal disequilibrium to the resource capital base throughout the life-cycle of the project/programme, can be said to be sustainable.

Proponents of large dams view the paradigms of both sustainable development and modernisation as long-term options for addressing the root causes of underdevelopment and poverty, which are said to be significant causes of environmental degradation as they reinforce each other (UNCTAD, 2002). Karshenas (1995: 754) views the mutual reinforcement of environmental degradation and under-development/poverty as 'forced environmental degradation' resulting from

> *[…] inadequate man-made capital stock, stagnant technology, lack of employment opportunities, and the inability to cater for basic human needs, [which] combined with a growing population forces the economy into a state where survival necessitates eating into the natural or environmental capital stock in order to survive. (ibid: 754)*

The above quote can be aptly illustrated in the case of energy. The World Bank (2006a/b) argues that unreliable energy services constrain economic activities, which lead to poor utilisation of resources, low yield from assets and commercial and technical inefficiency, with high technical and financial losses and significant impact on climate change. It believes that large dams could ameliorate some of these problems and provide a platform from which to pursue fulfilment of the MDGs and deal with climate change and variability.

The implication of large hydropower dams as sources of energy which might contribute to carbon reduction comes into sharp relief when considered against the argument that four out of five people living in rural areas are without access to electricity or any form of modern and sustainable energy services (World Bank, 2006a/b). Rural areas are thus deprived of opportunities for the economic development and improved living standards necessary to achieve the MDGs and combat climate change/variability (ibid). Energy for lighting, cooking, heating, refrigeration, transportation and electronic communications, at both the micro and macro level, are the modern energy-dependent services identified as indispensable to increasing productivity, creating enterprises, generating employment and improving incomes for the economic development and social progress (ibid) necessary for achieving sustainable development. The application of large hydroelectric dams as modernising tools to address some of these energy needs at the micro and macro levels are essential for sustainable development.

The perception of large hydroelectric dams as unsustainable sees them as undermining the pursuit of the MDGs and sustainability if viewed in the context of available electricity/energy generation options. In most cases the available energy options of fossil and wood fuel and charcoal are detrimental to the economy and environment because they denude forests and release carbon dioxide/monoxide into the atmosphere, leading to climate change. Some of the energy options also have health implications because they cause burns and eye and respiratory diseases in those who use them (Spies, 2008). Access to modern sources of energy is therefore not only essential but critical to achieving sustainable development, the MDGs and reducing carbon emissions (ICOLD, 2005). In this context Karekezi and Kimani (2002) argue that large hydroelectric dams provide secure modern energy services at low cost and minimise the energy gap for economic development and social progress.

Another area where large dams are perceived as important to development is their ability to store water from rivers which would otherwise be lost to the sea. The stored water is used for drinking, personal hygiene and irrigation, thereby contributing to basic needs like health, food security and improved livelihoods; key requirements of sustainable development. According to Donkor (2003), large dams secure a reliable supply of water to support socio-economic development and protect lives and development gains from the potentially damaging impacts of climate variability like floods and droughts. Illustrating the role of large dams in ameliorating the impacts of climate variability, ICOLD (2005) observes that during the 1980s and 1990s droughts Morocco was able to sustain its socio-economic development because existing large dams –constructed based on dam policy initiated in the 1960s – provided water for the domestic water supply and crop irrigation. Based on the Moroccan experience of dams' role in ameliorating climate variability about 110 more dams with a storage capacity of almost 16 billion m^3 were constructed (ibid). To the proponents of large dams, the Moroccan experience exemplifies the imperative need for and sustainability of large dams.

However, opponents contend that large dam services such as irrigation, electricity, flood control, and water supply largely favour elites living in cities and urban centres but are of little or no benefit to rural dwellers, who in most cases rely for their water on free-flowing rivers (Pearce, 1992; McCully, 1996; WCD, 2000; IRN, 2002a). Karekezi and Kimani (2002) agree that the provision of electricity is largely confined to privileged urban middle- and upper-income groups and the formal commercial and industrial subsector. This observation is said to also apply to beneficiaries of irrigation schemes and water supply facilities from large dams (Pearce, 1992; McCully, 1996; WCD, 2000). Hence based on the perceived disproportionate benefits of large dams enjoyed by people in the urban areas, critics of large dams are sceptical about whether development goals can be met (Clarke, 2000).

From the above discussion of the sustainability or otherwise of large dams as modernising tools in the context of climate change/variability and the MDGs, I surmise that the sustainable development and modernisation paradigms are conceptually and practically complementary.

3.3 The WCD report and stakeholders reactions

The mixed reactions to the 2000 WCD report into large dams and development reflect long-existing gaps and differences – differences and gaps that the WCD process sought to bridge – among large dam stakeholders. Though the WCD provided a platform for a dialogue between supporters and critics of large dams about the pros and cons of large dam construction to map the way forward for their future in development (WCD, 2000a), its report's conclusions and statements seem rather to intensify the debate about large dams and their role in development.

Notably, the most contentious part of the WCD conclusions and statement are the five key points, which had the unanimous support of the WCD commissioners which were supposed to be the issues around which all stakeholders were meant to coalesce. The statement and conclusions about large dams were that:

> 1. Dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable.
>
> 2. In too many cases, an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment.
>
> 3. Lack of equity in the distribution of benefits has called into question the value of many dams in meeting water and energy development needs when compared with the alternatives.
>
> 4. By bringing to the table all those whose rights are involved and who bear the risks associated with different options for water and energy resources development, the conditions for a positive resolution of competing interests and conflicts are created.
>
> 5. Negotiating outcomes will greatly improve the development effectiveness of water and energy projects by eliminating unfavourable projects at an early stage and by offering as a choice only those options that key stakeholders agree represent the best ones to meet the needs in question. (WCD, 2000a: xxviii)

In outlining these key statements, the WCD commissioners had no 'justifiable doubts' (ibid) about their significance and importance. They therefore argued that the statement provided an opportunity 'to break through the traditional boundaries of thinking' (ibid) about large dams that had gripped various stakeholders in the past. The commissioners contended that the key points provide the prospect for issues about large dams to be appreciated and examined from different perspectives than before, and offer scope for progress in the large dam debate that no single perspective can offer on its own (ibid).

The WCD commissioners envisaged that future large dams should conform to Bruntland's (WCED, 1987) argument about sustainable development to minimise if not eliminate the social and environmental problems associated with large dam construction and operation. In this context the WCD commissioners postulated that adopting their statement would ensure that decision making about water and energy development would reflect a comprehensive approach to integrating the social, environmental, and economic dimensions of development (WCD, 2000b); would create greater levels of transparency and certainty for all involved in large dams; and would increase levels of confidence in the ability of nations and communities to meet their future water and energy needs (WCD, 2000a). This position relies heavily on the concept of sustainable development (WCED, 1987) which has taken root and gained influence in development discourse, policies, and practices.

The stakeholders' reactions were not only as diverse as their different interests but were also not uniform among groups with similar interests. According to a monitoring study of the WCD process commissioned by the World Resources Institute (WRI), Lokayan and the Lawyers' Environmental Action Team in 2001, the tone of initial responses to the WCD report ranged from glowing to scathing, with the majority of stakeholders cautiously receptive (Dubash et al, 2001). An interim report by the UNEP Dam and Development Project (DDP) (2003) on the analysis of reactions to the report broadly concurred with the WRI-commissioned report.

The DDP (2003) analysis of stakeholders' reactions to the WCD report indicates that while NGOs generally welcomed the report and advocated its implementation, governments' reactions were not uniform. Those of Vietnam, Thailand, Nepal and South Africa cautiously accepted the WCD report's recommendations and conclusions on condition that it should be the basis for dialogue about the future of large dams which are imperative to their countries' socio-economic development (ibid). But others, such as Spain, Turkey and some developing countries were highly critical and voiced strong reservations about the WCD's conclusions and recommendations because implementing them would undermine their long

term socio-economic development interests (ibid). India and China, among other developing countries, completely rejected the report because its conclusion and statements were inconsistent with their development aspirations and interests (ibid).

The responses of the multilateral development banks and the dam development industry to the WCD report were also cautious. Both accepted the core values of equity, efficiency, participatory decision-making, sustainability, and accountability deemed necessary to further the development of large dams (DDP, 2003; Scudder, 2005). However, they expressed strong reservations about some of the strategic priorities and their accompanying implementation guidelines. Nakayama and Fujikura (2006) believe these to be inconsistent with the WCD report findings and that accepting them would weaken the development of some countries (DDP, 2003; Scudder, 2005).

The different responses of stakeholders to the WCD report, with NGOs concurring with the entire report and asking for full compliance and implementation of core values and strategic priorities to curb the negative impacts of large dams; governments either cautiously and conditionally accepting, criticising or entirely rejecting the report because it is not consistent with their development interests; and multilateral development banks and dam development industries accepting parts of the report but rejecting others, are the fuel that keep the large dam debate burning without any sign of abating almost a decade after the report was issued. Scudder (2005), one of the WCD commissioners, observes that the report has yet to foster the type of discussion that could lead to a new water resources development paradigm for the 21st century and beyond.

3.3.1 Specific response of multi- and bilateral funding organisations

Although the specific responses to the WCD report of multi- and bilateral organisations were varied, they were laced with scepticism. Nevertheless, these funding organisations sought to further the WCD discussions because the report was used as a basis for self-appraisal and introspection regarding their activities. Such appraisal led to reviews of organisational policies, practices and guidelines which embraced some of the WCD statements, international conventions and protocols for engagement with large dam development in order to balance social and environmental concerns against the mounting global need for water and energy.

In response to the report, for instance, the World Bank released a strategic document, the *Water Resources Sector Strategy (WRSS): Strategic Direction for World Bank Engagement* (World Bank, 2004), a sequel to its initial cautious reaction (World Bank, 2001). The WRSS acknowledges some concerns about the WCD

report but nonetheless stresses the continuous need for broad-based water resource interventions with stringent funding guidelines (World Bank, 2004). The interventions envisaged are those related to major infrastructure development such as large dams and inter-basin transfers which could benefit people – including poor people – at national, regional and local levels (ibid).

Justifying its position on water infrastructural intervention the World Bank argues that:

> *"Providing security against climatic variability is one of the main reasons industrial countries have invested in major hydraulic infrastructure such as dams, canals, dykes and interbasin transfer schemes. Many developing countries have as little as 1/100th as much hydraulic infrastructure as do developed countries with comparable climatic variability. While industrialized countries use most available hydroelectric potential as a source of renewable energy, most developing countries harness only a small fraction. Because most developing countries have inadequate stocks of hydraulic infrastructure, the World Bank needs to assist countries in developing and maintaining appropriate stocks of well-performing hydraulic infrastructure and in mobilizing public and private financing, while meeting environmental and social standards" (World Bank, 2004: 3)*

The World Bank further argues that although some past experiences with dams have been unpleasant, their stigmatisation as 'unnecessary and destructive' is extreme and wrong because 'in most developing countries both management improvements and priority infrastructure have essential and complementary roles in contributing to sustainable growth and poverty reduction' (World Bank, 2004: 12). Consequently, 'the historical challenge of water resources management has been the reconciliation of human needs for predictable and regular flows of water with the variable patterns of precipitation and stream flow' (ibid: 21). To achieve this, 'societies have developed a combination of structural and non-structural mechanisms for attempting this reconciliation' (ibid: 21). In this context, the World Bank suggests that 'the principal lessons from the experience of industrial countries are; first, that infrastructure (dams, levies and canals) is critical, and, second, that infrastructure investments need to be complemented by previously neglected non-structural investments (in watershed management, land use planning and information, and systems management, for example)' (ibid: 21). The WRSS was the clearest indication by the World Bank of its reengagement with the development of large dams, particularly in developing countries where the need for water and energy is most acute and affirm the importance of large dams.

Other regional development banks also reviewed their large dam lending portfolios and issued new guidelines for future funding. The ADB, after reviewing its large dam lending, concluded that their existing lending policy framework and safeguards have considerable synergy with some of the WCD recommendations and therefore are adequate to deal with some of the issues raised in the report (ADB,

2005). According to Preben Nielsen[6] (2001) ADB's policies do not preclude the adoption of new ideas and practices considered relevant, so funding for dams will be undertaken based on the local context and on a case-by-case assessment (ADB, 2005). Consequently, the ADB intends to undertake 'a sequential order of country-wide and sub-regional river basin management studies, hydropower master planning, and energy options studies prior to detailed feasibility studies' with the concurrence of its Developing Countries Members (DMC) before new dams are considered (ibid). Instead of compensation for those affected by large dams, the ADB suggested that an integrated rural development in the dam project area would be pursued to ensure enhanced livelihoods (ibid). ADB funding for large dams will also be dependent on adherence to international conventions that provide a framework for addressing environmental impacts. These include the Convention on Biological Diversity, the Ramsar Convention, the UN Convention on Non-navigational Uses of Watercourses, and the UN Economic Commission for Europe Convention on Environmental Impact Assessment in a Transboundary Context (ADB, 2005). The above are some of the measures the ADB believe to be sufficient to address some of the issues about large dams raised by the WCD's report and improve on the sustainability of large dams.

In their effort to address some of the WCD report concerns about large dams, some private financial and investment institutions and professional groups incorporated some of the WCD's recommendations. *The Environmental Handbook of the Overseas Private Investment Corporation* (OPIC),[7] which covers areas like environmental management and monitoring plans (EMMP), Environmental Impact Assessments (EIA), and Major Hazards Assessment (MHA), among others, 'provide Overseas Private Investment Corporation [OPIC] users and the public with a consistent framework for interacting with OPIC on environmental matters' (OPIC, 2004: 3). The handbook also provides guidelines for participation in large dams and other project development in which OPIC members have financial interests (ibid). The Japan Bank for International Cooperation (JBIC) specifically uses its Environmental and Social Checklist for Hydro Power Projects to assess dams before funds can be approved for their development (JBIC, 2002). Coface, a French multi-national private credit insurance and management firm, broadened the definition of environmental impacts in its environmental guidelines for hydroelectric power stations and large dams to include local populations (Coface, 2003). Swiss Re, a leading global life and health reinsurer weighed in with its *Constructive Dialogue on Water* guidelines which consider the economic considerations of large dams as important as the requirements for environmental sustainability (Swiss Re, 2003). These efforts

[6] Mr. Preben Nielsen is the Deputy Director, Infrastructure and Financial Sectors Department, Region West, of the Asian Development Bank. He made these comments in a speech at the 3rd WCD Forum meeting in South Africa in February, 2001 (http://www.dams.org/commission/forum/f3_adb.htm accessed 2006).

[7] The OPIC group seek to mobilise and facilitate the participation of United States private capital and skills in the economic and social development of less developed countries and countries in transition from non-market to market economies (OPIC, 2004).

seem to show that despite the reservations of the financial and investment institutions about some of the recommendations of the WCD, non-controversial recommendations are being incorporated into policy and operational guidelines.

Many more institutions and agencies responded to the WCD report's concerns about large dams. Some of these institutions and their responses are; the European Investment Bank's environmental statement (EIB, 2004), the European Bank for Reconstruction and Development's (EBRD) Environmental Policy (EBRD, 2003), HSBC's Freshwater Infrastructure Sector Guideline (HSBC, 2005) and the OECD's agreement to strengthen its common approaches to evaluating the environmental impact of infrastructure projects supported by member governments' export credit agencies with a view to ensuring that these meet established international standards (OECD, 2003), among several others. These are a few selected responses and efforts by the bilateral, multilateral and private sectors that positively engage with the WCD's findings. They involved reviewing past practices and determining how some of the WCD's recommendations can be incorporated into the policies and practices of current and future organisational activities and projects.

The above efforts by different institutions to incorporate some of the WCD recommendations into their environmental and social policies are based on the desire to ensure that environmental and social issues are adequately addressed in any future large dam construction in which they engage. This aspiration also influenced about 36 institutions in the financial industry to pursue a ten-point revised framework which enables them to determine, assess and manage environmental and social risk in financing projects of more than $50 million as members of the Equator Principles Financial Institutions (EPFIs) (EP, 2006). EPFI members believe that the implementation of the Equator Principles (EP) will guarantee that projects they finance are developed in a manner that is socially responsible and reflects sound environmental management practices.

> *'[The] principles are intended to serve as a common baseline and framework for the implementation by each EPFI of its own internal social and environmental policies, procedures and standards related to its project financing activities. We will not provide loans to projects where the borrower will not or is unable to comply with our respective social and environmental policies and procedures that implement the Equator Principles. By doing so, negative impacts on project-affected ecosystems and communities should be avoided where possible, and if these impacts are unavoidable, they should be reduced, mitigated, and/or compensated for appropriately. We believe that adoption of and adherence to these Principles offers significant benefits to ourselves, our borrowers, and local stakeholders through our borrowers' engagement with locally affected communities. We therefore recognise that our role as financiers affords us opportunities to promote responsible environmental stewardship and socially responsible development. As such, EPFIs will consider reviewing these Principles from time-to-time based on implementation*

experience, and in order to reflect ongoing learning and emerging good practice' (EP, 2006: 1).

The institution of all these guidelines in corporate practice further illustrates the commitment of the financial services to ensuring that their activities are adaptable and flexible enough to take on board some of the WCD's recommendations without undermining the importance of large dams in socio-economic development.

Nonetheless, it should be recognised that the institution of these guidelines is not an indication that they will be implemented to the letter. For instance, there are no internationally-recognised quantitative standards such as World Bank guidelines on which to base the definition of the levels of acceptability of the impact of hydroelectric power stations or any other large dam project on the environment (Coface, 2003). Scudder (2007; personal communication) is also sceptical about the efficacy of the measures by the World Bank and regional development banks like the ADB because he thinks that they are being weakened by management due to concerns that they will lose out on funding projects in China, Brazil, India and other parts of the world to private sectors and government agencies, implying that some large dams might be constructed without ensuring that they are consistent with the banks' own funding guidelines and regulations.

The lack of international standards and Scudder's concerns about weakening standards is, however, tempered by recognition that the field of environmental assessment and management is an evolving science (OPIC, 2004) which in the long run might enable some of these organisations to accomplish their diverse mandates of financing and supporting development, particularly large dam construction, in the developing world. The reviews of policies, practices and guidelines about large dams in the light of the WCD report demonstrate the efforts being made by the multi- and bilateral funding organisations towards further discussion of the water infrastructure development imperative.

3.3.2 Specific response of dam-building industries and associations

The dam-building industries, through their respective professional bodies, notably ICOLD, IHA and ICID have taken steps to address some of the concerns raised in the WCD report. ICID, for instance, set up an eighteen-member task force known as TF5 under the chairmanship of Mr. Z. Hassan[8] to develop appropriate decision-making procedures for new dams. The task force recommended a nine-point road map of procedures to be followed for constructing new dams (ICID, 2004). TF5's recommendations in

[8] Mr. Z. Hassan is India's former Secretary of the Ministry of Water Resources and also former chair of the Indian National Committee on Irrigation and Drainage (INCID).

past decision-making processes were based on historical analyses of national strategies, legal frameworks and institutional set-ups of dam building in countries such as China, India, Mexico, Iran, Australia, Spain and Indonesia (ibid). The IHA (2004), on the other hand, introduced generic 'sustainability guidelines' for its members which link hydropower generation to environmental, social and economic sustainability. The sustainability guidelines acknowledge that each particular hydropower scheme and development project has its own unique set of circumstances influenced by scale, geographic location, social, legal and political constructs (ibid). The IHA argues that its sustainability guidelines should be able to adapt to the specific context of each particular project (ibid). The above-mentioned initiatives emphasise the other core pillars that make up the triumvirate of sustainable development, the social and the environmental, where in the past the main focus was on economic aspects. These efforts indicate how engaged and committed ICID, ICOLD and IHA are to addressing the concerns about large dams raised in the WCD report.

3.3.3 Specific responses of NGOs and civil society groups

Some NGOs and civil society groups' response to the WCD report does not further discussions about the importance of large dams. The NGOs and civil society groups have called for a moratorium on the future construction of new large dams and the suspension of those still under construction until a review confirmed that they complied with the WCD's proposed strategic priorities and guidelines (WCD, 2000a; Gujja, 2001; IRN, 2001; Refaat et. al, 2001; DDP, 2003). The call for a moratorium was based on the WCD report's criticism that large dams disproportionately place a higher cost on local communities and the environment and are inequitable in benefit distribution, hence an indictment on large dams' performances over the years (ibid). By insisting on the moratorium and the implementation of the WCD recommendations, NGOs and civil society groups appear to have adopted an entrenched adversarial position regarding large dams.

The call for a moratorium on large dam development was rejected by other large dam stakeholders because it could curtail the socio-economic development of countries in the global South which are much affected by water, food, and energy-related development problems. The World Bank (2001) summed up other stakeholders' opposition to the NGO and civil society position when it said that implementing some of the WCD recommendations would amount to handing to local and indigenous people, NGOs and civil society the power to veto the future development of large dams and development programmes of national governments. Some NGOs and other civil society groups have capitalised on the disagreement over a moratorium on large dams and unceasingly campaign against their construction, especially in tropical developing countries.

The apparent success of these campaigns led the co-founder of Greenpeace, Patrick Moore, to observe the triumphalist posture of some environmental NGOs which boast of halting the development of about 200 large dams in recent years (Bill Durodie via e-mail, 24/02/2006 citing Patrick Moore). The implications of stopping the construction of these dams seems however to be lost on some NGOs and civil society as it may have deprived some developing countries with feasible sites for large dam construction and their people of the ability to meet their socio-economic development aspirations and needs.

Some NGOs also appear to be determining guidelines and operational principles for other stakeholders to abide by. For instance, in 2003 WWF released *An Investor Guide on Dams*, which outlines the criteria for sound water infrastructure projects using the WCD guidelines, a checklist to follow and 'financial pitfalls to avoid when investing in dams' (WWF, 2003). Another is the IRN's *Citizens' Guide to the WCD* which seems to encourage people to oppose the future development of large dams. The WCD guide is 'intended as a tool for people in their struggles for social justice and environmental protection' (Imhof et. al., 2002). The issuance of these guidelines appears to undermine NGOs' claim to be interested in dialogue with other large dam stakeholders on how to lessen large dams' negative impacts.

Some NGOs seem to keep watch over the policies of other stakeholders with regard to financing large dam projects. The paper *Policies and Practices in Financing Large Dams* assesses twelve commercial and three development banks'[9] funding mechanisms, policies and practices with regard to large-scale dam projects (Worm et. al., 2003). The assessment links the banks' funding to 23 large dam projects[10] deemed controversial because they faced strong NGOs opposition due to their perceived social and environmental consequences (ibid). Also, through the Global Policy Forum (GPF)[11] some NGOs took issue with the Equator Principles and argued that they themselves should be involved in assessing dams that need financing from members of the EPFIs (GPF, 2003). The GPF presumed that their involvement in the EPFI

[9] Some of the banks are: ABN AMRO Bank, The Netherlands; Barclays PLC, UK; Crédit Suisse, Switzerland; Crédit Agricole, France; Deutsche Bank, Germany; J.P. Morgan Chase and Company, United States; the Mitsubishi Tokyo Financial Group (MTFG), Japan; European Investment Bank, European Union; and the World Bank among others.

[10] Some of the dams they are associated with are: Bujagali Falls, Uganda; Nam Theun I and II, Laos; Urrá, Colombia; Caruachi, Venezuela; Maheshwar, India; Three Gorges, China; Birecik, Turkey; Lesotho Highlands Water Project (LHWP) - phase 1B, Lesotho; Ralco, Chile and others (ibid, 2003).

[11] 'Global Policy Forum's mission is to monitor policy making at the United Nations, promote accountability of global decisions, educate and mobilize for global citizen participation, and advocate on vital issues of international peace and justice. GPF responds to a globalizing world, where officials, diplomats and corporate leaders take important policy decisions affecting all humanity, with little democratic oversight and accountability. GPF addresses this democratic deficit by monitoring the policy process, informing the public, analyzing the issues, and urging citizen action. GPF focuses on the United Nations – the most inclusive international institution, offering the best hope for a humane and sustainable future' (GPF, http://www.globalpolicy.org/visitctr/about/introduction.htm (accessed 20/09/2007).

would create a multilateral forum similar to that of the WCD to ensure more meaningful and transparent implementation of projects because GPF members are capable of advocating best practice and standards in the application of the Equator Principles to project financing (ibid). Some NGOs like the IRN have characterised the World Bank's reengagement in water infrastructure development as 'reactionary, dishonest and cynical' (IRN, 2003). These confrontational approaches of some NGOs towards other large dam stakeholders undermine the purpose and outcome of the WCD process.

However, WWF has recently acknowledged that large dams can meet developmental needs and still cater for the environment and dam-affected people (WWF, 2007). According to WWF (ibid) the lack of progress in the large dam debate is partly because the methods of opposing dam construction have further widened the gap between large dams' opponents and supporters, 'removing any scope for genuine dialogue' (ibid: 1 and 2). 'Efforts to stop loans from the World Bank and other aid agencies for prominent projects have, for example, meant that some governments proceeded without external loans or did not even request support' (ibid), hence without the necessary environmental safeguards that could have been agreed between the funding and recipient parties (Mallaby, 2004). Engaging constructively with other large dam stakeholders could therefore ensure that some, if not most or all of the WCD recommendations are implemented.

3.4 Conclusion

The various responses of large dam stakeholders to the WCD report seem to have stalled the large dam debate. Scudder (2007, personal communication) said that this stalemate resulted from misinterpretations of the WCD report by pro- and anti-large dam groups using the report to suit their own interests. According to Scudder (ibid), the report did not give the power of veto to any group of people, including those affected by large dam construction. From this discussion of stakeholders' specific response to the WCD report I deduce that in contrast to the activism of some NGOs and civil society groups against new large dam construction, other stakeholders – financiers, builders, and governments – generally in favour of large dams have sought to move the WCD debate forward by ceding some ground and have reviewed their large dam development policies to include some of the WCD's recommendations.

CHAPTER 4

CAPABILITY AND FUNCTION OF LARGE DAMS VERSES ALTERNATIVES

This chapter analyses what dams can do technically versus what their alternatives can and cannot do. It relates more to the function of dams than to the ideologically-contested views of them discussed in the last chapter. The chapter assesses the key factors of water, energy, flood control and food that have historically been the basis for constructing large dams. It also examines new factors such as climate change and increasing climate variability, efforts to meet the MDGs, historical increases in the price of crude oil and other factors that were not dominant prior to the WCD's report about large dams but which now contribute to that debate. The analysis of these issues is situated within the concepts of sustainable development and modernisation.

4.1 Large dams, water, food, and energy

In the midst of stakeholders' ideologically-contested views about large dams a bleak picture of the world's water, energy, and food situation is emerging in reports and studies by international intergovernmental and independent institutions such as the annual FAO food security reports 2004, 2005 and 2006, the World Energy Outlook reports, 2005, 2006 and 2007 for the World Energy Commission/International Energy Agency and Gleick's *The World's Waters*: *Biennial Report on Freshwater Resources*, 2001, 2003 and 2005 which are less than optimistic about the world's future food, water and energy.

Despite some significant investment and improvement in recent times, guaranteeing accessibility to water, food, and energy is challenging. This is particularly so in the context of mounting concern about climate change impacts and global efforts to achieve the MDGs. The challenge to society to ensure the availability of water, energy, and food places an enormous burden on and tests the ingenuity, resourcefulness, inventiveness and creativity not only of those directly affected but also the global community to find ways to at least ameliorate the mounting impact of these problems.

It is argued that large dams could support food, water and energy provision for human development in response to the heavily-overdrawn groundwater resources and floods in many parts of the world (Altinbilek, 1999; White, 1999; ICOLD, 2001). One response to floods and groundwater depletion has been the construction of 45,000 large dams and many smaller ones in the last 55 years for irrigation and drainage, hydropower, drinking water supply, flood control and recreational opportunities, to improve on the quantity and quality of water for human use and development (ibid). This means that the depletion of groundwater resources and heavy floods could increase reliance on large dams to capture surface water for storage and the protection of lives and property.

For instance, it is estimated that in the latter part of the last century, floods claimed about 1.5 million lives (in some years about 100,000 lives), accounted for about 40 percent of all fatalities from natural catastrophes worldwide and caused damage worth about $231 billion – approximately GBP 125.5 billion at the 2006 exchange rate (see Footnote 3 for source) (Altinbilek, 1999; White, 1999). The impacts of too much or too little water on the lives and property of society are huge and extremely severe for vulnerable groups (ibid). This means that society needs some form of insurance against the extreme impacts of water which large dams could provide.

However, Scudder (2007, personal communication) cautions that using large dams for flood prevention requires strict adherence to operation and maintenance (O&M) procedures, including willingness to lower water levels in reservoirs before the onset of the rainy season and near-accurate rainfall forecasting. Failure to reduce reservoir water levels because of pressure to leave them full for hydropower generation and irrigation due to uncertainty about rainfall has been responsible for dam-induced floods in China, Nigeria, Mozambique, India, Vietnam, and the US (ibid). Another example is the unplanned releases of water from the Bagre dam in Burkina Faso, which flood northern parts of Ghana (ibid). Bergstrom (2006) has estimated that 'about one percent of all dams built in the world have failed' (ibid: 38) due to 'underestimation of floods, often in combination with technical problems' (ibid). Scudder's observation and Bergstrom's estimation of dams and floods, demonstrate that large dams are not always successful in dealing with floods but are in some instances the cause of floods because of unplanned releases of water which flood downstream areas and is exacerbated by the tendency of people to move onto floodplains, believing that the dams will keep them safe.

The provision of potable water is key to achieving the MDGs, and dams have contributed to significant improvement in the availability of drinking water in the past few years; 5.2 billion people, or about 85 percent of the worlds' population, now have access to potable water (UN/WWAP, 2003; Winpenny, 2003; UNESCO et al, 2006). But there are still about 1.1 billion people, mostly in the global South, who lack of access to water, and 2.4 billion without adequate sanitation (ibid). As a result of lack of access to adequate water and sanitation about 7 million of these people die every year of waterborne diseases, including 2.2 million children under the age of five (UN/WWAP, 2003; UNESCO et al, 2006). Problems of access to water and sanitation are predicted to get worse by the middle of this century because between 2 to 7 billion people in 48 to 60 countries are likely to face water scarcity, some caused by climate change and variability (Winpenny, 2003; UN/WWAP, 2003; WHO/UNICEF, 2005; UNESCO et al, 2006). In

circumstances of water scarcity large dams may well aid in meeting the aims of the MDGs by ameliorating the impacts of climate change and variability.

Generating hydroelectric power from large dams is another factor in the development imperative of large dams because they have made tremendous contributions towards improved global electric energy supply over decades. Presently hydroelectric power's share of the world electricity supply mix is about 20 percent, and enabled socio-economic development in several countries (World Bank, 2006a/b). Electricity from hydropower supplies more than 50 percent of national electricity in about 65 countries, more than 80 percent in 32 countries and almost all the electricity needs of 13 countries, increasing citizens' access to electricity and thereby safeguarding national security, economic growth and the objectives of the MDGs (ibid). This illustrates the significance and thus development benefits of large hydropower dams.

However, a significant number of people are yet to benefit from of large hydroelectric power dams because they have not been constructed on some technically and financially feasible sites in some developing countries. Consequently about 1.6 billion people do not have access to electricity and nearly 2.4 billion people still use traditional biomass fuels – wood, agricultural residues and dung – for cooking and heating worldwide (World Bank, 2006a), some 2 billion people have no access to electricity at all, about 1 billion people use uneconomic electricity supplies such as dry cell batteries, candles or kerosene, and an additional 2.5 billion in developing countries have no access to commercial electricity (UN/WWAP, 2003). The lack of adequate electricity for such a huge number of people exacerbates the energy, economic and social poverty that result from lack of electricity and has some impact on climate change.

A World Bank report aptly illustrates the implications of inappropriate energy sources for economies and several million livelihoods:

> *Low grade fuels and poor environmental controls in households, power generation, transport, and industry are leading sources of severe urban air pollution in the fast-growing cities of developing countries. Levels of suspended particulates and sulfur dioxide are highest in areas where extensive coal burning occurs. The people that rely on traditional biomass fuels for cooking and heating suffer from indoor air pollution, which is the fourth leading cause of illness and death in these countries, with women and children disproportionately at risk. Indeed, more than 80 percent of all deaths in developing countries attributable to air pollution-induced lung infections are among children under five. Indoor air pollution is estimated to cause the death of 2 million people a year, primarily young children and women, accounting for about 4 percent of the global burden of disease. Urban air pollution, primarily transport related, is responsible for upwards of 800,000 deaths globally each year. (World Bank, 2006a: 3)*

In the light of the above developing feasible large hydroelectric power dams could help to reduce this number of people without electricity by connecting the populations concerned to the power grid to achieve the MDGs and significantly reduce poverty by 2015 through improved living standards, increased productivity and opportunities in areas such as health and education, especially for women and children, through available and affordable electricity (IHA et al, 2000; OECD/IEA, 2002; DOE/EIA, 2004; UNIDO, 2006). Electricity from large hydropower dams for cooking and lighting may well reduce the impacts of low grade fuels and fossil fuels on health, livelihoods and climate change.

Another global challenge and a factor that affirms the development imperative of large irrigation dams is the need for adequate food to feed the growing world population and achieve the MDGs. The need for large irrigation supply dams is growing because climate variation has made reliance on rainfall for increased food production historically unsuccessful. It is estimated that about 60 percent of the future extra food required to feed some 850 million people who go hungry in the world will come from irrigated land (FAO, 2003; ICID, 2003; UN/WWAP, 2003; Winpenny, 2003). To meet the MDG target of reducing the number of hungry people to 610 million in 2015 – which is still short of the World Food Summit (WFS) target of 400 million – and reduce the number of 15,000 children's deaths a day from hunger and malnutrition, irrigation is seen as important (FAO/IFAD, 2006). Efficient and effective large irrigation dams are therefore required to achieve the hunger reduction objectives of MDGs and significantly affect the socio-economic and sustainable development of countries.

The enormity of the supply, access and security of water, food and electricity necessary for development are factors that influence the construction of large dams and are relevant today. New challenges such as climate change and increased global poverty, and attempts to address them through the MDGs, have made the need to address the water, food, and electricity gaps more acute than ever. In this context large dams might continue to play a significant part.

4.2 The foundation and building blocks of the large dam debate

Historically and contemporarily the need for water, food and energy security constitute the foundation and building blocks of the debate about the capabilities and functions of large dam technology, although in recent times large dams have come under increased scrutiny because of concerns about their social and environmental impacts.

Scudder (2005) traces the genesis of the large dam debate to the mid-1960s when dam industry researchers and practitioners raised concerns about their unintended environmental and social

consequences. In a series of forums, seminars, and conferences on dams and manmade lakes these social and environmental concerns crystallised as several presenters reported on the impact of large dams on the people, the environment and inequitable economic benefits in their locale.

Some of these seminars, forums and conferences were articulated in publications, including those by professional bodies. Among the publications (see Table 4.1 for detail) are those edited by Lowe-McConnell (1966), Leticia E. Obeng (1969), Ackermann et. al. (1973), Farvar et al (1973) which identify environmental and social problems connected with large dams and reservoirs. Consequently, the Committee on Water of the US National Academic of Sciences - National Research Council (NAS-NRC) (1966) report proposed some alternatives to water infrastructure development (cited in Scudder, 2005). The International Council of Scientific Unions' Scientific Committee on Problems of the Environment (SCOPE) report *Man-made Lakes as Modified Ecosystems* (1972) called for assessment of the full range of impacts and other options before reservoirs are constructed (ibid), and considered that water development planning should centre on the needs of the populace of a particular area rather than on water *per se* (SCOPE, 1972). Also recognised were that water resource decision-making processes required new institutional arrangements to deal with complexities, should be responsive to advances in science and technology, the availability of possible alternatives and the use of science and technology to evaluate these (ibid). This critique of large dams' environmental and social impacts became the basis for opposing large dam construction.

To further highlight the environmental and social impacts of large dam technology, NGOs and civil society groups used arguments in publications 1 to 6 in Table 4.1 to launch campaigns against large dams by linking 'environmental impacts with adverse health, socio-economic and human rights impacts' (Scudder, 2005: 6). These anti-large dam campaigns led to publications 7 to 11 (see Table 4.1), which criticised what was perceived as the notoriety of large dams and drew wide and high-profile attention to the environmental and social impacts they posed. The latter publications 'also questioned the extent to which justifying benefits forecast in feasibility studies were being realised' (ibid: 7).

These campaigns against large dam technology brought together a potpourri of international and local environmental, civil society and human rights groups to challenge large dam construction, especially in the global and tropical South. Ritvo (2003), for instance, traces the origin of environmental activism and campaigning against large dams to the late nineteenth century, when the people of Cumberland and Westmorland attempted to thwart the conversion of Thirlmere Lake into a reservoir to support industrial development and the growth of Manchester in 1876. They formed an *ad hoc* group known as the

Thirlmere Defence Association (TDA) and campaigned unsuccessfully against the construction of the reservoir (ibid). The TDA campaign is said to have inspired the Sierra Club in its campaign against the Hetch Hetchy Reservoir in California a generation later (ibid), and thus began the wider campaign against developing large-scale water infrastructures.

4.3 Social dimensions of large dams

The suggested social impacts of large dams – resettlement; compensation for land, houses, and crops to affected populations; loss of archaeological, traditional, and ancestral burial sites; impact on downstream livelihoods, and resettlers' emotional and psychological problems – are said to be among the issues that bring the imperative for large dams into question. These issues received less attention when dams were being planned and constructed in the past but are now seen as being of greater significance (Scudder, 2005).

The number of people displaced by large dam construction has come under severe criticism in recent years. Although there are no accurate data on this, the WCD estimates that the number of people affected is between 40 and 80 million (WCD, 2000a). However, resettlement literature, including that of the World Bank's resettlement review of displaced people in 1994 reviewed by Fernandes and Paranjpye (1997), Cernea (1997a & b), Jing (1999) and Scudder (2005) concludes that this number is a gross underestimation because large dam displacement accounted for 63 percent of total infrastructure-induced involuntary resettlement (ibid). Scudder (2005) believes that the lack of familiarity of most planners and practitioners with resettlement issues is the main cause of unsatisfactory resettlement planning and execution.

In a study of the resettlement outcomes of 50 large dams on five continents, Scudder (ibid) concludes that resettlement living standards improved in about 7 percent of all cases and 11 percent had their livelihoods restored, but the remaining 82 percent were worse off than before resettlement. In Thukral's *Big Dams, Displaced People: Rivers of Sorrow, Rivers of Change* (1992), most authors explicitly criticise the inability to effectively and satisfactorily manage large dam-induced resettlements in India (Mankodi, 1992; Singh and Samantray, 1992; Viegas, 1992; Singh, 1997). While Rich (1994) recounts how large dams in Brazil, India, Thailand, and Indonesia have led to displacement and hardship for several thousand people, Pearce (1992) refers to the Akosombo and Kainji resettlements as horror stories displacing 80,000 and 40,000 people respectively. Consequently, if the purpose of resettlement is to restore and improve the living standards of dam-affected people to better than pre-project levels, the inability to meet this target is a huge failure of large dam resettlement (Scudder, 2005).

Table 4.1: Publications and reports about the environmental and social problems of large dams

No	Name of Report	Organisation/Author(s)	Date Published
1	Alternatives in Water Management	Committee on Water of the US National Academic of Sciences - National Research Council (NAS-NRC)	1966
2	Problems Arising from Man-Made Lakes in the Tropics	Lowe-McConnell	1966
3	Man-Made Lakes, The Accra Symposium	Ghana Academy of Arts and Sciences/Leticia E. Obeng (Ed)	1969
4	Man-made Lakes as Modified Ecosystems	International Council of Scientific Unions' Scientific Committee on Problems of the Environment (SCOPE)	1972
5	Geographical Monograph on 'Man-Made Lakes: Their Problems and Environmental Effects'	American Geographical Unions/Ackermann et. al., (Eds)	1973
6	The Careless Technology: ecology and International Development	Farvar and Milton (Eds)	1973
7	Social and Environmental Effect of Large Dams	Goldsmith and Hildyard (Eds)	1984&1986
8	The Dammed: Rivers, Dams, and the Coming World Water Crisis	Pearce	1992
9	Mortgaging the Earth: The World Bank, Environmental Impoverishment, and the Crisis of Development	Rich	1994
10	Silenced Rivers: The Ecology and Politics of Large Dams	McCully	1996
11	Dams As Aid: A Political Anatomy of Nordic Development Thinking	Ursher (Ed)	1997

Source: Author with some data from Scudder (2005)

However, using the number of dam-induced displaced people and problems of resettlement as a basis for criticising dams has been challenged. For instance Varma (1999) argues that local politicians, NGOs and intermediaries are misleading and exploiting dam-affected people for their own ends by blaming the dam industry for resettlement problems while doing little themselves to aid displaced people, and he recommends that more effort should be made to effectively, judiciously and comprehensively implement the resettlement and rehabilitation of dam-affected people (ibid). It is therefore suggested that peoples' priorities, their socio-cultural frameworks and economics would enable them to achieve improvement in their standard of living by taking advantage of new economic opportunities in the areas of tourism, fisheries, and irrigation while at the same time preserving – to the extent possible – the social characteristics of their lifestyle (ICOLD, 1997; Varma, 1999).

Compensation for properties such as land, houses, and crops affected by large dams is undervalued and not transparent. Singh and Samantray (1992) and Viegas (1992) argue that people displaced by the Hirakud and Nagarjunasagar Dams in India were cheated of their compensation through underpayment. In some cases, compensation for properties forfeited to dam projects were either unduly delayed for several years or not paid at all (Viegas, 1992). Displaced people are also said to have been defrauded of their lands through the use of a law which allowed replacement of land lost to the project with other land around the project site by offering them about a quarter of their original land area (ibid). This led some displaced people to resort to the law courts for redress (Bhanot and Singh, 1992; Viegas, 1992). These problems are among the issues used to argue against large dam construction.

There are arguments that people uprooted from their ancestral land and resettled elsewhere suffer physical, psychological and emotional problems, particularly the elderly, women, and children (Scudder, 2005). The loss of archaeological and ancestral burial sites with important significance for traditional religious beliefs and cultural practices is also said to be a highly stressful experience for local and indigenous people (ibid). Accordingly, Scudder (ibid: 24-28) argues that there are four categories of stress associated with resettlements which have a huge impact on resettlers: physiological stress, which 'refers to the various health impacts associated with removal'; psychological stress relating to 'anxiety over the future' and the loss of home in the sense of 'community', 'surrounding landscape', 'historical accounts', 'myths' and 'religious symbolism'; socio-cultural stress, which is 'precipitated by threats to a community's cultural identity'; and multidimensional stress 'prevalent during the years that precedes resettlement, during physical relocation and during the years immediately after resettlement' and can continue for a while due to 'unsatisfactory outcome' (ibid). These physical, psychological and emotional stresses associated with large dam resettlements make them the antithesis of sustainability.

The stresses that resettled people experience are a 'totalising' experience that is 'the most acute expression of powerlessness because it constitutes a loss of control over one's physical space' (Scudder (2005), citing Oliver-Smith (2002), and Koenig (2001)). Resettlement stresses are said also to impoverish the people because they take away 'economic, social and cultural resources all at the same time', as also 'political power, most dramatically the power to make a decision about where and how to live' (ibid: 22). Scudder therefore argues that most 'educated and mobile professionals continue to be unaware of how stressful involuntary resettlement' could be 'for people with strong ties to their homes' and with 'little education and experience' outside their immediate area. He adds that academics – particularly those involved in resettlement – 'run the risk of underemphasising the trauma involved' in involuntary resettlement (ibid). The criticism about the traumatic impact of large dams on resettled people, though less researched, attracted attention particularly within the health sector and became an issue for the anti-large dam campaigners (ibid). The implication is that the psychological, physical, and emotional stresses suffered by resettled people outweighed the socio-economic importance of large dams.

Large dams are said to contribute to the destruction of the livelihoods of millions of downstream local people who depend on the annual and seasonal flooding of floodplains by flowing rivers for their sustenance. Downstream floodplains are used for flood recession agriculture to supplement rain-fed farms, riverine and floodplain fishing and fish farms, and they support livestock grazing in dry seasons (McCully, 2001). Scudder (2005) argues that the tendency to ignore or belittle the productivity of 'flood-dependent economies' against that of large dams is because planners usually misconceive their productivity by measuring it in terms of units of land instead of units of water, capital, and labour productivity, especially in cases where large dams for irrigation schemes are concerned. Overall, the impacts on downstream communities' livelihoods have rarely been factored into large dam development and this has led to their needs being neglected in large dam planning and implementation, denying them the right to compensation for loses incurred by large dam construction upstream (ibid). The impacts of large dams on the livelihoods of downstream communities undermine their significance and suggest that such communities would be better off without them.

It appears that the damage caused by large dams to local and regional societies results from factors that have either been inadequately considered or completely neglected by dam planners. These are resettlement and compensation for land, houses, and crops to affected local and indigenous people; loss of archaeological, traditional, and ancestral burial sites; impact on downstream people's livelihoods, and the accompanying emotional and psychological problems endured by resettlers. These social factors are still

relevant to large dam construction and need to be seriously considered in all large dam planning and execution, not added as an afterthought.

4.4 Environmental consequences of large dams

The impact of large dam construction on the environment is another reason that large dams are criticised. Some of these impacts are connected with: 1) ecological concerns; 2) fisheries; 3) sedimentation; 4) earthquakes; 5) greenhouse gas emissions and 6) salinisation and waterlogging. They are usually perceived as negative and are discussed in detail below.

4.4.1 Ecological impacts

Transformations in ecological structure both up- and down-stream of large dams are said to have accompanying hydrological and environmental implications. The complex nature of such ecological transformations have long-term impacts on the physical, chemical, biological and hydrological regimes as a result of changes in fluxes (inflows and outflows) which affect the water balance of the basin in which the dam is constructed (Szesztay, 1973). Ecological transformations also occur because artificial lakes created by large dams convert riverine ecosystems to lacustrian ones, which affects the biological productivity of floodplains (McCully, 2001; Scudder, 2005).

Uncertainty about the behaviour of aquatic ecosystems in artificial lakes and their impact on terrestrial ecosystems are two of the ecological concerns raised regarding large dams (Benson, 1973; Seaman, 1973). For instance, it is suggested that the poor presence of phytoplankton and zooplankton in the lake formed by Kainji dam could be attributed to the low concentration of nutrients and poor penetration of light (Visser, 1973). Bardach and Dussart (1973) observe the possibility of large dams being ‘instrumental in eliminating unique wildlife habitats’ and endangering the ‘survival of rare space-restricted species’ living in ‘best niches of wildlife’ (ibid: 813), as ‘most species of large and small game have territories, home ranges and feeding circuits associated with the main stream and/or its tributaries’ (ibid). Consequently the implications of the ecological impact of artificial lakes on aquatic and terrestrial ecosystems make large dams unsustainable.

However, Varma (1999) counters that the ecological problems associated with large dams are overstated. He suggests, for instance, that there is evidence that wildlife flourishes in the vicinity of reservoirs such as the Idukki hydropower project in Kerala, India, which provides water for wildlife already existing in nearby forest areas and has even attracted new species of birds and animals to the reservoir area (Varma, 1999). In the case of lost forest due to large dam construction, this forms an insignificant percentage of the

land area to be irrigated and is usually compensated for by reforestation of degraded land or by expansion in land area under forest cover over the reservoir and catchment area (ibid). For example, less than 12 percent of forest land has been lost to dam construction in India and constitutes about only two percent of the land to be irrigated by the dam project (ibid). Only 981,000 trees on about 4,523 hectares of degraded land would be submerged by the Sardar Sarovar Dam as opposed to the exaggerated estimate of 13,000 hectares (ibid). The Sardar Sarovar Dam will have 11 million trees planted as compensatory afforestation, a canal bank plantation and the wildlife and marine sanctuaries will be created (ibid). The above arguments imply that large dams can enhance the ecological diversity and environment of some rivers and are therefore ecologically sustainable.

There is a further argument that the ecological sustainability of large dams is being improved due to ESIA requirements. Detailed studies are carried out on large dams' effects on flora and fauna and mitigation measures are proposed before funding is approved and dam construction begins (ICOLD, 1997). Moreover, the integration of biodiversity issues – optimising the downstream flow regime and environmental flow releases – and productivity of large dams are part of contemporary large dam design (ICID, 2001; Varma, 2003) which might improve their sustainability.

4.4.2 Impacts on fisheries

The impact of large dams on fisheries forms another basis from which to question their sustainability. It has been argued that dammed rivers generally contain fewer fish species than in their original state due to physical and chemical changes, available food, spawning conditions and the inability to move up and downstream of the river (Lowe-McConnell, 1973; McCully, 2001). In the Jeziorsko Reservoir constructed over the Warta River in Central Poland, for instance, upstream and downstream fish production never reached the values of pre-impoundment in the four years from 1986 to 1989 after impoundment (Penczak, 1992). Downstream of the Kainji Dam in Nigeria there was also a decrease in fish catches from 19.6 mt in 1967 to 12.2 mt in 1969 at Jebba and from 27.9 mt to 10.9 mt at Pategi (Lelek and El-Zarka, 1973). Species loss and the declining productivity of downstream riverine and marine fisheries, the destruction of downstream spawning grounds and of estuarine and coastal aquaculture due to changes in river flow regimes are some of the impacts of dams on fisheries (Pentulu, 1973; Lelek and El-Zarka, 1973; McCully, 2001) which lead to the criticism that large dams are not sustainable in this regard.

But evidence as to whether large dams lead to gains or loses in fisheries is mixed. Varma (1999) reports that nutrients released from submerged rotten vegetation and soils in lakes created by increased populations of micro-organisms in dams have led to an expansion of fish populations that favour the new

conditions in reservoirs, which compensates for the loss of species and downstream fisheries. In the Volta Lake fish production has increased about tenfold from 6,000 mt to more than 60,000 mt between 1969 and 1970 (Lowe-McConnel, 1973). Latif and Rashid (1973) also noticed significant increases from 764 mt in 1966 to 4545 mt in 1969 in Lake Nasser fisheries following the construction of the Aswan High Dam. In the Nam Pong Reservoir on the Mekong River, the fish catch post-impoundment increased to 1,300 mt from what Pentulu (1973) refers to as 'negligible harvests in the stream prior to impoundment' (ibid: 677). The design of 'fish passes' – either 'steps', 'fish ladders', or by-pass channels – to aid the smooth movement of fish through the dam barrages are a response to the needs of migratory species, although they have not been entirely successful (van Robbroeck, 1999; Varma, 2003). Pentulu (1973) argues that fisheries need not necessarily suffer from large dam construction because '[with considerable effort in] planning and management the benefits from fisheries can be increased considerably' (ibid: 677).

4.4.3 Sedimentation problems

The likelihood of large dam reservoirs being overwhelmed by sediment is of concern to some opponents. Although the amount of sediment retained in reservoirs is dependent on several factors – including the ability to flush them out – the ultimate issue is its impact on the future and long-term performance of large dams. Instead of sediment from upstream fertilising and enhancing downstream floodplains' productivity, it is deposited at the bottom of reservoirs where it reduces the water retention capacity of reservoirs and their useful life and increase downstream erosion (ICOLD, 1999; McCully, 2001). Glymph (1973) therefore contends that sedimentation is a 'liability expressible as the lesser of either the cost of services foregone because of the sediment or the cost required to remove the sediment from the reservoir or to keep it out in the first place'. The impact of sedimentation on large dams and downstream areas is one of the reasons that large dams are said not to be sustainable.

However, new engineering techniques such as dredging and sediment flushing through specially designed outlets, sluicing and the prevention of erosion by maintaining the natural vegetation through minimisation of deforestation and wrong agricultural and other land use practices in both up- and downstream areas are addressing the concerns about sedimentation (ICOLD, 1999; Varma, 1999). Sedimentation may have some positive effects on reservoir habitats because sediment is deposited at the entry zone of reservoirs and provide highly diversified habitats for wildlife (ICOLD, 1999). In addition, when suspended solids (sediment) settle in a reservoir the water released becomes less turbid, thereby improving water quality downstream and making water treatment less expensive and easier (ibid). People living in downstream areas with clearer waters may benefit from enhanced recreation opportunities, improved local living conditions of riparian aquatic wildlife (ICOLD, 1999). Thus some level of sedimentation in large dams

might be appropriate for the purpose of the improvement of downstream water quality and wildlife habitats.

It is further argued that sediment in large dam reservoirs may act as sinks for soil organic carbon and therefore as net sinks for carbon dioxide (CO_2). There are two schools of thought about soil erosion-induced sediment in reservoirs. Agronomists think it is a net source of emissions, whereas other disciplines think it sequesters carbon in depositional sites and aquatic systems (Lal, 2007). In the latter case large dams may be carbon sinks which ameliorate the emission of CO_2 and its effect on global warming and climate change.

4.4.4 Greenhouse gas emissions

The possibility of large dams emitting greenhouse gases (GHG) is said to have undermined its claim to be a clean, renewable and reliable source of energy and therefore sustainable. McCully (2001) and Fearnside (1995) argue that the emission of methane and carbon dioxide from the 'dirty reservoirs' (McCully, 2001: 3) of large dams due to rotten vegetation are very significant, and cannot be classified or accepted as sustainable. Hathaway (2005) sees dams and reservoirs as globally-significant sources of GHG emissions because scientists have recorded emissions of methane or carbon dioxide or both in about 30 reservoirs – none identified – at which field studies were conducted. One of the theories about GHGs from reservoirs suggests that 100 percent of biomass in a reservoir would take about 100 years to decompose, with 20 percent of its carbon emitted as methane (WCD, 2000c). Hathaway (2005) argues that the impact on the climate of reservoir–based hydropower schemes in the tropics is worse than that of fossil–based alternatives. Galy–Lacaux et al's (1999) study of methane emissions 16, 17, and 31 years after construction of the Buyo, Taabo, and Ayame reservoirs in La Cote d'Ivoire also provides evidence that large dams are not GHG-neutral.

However, the argument that large dams produce GHG is inconclusive due to scientific uncertainty over the volume of net emissions based on very few restricted field studies of hydropower reservoirs (Rosa and dos Santos, 2000). The argument is that most GHG studies are short-term and only provide snapshots of reservoirs' mechanisms (Tremblay et. al., 2005). In a thematic review of the linkage between climate change and dams the WCD (2000c) acknowledge that some controversies still surround the issue of GHG emissions from large dams, particularly the extrapolation of measured emissions per m^2 in selected parts of a reservoir to the entire reservoir area (ibid). The review also recognises that emissions almost certainly vary according to depth and the distribution of the submerged biomass and water residence and flushing time. The WCD accepts the paucity of time series data that would have enabled the full lifecycle of

emissions to be characterised (WCD, 2000c). This is one of the bases for questioning the grounds on which large dams are said to emit significant GHG, making them unsustainable.

Despite the uncertainty about GHG emissions from dams due to lack of adequate data, Rosa (2001) and the IAEA (1996) argue that international research has confirmed that net GHG emissions from hydropower reservoirs are substantially less than those of fossil fuel generation – 35 to 70 percent less GHG per TWh than thermal. Varma (2003) and Tremblay et. al. (2005) pointed out that GHG emissions are site-specific and depend on the water quality, which is determined by the amount of biomass per hectare and varies according to climate. It has been estimated that reservoirs older than ten years emit GHG 'similar to natural lakes or rivers' (Therrien et. al., 2005: 250), although emissions from some tropical reservoirs might be higher and take a longer time – more than ten years – to level out (Delmas et. al., 2005). This requires a case-by-case assessment of GHG emissions from reservoirs (Rosa and dos Santos, 2000; Tremblay et. al. 2005) using a long-term approach – longer than 100 years – to better understand GHG dynamics (Tremblay et. al. 2005). For instance, a comparison of GHG emissions between a tropical hydropower reservoir – Petit Saut in French Guiana – extrapolated over its expected lifetime of 100 years and a thermal alternative showed that after emitting more GHG for the first 25 years, the GHG emissions from the reservoir levelled out and fell below the thermal fuel sources of coal, oil in 35 years, and gas in 57 years[12] (Delmas et. al., 2005). Even so the level of GHG emissions in tropical reservoirs could be reduced by clearing vegetation and harvesting commercial trees in the area to be flooded (ICOLD, 1999). Thus even if large dams emit significant levels of GHGs, there are mechanisms to reduce them.

Other arguments have been advanced to further counter the notion that large dams are unsustainable because they significantly contribute to GHGs. Spadaro et. al. (2000) argue that the use of analytical tools such as Life-Cycle Assessment (LCA) or Process Chain Analysis (PCA) – which deal with 'environmental burdens associated with the creation of a product by taking into account mass and energy flows at each stage of the procedure' – (ibid: 20); Input-Output Analysis (IOA) – which measures the 'indirect emissions attributed to the different economic sectors that contributes to the final product such as electricity used in processing, machine design, and labour' – (ibid: 20) and the Full Energy Chain (FENCH) calculations of different energy systems – which 'considers all the steps from "cradle-to-grave"'

[12] Although the authors acknowledge that there are great uncertainties in the calculations used to arrive at the figures because they used emission data from the first three years (1994-1997) of impoundment of the Petit Saut reservoir (Delmas, et. al., 2005), which are obviously very high, instead of using stabilised GHG emission data from the reservoir, I still believe that the comparison illustrates the long-term benefits of large dams for hydropower over some of their alternatives.

[in the] comparison of 'climate and environmental burdens of different technologies' – (ibid: 22) give different perspectives of GHG emission intensities of all electricity generation technologies. Data presented by Spadaro et. al. (2000) show that GHG emissions were lowest in nuclear plants. GHGs from hydroelectric power plants in the data were lower those from solar energy but greater than from wind energy, but when backups for intermittent technologies such as wind, solar and to a lesser extend hydropower are factored into the system analysis (ibid) wind energy GHG emissions are higher than those of hydropower (ibid). The analysis by Spadaro et. al (2000) implies that large hydropower dams' GHG emissions are lower than those of other electricity generation methods.

Some examples of how large hydropower reservoirs have ameliorated the impact of GHG emissions are discussed below. In Norway, the benefits of power generated by 51 hydropower plants from 1944 to 1998 have avoided the acid rain that would otherwise have been produced by approximately 380TWh of fossil fuel generated emissions of Carbon dioxide, Sulphur dioxide and Nitric oxide (Norwegian Institute for Nature Research et. al., 2000). Also the global population and environment gained from the Kariba Dam in Zambia which prevented GHG emissions from coal-fired generation of electricity (Soils Incorporated Ltd, Chalo Environmental & Sustainable Development Consultants, 2000). This suggests that GHG emissions from large dams are insignificant in comparison to their role in ameliorating the unpredictable impact of climate change on society by offsetting droughts and controlling flooding (Varma, 2003).

4.4.5 Dam-induced earthquakes

The possibility has been suggested of large dams inducing earthquakes either during the filling period or because of their weight on the earth's crust and the potential impacts of this on life, property, and nature. Rothe (1973) has catalogued earthquakes and shocks that occurred during and after the filling of dams around the world. These include the Hoover Dam and Lake Mead in the USA, which experienced a major shock of 5.0 on the Richter scale just a year after filling was completed; the Kariba Dam in Zambia, with a 6.3 major earthquake just a month after filling; and the Monteynard Dam in France with shock of about 5.0 on the day filling was completed. Other dam-induced earthquakes led to the destruction of property and life. The Italian Vaiont Dam caused the death of about 2000 people; the 6.2 magnitude earthquake at the Kremasta Dam in Greece destroyed 480 houses, injured 60 people and left one person dead; the 6.4 magnitude earthquake at the Koyna Dam in India caused the death of 177 and wounded 2,300 people (ibid). The key factors linking these dams are water column height and reservoir depth. Reservoirs with depths exceeding 100 meters are more susceptible to inducing earthquakes (Rothe, 1973). These

experiences of dam-induced earthquakes and the associated loss of life and property make dams unsustainable.

However, it has been argued that the number of large dams that have caused earthquakes is minuscule in comparison to the number of those that did not. For instance, out of 425 large dams studied recently only in 1.2 percent were seismic forces observed, but without any destructive potential (Altinbilek, 1999). Altinbilek adds that 44 earthquakes with a magnitude of more than 6 on the Richter scale have not affected any dams in Turkey since 1930 although 53 dams are located within the earthquake zone, because the experience and knowledge is available in the dam industry to address reservoir-induced seismicity (RIS) (ibid). The 300 meter-high earthen Nurek Dam located in a highly-seismic region in Russia withstood a seismic shock of 7.0 on the Richter scale without any damage (Varma, 1999), and the Aswan Dam withstood a magnitude 5.6 earthquake in 1981 (Osman, 1999), further illustrating engineers' knowledge of how to build in resilience to earthquakes. Varma (ibid) also found that out of 11,000 reservoirs only 60 (0.5 percent) were reported to have experienced RIS, highlighting technological advances in large dam technology.

4.4.6 Salinisation and waterlogging

Waterlogging and salinisation caused by over-irrigation, excessive seepage and sub-surface drainage are among problems related to large irrigation dams and led to criticism of large dams. Waterlogged and saline lands ultimately become unfit for cultivation, rendering irrigation projects –particularly those in the early stages – ineffective (Varma, 1999).

However, the area of waterlogged and salinised irrigated land is small compared to the general irrigated area. Available data indicate that the percentage of waterlogged area varies between 1.5 to 10 percent of the total area of various projects, and can be reduced further by management practices such as canal lining and adequate drainage networks (Varma, 1999; ICID, 2001). Because waterlogging and salinisation can easily be carried out through effective implementation and management of large irrigation dams, they should not impinge on the development imperative of large dams.

4.5 Economic implications of large dams

The economic benefit of large dams is a point of contention which revolves around their perceived benefits and costs. To critics, these benefits are overstated to make large dams attractive to investors and the public (Pearce, 1999; McCully, 2001). The benefits are also not equitably distributed because they favour industries and cities dwellers (ibid). Using the example of hydropower dams to elaborate on

overstating the benefits of large dams, McCully (2001) states that projected generation capacities are so grossly exaggerated that the dams never meet their stated targets. For instance, he claims that the Aswan dam was to generate about 10,000 GWh/yr of electricity but in fact generates 7,161 GWh/yr (ibid). In the case of irrigation, McCully (2001) and Singh (1997) argue that most irrigation areas are degraded, waterlogged and saline. The concentration of irrigated farms on cash and export crops to the detriment of domestic food crop production, coupled with low prices for agricultural primary produce on the world market because of reduced government subsidies for irrigated agriculture have severely curtailed production (ibid). This suggests that large dams' contribution to productivity is insignificant and exaggerated because they do not meet their anticipated targets.

Therefore McCully (2001) dismisses large dams' contributions to other economic areas. For instance, McCully calls that the argument that large dams control floods a myth because in some cases floods have worsened and large dams' contribution to water supplies in towns and cities is negligible (ibid). He also states that it is not the case that large dams improve river transport and the navigation improvements because small boats and canoes cannot safely travel on the lakes, that alleged increases in fishery catches from reservoirs are unsubstantiated and that the benefits associated with recreation are based on the vested interests of their promoters (ibid). These assertions imply that large dams have not been beneficial to society economically.

Inequity in the distribution of benefits is another criticism of the economic performance of large dams. McCully (2001) argues that most large dam beneficiaries are well-connected and resourced elites who are capable of paying for pipe-borne water, irrigation services and electricity from hydropower and flood control dams. In most cases local people are denied access to the benefits generated by dams although they pay the greatest cost for and are most in need of them (Singh, 1997). These perceived inequities in benefit distribution suggest that large dams are not entirely economically beneficial or sustainable.

However, the arguments that large dams have made an insignificant contribution to economic development are believed by Ersumer (1999) and Varma (1999) to be untrue. Comparing the performance of dams built for different purposes against one universal standard is arguably wrong, as the value of goods and services provided by each are different. Using Turkey's 678 large dams to illustrate their economic benefits, Ersumer (1999) states that large hydroelectric power dams create benefits worth $4 billion annually for the national economy compared to the possible loss of $40 billion the economy would suffer without them. Varma (1999) says that electricity generated from Hirakud Dam on the Mahanadi River in Orissa State in India has attracted steel, cement, paper, textile and other auxiliary industries and is

boosting economic development in the area, and new centres of advanced studies in engineering, medicine, and university have opened in the Orissa state because of the Hirakud Dam. These arguments imply that large dams bring significant direct and indirect economic benefits to the locations in which they are built.

Large irrigation reservoirs' performance in cash and staple crop production and financial returns are said to be consequential to the viability of irrigation schemes. Rice productivity at the Hirakud Dam in India is said to have increased from one to three tonnes per hectare and farmers' incomes from irrigated land have grown by more than 60 percent compared to those from non-irrigated land (Varma, 1999). Ersumer (1999) reports that Turkish farmers believe from experience that large irrigation dams bring prosperity and wealth. Therefore it is important that large irrigation dams are economically driven and managed (van Robbroeck, 1999). The benefits of increased income and productivity from large irrigation dams to farmers in Turkey seem to further demonstrate dams' economic contribution to development.

Large flood control dams have significantly prevented the destruction of lives and property. The Hirakud Dam in India, for instance is said to have moderated the 1961 and 1982 floods, which could have affected mostly economically disadvantaged people's lives, crops, and property (Varma, 1999). This implies that large flood control dams do not serve only the elite in cities because floods impacts are greater on the poor.

Criticism of large dam technology also relates to cost overruns against planned estimates. According to the WCD (2000a), large dams are plagued by cost overruns, construction delays and deficits in meeting stated targets. Pearce (1992) points out how the cost of the Yacyreta hydro plant in Brazil rose from $1.5 to $12 billion on completion. Singh (1997) finds that the costs of all large dam projects in India exceed their original estimates. Some of the cost overruns are attributed to foreign expertise, income and equipment, which devalue the benefits gained by developing countries from hydro projects but encourage rich countries to 'subsidise dam construction overseas with aid loans' (McCully, 2001: 135). For instance, the Diama and Manantali Dams used $784 million of their budgeted $800 million to pay expatriate firms, mostly from Europe (ibid). Dams' cost over-runs and delays lead generations of citizens and governments of developing countries into debt and perpetuate a vicious cycle of poverty instead of the prosperity promised by their construction (ibid).

However, it has been argued that cost overruns and delays are not limited to large dam construction because roads, tunnels and other large, medium and small infrastructural projects the world over

experience the same (van Robbroeck, 1999). In the UK, for instance, about 75 percent of state-funded projects were reported to be behind schedule (ICID, 2001). Cost overruns are dependent on not project size but on factors like management, market conditions, planning of resource allocation, extent and intensity of initial investigations, and the technology available or deployed: several small dam project costs also far exceed the original estimates (ICID, 2001). ICOLD (1997) explains that the costs of large dams are inclusive of impacts on the natural and social environments and are weighed against the project benefits – enhanced assets, project revenue, environmental compatibility, social advantages, the cost of selected alternatives and multi-purpose benefits that aid the entire economy.

4.6 Large dams as an abuse of technology

The construction of large dams as an antidote to water scarcity and climate variability is seen by some as an abuse of technology. Pearce (1992) argues that while large dam technology is 'barely tested in the landscapes of Europe and North America' they have been unleashed on 'very different and more vulnerable environments with reckless disregard for their possible consequences' (ibid: 134). It has been suggested that the building of dams stems from a mentality that 'sees water-scarcity problems as technological challenges' (Falkenmark, 1989a: 113). Although dam building was initially embraced as a long-term solution to generating clean and cheap hydroelectric power and irrigation for increased food production, it soon emerged that the lack of educated manpower and access to advanced technologies makes it unrealistic to develop more dams even if the funding were available (ibid). It is therefore seen as misguided to provide electricity and irrigation in places where they are not needed because there is already highly-productive farmland which benefits from seasonal floods on which the livelihood of millions of farmers and fishermen depend (Pearce, 1992). According to David Brower,[13] 'no work of man [has] violated nature as completely as irrevocably as a dam'; he asserts that 'all technologies are assumed guilty until proved innocent' (Pearce, 1992: 134/5; Mander, 2004). Therefore the proliferations of large dams, particularly in the global South, in the quest to develop and modernise is perceived as inappropriate because 'countries may have to rely upon alternative water strategies in order to support their development efforts' (Falkenmark, 1989a: 133).

There are some contrary views to those about large dams being an abuse of technology. It is suggested that the need for clean energy, increased food productivity and protection of infrastructure from floods depend on low-cost, cost-effective, multiple-benefit and high-impact solution technologies (World Bank, 2006b).

9. David Brower, who later became the head of the Sierra Club, is an environmental activist who led and transformed the Sierra Club, founded the Friends of the Earth, the John Muir Institute of Environmental Studies and the Earth Island Institute. He also helped to organise the Alliance for Sustainable Jobs and the Environment.

This requires the promotion of a wide range of technologies which includes large dams, which are perceived as both affordable and easy to maintain (Donkor, 2003). Consequently large dam technology is thought of as part of the compendium of available technology options required for socio-economic development.

4.7 Alternatives to large dams

The social, economic and environmental impacts of large dam technology and subsequent backlash led to the proposal of alternatives to their construction. For this reason the pursuit of flood control, water, energy and food security to meet developmental needs require the application of different mechanisms (Adams, 2001). Some proposed alternatives and mechanisms are outlined below in Table 4.2. Part 'A' of Table 4.2 deals with alternative mechanisms to large dams which require that existing large water infrastructures are utilised to their maximum by increasing efficiency with less emphasis on the development of new ones, while part 'B' outlines different scales of technological alternatives to large dams. Together, these are perceived as innovative, benign, sustainable, small-scale, locally-managed, technical, institutional and economic solutions to the world's water quality and quantity problems (WCD, 2000a; McCully, 2001; Jowitt, 2006).

Table 4.2: Proposed large dams alternatives and mechanisms

A	**Alternative mechanisms to water development**
1	increase efficiency in water use
2	intelligent water conservation
3	demand management
4	install new efficient equipments
5	appropriate economic and institutional incentives to shift water among users
6	increase efficiency in industry, agriculture and domestic use
B	**Alternatives water and energy technologies**
1	water-conserving land management
2	rainwater harvesting
3	shallow wells
4	low-cost pumps
5	micro dams
6	run-of-river hydro-systems
7	solar
8	wind
9	geothermal
10	hydro powered fuel cells
11	wave and tidal energy systems, hydrogen, and bio-
12	hydrogen cells
13	bio-fuels

Sources: WCD, 2000a; McCully, 2001; REN21, 2005; Flavin and Aeck, 2006; Jowitt, 2006.

4.7.1 Alternative mechanisms to water development

The backlash against large dams and investment in large-scale water infrastructure led to calls for shifts from supply management to demand management (Rijsberman, 2006) as water use is often characterised by high level of losses (Molle and Turral, 2004). Also, large dams and irrigation expansion encountered growing costs and environmental externalities, generating significant political opposition (Molle and Turral, 2004). Water demand management is defined as a "policy that stresses making better use of existing supplies, rather than developing new ones" (Winpenny, 1997). Water demand management uses a set of inducements that includes price incentives by making it a tradable commodity through the introduction of water markets, subsidies, quotas, conservation measures, treatment and recycling, awareness raising or educational programmes and establish river basin authorities that integrate the usually fragmented government responsibilities for water into a single authority responsible for a hydrographically defined area, the river basin (Molle and Turral, 2004; Rijsberman, 2006; de Fraiture and Perry, 2007). This means the "[b]etter use" of existing water resources which encompasses conservation measures to raise the efficiency of water use, but also the reallocation of water to users with higher economic and/or social benefits, thereby increasing the productivity of water (Molle and Turral, 2004).

It is in this vein that many water experts and professionals embraced and popularised the concepts of demand management (Frederick, 1993; Hamdy et al. 1995; Brooks, 1997; Winpenny, 1997). The concept of water demand management is based on the premise where the cost of providing water delivery service is recovered, serves as an incentive for efficient use of perceived scarce water resources and provide potential resources for further investment in water to benefit others in the society, in addition to participation of water users often through the establishment of forms of water user associations and decentralisation (Rijsberman, 2006; de Fraiture and Perry 2007) is what Gleick (2003) considered the 'soft path' approach to the utilisation and development of water resources.

Alternative mechanisms for agriculture

The application of the concept of demand management has been notably in the irrigation sector where water usage is said to be high and a waste. For instance it is argued by FAO, (1998) and WRI (1998) that two third of surface irrigation water never reaches plants due to heavy losses (cited in Molle and Turral, 2004). The WCD (2000a) argued that the considerable under-performance of large dam irrigation schemes is exacerbated by increasing competition for water which in turn highlights the inefficiencies in irrigated agriculture. Furthermore, irrigation systems with long conveyance lengths loss a disproportionate amount of water due to seepage in canals and thus never reaches the farmlands (ibid). In addition, inadequate

maintenance is a common feature of a number of irrigation systems, particularly those in developing countries (ibid). For instance, the WCD (2000a) citing a World Bank report said that an impact evaluation of 21 irrigation projects concluded that a common source of poor performance was premature deterioration of water control structures resulting from poor maintenance which reduces irrigation potential and affects the performance of systems. The seepage and poor maintenance often leads to salinity which affects approximately 20 percent of irrigated land worldwide (ibid). These situations are exemplified in countries like Nigeria where only 52 percent of irrigation from large-scale schemes was actually used in 1993 (ibid) and also in the combined Gezira-Managil schemes in Sudan where 126 000 ha had to be taken out of production due to sedimentation and weed growth in canals. It is to arrest some of these situations in the irrigation sector that demand management of water – the 'soft-path' approach - is an appealing concept that is embraced and popularised by Frederick (1993), Hamdy et al. (1995), Brooks, (1997), and Winpenny, (1997).

Consequently, the WCD (2000a) proposed that future assessment of alternatives to large irrigation dams will need to clearly consider improvements to the efficiency and productivity of existing irrigation systems, adaptation and expansion of local and traditional water management solutions, more co-ordinated management of surface and groundwater resources, and improvement of the productivity of rainfed agriculture before planning and implementing new ones. However, the utility of these options proposed by the WCD is site-specific and contingent on the techniques applied in the context of their effects on soil and water conservation (ibid).

Meanwhile, the concept of demand management and its application to irrigated agriculture, particularly the case of pricing water as a way to curb water use have been very controversial and problematic (Molle and Turral, 2004; Rijsberman, 2006). Though water pricing as a potential tool to help 'rationalise' water use in ways that increase the economic of both water use and allocation has met with some success in the domestic and industrial water sectors (Molle, 2007), he contended that the application of pricing mechanisms has so far failed to produce convincing examples in the large-scale public irrigation of developing countries (ibid). Therefore to Molle and Turral, (2004) demand management through pricing is often more effective in domestic water supply than in the agriculture sector because most interventions result in spatial shifts in water use rather that savings thereby increasing the water use of some users upstream to the detriment of downstream users. It has been subsequently argued by Pitman (2002) that though "pricing promotes efficiency and conservation… there are few successful examples because of the economic and cultural difficulties of putting a value on a natural resource" (cited in Molle and Turral, 2004) and the "yawning gap between simple economic principles… and on-the-ground reality (World

Bank, 2004 cited in Molle and Turral, 2004). Molle and Turral (2004) thus argued that that is why there are so few convincing cases where prices have curbed water use in large scale surface irrigation. Consequently, they concluded that the gains that can be achieved through demand management particularly in irrigated agriculture have been much over estimated and oversold (Molle and Turral, 2004).

Molle and Turral (2004) therefore posit that "rather than raising prices to deleterious levels, a both politically and socially unattractive option, the reasoned rationing of supply can generally be a more viable option." In this context they proposed that "fixing quotas appears to be more efficient and straight forward and allows maintaining a certain degree of formal equity providing the administrative arrangements for doing so are transparent and properly administered" (ibid). Therefore "supply management remains indeed the most effective way to reduce water use, and that in many cases supply augmentation cannot be avoided" (ibid). Furthermore, Allan (2001 cited in Tyler, 2007) argued that the "subsidization of irrigation water is widely attributed to the political importance of agricultural livelihoods, and to widely shared, socially and culturally constructed assumptions of access to water by rural populations" which makes it difficult for "sweeping policy reforms that would reinforce more efficient use of water" (ibid) possible. Adding that water reform such as demand management is not "driven by the relentless logic of environmental and economic analysis, but by political opportunism and social change" (ibid).

Energy and electricity alternative mechanisms

In a broader sense increased efficiency in energy could deliver improvement of energy and electricity services. The WCD (2000a: 151) argued that such improvement could occur through "demand-side management options" which concerns efficiency on the user side by metering for instance electricity consumption and "supply-side efficiency measures" (ibid) which is contingent on "how efficiently electricity is generated by centralised or local supplier and transmitted and distributed to users" (ibid). On both counts – demand-side management options and supply-side efficiency measures - these "represent an opportunity to reduce the need for electricity generation and consequently the need for large dams" (ibid).

The alternative mechanism of demand–side management of energy and electricity is based on the understanding that consumers will use less electricity and what is used is used more efficiently in residential, commercial, industrial and government sectors by the introduction of improved appliances, standards, cost and availability and consumer awareness and affordability (WCD, 2000a). In the view of the WCD (2000a) using efficient appliances will be adequate to avoid further investments in new supply source such as large dams and their associated environmental and social costs.

In the context of supply-side efficiency as an alternative mechanism to large dams, the WCD (2000a) argued that there are numerous technical and non-technical losses between the point of electricity generation and end-use destination such as consumption at the power station, step-up transformer losses, and transmission and distribution losses. Reduction in the high level of losses, estimated at about 35-40 percent between power generation to consumption can lead to considerable savings, and often defer the need for new supply sources like large hydropower dams (ibid). In India for instance electricity transmission and distribution losses could be reduced by 20 percent from the current 35 percent (ibid). Also, loss reduction in electricity generation is easier to implement than demand-side management (ibid). This implies that implementation of demand-side management options and supply-side measures as alternative mechanisms for energy and electricity could significantly reduce the need for constructing new large hydropower dams.

Water supply alternative mechanisms

Demand-side measures and supply-side options are also alternative mechanisms to water supply from large dams. Demand-side mechanisms influence consumption patterns among users. For instance water tariffs and rates are progressively raised for high level of consumption which leads to reduced water demand (WCD, 2000a). Also, significant reduction in water demand is achieved through the use of water efficient technologies, including regulatory standards for appliance and equipment manufacturers and subsidies to consumers to retrofit water-saving devices (ibid). In Denmark for example, per capita consumption dropped 24 percent over 10 years due to widespread adoption of water-efficient technologies, including toilets, showers, and washing machines (ibid). The recycled water could also be used for conventional sewerage systems and waste transport to reduce the significant proportion of high-quality domestic water used for such purposes (ibid). The use of recycled water and efficient technologies could serve as financial incentive for consumers to reduce their water demand if an effective and efficient yet cheap water metering system exists (ibid) thereby minimising the need for more large water storage reservoirs.

On the supply-side, reduction in leakages, prevention of illegal connections, in addition to alternative sources of domestic water supply such as rainwater harvesting through rooftops, tanks, and other methods are mechanisms that will reduce reliance and need for large dams (WCD, 2000a). Molle and Turral, (2004) observed that urban water losses through leakage in developing countries is between 30- 40 percent on average. Minimising such high level of leakages will lead to huge saving for both consumers and the

water authorities and by extension the need for large dams to provide portable water for growing urban centres.

4.7.2 Alternative energy sources

The electricity sources proposed as alternatives to large hydroelectric power dams are smaller-scaled projects such as micro dams, geothermal, solar and wind technology which are said to offer economic, social and environmental advantages over larger dams and are classified as renewable (McCully, 2001; REN 21, 2006). However, it is argued that the exclusion of large hydroelectric power dams from renewable energy sources 'cannot be justified on scientific grounds' (Egre et. al., 1999: 73). It is theoretically impossible to establish the difference between, for instance, hydropower and wind power, since 'both are forms of indirect solar energy' (ibid). They both 'convert [the] natural flow of unconcentrated energy in the form of wind or water into the useful form of electricity' and 'have a very short and efficient energy chain' (ibid). In this context Egre et. al.'s (ibid) argument is that large hydropower dams are renewable energy sources and should be treated as such.

Several perceived significant shortcomings about some of the proposed benign and sustainable alternatives to large hydroelectric dam technology have been identified. Jowitt (2006: 15) argue that the 'intermittent output characteristics of renewable energy supplies' and 'time-dependent nature of end-use electricity demand' limits the ability to integrate wind and solar energy into existing electricity systems or their use as stand-alone energy sources. It is also argued that wind energy systems, for instance, are located in remote areas – like some large hydropower dams – with poor grid interconnectivity access and distant from energy demand centres and subjected to intermittent supply (WCD, 2000a; Jowitt, 2006). These problems of wind and solar energy are compounded by environmental drawbacks such as endangering migratory birds, aesthetic ones such as obstructing coastal views and destroying landscapes, and noise impacts (van Robbroeck, 1999; WCD, 2000a). The problem is worse for wave and tidal energy systems because these are unlikely to operate in more hostile environments than wind turbines (WCD, 2000a; Jowitt, 2006). Some of these inadequacies show that the proffered alternatives to large dams have their own shortcomings which need to be addressed.

The technical credibility of large hydropower dam alternatives is questioned because of their current state of development. It is based on the fact that most of them – wave and tidal, wind and solar energy systems – are either still being developed, are not perfected, not mass-produced and therefore expensive (see Table 4.3 for cost differentials of renewable energy sources), and take up a large amount of ground space (van Robbroeck, 1999; WCD, 2000a; Jowitt, 2006). In the case of electricity from wind energy, for instance,

'two of the four wind speed regimes produce no power, calm air means no power, and gales faster than 25 meters per second (about 90 kilometres per hour) mean shutting down lest the turbine blows apart' (Ausubel, 2005: 5). The cost of generating electricity from wind – 5 to 8 cents/kwh for onshore and 8 to 12 cents/kwh for offshore farms is also expensive compared to large hydroelectric power at 3 to 4 cents/kwh (see Table 4.3) (REN21, 2008). Ausubel (2005) argues that solar energy efficiency is stuck at 10 percent because there have been no breakthroughs in 30 years. It costs between 12 and 80 cents/kwh depending whether it is roof-top Photo voltaic or concentrated solar thermal energy (see Table 4.3) (REN21, 2008). Jowitt (2006) and Robbroeck (1999) suggest that the cost of hydro-powered fuel cells is exorbitant, while bio-fuel requires a large area of land for production and releases carbon dioxide into the atmosphere. These arguments against the alternatives to hydropower, wind and solar energy imply that they are not more appropriate.

The environmental impact of smaller dams are said to be greater than those of larger ones and so they cannot be sustainable and credible alternatives. Van Robbroeck (1996) and Egre et. al. (1999) contrasted the energy and environmental impacts of some small and large hydropower dams and conclude that the impacts of a single large dam are much lower than the cumulative effect of several small projects yielding the same power-generating capacity (ibid). For example, the land area occupied by 50 projects with a capacity of 20 MW each would be greater than that required for a single 1000 MW project (Egre et. al., 1999). Smaller dams also lead to the disturbance of more rivers and wildlife habitats, increase floods if the dams are run-of-river schemes for hydropower generation and are incapable of meeting peak power demand, thus requiring supplemental sources of electricity whose impacts have to be considered (ibid). These examples of the impacts of small dams bring into question their credibility as sustainable alternatives to large hydropower dams.

Other suggested specific impacts of small dams are that 327 of the smallest reservoirs registered in the British register of large dams would be needed to replace the volume of the larger 382.8 million m^3 capacity Quoich Dam and would submerge an area 3.5 times that of of Quoich's 6705 ha (van Robbroeck, 1996). In South Africa, 422 of the smallest reservoirs in the register of large dams would be needed to replace 5,246 million m^3 of Gariep's volume with the area to be submerged 2.22 times larger (ibid). In India the smaller Girna Dam plus eight satellite storage reservoirs would cost 150 per cent more, occupy 60 percent more land and generate less energy than the proposed bigger Girna Dam in the Bahanadi Basin in Orissa (ibid). Smaller dams are also said to have higher evaporation rates than larger ones and to be more expensive to maintain but with a shorter life span, thus affecting long-term economic planning

activities (ibid). These comparisons of the impacts of dams of different sizes suggest that small dams cannot be said to be credible alternatives to large ones.

Table 4.3: Characteristics and costs of renewable technologies

Power Generation Technology	**Typical Characteristics**	**Typical Energy Costs (U.S. cents/kilowatt-hour)**
Large hydro	Plant size: 10 megawatts (MW) – 18,000 MW	3–4
Small hydro	Plant size: 1–10 MW	4–7
On-shore wind	Turbine size: 1–3 MW. Blade diameter: 60–100 meters	5–8
Off-shore wind	Turbine size: 1.5–5 MW. Blade diameter: 70–125 meters	8–12
Biomass power	Plant size: 1–20 MW	5–12
Geothermal power	Plant size: 1–100 MW Type: binary, single- and double-flash, natural steam	4–7
Solar PV (module)	Cell type and efficiency: single-crystal 17%; polycrystalline 15%; amorphous silicon 10%; thin film 9-12%	-
Rooftop solar PV	Peak capacity: 2–5 kilowatts-peak	20–80*
Concentrating solar thermal	Plant size: 50–500 MW (trough), 10-20 MW power (CSP) (tower); Types: trough, tower, dish	12–18†
Rural (off-grid) Energy		
Mini-hydro	Plant capacity: 100–1,000 kilowatts (kW)	5–10
Micro-hydro	Plant capacity: 1–100 kW	7–20
Pico-hydro	Plant capacity: 0.1–1 kW	20–40
Biogas digester	Digester size: 6–8 cubic meters	n/a
Biomass gasifier	Size: 20–5,000 kW	8–12
Small wind turbine	Turbine size: 3–100 kW	15–25
Household wind turbine	Turbine size: 0.1–3 kW	15–35
Village-scale mini-grid	System size: 10–1,000 kW	25–100
Solar home system	System size: 20–100 watts	40–60

"Note: Costs are economic costs, exclusive of subsidies or policy incentives. Typical energy costs are under best conditions, including system design, siting, and resource availability. Optimal conditions can yield lower costs, and less favorable conditions can yield substantially higher costs. Costs of off-grid hybrid power systems employing renewables depend strongly on system size, location, and associated items like diesel backup and battery storage. (*) Typical costs of 20–40 cents/kWh for low-latitudes with solar insulation of 2,500 kWh/m2/year, 30–50 cents/kWh for 1,500 kWh/m2/year (typical of Southern Europe), and 50–80 cents for 1,000 kWh/m2/year (higher latitudes). (†) Costs for trough plants; costs decrease as plant size increases. Source: See Endnote 18."
Source: REN21 (2008)[14]

[14] Data sourced from the National Renewable Energy Laboratory, World Bank, and the International Energy Agency and its various Implementing Agreements. Many current estimates are unpublished. No single published source provides a comprehensive or authoritative view on all costs. Changes in costs from the 2005 report edition reflect a

These criticisms of the alternatives to large hydroelectric dams have been recognised by some of those who proposed them. WWF (2007) and McCully (2001) acknowledge that small technologies proposed for electricity generation are not guaranteed to work and have undesirable social and environmental consequences. The promotion of technology-based alternatives to large hydropower dams is caught in Falkenmark's (1989a) trap of perceiving water and energy problems as technological challenges and are a repudiation of David Brewer's scepticism about technologies discussed in subsection 3.3. Alternatives to large hydropower dams may be equally susceptible to unknown and unanticipated future impacts.

It has been observed that in the discussion of alternatives to large hydroelectric power dams nuclear energy as a source of electricity is rarely mentioned by the opponents of large dams. Nuclear energy is perceived as the antithesis of sustainable development (NIRS/WISE, 2005; Jowitt, 2006; Bridle, 2006). The risk[15] of nuclear plants, nuclear waste, their economic cost and the emotions nuclear power evokes as a by-product of weapon programmes makes it unappealing as a carbon-free and renewable alternative to large hydropower dams (Jowitt, 2006; Lohr, 2006). James Lovelock[16] asserts that: 'Nuclear power is the only green solution' to the world energy crisis and is a sustainable alternative energy source to large dams (cited in Jowitt, 2006: 14). Other alternatives such as wind and solar energy are based on the interface between land area used and the average power intensity[17] (Ausubal 2005), and hinges on a 'Green credo' (ibid: 3) which argues against new infrastructure development. However, if new infrastructures are needed then they should be confined within the old infrastructures' footprints (ibid). Lovelock therefore contends that the power intensity of nuclear energy per square metre[18] is about 55,000 mega joules in contrast to about 5-6 watts for solar and wind energy, which require about 770 square metres of wind farm and 150 square kilometres and more for storage and retrieval of solar energy to generate the equivalent energy of 1,000 MWe of a nuclear plant (ibid). This implies that renewables like wind and solar energy as alternative sources of electricity use more resources than other alternative like nuclear energy.

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combination of refined estimates, technology changes, and commercial market changes. World Bank (2007b) for treatment of many technologies.

[15] According to Jowitt (2006), a series of serious accidents (such as at Three Mile Island in the USA in 1979, and at Chernobyl in the former Soviet Union in 1986), coupled with concerns following a succession of incidents connected with nuclear waste disposal and reprocessing, and more recently by the threat of world terrorism, seems to have undermined public confidence and support for the nuclear option.

[16] James Lovelock is an environmental scientist and creator of the Gaia hypothesis (Jowitt, 2006),

[17] The average power intensity – watts divided by land area (Ausubel, 2005).

[18] A nuclear power plant consumes about 10 hectares per unit, or 40 hectares for a power park (ibid).

Another dimension of wind and solar power as alternatives to large hydropower dams is that 'their development involves huge outlays of materials and energy before the plant is built' but they are 'environmentally friendly during power plants' operation' (Strupczewski, 1999: 23). Wind and solar energy require large and complex machinery during construction (Ausubel, 2005). Constructing a wind turbine operating with a 6.5 meters-per-second average wind speed requires 460 metric tons of steel and 870 cubic meters of concrete, compared to 40 metric tons of steel and 190 cubic meters of concrete per average megawatt of nuclear electricity-generating capacity; thus the infrastructure for wind energy uses 5-10 times the steel and concrete than nuclear (ibid, citing report by Per Petersen). In another context it is argued that,

> *[…] the amount of steel and non-ferrous metals needed per GWe.y[19] for solar systems are between 30 to 150 times larger than for nuclear power, and even the amount of concrete and cement is six times larger for solar than nuclear technologies. Moreover, the electricity requirements to produce all these materials and build the solar power plant are very large, reaching 30 percent of the total electricity that would be produced in the plant's lifetime. (Strupczewski, 1999: 23/24)*

Therefore Ausubel (2005) considers that scaling up wind and solar energy at this level of material consumption might not be sustainable.

The rate of development of the proposed alternatives such as solar and other renewables to large hydropower dams makes them incapable of achieving a financial competitive advantage, even if progress are extrapolated tenfold (Ausubel, 2005). The alternatives have only attained niches in the energy market and seem insignificant in the effort to provide the electricity power base for 8-10 billion people that will be required later this century (ibid). Jowitt (2006) and Bridle (2006) argue that it is important to consider a wide array of energy sources including hydropower and nuclear power to reduce GHG emissions from fossil fuels, which account for about 50 percent of pollution from energy production (OECD, undated cited in Strupczewski, 1999).

However, wind, solar and other alternative electricity sources have been denounced as gimmicks intended to marginalise the potential of large hydropower dams and promote the indispensability of nuclear energy (Scheer, 2004). This is because the claim of solar, wind and other alternatives to sustainability and renewability is said to be false because a relatively high volume of GHGs is indirectly emitted at various stages of processing and uses huge amounts of energy from fossil fuels (NIRS/WISE, 2005). Furthermore, the costs of nuclear power continue to rise despite the industry benefiting from huge subsidies over the last half-century (Scheer, 2004; NIRS/WISE, 2005; Jowitt, 2006). These arguments imply that nuclear energy cannot be an alternative to large hydropower dams.

[19] *GWe.y: Gigawatt of electricity per year.*

4.7.3 Irrigation alternatives

Alternatives proposed for publicly-owned large irrigation systems are varied. These are irrigation institutional reforms and the use of management tools to mitigate and minimise adverse impacts of irrigation and improve efficiency of existing irrigation systems (FAO, 1997; WCD, 2000a). The proposed structural alternatives for large irrigation dams are rainwater harvesting; developing individually-owned small-scale irrigation systems; sprinkler irrigation; micro-irrigation systems; treated wastewater reuse; treadle pumps; drip irrigation technology and importing food from other countries instead of seeking food self-sufficiency and security through increased domestic production (FAO, 1997; WCD, 2000a; WWC, 2000; NEPAD/FAO, 2002). The pursuit of these irrigation alternatives in conjunction with improving the efficiency of existing large dams would lead to decreased risk of waterlogging, less erosion and more efficient water use, thereby freeing water for other users and for a rapid increase in the land area under irrigation, providing farmers with the opportunity to sustainably raise their output and contribute to food security (Biswas, 1997; Djurfeldt et. al., 2005; OECD, 2006; ibid). These large irrigation dam alternatives are expected to improve on local food shortages and have a knock-on effect on global food security.

However, the above alternatives are said to be inadequate to meet the challenge of global food security. It is conceptually and practically difficult to reconcile the diverging short-term expectations of farmers with meeting the societal goals of long-term sustainable irrigation development (Biswas, 1997). Furthermore, micro-irrigation technologies are said to be capital intensive, which prevents their widespread adoption by smallholders in developing countries (WCD, 2000a). Also, Molle (2004: 10) argued that introduction of micro-irrigation, commonly held as a water-saving technology, has been shown to commonly lead to water depletion." In addition, importing food to meet domestic requirements is impractical because of the foreign exchange required and thus counterproductive to the income of small farmers in countries with large and poor rural populations (ibid). Consequently it is suggested that all forms of irrigation and water storage infrastructure are necessary to assure food security for personal, national, and regional economic benefits (Biswas, 1997; World Bank, 2004; Djurfeldt et. al., 2005). Therefore it appears inappropriate to eliminate large irrigation dams as part of the solution to food security problems, because the alternatives are incapable of solving the food security problems.

4.7.4 Flood control alternatives

Non-structural flood control alternatives are envisaged as more benign than large dams. These comprise the restoration of wetlands, floodplains and meanders (IRN, 2007; WCD, 2000a); small-scale storage of run-off; drainage improvement; managing catchments by protecting forests and afforestation; practicing

less intensive agriculture to reduce soil erosion and landslides; and integrating catchment and coastal zone management (WCD, 2000a). The use of these alternative flood control mechanisms could significantly eliminate the need for large flood control dam construction.

However, these non-structural alternative flood control measures may not be adequate to deal with the present threat of floods. The WCD (2000a) acknowledges that strategies for flood control need to be broadly complementary, based on both structural and non-structural means in the context of policy alternatives, technology and the capacity of people affected by floods to effectively cope with the situation (ibid). These approaches to flood control would use large dams as part of flood control systems where they offer the best option.

4.7.5 Water supply alternatives

Alternatives to large water supply dams are available to ameliorate the tyranny of large dam technology. Rainwater harvesting (Gould and Nissen-Petersen, 1999; WCD, 2000a; WWC, 2000); improved water efficiency in washing machines and water closet technologies; improved groundwater recharge through afforestation; desalinisation and recycling (Gould and Nissen-Petersen, 1999; Sutherland and Fenn, 2000; WCD, 2000a) would reduce the need for large water supply dams. The WCD (2000a) argues that community management of water supply systems can have a significant impact on coverage and efficiency. Applying the above alternatives could reduce need for the construction of large dams for water supply purposes.

However, the water supply alternatives proposed are not acceptable to Biswas (2004), who argues that the prevailing conditions of the locations under consideration should determine their efficiency (ibid). The water supply type so determined may be the construction of a large dam, a rainwater harvesting system, a mixture of the two or a combination of other water systems (ibid). So large water supply dams are permissible under certain circumstances.

4.7.6 Summary of subsection

The justifications for constructing large dams – water supply, food security, electricity, and flood control - are met with scepticism by those who believe that there are more benign and sustainable alternatives to meet these needs. These large dam alternatives are in turn met with equal scepticism by others who question their immediate viability and suitability to meet the growing demand for water, electricity, food and other large dam services (van Robbroeck, 1999; Clarke, 2000). Van Robbroeck (ibid) refers to the proponents of large dam alternatives – microdams, run-of-river hydro-systems, shallow wells, low-cost

pumps, water-conserving land management and rainwater harvesting – as 'starry-eyed'. Therefore large, medium or small scale dams and/or other alternatives such as rainwater harvesting and groundwater recharge could all be part of the solution required to ensure the development of countries faced with flooding, hunger, and disease (Biswas, 2004).

Biswas (2004) sums up the debate about large dams and their alternatives thus:

> *There is no one single solution that would be valid for a heterogeneous world, with differing climatic, physical, social, economic and environmental conditions; varying institutional, technical and management capacities; dissimilar institutional and legal frameworks for managing water; and divergent levels of development and available technology. No single paradigm can be equally valid for all these differing conditions, and this includes dams. What is needed is a systematic approach, where the main objectives of water developments are first identified, i.e., poverty alleviation, regional income redistribution, economic efficiency and environmental conservation. The best alternative available to achieve these objectives for the area in question should then be sought. The best solution may or may not include dams. In the field of water development, small is not always beautiful and big is not always magnificent. Solutions must be case-specific, and they could vary from one location to another, and even at the same location over time. There cannot be one, single, dogmatic, a priori answer of dams or no dams, in terms of optimal water resources development, which will suit all the different conditions of all the countries of this world, either at present, or for decades to come. (Biswas, 2004: 7)*

He adds:

> *The alternatives are not either/or, as the current debate would have us believe, but rather what alternatives will work best, where, and under what conditions. The discussions should be focused on how best to provide the water requirements of all segments of the society in the most cost-effective, efficient and reliable way, on a long-term basis. For the most part, the current debate on dams or no dams is an irrelevant one. What is needed is to assess the societal requirements for water, and then take steps to meet them in a socially acceptable way in the best manner possible. There is simply not one dogmatic solution that would fit all climatic, physical, social, economic and environmental conditions, for all countries of the world and for all periods in history. (Biswas, 2004: 7/8)*

Consequently, Molle, (2003) contended that

> *"Societal responses to scarcity of resources are driven not only by economic consideration or locally perceived needs. They must be understood in the wider political economic framework where costs and benefits are attributed to different categories of actors who, often, have antagonistic interests that are not even internally homogenous. The particular blend of responses selected by society at a particular point in time of its history to address water resources problems must therefore be understood within a framework that spans not only hydrological, physical or economic constraints but also the distribution of agency and power among actors, and their respective interests and strategies. (Molle, 2003:18)*

4.8 Conclusion

For many years large dams have been built and managed predominantly to maximise the quantity of available water for irrigation, water supply and energy perceived to be development imperatives. This has

led to significant social and environmental problems caused by large dam technology. It is in this context that alternatives are proposed to large dam construction. However, these alternatives also have weaknesses which undermine their viability and substitutability. The next chapter examines how large dams feature in Africa's development policy and political economy in the context of the broader global large dam debate discussed in this and the previous chapter.

CHAPTER 5

DEVELOPMENT POLICY AND THE POLITICAL ECONOMY OF LARGE DAMS IN AFRICA

5.1 Introduction

The commissioning, building, and operation of large dams in Africa are deliberate policy choices and at times politically-contested processes. Dams have been used since pre-colonial times in Africa to control river flows for socio-economic development (Harms, 1989; Adams and Anderson, 1988). Dam construction increased in the post-colonial era due to a combination of deliberate policy and improvements in technology (Adams and Anderson, 1988). This chapter analyses the policy choices and situational environments that influence large dam construction in post-colonial Africa and examines the past performance of some large African dams and their socio-economic impacts on the countries in which they are situated.

The situational and policy environments influencing large dam construction in Africa are determined by four major factors. These are: 1) the geophysical and hydrological conditions of the continent; 2) the prevailing economic development models or visions; 3) the politics of large dams and development in Africa, and 4) changes in water management and development paradigms. While the situational environment – factor 1 – is determined by natural characteristics and phenomena (Adams and Anderson, 1988; Harms, 1989;), the policy environment – factors 2 to 4 – is shaped by contested understanding of how the need for economic development and the provision of social services are to be achieved (Grove, 1993; Biswas, 2000). The combination of the situational and policy environments is said to have introduced a purposive large dam construction policy in Africa which is still found in the New Partnership for African Development (NEPAD) policy vision.

5.2 Large dams and the geophysical and hydrological characteristics of Africa

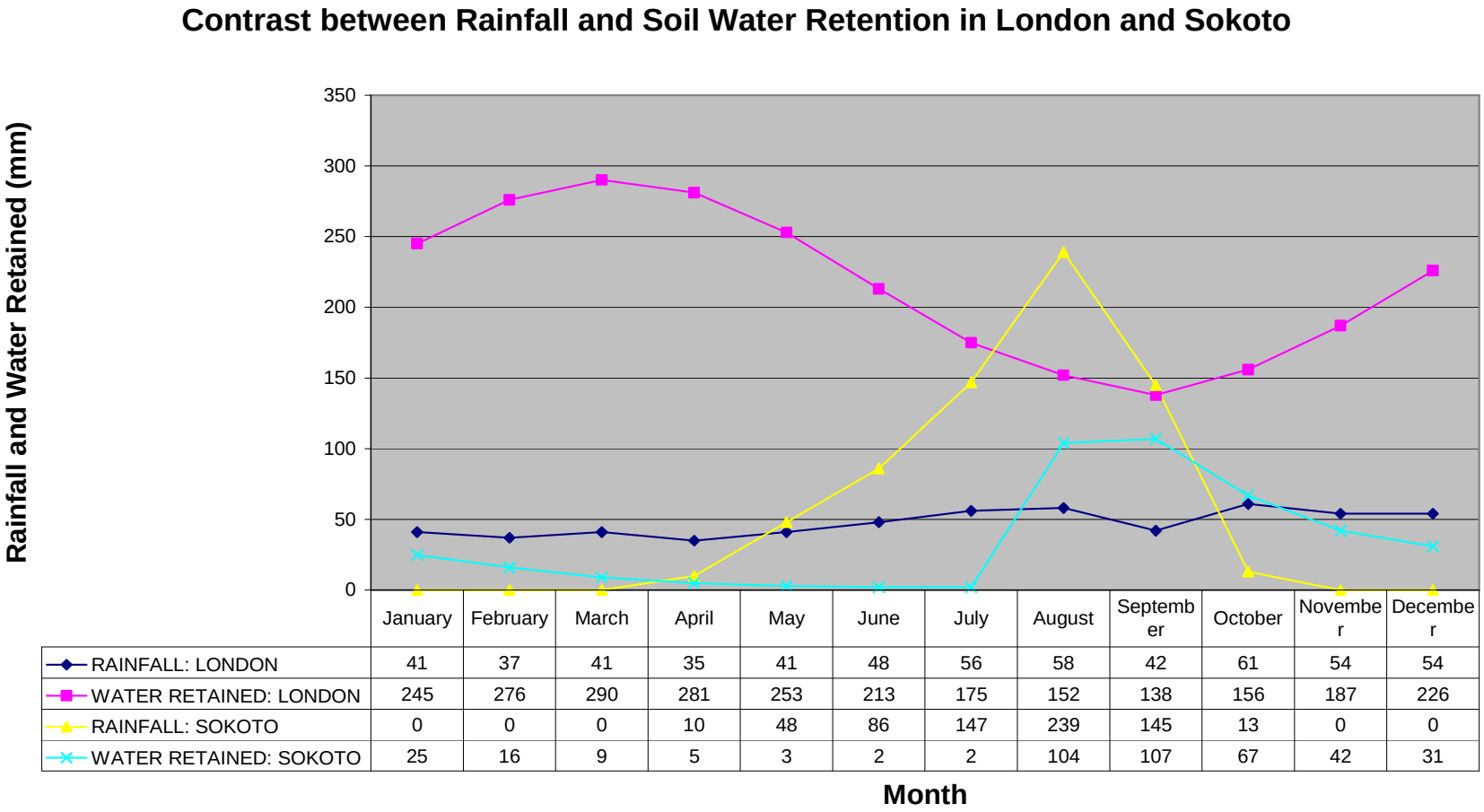
The geophysical and hydrology challenges facing Africa that influence large dam construction are rainfall, floods, river flow, soil water retention and temperature. Falkenmark and Rockstrom (2004: 109) elaborate on these challenges as ‘concentration of rainfall during one or two rainy seasons of 3-5 months; extreme high spatial and temporal variability of rainfall; high risk of meteorological droughts and dry spells; high intensity rainstorms resulting in high risk of storm surface runoff; and high atmospheric demand for water’. There are concerns that these hydrological and geophysical challenges – situational environment – will be further influenced by anthropogenically-induced factors such as GHG emissions.

Rainfall quantity and timing in Africa is the main determinant of livelihood and socio-economic development but is hydrologically unreliable. Falkenmark and Rockstrom (2004) claim that ‘average

rainfall' in Africa is an illusion, based on intra- and inter-year variability, but it is suggested as one reason for large dam construction (Biswas, 2004; World Bank, 2004; AWV, 2000). Rainfall deficiencies in 1970-1973, 1980-1984, and 1990-1993 due to huge inter-annual fluctuation led to severe droughts and associated humanitarian crises in Sub-Saharan Africa (Falkenmark, 1989a; Grove, 1993; IHP/UNESCO, 2002), causing a region-wide 'emigration of [millions of] environmental refugees' (Falkenmark, 1989a: 112). The first two years of the 1990-1993 droughts, for instance, rendered about 174 million people chronically hungry in Africa (NEPAD, 2005) and exposed the continents' extreme vulnerability to climate change. Large dams could mitigate the unreliability and livelihood impacts of African rainfall.

The variability of Africa's rainfall is brought into sharp focus by Ormerod's (1978) comparison of rainfall in London, UK to that of Sokoto, Nigeria. As illustrated in Figure 5.1, whereas London's monthly rainfall rate is reasonably uniform – from a 61 mm high in October to a low of 35 mm in April – over 92 percent of average rainfall in Sokoto occurs between the months of June and September, with the August recording the highest at 239 mm (ibid; Biswas, 1984). The wide differences in rainfall variability between a temperate country, the UK, with 517 large dams (ICOLD, 2003b) and a consistent level of rainfall, and a tropical country, Nigeria, with huge rainfall variability and only 54 dams (ibid) appears to justify the need for large dams in Africa.

Another major geophysical and hydrological challenge that suggests that large dams are imperative is the flow regime of African rivers, which is uneven as the depth and speed of water are subject to great inter-annual fluctuation (Church, 1968). Consequently about 70 to 80 percent of surface water is discharged into the sea annually, experience high seepage and evaporation and leave most African rivers dry for three to six months a year (Watt, 1968; Church, 1968; Grove, 1993; Gupta 1998). The variability in the African river flow regime, the huge discharge into the sea and evaporation form the situational environment that leads to the argument that excess water could be stored to be put to beneficial use.



	January	February	March	April	May	June	July	August	September	October	November	December
RAINFALL: LONDON	41	37	41	35	41	48	56	58	42	61	54	54
WATER RETAINED: LONDON	245	276	290	281	253	213	175	152	138	156	187	226
RAINFALL: SOKOTO	0	0	0	10	48	86	147	239	145	13	0	0
WATER RETAINED: SOKOTO	25	16	9	5	3	2	2	104	107	67	42	31

Source: Data from Ormerod (1978)

Figure 5.1 Rainfall and Water Comparison between London, UK and Sokoto, Nigeria

The need for large dams in Africa is based on the situational environment of soil water retention, because the amount of soil water retained over long periods is paramount for agricultural productivity and ecological functions of the soil. However, soil water retention in Africa is a significant problem for the continent's socio-economic development. Ormerod's (1978) comparison of soil water retention in London and Sokoto (see Figure 5.1) shows that Sokoto's highest soil water retention is 107 mm against London's 290 mm. Given that annual average rainfall for Sokoto and London are 688 mm and 568 mm respectively (ibid), soil water retention in the two areas should be similar. But the higher annual average rainfall in Sokoto does not translate into higher soil water retention, firstly because of the high soil temperature in African countries in 'hydrologically marginal zones' (Falkenmark, 1989b: 197) where 'practically all rain returns to the atmosphere by immediate evaporation from wet soils and foliage or by transpiration as part of the plant production process' (ibid), leaving a very small amount to recharge ground water and rivers (Falkenmark, 1989b). Secondly, Africa's soils have an overall low organic content of several compounds of humic and fluvic acid types (Schnitzer, 1976; Schnitzer, 1977 both cited in Biswas, 1984; Biswas, 1984). According to Ormerod (1978):

> *…high temperatures, long periods of drought, intense ultraviolet radiation and particularly high kinetic energy rainfall, which destroys the granular structure of soil, decrease the activity of soil micro-organisms so that there is little possibility in open land for the stable organic content of soil to build up; indeed there is a tendency to destroy. (ibid: 360)*

The low level of African soil water retention is an additional reason why it is argued that large dams could be beneficial to Africa's socio-economic development.

Flood is the last of the situational environments which influence support for large dams in Africa. Flood frequency and severity in Africa have increased in the past 30 years and led to the death of humans and livestock and the destruction of properties (Biswas, 1997; ICOLD, 2005). Over the past ten years Africa has experienced nearly a third of all worldwide water-related disaster events, with 20 percent of nearly 135 million people affected by floods (Unknown, 2004). For instance, floods in southern Africa seriously undermined the economy of the country in 2000, left about 850,000 people homeless and killed almost 1,000 (Unknown, 2004; Les de Villiers, 2006). Flood control systems are required to protect lives and investments (ICOLD, 2005). The human and financial impacts of floods support the argument for large dams in Africa's development.

These situational geophysical and hydrological factors – river flow, rainfall, soil water retention and flooding –provide some legitimacy for large dams in Africa (Palmer-Jones, 1987; Grove, 1993). This is why an estimated two-thirds of large dams built in the 1980s serve to control and regulate the flow of rivers for socio-economic activities, and the majority of African rivers with suitable sites are under

consideration for dam construction (Smith, 1968; Grove, 1993). However, Bergeret and Bister (2003) and Szesztay (1973) argue that dam building should be based on the answers to a quartet of questions; why, where, when, and how to construct dams in order to aid in the achievement of their intended benefits without much destabilisation of the hydrological cycle. More large dams will not automatically address the geophysical and hydrological challenges of Africa (ibid). Providing answers to the four questions above leads to the political and policy dimension of large dams in Africa, which is discussed in the next sub-section.

5.3 Large dams and Africa's development

The imperative of large African dams depend on three benefits, electricity, irrigation, and water supply, that African leaders believe could further socio-economic development (Biswas, 2004).[20] Africa's water resource infrastructure expansion (Grove, 1993; Gleick, 1998) is said to provide three benefits to support the sustainable growth of a nationally integrated economy (Biswas and Tortajada, 2001; Altinbilek, 1999; Varma 1999). Multi-purpose large dams have a higher utilitarian development benefit because water usage is assumed to be maximised in projects which are combined and operated together rather than standing alone (Biswas, 2004), as Figure 5.2, below, shows. So large dams on African rivers are perceived as economic entities to be mobilised for agricultural and industrial development (D'Souza, 2004).

Reflecting the development process in Africa, about 1,272 large dams[21] – 66 percent for irrigation,[22] 25 percent for water supply and 15 percent for hydropower – were constructed in Africa in the last century, with the majority commissioned in the decade 1985-1995 in four countries[23] (Church, 1968; Grove 1993; Altinbilek, 1999; WCD, 1999; IWPDC, 2006). They comprise some of the world's largest dams by height in metres (see Table 5.1). The rapid construction of large dams in Africa as a development imperative is captured by Oliver-Smith (2001) who succinctly observes that:

> *[a]dopting both the rhetoric and practice of the development industry, post-colonial nations have worked assiduously to expand […] through major investments in infrastructure […] national priorities based on the ideological constructions of a utilitarian nature. (Oliver-Smith, 2001: 14)*

[20] Flood control is not included because dams constructed for the other three purposes perform the function of preventing flooding; also no large dams have been constructed in Africa for the sole purpose of preventing flooding.
[21] 81 percent of these were single-purpose dams (IWPDC, 2006).
[22] The most irrigated countries are Egypt, 3.3 million ha; Sudan, 1.9 million ha; South Africa, 1.27 million ha; Morocco, 1.25 million ha; Madagascar 1.1 million ha. The least irrigated countries (less than 5000 ha under irrigation) are Djibouti, Botswana, DR Congo, Gambia, Liberia, Lesotho, and Rwanda (WCD, 1999).
[23] The countries with the most dams are South Africa (539), Zimbabwe (213), Tunisia (133), and Algeria (107), (WCD, 1999; IWPDC, 2006).

Table 5.1: Largest dams in Africa by height in meters

Name of Dam	River	Purpose	Country	Height (m)
Katse Dam	Zambezi River	Irrigation/Hydropower/ Water supply	Lesotho	182 m
Cahora Bassa dam	Zambezi River	Hydropower	Mozambique	171 m
Hassan 1	Lakhdar River	Electricity/ Irrigation/ Water supply	Morocco	145 m
Akosombo Dam	Volta River	Hydropower	Ghana	134 m
Bine El Ouidane	El Abid River	Irrigation/Hydropower	Morocco	133 m
Kariba Dam	Zambezi River	Hydropower	Zambia/Zimbabwe	128 m

Source: Data from (Chaponniere and Smakhtin, 2006; UNEP, 2006; World Bank, 2003; WCD, 2000a; WCD, 1999; Coyne et Bellier, 2006).

The antecedents, achievements, failures, and future of the three benefits of large dams – electricity, irrigation and water supply – in Africa's development are reviewed in the next subsections. However, the review is limited by the significant absence of post-large dam construction impact assessments (Biswas, 2004). This includes the vaunted WCD large dam assessments which, Biswas (ibid) claims, lack rigorous peer review, are neither objective nor comprehensive and are skewed to prove the 'dogmatic and one-sided views of the studies' authors', and 'irrespective of the current rhetoric' are of 'very limited use to the water and development professions' (ibid: 10).

Despite the absence of post-large dam construction assessments, current and future large dam projects in Africa (see Appendix 5.1) are discussed in relation to their compliance with NEPAD's key principles of good governance, participation, and regional integration (NEPAD, 2004 & 2001);[24] policies on involuntary resettlement, ESIA certification for projects funded by multi- and bilateral sources and broad stakeholder participation (Linaweaver, 2002; Mason, 2003; World Bank, 2003 & 2002). These principles and policies encourage accountability by project executing institutions (Lockwood, 2005). The lack of accountability in some past development projects is the major cause of their failure in Africa (NEPAD, 2001).

[24] The full complement of NEPAD's key principles are: 'Good governance as a basic requirement for peace, security and sustainable political and socio-economic development; African ownership and leadership as well as broad and deep participation by all sectors of society; anchoring the development of Africa on its resources and the resourcefulness of its people; partnership between and among African peoples; Acceleration of regional and continental integration; building the competitiveness of African countries and the continent; forging a new international partnership that changes the unequal relationship between Africa and the developed world; and ensuring that all partnerships with NEPAD are linked to the Millennium Development Goals and other agreed development goals and targets' (NEPAD, 2003/04: 12/13).

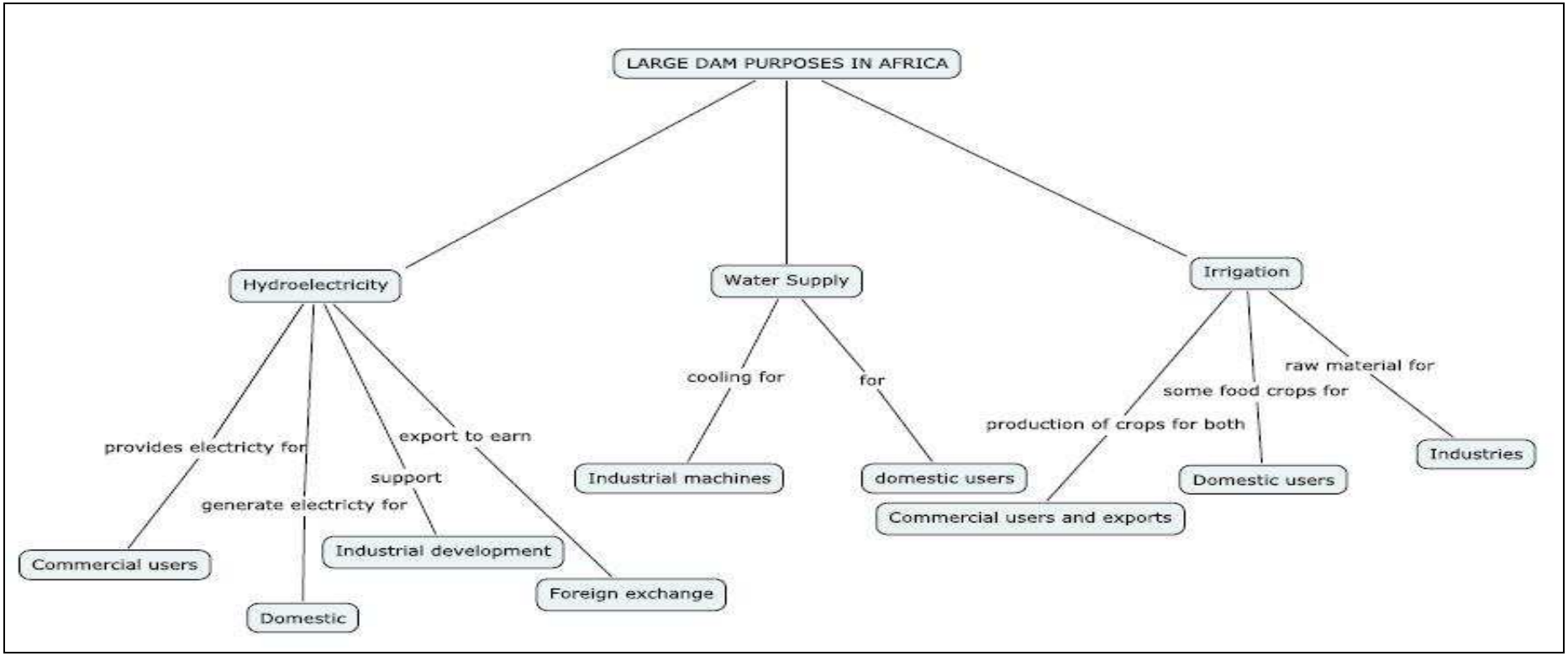


Figure 5.2: Inter-relational roles of large dams in development

The additional indicators against which the performance of electricity, irrigation, and water supply dams are analysed and evaluated are efficiency (economic performance and delivery of expected benefits in aggregate); equity (appropriate conflict resolution, resettlement, compensation, access to benefits, and opportunities for the disadvantaged); and sustainability (evaluation of benefits relative to environment and social impacts, capacity of the state to maintain infrastructure and maximise delivery of benefits).

5.3.1 Electricity in Africa

Electricity has overriding importance for countries anxious to accelerate their economic development and achieve a better quality of life (Elkan and Wilson, 1968; Biswas, 2006). Without the provision of ample, reliable, sustainable and affordable electricity to help address poverty, inequality, and environmental degradation, Africa's economies cannot develop (Mandil, 2005; and NEPAD, 2005). But Africa suffers from energy poverty because many Africans depend on traditional fuels – wood, plant residue, and animal dung – and over 90 percent of the population lacks access to modern energy supplies, which are also unevenly distributed (WEC, 2003). The lack of access to modern energy in Africa leads to energy 'entitlements failures' (Sen, 1984) – the inability of the poor to afford access to and use of energy resources even when they are available – thereby affecting Africa's socio-economic development and the population's quality of life.

Large hydroelectric power dams are, then, perceived as development solutions to some of Africa's energy poverty. Biswas (2006) and Church (1968) argue that some African countries prefer hydroelectric power to other sources of energy because of the perceived comparative advantages for Africa's economic and social transformation, energy security, the lack of which feeds into the cycle of poverty and the devastating socio-economic impact of the 1970s energy crises (Grove, 1993; Mandil, 2005) and lack of realistic alternatives. This implies that large hydropower dams could significantly improve the energy supply and by extension the socio-economic development of Africa.

Another reason why hydroelectric power is favoured as a development imperative in many African countries is because the continent's huge hydro capacity is underexploited. The expected 150 TWh/year hydropower generation in 2010 represents an increase of 83 TWh/year from the 1995 level (IJHD, 1997; WPDC, 1995) and constitutes only 7 percent of Africa's hydro potential, compared to Europe's hydropower usage of 75 percent and the Western world in general's 80 to 85 percent (WWDR, 2003; Gupta, 1998).

However, large hydropower dams in Africa have not always been successful due to the complexity of issues such as efficiency, equity and sustainability. The 700 MW, £100 million Kariba Hydroelectric Dam in Zambia (Church, 1968); the 72 MW Muela hydroelectric power component of the US$1.5 billion phases 1A and 1B of the Lesotho Highlands Water Project (LHWP), downstream of the Katse Dam (Tromp, 2006; Croucamp et. al. 1999) in Lesotho; and the US$500 million, 250 MW Bujagali hydroelectric power project in Uganda illuminate the complexities of large hydropower dams, as summarised in Table 5.2.

While the expected benefit of the Kariba Dam was premised on assuaging the electricity crisis for mining, commercial farming and domestic consumption in Zambia and Zimbabwe and on ceasing using coal for electricity generation (Church, 1968; Grove, 1993; WCD, 2000; Scudder, 2005), that of the Muela Hydroelectric Station was to attain energy security for Lesotho (Croucamp et. al. 1999; Tromp, 2006) (see Table 5.2 for development imperative summary). The decision to switch from coal to hydroelectricity at the Kariba Dam appears to have had huge implications for climate change, although this was not a factor in the decision to build the dam.

Three reasons are ascribed to Kariba's apparent benefits in Zambia. Firstly, industries and mines which depend on its electricity have provided over 80 percent of Zambia's national income for almost two decades (Grove, 1993). Secondly, the dam attracts and generates income from about half a million tourists to Zambia each year (WCD, 2000). Finally, the resettlement of the Tonga and We people improved their living standards because they had access to year-round farming and fishing around the Kariba dam in Zambia (Church, 1968; WCD, 2000). The benefits of Kariba to resettlers in the areas of fisheries and drawdown farming warrant replication by other large dam projects (Scudder, 2005).[25] The Kariba Dam benefits reflect the 72 percent stakeholder's favourability rating of the dam (Soils Incorporated and Chalo Environmental and Sustainable Development Consultants, 2000), implying that it is hugely valuable.

However, the Kariba Dam has its downside as well, as summarised in Table 5.2. Firstly the capital-intensive fishing in Kapenta, in Kariba's reservoir, excludes local fisherfolk in favour of commercial fishing enterprises (Soils Incorporated and Chalo Environmental and Sustainable Development

[25] Scudder (2005) thinks that drawdown farming could be significantly improved, and proposes two ways to do so. Firstly, a simple hydrological model could be formulated to allow government to advise farmers on an annual basis of when drawdown can reliably be expected, to begin an experiment with potential food and cash crops for the drawdown areas. Secondly, two-tier zoning, with the first tier legalising the Gwembe Tonga communal ownership of the drawdown area so as to restrict its privatisation by immigrant entrepreneurs and local elites. The second tier, which would be within the village area, to consist of zoned land for agriculture and grazing and possibly joint tourism and game management ventures with the private sector.

Consultants, 2000). Secondly, about 90 percent of Zambians depend on wood and charcoal for their energy needs due to limited electricity coverage, as apart from Binga a Tonga settlement in Zimbabwe, no other resettlement has been provided with electricity (ibid; Grove, 1993). In this circumstance the Kariba Dam is of little use to those who do not benefit from its services because the distribution of benefits appears to be inequitable.

In the case of the Muela Hydroelectric Station, the development goal of attaining electricity self-sufficiency failed to materialise (Tromp, 2006). The station's inability to provide sufficient electricity for Lesotho is compounded by problems of recovering basic administration, operation, and maintenance costs, which were not factored into its original project appraisals (ibid). In this context the station does not appear to be beneficial because it has failed to deliver its objective.

However, if Muela is viewed in the context of the entire economic activity of the Lesotho Highland Water Project (LHWP) it may be beneficial to Lesotho. The LHWP accounted for 13.6 percent of Lesotho's GDP, 35 percent of added value in building and construction, and 27.8 percent of government revenue in 1998 (Croucamp et. al., 1999). This income enabled Lesotho to support poverty reduction, employment creation and income generation (Croucamp et. al., 1999; Tromp, 2006); and Scudder (2005) considers that the general macro-economic goals are achievable. So in the wider context of the LHWP, Muela Hydroelectric Station may be beneficial.

But Scudder (2005) points out that the LHWP is also controversial and problem-prone. According to Choe (2006) and Hoover (2001), resettlement has impoverished the Basotho people because they are deprived of arable land on which they previously had the flexibility to cultivate a wide range of fruits and vegetables instead of their present sole crop of corn. Through failed compensation payments to affected people, unattained development objectives and failed participation policies approximately 1.5 percent of Lesotho's 2.2 million citizens have been negatively affected by the project (Hoover, 2001; Scudder, 2005), which has altered 40 percent of Lesotho's land area, of 30,345 km^2 which consisted of watersheds (IRN, 2001; International Journal of Hydropower and Dams, 2006), weakened local economies, strained relations between nearby villages and resettled communities (Hoover, 2001; Scudder, 2005 & 2003), – probably because pre-evaluation studies of the social, environmental, and economic impacts of the LHWP scheme did not capture all the impacts (Aylward et. al., 2001) – and involved corruption (IRN, 2002b/2004; World Bank, 2005; Bello and Guttal, 2006).

Table 5.2: Summary of the development imperative and tyranny of technology of some African large dams

Large Dam Name	Status	Capacity	Location	Construction Costs	Purpose	Achievements: large dams development imperative?	Failures: large dams tyranny of technology?	Remarks: tyranny of technology or development imperatives?
Kariba Dam	Completed	1.32 GW	Zambia/ Zimbabwe	£480 million	Hydroelectric power	1. Electricity for industries and mines main source - over 80 percent - of Zambia's national income for almost two decades 2. Income from about half a million tourists to Kariba dam each year 3. Positive resettlement of Tonga and We people due to higher living standard and healthy life style from improved dry season farming (2,700 ha under irrigation, 450 permanent and 3,000 casual jobs on irrigation schemes) and the acceptance of fishing as a source of livelihood	1. Kapenta fishing in the Kariba reservoir is capital intensive 2. Benefit commercial companies not local people 3. Limited coverage of electricity for about 90 percent of Zambians 4. No electricity for most settlements in Zimbabwe except Binga's and Tonga's.	More of a development imperative than a tyranny of technology.
Muela Hydropower	Completed	72 MW	Lesotho	$1.5billion	Hydroelectric power generation	LHWP with Muela: 1. accounted for 13.6 percent of Lesotho's GDP, 2. 35 percent of value added in building and construction, 3. 27.8 percent of government revenue in 1998.	1. Lesotho not still self-sufficient in electricity supply. 2. Costs of investment in Muela not recovered. 3.Basotho's resettlement deprived them of arable land for cultivating wide range of fruits and vegetables instead of the present sole crop of corn 4. Failed payment of compensation to affected people 5. Failure of participation policies 6.	Tyranny of technology though some elements of development imperative can be found.

							40 percent of Lesotho's land area (30,345 km^2) comprising of watersheds altered 7. Strained relations between nearby villages and resettled communities 8. Approximately 1.5 percent of Lesotho's 2.2 million citizens are said to be negatively affected by the project 9. Corruption and malpractice over LHWP execution.	
Bujagali Dam	Under Construction	250 MW	Uganda	$500 million	Hydroelectric power	1. 240 consultations with over 7,000 local residents from affected areas, 49 with 103 representatives of Ugandan cultural institutions; 235 with local government representatives; 110 with Ugandan government representatives; 128 with stakeholders; and 87 with environmental and nongovernmental organizations 2. Options assessments 3. Independent monitoring and verification of resettlement package implementation and compensation payment 4 Provide power to the nation of 23 million people, 3% of whom currently have access to power.	1. Scenically beautiful area downstream destroyed. 2. Would inundate an 8km stretch of Bujagali Falls, a popular tourist attraction 3. Resettle about 1,288 households, including Baganda residents on the West Bank and Busoga residents on the East bank	The development imperative or tyranny of technology cannot be determined because the project is not operational.
Merowe Dam	Under	1.25 GW	Sudan	$1.2 billion	Hydroelectric	1. 35 percent of the 10,000	1. Possible flooding of	Both development

	Construction				power, water supply and irrigation	affected families already resettled 2. US$700 million spent on new homes, clinics and other facilities 3. Raise electrification level from an estimated 30% to about 90% in the mid-term 4. Replace the 55 percent of electricity from oil-fired thermal plants	archaeological and cultural artefacts of the ancient Nubian civilization dating to about 5000 years 2. About 50,000 people or 10,000 families to be displaced 3. Sedimentation 4. Increased evaporation 5. Infestation of reservoir by water hyacinths 6. Massive daily fluctuations of water 7. Impacts on downstream agriculture; 8. Spread of waterborne diseases.	imperative and tyranny of technology.
Aswan High Dam	Completed	5.7 km3 and 2.1GW	Egypt	$1 billion	Hydroelectric power, irrigation, water supply and flood control	1. Farmers produce diversity of crops on a perennial basis (two or three crops a year 2. Boost to farmers' income 3. Six million feddans (2.5 million hectares) is under cultivation at Aswan 4. Annual financial return estimated at "E£255 million 5. E£140 million from agriculture, 6. E£100 million from hydropower generation 7. E£10 million from flood protection 8. E£5 million from navigation 9. Saved Egypt from nine-year drought - 1979 to 1987 10. Protected Egypt from the 1964, 1975, 1988 and	1. Livelihood impact of 100,000 Nubians resettlers - 50,000 in Sudan's drought and sediment prone Khashm el Girba irrigation and 50,000 in Egypt 2. Salt water intrusion into the Aswan delta 3. Algae bloom 4. Urinary *schistosomiasis* downstream 5. Increased reliance on inorganic fertilizers and pesticides for improved crop production because of reduction in phosphate and silicate from alluvial soils 6. Downstream erosion of the bed and banks of	Highly development imperative with some few element of tyranny of technology.

						1996 high floods 11. Egypt national income increased by 10 billion L.E., that is 20 times the AHD cost in first 10 years after construction of dam.	the dam 7. Retreating Nile delta coastline 8. Increased salinity 9. Rising water table which weakens foundations of; buildings, bridges, irrigation off takes and other infrastructures 10. Over fishing.	
Manantali Dam	Completed	200 MW	Mali	$500 million	Hydropower, Irrigation of 3,750 km2 land and navigation	1. Improved access to cheaper and more efficient electricity 2. Enhanced crop productivity 3. Economic and political cooperation between Mali, Mauritania and Senegal towards meeting development objectives 4. Navigation improved haulage of good and people	1. Used of expensive diesel to run irrigation pumps because hydropower component of the dam did not meet the initial 1988 completion date 2. Cleared 120 km2 of forest 3. Destruction of groundwater aquifers because of changes in the annual flood cycle 4. Involuntary resettlement of 12,000 people 5. Development of 100,000 instead of the planned 375 000 hectares of land for irrigation 6. High cost of inputs required for irrigation farming 7. Replacement of traditional sorghum crop with rice, which proved less productive and cost more than imported food	Less development imperative but more tyranny of technology.

							8. Impact on downstream fisheries 9. Abrogation of land rights of black peasants living along the riverbank because of land legislation changes in Mauritania 10. 70,000 Mauritanian peasants expelled to Senegal 11. Conflicts which left hundreds of people dead and near war between Senegal and Mauritania militaries in 1989	
Gezira Irrigation Scheme	Completed		Sudan		Irrigation	1. Farmers produce diversity of crops on a perennial basis (two or three crops a year depending on the crop type) 2. Boost farmers' income 3. Foreign income for Sudan 4. Provides employment for about 100,000 tenant farmers and more than a half million seasonal workers.	1. Lack of adequate structural maintenance, canals siltation and land mismanagement led to reduction in cropping intensity from 75 to 57 percent 2. Malaria disease prevalence in Gezira irrigation scheme area accounted for almost 40 percent of out-patients in local hospitals and caused 20.3 percent of recorded deaths	Both development imperative and tyranny of technology.

Source: Author with data from (Church, 1968; Tromp, 2006; Croucamp et. al., 1999; World Bank, 2002; 2003; 2004; UNDP, 2006; NEPAD, 2002a/b; UNEP, 2006; WEC, 2003; EIA/DOE, 1999; Bosshard and Hildyard, 2005; Grove, 1993; WCD, 2000a; Soils Incorporated (Pty) Ltd and Chalo Environmental and Sustainable Development Consultants, 2000; Hoover, 2001; Choe, 2006; Scudder, 2003; 2005; IRN, 2001; International Journal of Hydropower and Dams, 2006; Bello and Guttal, 2006; World Bank, 2005; Aylward et. al., 2001; Imhof et al., 2002; Linaweaver, 2002; Mason, 2003; Allan, 1999; Biswas, 2002; Tortajada, 2007; El Khalifa and Nour, 1991 [cited in Mason, 2003]; Biswas, 1982; FAO, 1995; WWF, *accessed, 01/16/2007* [citing New Scientist, 1987]; Horowitz, 1991; Salem-Murdock and Horowitz, 1994; IEA, 2000; Scudder, 1994; Bosshard and Hildyard, 2005; Nature, 2006).

The Build-Own-Operate-Transfer (BOOT)-financed[26] $530-million Bujagali Hydropower Project is assumed to be beneficial for Uganda because it will provide electricity to the nation's 23 million people – 3 percent of whom currently have access to power – and is an example of inclusive project participation, governance and regional integration (EIA/DOE, 1999; Imhof et al., 2002; World Bank, 2003; WEC, 2003).[27] One development benefit of the Bujagali hydropower project is shown in the breadth and depth of consultation carried out with government officials, legislators, NGOs, civil society, local people affected by the project and the project sponsors, all of whom gave their approval before construction commenced (Imhof et al., 2002; World Bank, 2003). Support for the project by the Busoga people, who have historically been marginalised, was the highlight of the consultation process (Linaweaver, 2002).[28] To ensure the accountability and transparency of the project's implementation, such as how it would affect local people, NGOs, civil society groups and legal counsels were able to monitor and verify resettlement and payment of compensation (World Bank, 2003). The consultation led to the appreciation of the development benefits of Bujagali by stakeholders.

Another development benefit of the Bujagali Hydropower Project is its regional significance. On completion it will supply at least 50 MW and at most 80 MW of electricity to Kenya for an initial period of 14 years (WEC, 2003), the sale of which will increase the viability of Bujagali, enhance its socio-economic development, improve political cooperation and create further integration between Uganda and Kenya.

However, some NGOs' constant criticism of some aspects of the Bujagali Project led to its suspension in July 2002, its expected operational year (EIA/DOE, 1999). Claims of mass opposition to the project by local people likely to be affected and environmental groups in Uganda (IRN, 2002a), and criticism of World Bank complicity in the Bujagali Project under cover of national sovereignty because the Bank believes the state has priority over natural resources use and the right to make decisions in the best interest of the entire community (Imhof et. al., 2002) were among the criticisms. Others were the inundation of about an 8 km stretch of the river and possible destruction of the scenic beauty of the Bujagali Falls, a

[26] The completed project appraisal by IFC/IDA in November 2001 received support from the World Bank which approved about US$225 million, the African Development Bank and Export Credit Agencies (ECA) in Sweden, Switzerland, Norway, Finland, and the Netherlands (IRN, 2002; Bartle, 2002; World Bank, 2003). But Knigge et al (2006) claims that approval of the project by funders was premature since the project did not meet environmental and social standards.

[27] The proposed site for the Bujagali project is Dumbbell Island, 8 km downstream of the existing Nalubaala Dam near the town of Jinja, where the Victoria Nile divides into two channels. The total project cost is estimated at US$582 million. The major physical components are a 30-meter dam with a small reservoir and associate spillway and outlet works, a 250 MW power station and about 100 kilometres of transmission lines with sub-stations.

[28] See Linaweaver (2002) for detailed discussion.

popular tourist attraction (Linaweaver, 2002; WEC, 2003), and the relocation of 1,288 households of Baganda residents on the West Bank and Busoga residents on the East Bank (EGS 2001, p. 307 cited in Linaweaver, 2002). These contributed to the reasons for which Bujagali was suspended when AES Corporation withdrew from the project in July 2003 (WEC, 2003).

The suspension of the Bujagali Project turned out to be a pyrrhic victory because it was soon revived with a new partner, Bujagali Energy, which signed a Private Partnership Agreement (PPA) with the Ugandan Electricity Transmission Company to develop the Bujagali Hydroelectric Power Project (World Atlas & Industrial Guide, 2006; WEC, 2003). This revival of the project supports its development benefits for Uganda.

The analysis of Bujagali, Muela and Kariba hydroelectricity dams has shown that any large dam creates both adverse effects and benefits because they address complex socio-economic, environmental and political issues. This creates some winners and some losers. But the divide between losers and winners can be minimised through inclusive stakeholder participation, consultation, and transparency in project appraisal, design and implementation. However, achieving the development goals of large dams requires the constructive engagement of all stakeholders to enable the best possible outcome for each project because the costs and benefits have a long gestation period. Though the short and medium terms are important in project planning, it is the long term that should govern large hydropower dam discussion and decision making, especially now that Africa is faced with the challenges of climate change and achieving the MDGs. What emerges from these evaluations of the Bujagali, Muela, and Kariba Dams is that every large dam is unique in its peculiar circumstances and therefore should be treated as such in order to maximise benefits and minimise costs.

5.3.2 Irrigation Dams

The development imperative of large irrigation dams is to boost the growth of agriculture for domestic food production, industrial raw materials and export crops for Africa's socio-economic development. The majority of large dams in Africa are built for irrigation (Bergeret and Bister, 2003) (see sub-section 5.2), and most of these are in the Sahel and other dryer parts of the continent where perennial drought and famine are common (Grove, 1993).

Another development benefit of large irrigation dams in Africa is based on the fact that land area cultivated under reliable water control for perennial agricultural production is very low in relationship to the available potential. Only 4.5 million ha of 30 million ha irrigation potential in Africa is utilised and

also only 179 million ha is cultivated of the 632 million ha available arable land (Gakou, 1987; FAO, 1997; UNEP, 2003a). The purpose of large irrigation dams is to maximise the use of arable and irrigable land available to Africa to bring about food security and socio-economic development.

The impact of not maximising potentially irrigable and arable land through the development imperative of large irrigation dams contributes to Africa's food security challenges. For instance, 20 percent of the population of 30 African countries in 2001 was undernourished, 35 percent of the population in 18 of these countries chronically hungry and a further 28 million people faced food emergencies due to drought, floods and strife (NEPAD, 2005). Consequently in 2001, imports of about US$18.7 billion and about 2.8 million tons of food aid were relied on to make up for the food deficits (NEPAD, 2005). Utilising the irrigable potential of Africa through the development of large irrigation dams could significantly reduce the amount of money spent on food imports.

However, large irrigation dams are also said to have serious drawbacks: they are prone to elite capture, their large scale favours those with higher financial and technological resources and they are associated with waterlogging and salinisation. These issues, which are further discussed in the case studies below, are among the reasons for which large irrigation dams are thought to demonstrate the tyranny of technology.

The development benefits of large irrigation dams are analysed in this sub-section based on the indicators of efficiency, equity, and sustainability set out at the end of sub-section 5.3. The large irrigation dams considered are the Gezira Irrigation Scheme, the Aswan High Dam, and the Manantali Dam. The Merowe Dam Project is also examined in the context of NEPAD's key principles of infrastructure development (see 5.2).

The benefits of the Aswan, Manantali, and Gezira irrigation dams are based on their efficiency, equity, and sustainability. The 5.7 km^3 capacity of the Aswan High Dam (Grove, 1993) is perceived as the solution to Egypt's water insecurity (Nicol, 2003),[29] while cotton production from the 0.8 million hectares irrigated by the Gezira Dam earns foreign exchange for Sudan (Grove, 1993; Mason, 2003; Lankford, 2005). Farmers in Egypt and Sudan produce two or three crops a year (Mason, 2003; Scudder, 2003) because the Aswan and Gezira dams reduce the risks accompanying rainfall variability. In this regard they bring development benefits to Egypt and Sudan.

[29] The Aswan Dam captures flood water (e.g. in 1964 and 1975 flood years) which is used particularly in drought periods (e.g. in 1972 and 1982) (Mason, 2003).

There are two specific reasons why the Aswan Dam is seen as beneficial to Egypt. Firstly the riverine people of the Nile have benefited greatly from it because irrigation has enabled a huge expansion in cropped land, estimated at six million *feddans* (2.5 million ha) (Church, 1968; Allan, 1999). Secondly, the Aswan Dam's annual return of £255 million (see detailed breakdown in Table 5.2) paid off its construction costs within two years of its completion (Biswas, 2002; Biswas, 2002; Shenouda, 1999). In this regard Tortajada (2007), Scudder (2003) and Biswas (2002 & 1997) agree that Aswan is a financial success and a good investment without which Egypt would have been in dire economic and political turmoil. This performance of the Aswan Dam makes it an integral component of Egypt's socio-economic development.

However, the Aswan Dam is also perceived to have some social and environmental impacts which far outweigh its benefits. These include: 1) the resettlement of 100,000 Nubians – 50,000 of them in the drought- and sediment-prone Khashm el Girba irrigation project in the Sudan and the other 50,000 in Egypt – and the impact on their livelihoods (Grove, 1993; Biswas 1982; Scudder, 2003); 2) the long-term risk of salt water intrusion into the Aswan Delta (Scudder, 2003); 3) algae bloom; 4) urinary *schistosomiasis* downstream (Mason, 2003); 5) increased reliance on inorganic fertilisers and pesticides to improve crop production; 6) downstream erosion of the bed and banks of the dam; 7) a retreating Nile delta coastline; 8) increased salinity of the Nile; 9) a raised water table, which weakens the foundations of buildings, bridges, irrigation offtakes and other infrastructure; and 10) overfishing (FAO, 1995; Scudder, 2003; WWF, 2007 citing New Scientist, 1987). In this context the Aswan Dam appears less successful.

Two reasons account for the development imperative of the Gezira Dam; it is a significant source of foreign income for Sudan (Mason, 2003) and it provides much-needed employment for about 100,000 tenant farmers and more than a half million seasonal workers (Grove, 1993). Grove (ibid) considers that the economic and livelihood significance of the Gezira Dam makes it a successful irrigation model to be emulated by other countries and a development imperative for the transformation of the socio-economic development of Sudan and other countries.

In spite of these positive reflections of the Gezira irrigation dam there are some criticisms that highlight its drawbacks, as presented in Table 5.2. Among these are the lack of adequate structural maintenance (Aquastat, 1997b cited in Mason, 2003); reduction in cropping intensity from 75 to 57 percent due to canal siltation and land mismanagement (ibid); and a high prevalence of malaria which causes more than 20

percent of recorded deaths around the Geriza irrigation dam in Sudan (El Khalifa and Nour, 1991 cited in Mason, 2003), all of which undermine the benefits of the dam.

The development benefits of the US$500 million Manatali Dam are based on its design to irrigate 375,000 ha of land and boost food security in the riparian countries of Mali, Senegal and Mauritania (UNEP, 2006; WEC, 2003; World Bank, 2002; EIA/DOE, 1999).[30] However, it is described by Peter Bosshard as 'an act of economic and environmental nonsense' (WEC, 2003).[31] Firstly, the planned target of irrigating 375,000 ha was reduced to 100,000; secondly, diesel instead of hydropower was used to operate the irrigation pumps because the hydropower component of the dam was not completed in time; and thirdly, 12,000 people were resettled for a project that did not meet its objective (Horowitz, 1991; Salem-Murdock and Horowitz, 1994; IEA, 2000; WEC, 2003; UNEP, 2006). The Manantali Dam did not meet its development goal.

A new generation of water infrastructure development imperatives like the Merowe Dam Project are emerging under the regional Nile Basin Initiative (NBI) against the background of older water infrastructures like the Aswan, Gezira, and Manantali dams. The NBI is an umbrella body for political cooperation, governance, participation, and integration in the equitable utilisation and sustainable development of Nile Basin resources for poverty alleviation and environmental management among the ten Nile Basin member countries[32] NEPAD, 2002b; (World Bank, 2004). Protecting the Nile ecosystem from Lake Victoria to the Mediterranean and constructing mutually-agreed water infrastructures for hydroelectric power generation and irrigation are the two pathways identified for managing the environment and tackling poverty in the Nile Basin (NEPAD, 2002a; World Bank, 2004; UNDP, 2006).[33] Dealing with poverty and environmental issues at basin level enhance regional security because tension and conflicts – identified as obstacles to growth and development in the Nile basin region – are reduced and risks and losses from floods due to uncoordinated development of the Nile basin averted while still delivering livelihood and food security through pro-poor economic growth (World Bank, 2004; Africa

[30] Other uses for the Manatali Dam are the expansion of navigation between the cities of St. Louis and Kayes in Mali, a landlocked country, and generating 200 MW of electricity for the capital cities of Bamako (Mali), Nouakschott (Mauritania), and Dakar (Senegal). The dam is said to be of significant importance to the Organization pour la Mise en Valeur du Fleuve Senegal (OMVS), an organisation formed to manage the Senegal River Basin (EIA/DOE, 1999; World Bank, 2002; WEC, 2003; UNEP, 2006).

[31] Peter Bosshard was with the Berne Declaration, a Swedish NGO, when he made the comment. He is now with the International Rivers Network (IRN).

[32] Egypt, Sudan, Eritrea, Ethiopia, DRC, Uganda, Kenya, Rwanda, Burundi and Tanzania.

[33] For NBI members, increased power trade will facilitate integration, development and cooperation among member countries (WEC, 2003). As a result, 22 projects have been identified and are being studied in order to select economically viable ones for implementation as regional power projects (generation and interconnection) to ultimately create a fully-fledged Power Pool for the Nile Basin (ibid).

Commission Report [ACR] 2005; NBI, 2006; UNDP, 2006). So the development imperative of the NBI based on the above discussion is coordination and cooperation in the development of water infrastructures for poverty reduction and socio-economic development, as well as for environmental management and protection.

To enhance the benefits of NBI programmes two fundamental ideas were applied by the programme members. Firstly, environmental and social issues are added into NBI investment planning at the local level (World Bank, 2006). To implement this, communities are provided with micro grants, advisory services for environmental education and watershed management to ensure the sustainability of the Nile ecosystem and dam infrastructure (ibid). The second idea is the active courting of civil society through the Nile Basin Discourse (NBD) in order to expand governance and participation in the NBI (Mason, 2004; UNDP, 2006) because dialogue among all stakeholders will help the integration of water sector interventions[34] and harmonise existing and emerging socio-economic policies and processes at regional, national and local levels with emphasis on poverty reduction and livelihood security, issues critical to the success of NBI (NBI, 2006). The application of these two ideas to the NBI process is significant for its development benefits because it will improve on the design, planning, implementation, execution and operation of both infrastructure and environmental projects, as many environmental problems have regional dimensions and an effective basin-wide cooperation is the best way to deal with such a transboundary environment (UNDP, 2005; World Bank, 2006).

However, the NBI's infrastructure development component is criticised by Hathaway (2006) for its impacts on local poor people. Also, constant drought in the region renders water infrastructures uneconomic and drains resources that might be needed to protect local people and the economy from drought shocks (ibid). The World Bank's encouragement of water infrastructures, particularly hydropower development in the Nile basin, is also criticised (ibid). It is surmised that Hathaway does not consider the infrastructure component of the NBI beneficial in the light of the historical social and environmental problems associated with large water infrastructure.

The NBI represents a new approach to the development imperative of large dam infrastructures for irrigation, hydropower, water supply and flood control in pursuit of economic development with environmental management to deal with climate variability and the MDGs amidst broader regional development goals in the Nile Basin region. The Merowe Dam in Sudan (see Table 5.2 case study

[34] Some of the water sector interventions are; irrigation, hydropower, watershed management or flood control infrastructure.

summary), scheduled for completion between 2007 and 2009, is a project backed by the NBI as a development imperative for the Nile Basin region. The US$1.2 billion1,250 MW Merowe Hydroelectric Power Project is currently the largest dam under construction in Africa.[35,36] It is of regional importance to the NBI as it will generate electricity for domestic consumption and export (NEPAD, 2002b; WEC, 2003; Bosshard and Hildyard, 2005). To the Sudanese and the NBI the Merowe Dam is a development imperative which reflects how resources are used to enhance economic diversification (Mason, 2004).

The advantages of the Merowe Dam to the Nile Basin region manifest in two ways. Firstly, the dam's environment and socio-economic significance for the region led downstream countries to pose no objection to its construction because of their involvement in the conception and design of the project as members of the NBI and an understanding that development of water infrastructures upstream is not necessarily detrimental to downstream countries (Mason, 2004). Secondly, Merowe and the BNI have helped to ease tensions and increase cooperation, promoting security and stability – important ingredients in attracting investment and integrating projects (WEC, 2003) – in a region rife with political and economic difference over resource use and past predictions of water wars (Gleick, 1998; Falkenmark, 1989a; Mason, 2004). The lack of objection by Nile Basin member countries and the easing of tension among them due to the Merowe Dam and the NBI are an indication of the significance and benefits of the dam for the Nile Basin region.

However, the Merowe Dam Project is plagued by social and environmental concerns. According to Scudder (2007, personal communication) it is not 'a well planned and implemented dam' because of environmental problems, displacement and 'a worst case scenario' resettlement of affected people (Scudder, 2007, personal communication).[37,38] The presence of ancient Nubian archaeological and cultural

[35] The dam and the transmission lines are being constructed by Chinese companies. Sudanese contractors are involved in building the dam and the resettlement sites. Western companies are also involved in the project: Lahmeyer International of Germany manages the construction of the project; Alstom of France is supplying electro-mechanic equipment; and ABB of Switzerland is building transmission substations.

[36] The dam project garnered funding from different sources: the China Export Import Bank; the Arab Fund for Economic and Social Development; and the Development Funds of Saudi Arabia, Kuwait, Abu Dhabi, and the Sultanate of Oman (Bosshard and Hildyard, 2005).

[37] About 50,000 people or 10,000 families are expected to be displaced by the Merowe dam (Bosshard and Hildyard, 2005). Mutaz Musa Abdalla Salim, Director of Finance at the Merowe Dam Project Implementation Unit in Khartoum, said that about 35 percent of the 10,000 affected families are resettled and US$700 million will be spent on new homes, clinics and other facilities (Nature, 2006).

[38] Environmental problems that Bosshard and Hildyard (2005) claim to have been identified by the EIA of Merowe Dam are: sedimentation of the reservoir due to massive erosion in Ethiopia, among other factors; evaporation from the reservoir; infestation of the reservoir by water hyacinth; massive daily fluctuations of the water level downstream of the dam with corresponding impacts on downstream agriculture; the spread of waterborne diseases. An executive director of the engineering consultants for the Merowe project, Lahmeyer International, Egon Failer said that the

artefacts at the dam site dating back about 5000 years is another major concern (Bosshard and Hildyard, 2005). In this regard the problems undermine the dam's benefits.

5.3.3 Dams for water supply[39]

Large dams for water supply and sanitation services are regarded as of benefit to Africa because access to portable drinking water is negligible in comparison to other parts of the world. For instance, only 24 percent of households in Africa have access and connections to piped water and 13 percent to sewage systems (WHO/UNICEF, 2004). There is great disparity in the distribution and access to water supply and sanitation between rural and urban areas. While about 65 and 73 percent of rural populations are without adequate water supply and sanitation, the equivalent figures for urban populations are 25 and 43 percent respectively (AWV, 2000). Consequently almost half of all Africans suffer from one or more of six water-related diseases – the worst being cholera and infant diarrhoea – due to lack of access to potable water and sanitation (AWV, 2000). Moreover, of 46 countries in which schistosomiasis or bilharzia are endemic, 40 are in Africa, and 16 of 19 countries reporting guinea worm infestation are also on the continent (ibid). So access to potable water and sanitation and the implications of their unavailability are of huge significance to Africa's socio-economic development.

Two factors will further strengthen the benefits of large dams in Africa. The first is the anticipated increase in population from 778.8 million in 1997 to 1,453 billion in 2025 – a growth rate of 3 percent per annum (UNPD, 1996) – and the second is the expected 5 percent per annum growth rate of urbanisation (AWV 2000:12). Without measures such as large dam construction to ensure adequate potable water and sanitation, the problem of water- and sanitation-related diseases will worsen. In this context large dams are thought of as part of the strategy to deal with Africa's water supply and sanitation problems.

The above analysis of the socio-economic development benefits and otherwise of large hydroelectric power, irrigation and water supply dams in Africa is a bundle of complexities that emanate from their functions of supporting economic development and the social and environmental impacts resulting from those functions. The functions produce winners and losers among the people, the economy and the environment based on equity, efficiency, and sustainability. Although the application of NEPAD principles of transparency, participation, governance and cooperation in new large infrastructure projects

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final design of the project will address some of the environmental problems such as sediment with flushing during the floods in July (Nature, 2006).

[39] Because most irrigation and hydroelectric power dams serve as water supply sources – e.g. Kariba, Aswan, LHWP, and Manantali – I do not intend to present specific case studies on large dams for water supply because it is rare for a large dam to be constructed in Africa solely for that purpose.

may be unable to do away with the complexities of large dams, they maximise the benefits of the new generation of large dams and reduce the unintended consequences of their development.

5.4 The politics of development and large dams in Africa

The large dam imperative discussed in the last sub-section appears to make them politically attractive to African countries. African leaders seem to view large dams as a symbol of nation-building and national pride and as national promoters of unity (Biswas and Totajada, 2001). Consequently they have become part of the political process as their visibility, tangibility, prestige and long lifespan are closely associated with the politicians who built them, providing an opportunity to be immortalised (Church, 1968; Grove, 1993) in contrast to social programmes whose outcomes are usually transient. Egypt's Aswan Dam and Ghana's Akosombo Dam are associated with Nasser and Nkrumah respectively because of their ambition to use them to industrialise and modernise their countries in the quest for socio-economic growth and thereby cement their place in history (Pearce, 1992; McCully, 2001). Thus the imperatives for large dams are derived from political as well as development goals.

Another aspect of large dam politics is their use as an electioneering tool. Large dam construction and operation create jobs and new skills and provide and support social services like water supply and electricity for schools and hospitals, which enhance the living conditions of the beneficiary country (Church, 1968). The use of large dams as an electioneering tool enables the electorate to hold politicians accountable to their promises, because dam benefits are a tangible issue over which they can be held to account.

The politicisation of large dam development led to the involvement of state institutions in the provision and management of dam infrastructure in an effort to further economic and political goals (Church, 1968), the consolidation of which placed the state at the centre of development and gave rise to the African developmental state (Church, 1968; Ayittey, 1992). In this context the developing state gave politicians control over state institutions which were employed as instruments to achieve political and development goals promised during electioneering.

The outcomes of the politicisation of large dam development and the subsequent use of state institutions to deliver political objectives are perceived as mixed. To Ayittey (1992), the objectives of equality, national unity and harmony which have underpinned most large dams and development projects have proven elusive. But to Nkwandawire (2001) and Mbabazi and Taylor (2005), judging the developmental performance of dams as either sound economic investment or a project of political vanity should be

contextualised and captured within the great variations in economic performance among and within African countries. As such the performance of large dams and other development programmes are thought to be successful in spite of episodic swings between good economic performance and stagnation over different periods (ibid). The implication here is that the outcome of large dams used for political purposes needs to be contextualised in order to appropriately judge their performance.

The emergence of the African developmental state, partly attributed to the politicisation of large infrastructure including large dam development and subsequent state institutions' involvement in their operations are mixed. On the positive side, it is possible for politicians and bureaucrats to determine the point at which the state's ideological underpinning enables them to seriously deploy administrative and political resources to further economic development policies (Ayittey, 1998). However on the negative side, such state intervention is constrained by obstacles such as political tyranny, instability and corruption which are inimical to development because they lead to capital flight and affect progressive development and the maintenance of existing infrastructures including large dams (ibid). It appears that although state institutions are key to large dam development when administrative and technical resources are deployed in conjunction with political resources, political tyranny, instability and corruption undermine the benefits of large dams because they mar their effectiveness in the delivery of the desired outcomes.

5.5 Africa's development failures and NEPAD

It is suggested that the politicisation of the development of large dams by African leaders and the emergence of the African developmental state were based on African leaders' ideological constructions of development which led to the design of short-, medium- and long-term development plans based on welfare primacy, wellbeing and legitimacy of leadership (Ake, 1981) (see Table 5.3 for development plans/milestones of Africa). These development plans enabled the state to engage in development activities such as large dam construction, either with private partners or alone (Grove, 1993; Maloka, 2002; Mbabazi and Taylor, 2005). The optimism about the success of large dams was so high that Nkrumah, for instance, believed that Ghana could achieve its development goals in only decades, where Western European countries like Britain took a century (Nkrumah, 1957).

However the optimism about African development aided by large dams is thought not to have yielded any significant outcome. Three factors partly account for the erosion of the achievement of Africa's development objectives: firstly, the emphasis on political emancipation encouraged by the OAU Charter of 1963 (OAU, 1963); secondly, the desire by the new leaders of Africa to hold on to political power; and

thirdly, the lack of cooperation among independent African countries due to political and ideological rivalry at sub-regional and regional levels.

In spite of the negative impacts of these three factors, Adedeji believes that African leaders have individually and collectively made some heroic efforts since the 1970s to craft indigenous alternative development paradigms (see Table 5.3 for African development programmes) (Adebayo Adedeji cited by Maloka, 2002). According to Ake (1981) these efforts emanated from linking underdevelopment to problems of poverty, the high incidence of disease, unemployment, military weakness, ignorance, technological backwardness, cultural deprivation, short life expectancy, social disorganisation and political instability. In this regard, regional development programmes and initiatives for Africa such as the 1980 Lagos Plan of Action (LPA), the 1985 Africa's Priority Position on Economic Recovery (APPER), the 1986-1990 UN Programme of Action for African Economic Recovery and Development (UN-PAAERD), the 1987 African Common Position on Africa's External Debt Crisis and the 1989 African Alternative Framework to Structural Adjustment Programmes for Socio-Economic Recovery and Transformation (AAF-SAP) and others detailed in Table 5.3 were intended to tackle Africa's development challenges.

Unfortunately these development initiatives do not appear to have dealt with the continent's development challenges significantly, even with the aid of large dams. The common denominators in the failure of the African development initiatives are lack of financial and technical resources and political will. For instance the LPA's (see detail in Table 5.3) two principles of self-reliance; self-sustaining development and economic growth could not be met because they were not supported by the requisite resources and so remained a blueprint (Tesha, 2002), to the extent that almost all subsequent initiatives detailed in Table 5.3 sought to address its two principles under different guises. Africa's structural development emphasised capital constraints and centralised planning resulting in 'disarticulation and incoherence' (Ake, 1981; Frimpong-Ansah, 1991) because African countries failed to ensure that accumulation of endowment structure in their economies – physical and human capital rather than labour and natural resources – endogenously determined the economy's optimal industrial structure (Lin, 2003). Consequently, Africa is the most foreign aid-dependent continent in the world and its economy is at the extreme margins of global economic interaction after nearly three decades of the LPA initiative.

The incoherence and disarticulation is said to have rendered African industries nonviable in an open competitive market as they do not match the comparative advantages of their particular economies, even though they are a priority for governments (Lin, 2003). In such a situation governments are compelled to

introduce measures which cause trade, financial and labour market distortions in an effort to support nonviable industries (ibid). In the short term these distortions enable the establishment of inefficient but capital-intensive industry in developing countries plagued by misallocation of resources, rampant rent seeking and macro economic instability (Ake, 1981; Frimpong-Ansah, 1991). The failure of industrialisation is one of the justifications for questioning the importance large dams in Africa.

It is argued that in spite of this disarticulation and incoherence of African industrialisation and development the momentum from its little industrial achievement, aided by large dams, can be sustained through increases in agricultural production (Grove, 1993). Grove argues that expanding irrigation and electricity from dams are possibly early stages in the move to industrialisation because they provide the essential inputs for many productive activities (ibid). The sustainability of large dams requires appropriate returns on investments from irrigation, electricity and a coherent economy with a high level of 'regional and sectoral complementarity and reciprocity' (Ake, 1981) to generate forward and backward linkages (Grove, 1993).[40] Complementarity and reciprocity occur when, for example, coal exploitation becomes economical because an industry has demand for it, generating a backward linkage, while the establishment of an iron and steel industry which stimulate the local manufacture of bicycles and other related products leads to forward linkages (Ake, 1981). On this basis large dams for electricity and irrigation development by African countries are considered an integral part of a comprehensive strategy of complementarities and reciprocity in a coherent economy.

The need to develop a coherently reciprocal and complementary African economy partly aided by large infrastructure like dams led to the formulation of the New Partnership for African Development (NEPAD). NEPAD provided a new development policy framework for Africa to tackle historically-recurring themes in its development discourse such as poverty linked to the MDGs with the overarching aims of halving world poverty by 2015 (UN, 2000 and 2005), economic growth, integration and political marginalisation (NEPAD 2004: 1) (see details of these and other programmes in Table 5.3).

The lack of internally vibrant African economies is identified as one underlying cause of Africa's political marginalisation, poverty, lack of economic growth and integration. Individual African economies are too small to generate the economics of scale necessary for socio-economic transformation (NEPAD, 2002); consequently, the strategic priority is an accelerated regional integration to enlarge them (ibid). Thus four

[40] One region specialises in agriculture while another supplies the agricultural sector with manufactured goods. Along with this general type of regional or sectoral reciprocity of exchanges is system of what economists call forward and backward linkages in production (Ake, 1981).

sectoral priorities – agriculture and market access, human resource development, infrastructure and the environment – are mapped out to facilitate the quest for regional integration (ibid) in order to provide the economics of scale needed to achieve NEPAD's objectives.

NEPAD's infrastructure priorities – information and communication technology (ICT), energy, water and transport development – to aid Africa's integration are of significance to large dams in contemporary Africa (NEPAD, 2002). The infrastructure needed for Africa's socio-economic integration is sufficiently huge in scale to promote the shared production, management and operation of facilities through hubs and development corridors for sustained regional economic development and trade (ibid). Thus large dams, as part of NEPAD's infrastructure, for irrigation, water supply, flood control and hydropower are required to aid Africa's socio-economic integration and economic growth and meet the MDGs because water is the most critical African natural resource and key to its development (NEPAD, 2002b; UNEP, 2003b;). This is why NEPAD (2002b) proposes that available water resources in Africa be harnessed for water supply and sanitation and contribute to food security through irrigation and hydropower to drive industry. This is important because only about 4 percent of available renewable freshwater resources are used, although an estimated 14 African countries suffer from water stress or water scarcity, with 11 more countries set to experience water stress in the next 25 years (UNEP 2003b). This implies that large dams are a development imperative in contemporary African development.

However, NEPAD advocates are accused of a having a neo-liberal mindset because NEPAD expresses a neo-liberal development theory and economic policies which have failed Africa in the past (NEPAD, 2001; Adesina, 2002a & 2002b). As a result De Waal (2002) and Adesina (2002b) characterise NEPAD's programmes, based on its core marketing strategy of addressing the challenge of poverty for Africa's development as thin on content and fraught with considerable weaknesses and problems.[41] Thus instead of NEPAD pursuing a neo-liberal development programme, a capitalist developmental model controlled by states would give prominence to African states and sub-regional priorities (NEPAD, 2001; Lockwood, 2005) because successful capitalist development requires substantial and not minimal state intervention

[41] Adesina (2002b) argues that NEPAD's understanding and prognosis regarding the way out of Africa's development dilemma is faulty. While the sponsors of NEPAD promote it as having poverty eradication as a core value, there is very little guidance in its main document and associated documents on how to dealwith the crisis. None of the six Task Teams established under the NEPAD framework are specifically concerned with poverty reduction or the human resource development rubric under which NEPAD addresses the it. The sponsors of NEPAD, it would seem, take the neo-liberal perspective of treating social development concerns as residuals of economic growth (ibid).

(Lockwood, 2005) ,particularly where infrastructures – including large dams – for African socio-economic integration and socio-economic development are concerned.[42]

Another concern about the soundness of pursuing a continental development programme like NEPAD is the historical failure of some similar programmes for Africa's socio-economic development due to lack of financial, technical and human resources. Although these are still unresolved this has not dimmed African leaders' penchant for new declarations and programmes (Tesha, 2002). De Waal (2002) is concerned that NEPAD is repackaging past failed development programmes in the guise of poverty reduction and meeting the MDGs, and that NEPAD (2001 & 2002b) has identified energy and water infrastructures as one of four sectoral priorities in the promotion of regional integration, economic development and trade in Africa. [43,44,45] He asserts that the implied emphasis on large water and energy infrastructure projects such as large dams evokes unpleasant memories of failed major infrastructure projects loaded with vague promises under similar grand plans in the 1960s and 1970s (De Waal, 2002).

In spite of the reservations and criticism about NEPAD's ability to deliver the development aspirations of the continent, African leaders are enthusiastic because NEPAD represents a major continental initiative on a par with the unsuccessful 1980 OAU Lagos Plan of Action and the 1989 United Nations Economic Commission for Africa (UNECA) AAF-SAP (Adesina, 2002b) (see Table 5.3), during which there was some significant infrastructure development, including large dams.

[42] The characteristics of the 'capitalist developmental state' as presented by Lockwood (2005) involve: economic development (meaning growth, productivity and competitiveness rather than welfare) as a top priority for the state; the state is committed to private property and the market, but guides the market with instruments formulated by an elite economic bureaucracy; the state consults with and coordinates the private sector through numerous institutions as an essential part of the policy making process; state bureaucrats rule, politicians reign, so that the latter provide political space for the former to act, but also require bureaucrats to respond to groups on which the stability of the system rests; and finally, heavy and consistent investment in education.

[43] UNEP (2003) points out that even though Africa uses only about 4 percent of available renewable freshwater resources, water is becoming one of the most critical natural resource issues. It estimates that 14 countries on the continent suffer from water stress or water scarcity and 11 more will join them in the next 25 years. Thus water is widely recognised as a key resource in Africa's development.

[44] Infrastructure referred to includes energy, water resource development, transport, information and communication technology (ICT) (NEPAD, 2004).

[45] The full complement of the four sectoral priorities set out by NEPAD are agriculture and market access, human resource development, infrastructure and the environment (ibid).

Table 5.3: Selected milestones in Africa's development priorities after independence

No	Agenda	Date	Aim(s) and Objective(s)	Comment(s)	Performance Verdict[46]
1	Charter of the Organisation of African Unity	1963	Seeking better life for the people of Africa through co-ordination and intensified cooperation among member states.	Concentrated on political emancipation from colonial rule and independence. However, it did not include a development agenda for the continent.	***Failed***: Not much political and economic coordination and cooperation among African countries.
2	Monrovia Declaration of Commitment of the OAU Heads of States and Government	1979	Developing strategies and programmes for rapid socio-economic changes by establishing a solid domestic and intra-African base for self-sustaining, self-reliant development and economic growth by mobilising the creative potential and initiatives of the people including scientific and technological innovation.	This laid the groundwork for the Lagos Plan of Action the following year.	***Failed.*** Noting has been done to meet the stated objectives, particularly in the area of African technological and scientific innovation.
3	Lagos Plan of Action (LPA)	1980	Provide the political support necessary for the success of measures to achieve the goals of self-reliance and self-sustaining development and economic growth.	The Lagos Plan of Action and the Final Act of Lagos together with the earlier Monrovia Declaration in 1979 reflects the concrete steps that African leaders thought they needed to take in order address the issue of development by setting short, medium, and long term development agenda and targets for the 1980s towards the year 2000. Informed by their belief that the "same determination that has virtually rid the continent of political domination is required for our economic liberation" the LPA was anchored on the two principles of self-reliance and self-sustaining development and economic growth. According to Tesha, (2002) the LPA was not supported by the requisite resources and remained a blue print.	***Failed***: more than two decades after Africa is more dependence on foreign aid than any other continent in the world, with its economy being at the extreme margins of global economic interaction.
4	African Charter	1982	This was an affirmation of the	This was adopted when authoritarian regimes held sway in	***Failed***: Even though

[46] The performance verdict column with the criteria of successful, moderately successful and failed is determined against the set aims and objectives of declarations and programmes by either African leaders or the various international development agencies. Because most of these lack an evaluative mechanism, other general development indicators and indexes such as the HDI, transparency international corruption index, governance, world food report, world economic report/indictor etc. were used.

	of Human and Peoples' Rights (Banjul Charter).		Universal Declaration of Human Rights. To promote and protect fundamental human and peoples' rights'. This also include social and cultural rights	Africa and was also informed by the developmentalist notion of human rights. By linking civil and political rights to economic development. The outcome of this charter was the setting up of the African Human Rights Commission at Banjul, in the Gambia.	democratic leadership and institutions are evolving in most African countries, there are still wide spread human and people's right violations. The main reasons for these are the dominant winner takes all nature of government and lack of independence and resources of state institutions for implementation and monitoring.
5	UN Declaration on Critical Economic situation in Africa.	1984	Concerted action by the international community to assist the efforts of African governments by providing immediate emergency relief, and medium-term and long-term development aid.		***Failed***: The emergency relief operations in Africa by the international community is usually characterised by knee-jerk reaction to crises situations on the continent and has not on the whole been even been successful in providing short term stability for medium and long term development aid to be effective. The provision of development aid, either in the medium or long term has neither been concerted nor sustained to make any significant impact on African socio-economic development.
6	Africa's Priority Position on Economic	1985	Mobilise the international community through the UN to address Africa's plight.	This was an attempt to revive the LPA after five years of non-performance. It also identified Africa's debt burden as another challenge.	***Failed:*** No funds were ever made available for its implementation four years

	Recovery (APPER).				after its adoption. Neither was the debts burden of Africa addressed until the HIPC initiative.
7	UN Programme of Action for African Economic Recovery and Development (UN-PAAERD).	1986-1990	The main aim was for the international community to aid Africa in implementing the APPER. African leaders were to pursue and commit themselves to implementing "sharply focused, practical, and operational set of activities, priorities and policies" at national, sub-regional, and regional levels as elaborated in the APPER. With the international community providing support by mobilising resource through aid in particular.	This was a compact between African leaders and the international community and based on the principles of mutual commitment, responsibility, and cooperation. The amount required for implementation was $128.1 billion with Africa mobilising $82.5 billion domestically. Agriculture and food security were singled out as priority sectors, because it was believed that the development of these sectors would have a trickle down effect on African economies.	***Failed:*** Both the international community and African governments were unable to meet their financial obligation and commitments to implement this programme.
8	African Common Position on Africa's External Debt Crisis.	1987	To seek through international cooperation, continues dialogue and shared responsibility for the implementation of a flexible development oriented strategy that will address African debt crisis.	There have been since been some debt forgiveness to some African countries through the Highly Indebted Poor Countries Initiative by the world bank and other multilateral and bilateral lending organisations and countries. This however did not result from this programme.	***Failed:*** Nothing came out of this because there were no any serious discussion about the debt burden of African countries and so they were not forgiven.
9	African Alternative Framework to Structural Adjustment Programmes for Socio-Economic Recovery and Transformation (AAF-SAP).	1989	The aim was to present an alternative to the World Bank's and IMF's Structural Adjustment Programme (SAP).	AAF-SAP was promoted by the ECA as a rejection of SAP because it has caused great social problems and therefore was becoming increasingly unacceptable.	***Failed:*** The ECA and the supporters of AAF-SAP lacked the financial muscles and political leverage of the world bank and IMF and were therefore unable to muster enough support and resources for the AAF-SAP implementation nor were they able to convince the world bank and IMF to pursue their proposed

					alternative.
10	African Charter for Popular Participation in Development and Transformation.	1990	The objective of this charter is to affirm Africa's acceptance of the role of democracy and participation in governance play in development.	Due to increasing pressure from both internal and external sources, many one party and military governments which once held sway on the continent are given way to democratically elected governments.	***Moderately Successful:*** This process have generally been slow and in some cases revived old tensions and bad blood among political opponents. This has led to civil strife and conflicts in certain parts of the continent. The winner take all concept of the democratic process also makes it difficult to build consensus for nation building and development. Government still controls and dominates all aspects of political and economic institutions and are therefore are prone to exhibit dictatorial tendencies.
11	Treaty Establishing the African Economic Community.	1991	For a larger and fuller economic integration in order to share in a equitable and just manner, the advantages of cooperation among member states as to promote a balanced development in all parts of the continent.		***Failed:*** Despite some move towards increasing trade and cooperation among countries of Africa, the level of such interaction has not yet met the objective of promoting a balanced development in all parts of the continent.
12	United Nations New Agenda for the Development of Africa (UN-NADAF) Mid-term Review.	1992	This was to affirm that, the issues of UN-PAARED begun in 1986 were still of relevance since the problems affecting Africa's development still existed. There was therefore the need for	The UN efforts were not entirely futile as it may seem because it encouraged the Japanese government to convene its Tokyo International Conference on African Development (TICAD). For the purpose of coordination and as a follow up mechanism for the implementation of UN-NADAF an Inter-Agency Task Force on African	***Failed:*** In spite of the panel of experts and task forces and conferences that emanated from the UN-NADAF, noting of significance came out of it.

			accelerated transformation, integration, diversification and growth of African economies, in order to strengthen them within the world economy, reduce their vulnerability to external shocks and increase their dynamism, internalise the process of development and enhance self-reliance. The principle was also shared responsibilities and full partnership. About $30 million was require for 1992 for Africa to reach 6 percent annual GDP growth target, and Aid flow to the continent were thereafter to grow annually by 4 percent in order to make a significant dent in Africa's developmental problems.	Economic Recovery, which includes all UN Agencies, the OAU, African Development Bank and chaired by UN-ECA was set up. In 1992, the secretary General established a Panel of High Level Personalities on African Development as part of the UN-NADAF initiative but also to act as a think-tank. Similarly, within the UN secretariat, a Special Coordinator for Africa and other Least Developed Countries was appointed in the Department of Policy Coordination. These measures were reinforcement of the System-Wide Plan of Action for African Economic Recovery and Development. This process resulted in the launching of Special Initiatives on Africa in 1996 within the UN with five working group focused on water problems, food security, governance, social and human development and resource mobilisation.	As a continent Africa continue to face the challenges that the initiative sought to address.
13	Re-launching Africa's Economic and Social Development: The Cairo Agenda for Action.	1995	The purpose was to adopt a new vision for Africa development and translate the vision into appropriate programmes so that Africa can participate fully as a credible partner in the world system and promote her fundamental interests and concerns.	This was in response to closer European cooperation and integration through the creation of a single market, the conclusion of the Uruguay Round agreements and the establishment of the World Trade Organisation.	***Failed:*** This did not change anything as African policy responses were as fragmented as the number of countries on the continent.
14	Cairo Plan of Action: Africa-Europe Summit under the Aegis of the OAU and the EU.	2000	This is geared towards Africa and Europe fashioning out a new strategic global partnership to implement all past declarations for African development.		***Failed***: No new strategy has come out of this initiative to implement past declarations. These declarations and programmes are still gathering dust and mouldy in the respective offices of the OAU in Addis Ababa

					and EU in Brussels.
15	Constitutive Act of the African Union.	2000	To bring about and facilitate the integration of African countries and address the development shortcoming and problem in the light of the challenges of the 21st century.		***No significant progress***: Six years on, African governments are no where near this goal. Given the magnitude of the challenges facing the continent, it would have been thought that there will have been huge strides in this direction.
16	Conference on Security, Stability, Development and Cooperation (CSSDCA).	2000	The aim is to address the inter-linkage between security, peace, stability, development and cooperation as a bed rock progress in the continent.		***No significant progress***: The level of insecurity and instability on the continent is still high for any meaningful development to take place and to attract a broad spectrum of investment for economic growth.
17	New Partnership for Africa's Development (NEPAD).	2001	The aim is poverty eradication by placing African countries individually and collectively on the path of sustainable growth and development and to participate actively in the world economy and body politic.	New Partnership for Africa's Development (NEPAD) is an attempt to address one of the weaknesses that was at the core of the problems that all the above initiative faced; the lack of political will in the area of democracy, governance and human rights. NEPAD is now the lead programme of action for Africa though it is linked to the Constitutive Act and the Conference for Security, Stability, Development and Cooperation.	***Implementation stage:*** So far the NEPAD programme has attracted much praise from Africa's development partners than substantive injection of resources for its successful implementation.

Source: Author (2006), with data from *Africa Institute of South Africa, 2002 [Introduction by Eddy Maloka, 2002]*

The enthusiasm over NEPAD programmes is aided by a decline in political tensions in Africa and promised donor support for water, energy and other infrastructures required for the country's development.[47] Consequently NEPAD is presented as the main vehicle of Africa's socio-economic development to be complemented by multi- and bilateral development initiatives (G8, 2001; World Bank, 2004) rolled out by the G8, the USA, China, the UN and the EU (see Table 5.4 for recent international development initiatives and programmes for Africa) as partnership programmes with African governments.

However, the desirability of these multilateral and bilateral development partnership programmes appears questionable. This is because of the selective nature of the proposed partnerships, their aims and the performance of past bilateral and multilateral development aid and programmes for Africa seem to indicate geopolitical competition for influence and economic gains. For instance, while bilateral programmes like the US African Growth and Opportunity Act (AGOA) and the Africa Caribbean Pacific European Union (ACP-EU) Partnership Agreements are believed to promote sustainable development and free markets in order to integrate Africa into the world economy (ACP-EU, 2000; AGOA, 2000), Chinese-African Cooperation (2004) is based on China's quest for resources but presented as based on mutual respect and equality in economic and social development. Therefore while the multilateral and bilateral partnerships further integrate Africa into the global economy they also marginalise it politically and economically through self-serving partnership programmes (Tesha, 2002). [48]

NEPAD is therefore believed to be a continuation of the politicisation of development – including large dam construction – which is ideologically driven to achieve socio-economic and political goals. In this context NEPAD's long-term sustainability as a continental development policy will probably hinge on donors' continued enthusiasm and tangible support if it is not to suffer the fate of past African development programmes. African leaders' commitment to maintaining peace and cooperation in the region for economic integration is also believed to be a key prerequisite for NEPAD's success. This could

[47] The impetus driving NEPAD results from the decline in political tensions and divisions among African countries because of the end of the Cold War and a tilt towards democratic governance supported by the Organisation of African Unity's (OAU) adoption of the African Charter for Popular Participation in 1990 (Maloka, 2002). This set of circumstances provides a political climate for the resolution of intra- and inter- state conflicts, as well as a congenial environment for Africa's socio-economic and political recovery (ibid).

[48] Africa's integration in the global economy through colonial imposition and further restructuring of its economies and politics by emerging multilateral institutions as key actors in the policy management of development cooperation have distorted and at times undermined the efforts of Africans to recover from the effects of such integration. That the multinational institutions are currently responsible for setting the pace, direction, conditionalities and cross-conditionalities of development cooperation and international relations is one feature that negatively affects African development which Tesha (2002) attributes to neo-colonialism.

enable the benefits of large dams to flourish as part of the infrastructure base for Africa's socio-economic integration and development to address poverty.

5.6 Changed development and water resources paradigms

Africa's large dams and development initiatives are said to evolve around changed development and water resources paradigms. In the case of development paradigms, sustainable development is now a counterpoint paradigm to modernisation and reflects changed political and development ideology at a different historical time (Long, 1992; Preston, 1996; Simon, 1997). It is argued for instance that modernisation leads to the formation of an industrial society which expands social cooperation and increases humans' control of nature and society based on the application of advanced technology and science (Hancock, 2006). In most cases industrialisation is attained under a political authority based on a rationalised, standardised and legally convenient format of administration in order to simplify performance and with sovereignty over a territory; the State (Scott, 1998). Such a political authority with sovereign territory levies taxes in order to enhance the state's capacity to design and implement development programmes, which are 'classic state functions' (ibid: 2) such as the large dams constructed by the US Corps of Engineers in the early 19th century for irrigation, hydropower and flood control in the mid and western United States. Such state-led development programmes resulted from a convergence of politics and economics.

The impact of a type of development paradigm on the construction of large dams was amply demonstrated when modernisation was the dominant development paradigm from 1950 to 1989, when about 22,270 large dams, as detailed in Table 5.4, were constructed including some in Africa (Bergeret and Bister, 2003). Thus because the modernisation paradigm emphasises the use of science and technology for industrialisation it favoured the construction of large dams to support irrigation, hydropower, water supply and flood control in Africa.

Table 5.4: Recent international declarations and programmes

No	Programmes	Relevance to Africa	Date
1.	US African Growth and Opportunity Act (AGOA)	The Act seek to offer tangible incentives for African countries to continue their efforts to open their economies and build free markets and to helps integrate Africa into the global economy.	Signed into law on May 18, 2000
2.	China-Africa Cooperation in Economic and Social Development	To acknowledge the imperatives for a dynamic, new strategic partnership between Africa and China with a commitment to co-operating in all fields, especially social and economic development, on the basis of equality and mutual respect with a view to renewing, developing and expanding China-Africa co-operation in the 21st century.	China-Africa Cooperation Forum -- Ministerial Conference, October 12, 2000 in Beijing.
3.	ACP-EU Partnership Agreements	The agreement aims to alleviate poverty and to promote sustainable development and the integration of the ACP countries into the world economy.	Though signed in Cotonou, Benin. June 2000 it took effect in 2003.
4.	UN Millennium Declaration	The main purpose was to address the imbalance in the distribution of benefits and costs as a result of globalisation even though it offers great opportunities. In this regard developing countries and countries with economies in transition face special difficulties and challenges. Thus, only through broad and sustained efforts to create a shared future, based upon our common humanity in all its diversity, can globalization be made fully inclusive and equitable. These efforts must include policies and measures, at the global level, which correspond to the needs of developing countries and economies in transition and are formulated and implemented with their effective participation.	8 September 2000
5.	G8 communiqué at the Genoa Summit	To support the consolidation of democracy, pluralism and electoral fairness in an increasing number of African countries. Encourage similar progress towards political openness where democratic principles and the rule of law are weak. Stress the importance of working in partnership with African governments to improve access of African products to world markets, attract foreign direct investment and promote investment in key social sectors, in particular health and education. Implementing the HIPC Initiative will release resources for such expenditure.	July 2001
6.	Millennium Challenge Corporation	The United States Government Millennium Challenge Corporation (MCC) mission is to reduce global poverty by working with the poorest countries in the world through the promotion of sustainable economic growth based on the principle that aid is most	Established in January 2004

		effective when it reinforces good governance, economic freedom and investments in people.	
7.	Gleneagles Declaration	A doubling of aid by 2010 - an extra $50 billion worldwide and $25 billion for Africa; Writing-off immediately the debts of 18 of the world's poorest countries, most of which are in Africa. This is worth $40 billion now, and as much as $55 billion as more countries qualify; Writing off $17 billion of Nigeria's debt, in the biggest single debt deal ever; A commitment to end all export subsidies. A date for this, probably 2010, should be agreed at the World Trade Organisation's Ministerial in December. The G8 have also committed to reducing domestic subsidies, which distort trade; Developing countries will "decide, plan and sequence their economic policies to fit with their own development strategies, for which they should be accountable to their people"; As close to universal access to HIV/AIDS treatments as possible by 2010; Funding for treatment and bed nets to fight malaria, saving the lives of over 600,000 children every year; Full funding to totally eradicate Polio from the world; By 2015 all children will have access to good quality, free and compulsory education and to basic health care, free where a country chooses to provide it.	2005
8.	The Africa Commission Report	Its aim has been to generate ideas and action that will 'accelerate and sustain Africa's growth and development, leading to a strong and prosperous continent.'	March 2005

Source: The African Growth and Opportunity Act (2000), Programme for China-Africa Cooperation in Economic and Social Development, (2004), ACP-EU Partnership Agreements (2000), Millennium Declaration (2000), G8 communiqué at the Genoa Summit (2001), Gleneagles Declaration (2005), and The Africa Commission Report (2005). Millennium Challenge Corporation (accessed 21/11/2007) http://www.mcc.gov/about/index.php

But the rise of the sustainable development paradigm as an antithesis of modernisation led to a significant reduction in the number of large dams built in Africa, even though there are still believed to be technically- and financially-feasible large dam sites on the continent. The reduction of large dam construction is attributed to the conceptual underpinning of sustainable development to safeguard the welfare of future generations and the environment (OECD, 2001). Sustainable development therefore requires the elimination of what are regarded as negative externalities of development projects such as large dams perceived to be responsible for natural resource depletion and environmental degradation in order to prevent developmental or demographic overshoot that might result in social impoverishment and the collapse of ecological systems (OECD, 2001; Caldwell, 1996). The sustainable development paradigm therefore contributed to the fall in the number of large dams built from 1990 to 1999 in comparison to other decades, as shown in Table 5.5. In this case the sustainable development paradigm highlights large dams' environmental and social costs.

Table 5.5: Number of additional new dams constructed by decade 1950 - 1999[49]

Time Periods (Decade)	Number of New Dams Constructed
1950 – 1959	3213
1960 – 1969	5972
1970 – 1979	7511
1980 – 1989	5574
1990 – 1999	3354

Source: With data from Bergeret and Bister (2003)

The debate about large dam construction in Africa is also partly influenced by paradigmatic shifts in water resources development. In the past, water infrastructures dominated water resources development but they were jettisoned in favour of integrated water resources management (Biswas, 2004). The change in paradigm was due to three factors. The first was disfavour with the social and environmental impact of large water infrastructure, partly influenced by Schumacher's (1973) 'small is beautiful' thesis of development which argues against modern industries and infrastructure because they require much resource use yet are said to accomplish little because of their high level of inefficiency (ibid). Schumacher (1973) believes that large-scale projects could not represent progress because they are environmentally destructive and lead to the concentration and consolidation of economic power in the hands of a few (ibid), and are therefore an inappropriate development strategy (Lin, 2003). Schumacher (1973) and Lin (2003) also argue that minor technology transfer to Third World countries will not solve the underlying problem of unsustainable economic development, even though it is based on the need to close the industry

[49] From 1900 to 1949, an average of about 1000 new dams was added every decade (ICOLD, 2003).

and technology gap between developed and developing countries. Consequently, Schumacher calls for 'a new orientation of science and technology' (ibid) towards small-scale projects – including water-related ones – in communities because they have a greater impact on the needs of local people and poverty in contrast to large-scale projects which almost never benefit the majority or poor members of society (ibid). This critique of large projects questions the imperative of large dams and has significantly contributed to the reduction in their construction.

Finite and declining water resources – particularly their long-term impact on the environment – is the second factor that contributed to the paradigmatic shift from water resources development to management (Falkenmark, 1989a & 1990; Gleick, 2000 & 2002; WWC, 2000). Water management, according to Falkenmark and Rockstrom (2004), is based on increased understanding of the interrelationships between water and the environment which led to a 'shift in thinking […] that links water security, food security and environmental security' and 'respond to the problems and benefits caused by the evident links […] between water and ecosystems' (ibid: xix). This suggests that large dams are not the only solution to water problems.

The third factor is the poor performance of agriculture and industry which large dams were to support for Africa's socio-economic development. African-owned industries' contributions to development are modest because their low-level technologies are unable to challenge multinationals' production of capital intensive goods (Ake, 1981; Lewis, 1992; Grove, 1993).[50] Consequently Africa accounts for only 1 percent of manufactured products globally because of its insignificant economic diversification and lack of capacity to produce industrial goods like vehicles, chemicals, machinery and electrical wares (Ake, 1981). This implies that large dams are unable to bring about transformation in the socio-economic development of Africa led to a reduction in the number of large dam construction in Africa.

5.7 Conclusion

Africa's chequered development still faces huge though surmountable challenges. The policy and situational challenge of its development require a continent-wide potable water supply, food security and

[50] The diverse forms of early industrialisation in Africa as identified by Grove (1993) involved the processing of locally-produced commodities such as cotton, groundnuts, cocoa, coffee, tea, sugar, palm oil, tobacco, timber and fish. Others countries were extracting products such as gold, copper, phosphates and other minerals, followed by the manufacture of heavy constructional materials such as cement and concrete blocks which was linked to the provision of infrastructure through building and road construction. Import substitution industries designed to replace imported foodstuffs, beer, soft drinks, tobacco, textiles and metal utensils, footwear and furniture, coupled with assembly lines for bicycles, tractors, radios, shoes and plastic products were a key part of the industrial plans of African governments. These activities consequently generated another set of sectors involved in the repair and maintenance of this equipment and machinery (ibid, Ake, 1981).

the provision of clean energy to serve as its socio-economic foundation. Africa's post-colonial attempts to tackle these challenges by marshalling state machinery and resources through different strategies in national, regional and international programmes have had varying degrees of success in different epochs, but not throughout the continent.

Large dams are among the strategies adopted to meet the energy, food and drinking water requirements of the people and to provide a firm base for economic and industrial development. Although they have played a huge role in Africa's development, their construction and performance over the years have been mixed and subject to power play by competing interests and actors at local, national, regional and international levels, especially in the geo-political and financial world. As a result, the dream of industrialisation and food self-sufficiency has eluded Africa, leaving it at the margins and under the control of the global economy.

The next chapter examines the impacts of a whole gamut of global issues – geopolitical, financial, social and environmental movements, environmental and development politics and proposed large dam alternatives in the current debate about large dams and Africa's socio-economic development.

CHAPTER 6

THE CONTEMPORARY DEVELOPMENT OF LARGE DAMS IN AFRICA

The contemporary development of large dams in Africa is dependent on the confluence of several factors. But the three key ones identified in this chapter as a *sine qua non* are sources of large dam funding; governance and cooperation in and among African states; and the viability of large dam alternatives in Africa. These three key factors are in turn influenced by geopolitics and financial regimes, environmental and development politics and social and environmental movements at global level. This chapter contends that these latter factors as they are presently constituted and function appear to militate against large dam development in Africa because they are dominated and influenced by Western philosophies of development.

6.1 Governance and cooperation in Africa's development and large dams

Political, social and economic cooperation and governance in and between African countries and sub-regional groups could aid the development of large dams in Africa. The Constitutive Act of the African Union and the Conference on Security, Stability, Development and Cooperation (CSSDCA), both in 2000, and NEPAD in 2001 (see Table 5.3) are African initiatives which recognise the importance of the cooperation and integration of African countries in addressing the challenges of development shortcomings; the linkage between security, peace, stability, development and cooperation as a bedrock of progress on the continent; and the eradication of poverty by placing African countries individually and collectively on the path of sustainable growth and development and active participation in the world economy and body politic (Africa Institute of South Africa, 2002). The initiatives of governance and cooperation in Africa are therefore necessary for the success of NEPAD's infrastructure development programme which includes large dam construction for irrigation, hydropower and water supply.

Development governance involves how institutions and structures of authority are used either collaboratively or individually to allocate resources – such as the determination to construct large dams – by coordinating activities in a society or its economy (World Bank, 2005). Thus UNDP (2001) defines governance as 'the exercise of political, economic and administrative authority in the management of a country's affairs at all levels', which comprises 'the complex mechanisms, processes and institutions through which citizens and groups articulate their interests, mediate their differences and exercise their legal rights and obligations'. These definitions of governance include participation, rule of law, transparency, responsiveness, consensus orientation, equity and inclusiveness, effectiveness and efficiency and accountability as criteria necessary to ensure that the views of minorities and the most vulnerable in society are heard in decision-making, that corruption is minimised and resources are used equitably and

effectively (Huque and Zafarullah, 2006; UNDP, 2001; World Bank, 2005). These criteria are now an inextricable part of development strategies and aims (Cleaver and Franks, 2005), implying that the imperative of large dams in contemporary Africa may be assured if they meet standards of good governance in their conception, planning, design, implementation and operation.

However, there is disagreement as to the scale at which governance can be effective. While the World Bank (2005) perceives governance as operating at all levels, Cleaver and Franks (2005) believe that 'it is most relevant at the meso and micro levels of society' (ibid: 4) because it is at these levels that 'the partnerships and networks are formed which most strongly influence daily lives, particularly of poor people' (ibid). Franks (2004) therefore defines 'governance as a localised, context-specific concept about the way people make decisions and do things in practice' and 'about the way stakeholders in society shape their relationships to order their affairs' (Cleaver and Franks, 2005: 3). On the one hand this means that large dams can be subject to governance criteria based on the World Bank's concept of governance, and at the local scale it could empower those most likely to be affected by large dam construction to either challenge or support them through negotiations based on local networks and partnerships in order to derive maximum benefits from their operation.

Meanwhile, it is important that governance networks and partnerships between stakeholders at the local level are scaled up to the national and global level (DFID, 2006). This is firstly because decisions about large dam construction are finally agreed at national and global levels due to their huge technical and financial outlay. Secondly, scaled-up governance networks and partnerships between stakeholders take cognisance of ideas, prescriptions, and legal frameworks relating to the development and environment goals of global development and environment institutions and donor organisations such as the World Bank, World Trade Organisation (WTO), International Monetary Fund (IMF), World Wide Fund for Nature (WWF) and International Conservation Union (IUCN), including regional bodies like the AfDB (Huque and Zafarullah, 2006) because they might be important to large dam construction. In this context partnerships and networks of national governments and non-governmental actors at the national and international levels can challenge, support, or negotiate acceptable conditions for large dam construction based on global and national interests (Leftwich, 2006). In this regard the effectiveness of localised governance criteria to assure the development imperative of large dams is possible when connected with national and global governance.

Creating a bigger market in Africa through cooperation to encourage trade and investment is significant in the future of large dams and the continent's development. Such cooperation will involve undertaking joint

projects, including constructing and managing large dams to facilitate the integration and expansion of Africa's fragmented market to reduce the transaction costs of doing business on the continent and aid industrialisation (Taylor, 2005; Ake, 1981).[51] Expanding the African market in this way will mobilise capital for project development with a regional flavour, increase inter-African trade - which is currently at only 12 percent – among Sub-Saharan African countries and improve efficiency in the use of human and natural resources (ibid). The NEPAD infrastructure programme, and large dams in particular due to their size, can be a tool for cooperation and market integration in Africa. [52,53]

Governance and cooperation are essential to securing the future of large dam development in contemporary Africa. Governance at all levels from local to global can enable all stakeholders, through either partnerships or networks, to participate in making decisions about the equitable and effective utilisation of resources including large dams for the benefit of society. Governance at local and national level ensures that the benefits of large dams are proportionate to their cost burden at each level of society. Consequently the future of large dam development in contemporary Africa will be significantly improved if African countries deepen cooperation among themselves and institutionalise governance in the national body polity.

6.2 Funding large dams in contemporary Africa

An essential issue for the construction of large dams in Africa is the funding sources and type of funding regime. In the past the World Bank was the major financier of large dams but this has declined significantly because of what it calls non-involvement in potentially controversial hydraulic infrastructure financing (World Bank, 2004). 'For example, whereas the World Bank financed 3.5 percent of dams constructed in the 1970s, it financed less than 1 percent in the 1990s, with World Bank lending accounting for less than 0.5 percent of total financing for new dams in developing countries. And Bank investments in hydropower declined by 90 percent over the last decade' (ibid: 35). The reduction in World Bank investment in large dams has contributed hugely to the decline in large dam construction, as shown in Table 5.5, and highlights the importance of reliable and consistent sources of funding for large dams in Africa.

[51] The most significant of these large dams is the proposed Inga Dam on the Congo River. The Democratic Republic of Congo is planning to develop the 40,000-MW Grand Inga facility. If constructed it will possibly be the largest in the world. The project will provide hydroelectric power primarily for export to the 12-member nation South African Power Pool (SAPP) (Grove, 1993; EIA, 1999; Akosah-Sarpong, 2002).

[52] One main issue facing inter African trade is the bad nature of infrastructure linking the continent together. NEPAD is likely to address this in an effort to promote trade and the free movement of people and services and should not be left to hang on the drying line of pessimism.

[53] The five countries that dominate trade outside South Africa are Cote d' Ivoire, 25 percent; Nigeria, 20 percent; Kenya, 9 percent; Zimbabwe, 9 percent and Ghana, 9 percent (Taylor, 2005 cited from UNECA, 2003: 40).

Funding sources for large dams in Africa are determined by the purpose for which they are being constructed. At present large dams funding is dominated by the public sector with some support from international donors (Winpenny, 2003; World Bank, 2004). Winpenny (2003) observes that about 65-70 percent of funding for water and sanitation projects in Africa and other developing countries comes from the domestic public purse, 5 percent from the domestic private sector, and 10 and 15 percent respectively from international private companies and donors. The main sources of funding for irrigation, drainage and hydropower are governments, aid donors and international development agencies (ibid) with little involvement of the private sector. The dominance of the public sector in funding all types of large dams is an indication of how large dams are perceived by public sector institutions.

The dearth of private investment in water infrastructure, including in large dams, in the developing world is particularly felt by African countries. Private investment in water infrastructure in developing countries is minimal and varied across continents, depending on the infrastructure type, and is usually supported by lending guarantees (Winpenny, 2003). For instance, hydropower construction in developing countries received less than 10 percent of annual investment in the water sector (ibid). The paucity of private investment in Africa is illustrative because out of $700 billion infrastructure investment made in developing countries, all 10 percent of investment in water supply, sanitation, and hydropower were in East Asia and Latin America which are perceived as relatively low-risk economies; there was no investment in Africa because it is a high-risk continent (World Bank, 2004). This exposes the limited funding sources for large dams in the developing world and in Africa in particular, and the need to lessen the economic and political risks associated with the continent in order to broaden its funding base for water infrastructure development.

This pattern of investment in Africa's water infrastructure, particularly in large hydropower dams, is said to follow historical precedents. Lending for hydroelectric power projects in Africa faces stringent economic requirements in industrialised countries under the guise of conserving capital for more profitable investment (Smith, 1968). Large African hydropower dams are also subject to other arbitrary financing requirements such as understating the value of other benefits like irrigation, flood control, urban water supply, reclamation, navigation and recreation which undermine their economic viability; paying 14 percent interest on commercial loans secured for the project – that is, more than double the normal 6 percent required and even higher than what applies to hydroelectric projects constructed and funded in the industrialised countries; and after all these conditions hydropower is expected to be cheaper than

thermoelectric alternatives (ibid).[54] A comparative analysis of hydroelectric projects in West Africa from 1951 to 1963 shows lower cost estimates than those for similar projects throughout the world (Smith, 1968). These funding restrictions and newer requirements for environmental and social impact assessments, mitigation and restoration have added to the cost of funding large dams in Africa and appear to undermine their socio-economic benefits (UNEP, 2000; Linaweaver, 2002; World Bank, 2004).

The funding restrictions on large dams pose a significant challenge for their contemporary construction in Africa. The World Commission on Water envisages that about $180 billion a year for investment in water infrastructure needs to be raised to ensure water security by 2025 (World Bank, 2004). This amount doubles the $70 billion a year – this comprise of $17 billion for hydropower, $28 billion for water and sanitation and $25 billion for irrigation in current investments from public sources and multilateral financing – the World Bank, regional development banks, and some private investors who seek to maximise capital flow from their investments (World Bank, 2004; idsnet, 2005). So the paucity of funding source is a huge problem that Africa needs to be overcome.

However, the imperative of large dams in Africa's development received a boost in recent years from the World Bank, regional banks and Chinese investment. The World Bank and ADB for instance argue that large dam infrastructure can be beneficial to local people and nations because they provide security against climate variability, which affects the livelihood of poor people the most (see in subsection 3.4.1) (World Bank, 2004; ADB, 2005). But the support of China for large dams, which has led to their resurgence in Africa, is of great significance. Some of the dams benefiting from China Export and Import (EXIM) Bank funding are the US$ 620 million Bui Hydroelectric Power Dam, which could have a significant impact on the power generation capacity of Ghana (Davies et. al., 2008); a 1000MW hydroelectric plant in Mambila, Nigeria (Wild and Mepham, 2006a); the Merowe Dam in northern Sudan; and the Mphanda Nkuwa Dam in Mozambique jointly financed with the World Bank (Davies et. al., 2008), among several others. The renewed interest in funding large dams for hydropower, irrigation, water supply and flood control in Africa seems to recognise their role in tackling water scarcity due to climate variability and the achievement of the MDGs.

[54] A 3 percent interest rate was used in economic justification studies and in financing most of America's great hydroelectric projects, including the Grand Coulee, Boulder Dam, and the Tennessee Valley Authority (TVA) (in full this first time, followed by initials in brackets), built in the depressed and underdeveloped regional economies of the 1930s. These dams have repaid the investments a hundredfold in direct and indirect economic benefits, thereby silencing the Cassandras (Smith, 1968).

Chinese investment in large African dams appears to be part of a broader investment partnership drive in the infrastructure and resource sectors on the continent. For instance a $5 billion China–Africa development fund has been created to encourage Chinese investment in Africa, and Chinese FDI in Africa had reached $1bn by mid-2005 (World Bank, 2004a cited by Wild and Mepham, 2006a Lammers, 2007) including investments in the energy and resource sectors (Wild and Mepham, 2006a). Recent Chinese loans focusing on building energy infrastructure in Africa are said to be in the region of US$ 10 billion per year (*Financial Times* 6-2-2007). As the sole provider of concessional financing consistent with China's policy towards infrastructure development, China's EXIM Bank had financed over 300 projects in Africa by mid-2007, constituting almost 40 percent of its loan book (Davies et. al., 2008). The pledge of about US$20 billion in infrastructure and trade financing to Africa – include concessionary loans – in the next three years, made at the annual meeting of the African Development Bank in Shanghai in May 2007, shows the scale of China's commitment and engagement in Africa (Davies, 2007). This sum eclipses many of the continent's traditional big donors with a single pledge – the AfDB African Development Fund is $5.4bn while the World Bank's total IDA is about US$21.6 for three years (ibid). The financial muscle and commitment of China to investing in African infrastructure gives the continent a real alternative to its traditional funding sources for large dam construction.

The flow of Chinese investment into Africa for the construction of infrastructure has provided some optimism for the future of the large dam development imperative and African development. Three factors account for this optimism. The first is the quality of the Chinese FDI, loans and development aid offered to Africa. Chinese FDI in Africa is low-cost capital and comes from Chinese firms which are either wholly or partly state-owned with long-term operations on the continent (Kaplinsky et. al. 2007). The investments are closely bundled with aid to either explicitly or implicitly achieve strategic objectives such as long-term access to raw materials (Broadman, 2007 cited by Kaplinsky et. al., 2007). This contrasts with European, North American and Japanese-sourced FDI in Africa, which have historically come from privately-owned corporations focused on profit maximisation and generally have relatively short time-horizons (Kaplinsky et. al. 2007). Secondly, good-quality infrastructure constructed by Chinese firms appears to be a quarter to half less costly than Western firms and at a price discount of 20 to 50 percent lower compared to other foreign investors (ibid). Lastly, the lack of the intrusive conditionality and costly procedures for development projects associated to Western countries has made Chinese investments extremely attractive to African governments (Hilsum, 2006). African countries now have a wider spectrum of funding options than in the past, and based on cost, conditionality, funding type and the time frame of investments Africa is likely to have a preference for Chinese investment in large dam

infrastructure over that from Western-dominated and controlled donor institutions and countries who have been Africa's traditional development partners and funding sources.

However, there are some criticisms of China's investments activities in Africa. These are summarised in Table 6.1 and are raised by Western countries' media and politicians (Sautman and Hairong, 2006). The Western criticisms are:

1. China's support for the Millennium Development Goals, the African Union and the New Partnership for Africa's Development (NEPAD) is rhetoric (Lammers, 2007);
2. Chinese aid is almost entirely bilateral and outside the existing architecture of international development assistance (ibid);
3. Environmental and social costs (ibid);
4. The impact on human rights and democracy (ibid; Sautman and Hairong, 2006);
5. China behaviour in Africa is predatory (Sautman and Hairong, 2006);
6. China's use of tied aid which increases the cost to recipients by about 15 to 40 percent (Davies, 2007);
7. Debt sustainability (ibid); and
8. The high ratio – 70:30 – of Chinese expatriate workers to Africans in construction (Rocha, 2006).

These criticisms of Chinese investment activities in Africa infrastructure such as large dams question their development imperative in Africa's socio-economic development, particularly on the issue of the MDGs and dealing with climate variability on the continent, although they may also be a way of subverting Africa's development interests.

However, it is the impacts of Chinese investments in Africa on Western investment interests that has led to some of these criticisms and compelling some Western institutions to adjust their conditionalities for funding projects in Africa. For instance Chinese investment impacts are said to be so huge that the European Investment Bank (EIB) has suggested the need to lower social and environmental standards in order to avoid 'excessive conditions' imposed on projects in Africa (Davies, 2007: 74). The OECD has weakened the agreed Common Approaches of its export credit agencies' conditionality on investment in Africa (ibid).

But the Chinese and others have rejected the criticisms. They argue (see summary in Table 6.1) that unlike Western countries' investments, Chinese investment activities in Africa are benign and have delivered significant dividends and benefits to recipient countries in response to socio-economic development needs because Chinese aid to Africa is on grounds of political equality and mutual trust, economic win-win

cooperation and cultural exchange (FMPRC, 2006). Among the arguments against the charge that China's behaviour in Africa is predatory are: i) Chinese aid often goes to infrastructure which deepens economic ties and not directly into recipient government accounts – as practiced by Western firms – which could easily be siphoned off (Sautman and Hairong, 2006); ii) Chinese companies have low profit expectations – at 3 percent – in contrast to European firms which expect 15 percent or more (ibid); iii) China is less interventionist; and iv) Western-funded projects are extensively bureaucratic, have high overheads and often employ expatriate personnel. Consequently, Hilsum (2005) citing the Sahr Johnny, Sierra Leone Ambassador to Beijing stated that; African governments are comfortable with Chinese investment because it produces results in comparison to the huge amount of money invested by western countries over the past decades, for which not much is seen (ibid). This indicates that for Africa to make good progress in infrastructure such as large dam construction for socio-economic development, China is currently the best choice.

Western criticism against China is said to be insincere as Africa has historically been perceived as the resource pool of the developed world. In this regard 'both China and western governments are leading forces in an international political economy that positions Africa as a resource-supplying continent' (Sautman and Hairong, 2006: 54). So if Chinese investment in Africa is predatory, then it is following a well-trodden pattern that Western countries have perfected over centuries based on former colonial ties (Wild and Mepham, 2006b). Thus 'China's growing role in Africa has large implications for the policies of western governments, companies and NGOs as it creates a new triangular dynamic which benefits Africans because of increased competition for trade, investment and even aid, weakening the effect of western-imposed conditionality on African governments' and '[requires] western policy makers to adapt their development strategies since Africans can now 'look east' for investment trade, aid and other forms of assistance' (ibid). African countries now have the opportunity to choose their development partners based on aid conditions and effectiveness that meet their development interests.

The description of China's support for the Millennium Development Goals, the African Union and NEPAD as rhetoric is not true and lacks evidence (Lammers, 2007). China does not have an African strategy and Chinese aid to Africa is based on specific requests from governments and not determined by China (Tjønneland et. al., 2006; Davies, 2007). Sautman and Hairong (2006) observe that 'differentiated responses are required in different contexts and countries, but some forms of coordination of country level and regional strategies may be useful, and may help to ensure that ordinary Africans derive greater benefits from the continent's relationship with China' (Lammer, 2007: 63). Consequently, the African Union (AU) is to help member states create a strategy for China to enable African countries to develop a

collective response to the future challenges that may emerge in the Africa-China partnership (ibid). It is in this regard that China has initiated a permanent Forum on China-Africa Co-operation (FOCAC) as the chief instrument and mechanism for dialogue and co-operation between Africa and China (Tjønneland et. al., 2006). So it is left with AU/NEPAD to ensure that FOCAC is aligned with their development (ibid).

The structure of the international development assistance programme is viewed with suspicion and scepticism by the Chinese, who believe that the priorities of the international donor community such as the OECD, the World Bank and others do not reflect those of African recipient countries (Tjønneland et. al., 2006). The OECD's donor structure is donor-dominated and problematic for China because it is very 'politically oriented' and 'built on a fixed model which is difficult to change' (Davies, 2007: 68). China is sceptical about the international donor process and its inability to cater for varied donor and recipient countries' interests.

Despite this unwillingness to work within the confines of the international donor framework, China, through the AfDB, has provided 314 million U.S. dollars to 14 projects in 8 African countries (Davies, 2007) and worked through FOCAC to support and cooperate with AU and NEPAD (ibid) and with the UN on joint projects. China has also signed a memorandum of understanding (MOU) with the World Bank to improve cooperation on road and energy investment projects in Africa, initially focusing on Uganda, Ghana and Mozambique (ibid). Wild and Mepham (2006b) suggest that the new EU-African Partnership for infrastructure worth €5.6 billion from the Tenth European Development Fund (EDF 2008-2013) to support regional development in four priority areas – transport, energy, water, and information technology and communication networks (European Commission, 2006) – might be a useful platform from which to engage and cooperate with China on Africa. The EU-African Partnership could provide the opportunity to identify common interests and to coordinate responses to common problems (ibid). Such cooperation between China and other donors might enhance the imperative for infrastructure such as large dams in dealing with climate variability and MDG.

Table 6.1 Criticisms of Chinese investment in Africa

No	Western Criticisms	Chinese Response	Suggested solution
1	China's support for the Millennium Development Goals, the African Union and the New Partnership for Africa's Development (NEPAD) is rhetoric.	China's aid to Africa includes the construction of hospitals, clinics, schools, roads, agriculture and energy which supports the MDG and NEPADs and AU initiatives and priorities. China committed to support and cooperates with AU and NEPAD - FOCAC Secretariat - by establishing a liaison office and expertise committees to evaluate the feasibility of individual projects and electoral priorities in infrastructure, human resource development and agriculture.	NEPAD and the AU - through FOCAC Secretariat - to develop and coordinate collective and individual -differentiated responses are required in different context and countries - strategies for African response to future challenges that may emerge in the Africa-China partnership to help ensure that ordinary Africans derive greater benefits from the continent's relationship with China.
2	China's aid to Africa is almost entirely bilateral and outside the existing architecture of international development assistance.	China's aid modalities and projects are based on demands and proposals from the recipients to achieve tangible results rather than specific country strategies. China's non-prescriptive policies in Africa differentiate it from the principal western states, which are seen as imposing diminished growth, a huge debt and ongoing poverty through SAP and other means. Western governments use aid to compel compliance with economic and political conditions while employing protectionism and supporting authoritarian rulers. Officially, at least, China celebrates Africa's culture and achievements in contrasts with a western view that depicts post-colonial Africa as 'the hopeless continent'. The OECD DAC is seen as very "politically oriented", too donor dominated and built on a fixed model which is difficult to change.	The UN is China's first choice if engaging in joint donor initiatives. Cooperation can be extended to the World Bank, EU and other international organisation if common ground can be found.
3	China behaviour in Africa is predatory.	China less interventionist. Both China and western governments positions Africa as a resource-supplying continent. China's activities in Africa are benign, more helpful to Africans than	Effective African states can strike more favourable deals with external investors and ensure greater developmental benefits e.g. Latin America experience.

		those of the west, and based on political equality and mutual trust, economic win-win co-operation and cultural exchange. Many Chinese firms working on infrastructure have low profit expectations e.g. three percent in Ethiopia, while European firms seek 15 percent or more. Western oil firms pay royalties that sometimes line the pockets of officials, while china often builds infrastructure in exchange for oil. Chinese aid goes to infrastructure and not directly into recipient government accounts, making difficult to siphon off".	
4	Undermine human rights and democracy.	Western companies are involved in regimes responsible for human rights violations, such as Total in Burma, Exxon Mobile in Equatorial Guinea and Shell in Nigeria. China's commitment to respect national sovereignty and not interfere in the internal affairs of states is appreciated by many African governments. Africans thinking on sovereignty and governance is progressive because NEPAD and AU are strongly committed to democracy, better governance and the observance of human rights.	African civil society restates the legitimacy of democracy and human rights not only because they are important but they reinforce economic development.
5	China use of tied aid.	Chinese companies with tied aid have contributed to lower procurement costs. Western governments and international institutions aid tied to donor economic interests, e.g. about 80 percent of US grants to developing countries must be used to buy goods and services from US firms and NGOs. It took western donors 40 years to agree to untie only a proportion of their bilateral aid in 2001 but most failed. So China - a new donor - cannot be accused of aid tying which western donors continue to practice.	Chinese and local African companies work in tandem to develop service delivery capacity and improve quality of services.
6	High ratio - 70:30 - Chinese expatriate workers to Africans in construction is high.	Chinese work force in the construction sector in Africa is not always accurate because it varies from country to country.	Enhance human resource development and skills in all sectors of the economy.
7	Cost to the environment and	China's investment activities costs to the society and environment are not	Need to lower social and environmental

	society.	different from that of the west in the past.	standards should be a thoroughly debated by donor community and aid recipient countries to avoid excessive social and environmental conditionality. Joint discussions and cooperation to secure benefits for local people and the environment.
8	Debt sustainability.	Government to government loans are cancelled if borrowing governments face pay back difficulties because China has a long history of debt forgiveness. China provided US$1.38 billion debt relief to 31 African countries and pledged to cancel interest free and low interest governmental loans owed by HIPCs and LDCs in Africa. China has called on traditional donors to fulfil their pledges on Africa debt relief and adopt substantial measures for debt cancellation. The Exim Bank of China has good repayment record because they look at the repayment potential in the long term horizon, effectiveness of project and debt sustainability is based on: 1. Robust project returns; 2. Consultation with local IMF office; 3. Project is part of the country's development plans.	

Source: (Davies, 2007; Lammers, 2007; Sautman and Hairong, 2006; Rocha, 2006; Obiorah, 2006; Sautman and Hairong, 2006; FMPRC, 2006; Wild and Mepham, 2006b; Davies, 2007; Tjønneland et. al., 2006).

China's response to other criticisms about environmental and social costs, undermining human rights and democracy, its use of tied aid, debt sustainability and the high ratio of Chinese expatriate workers in Africa (see Table 6.1) is that:

1. China is cooperating with Africa on the environment – climate change, water, biodiversity, disasters and humanitarian assistance, emphasising the role of NGOs and media cooperation, although activities and projects funded in this area appear limited so far (Tjønneland et. al., 2006);

2. Some Western companies have been involved in countries and regimes responsible for human rights violations, such as Total in Burma and Exxon Mobile in Equatorial Guinea. (Davies, 2007);

3. Some evidence shows that despite tied aid Chinese companies have contributed to the lowering of costs in procurement of Chinese goods and services (Davies, 2007);

4. The aid provided by Western governments and international institutions is often tied to donors' economic interests, e.g. about 80 percent of US grants to developing countries must be used to buy goods and services from US firms and NGOs (Sautman and Hairong, 2006). For example during negotiations over the Volta River Project (VRP) of Ghana, Eugene Black said that '[…] our foreign aid programs constitute a distinct benefit to American business.[55] The three major benefits are: 1) Foreign aid provides a substantial and immediate market for U.S. goods and services. 2) Foreign aid stimulates the development of new overseas markets for U.S. companies. 3) Foreign aid orients national economies toward a free enterprise system in which U.S. firms can prosper' (Magdoff, 1969: 176 cited in Hart, 1980: 45).

5. China's aid is not generally directly tied (Sautman and Hairong, 2006);

6. 'Western governments use aid to compel compliance with economic and political conditions, while at the same time, employing protectionism and supporting authoritarian rulers' (ibid, 2006: 60);

7. 'Officially, at least, China celebrates Africa's culture and achievements in contrast with a western view that depicts post-colonial Africa as "the hopeless continent"' (ibid, 2006: 60);

8. Most Western donors fail to untie their aid and the bulk of donor contracts are awarded to host country firms (Davies, 2007);

9. China will cancel debts if borrowing governments face difficulties paying them back because China has a long history of debt forgiveness (ibid);

10. China has provided debt relief to 31 African countries to the sum of approximately US$1.38 billion and further pledged to cancel interest-free and low-interest government loans owed by heavily indebted poor countries (HIPCs) and less-developed countries (LDCs) in Africa which was honoured at the end of 2007 (ibid);

[55] Eugene Black was the Executive Director, President and chairman of the World Bank from 1947 and 1962 (Magdoff, 1969: 176 cited in Hart, 1980: 45).

11. The Chinese government challenges traditional donors to fulfil their pledges on debt relief by adopting more substantial measures for debt cancellation (ibid);
12. China has committed to taking 'an active part in debt relief operations for Africa within the international multilateral framework' (ibid: 90);
13. EXIM Bank of China ensures that project returns are robust, consults with the local IMF office to discuss loans in the context of the debt sustainability framework and ensures that projects are part of the country's development plans to ensure debt sustainability (ibid);
14. There is a good repayment record on Chinese loans due to the effectiveness of projects. For projects with limited returns, government guarantees are important (ibid);
15. China looks at the potential of African countries in the long term, rather than assessing their immediate ability to repay loans (ibid);
16. China's debt cancellations and zero-rating of tariffs on products from least-developed African countries are significant initiatives (Tjønneland et. al., 2006: ix);
17. A survey commissioned by DFID on China's involvement in Africa's construction and infrastructure sectors in four countries concludes that the Chinese companies examined were usually found to employ a large amount of local labour, making up 85–95 percent of the total workforce (Davies, 2007).
These responses are a robust repudiation of Western criticism – perceived as hypocritical given their own past and present record in Africa's socio-economic development trajectory – of the impacts of Chinese investment in Africa.

On the whole Africa's political response to the new Chinese investment offensive seems positive. African leaders 'emphasised the importance of China for growth in their economies as a supplier of development finance and technical assistance, and as a political ally and friend' due to 'China's emphasis on "non-interference"' (Tjønneland et. al., 2006: x). Chinese assistance is channelled to focus on the provision of physical infrastructure, agriculture, capacity building and the social sector – science, health and education – and strengthen management and institutional capacity (Tjønneland et. al., 2006). So Chinese investment in Africa such as the rebuilding of hydropower infrastructures as a development imperative to address energy security is undoubtedly a positive experience which should be effectively used for Africa's socio-economic development (Rocha, 2006).

It is said that Africa's leaders perceive China's successful socio-economic policy regime and experience as an example to be emulated if they are to achieve sustained economic growth. While 'China experienced massive reduction in levels of absolute poverty – the number living below the US$1-a-day benchmark fell by 165 million' between 1990 and 2001, 'the number living in absolute poverty in Africa increased by 77

million' (Kaplinsky, 2006: 12). This huge rise in the number of African people living in absolute poverty occurred under the 'prescriptions of the Washington Consensus foisted on Africa and other developing economies […] by the World Bank, IMF and many western aid donors, favouring liberalisation of foreign trade and domestic markets, privatisation and a reduced role for the state' (ibid: 12). These prescriptions made some African nations bristle because they interfered in the policy domain of the state (Swann and McQuillen, 2006). 'The fact that a country gives you aid makes them think they have a license to tell you how to run your affairs' (Robert Kabushenga, a spokesman for Uganda's government cited in Swann and McQuillen, 2006: 13). This implies that African leaders could prefer dealing with China in their quest for investment because they perceive a greater common interest and bond with China than with Western countries.

The preference for a Chinese policy regime of socio-economic development by African countries has deepened economic ties. China builds power stations, railways and other infrastructure for Africans in lieu of payment for raw material and other investments, leading Africans to discuss a 'Chinese Model of Development' on the continent characterised by large-scale, state-led investment in infrastructure and support services (Ramo, 2004). This discussion intersects with a 'Beijing Consensus' – constant innovation as a development strategy – which 'uses quality of life measures, and not just GDP growth, to gauge development' and 'defends developing countries' sovereignty' instead of neo-liberal orthodoxy and hierarchy embedded in the Washington Consensus-related international institutions (Ramo, 2004) which 'often provides a huge Western role in overseeing African states' economic and foreign policies' based on ideological positions as well as practice (Sautman and Hairong (2006). Consequently, there appears to be a preference for Chinese investment and development model.

6.3 Global geopolitics and large dams

The imperative for large dams in contemporary Africa is said to be partly determined by global geopolitics. This is firstly because changed development and water resource paradigms, funding sources of technical and financial support for large dams in Africa and benchmarks for governance which partly led to the decline in large dam construction in Africa are determined by Western-dominated institutions, intellectuals, NGOs and countries (Tortajada, 2007). Secondly, the changes in the development and water resources paradigms, funding and other conditionality for large dam construction occurred when most of the best technically and economically feasible dam sites in most developed countries with the technology and financial resources to construct new dams had been utilised, in contrast to those of Africa and other developing countries (Church, 1968; Grove, 1993; Bartle, 2002; Bergeret and Bister, 2003). This

imbalance in global geopolitics is an issue that appears to influence the imperative for large dams in African development.

For instance, changed water resource and development paradigms are said to have contributed to the significant decline in large dam construction from its peak of 7511 in 1970–1979 to 3354 in 1990-1999 (see Table 5.5) (Bergeret and Bister, 2003). Africa and other developing countries were the losers because large dams are vital to their socio-economic growth (ibid). So with the main advocates of development and water resources paradigm change being Westerners, the large dam debate 'has taken on a North-South structure' (WWF, 2006: 2) because the 'most vocal dam opponents come from the North' (ibid). Thus a perception was created that some Western-dominated institutions and countries sought to deliberately sabotage southern countries' quest for socio-economic development (Tortajada, 2007).

The genesis of the perception that large dam development in Africa was being subverted by Western-dominated institutions and countries can be traced to the hydropolitics of the then two global superpowers, the US and the USSR, and their rivalry in the Cold War era. The two superpowers deliberately maligned each other's development activities such as large dams in countries of different political persuasions from their own (Tortajada, 2007). In this superpower duel, it appears US action regarding large dams in Africa was more obvious than that of the USSR.

For instance, the imperative of the Aswan Dam for Egypt was attacked by the US government 'at the beginning of a nascent global environmental movement which strongly argued that "small is beautiful"' (ibid: 3) because of perceived negative environmental and social impacts. Tortajada (2007: 3) asserts that the criticisms of the Aswan Dam were 'half-truths, sweeping generalisations and outright lies'. The USSR dared to aid Egypt in the dam's construction when Western countries – USA and Great Britain – withdrew their support for the project because Egypt refused to accept conditionality thought to be unfavourable to the country's national interest (ibid). The exaggerated and sometimes false claims about the Aswan Dam's social and environmental problems 'were extensively published in influential Western media like the *Washington Post*' and 'struck a chord' with anti-large dam movements (ibid). In this regard the criticism of large dams is based on geopolitical differences.

Consequently, large dams in Africa were contingent on good political relations between the source and recipient countries which gave rise to global 'hydropolitics' (Gupta, 1998). Financial and technical support for large dam construction became an ideological competition between the West, led by the US, and the East, led by the then USSR (idsnet, 2005). So large dams financed by Western nations and the

former USSR were ideologically symbolic of the power of either capitalism or communism (ibid) which led to two negative issues; the first that large dam aid recipients were to some extent dependent and susceptible to political control by the countries providing the support (idsnet, 2005); secondly, dependence on external financial and technical support for large dam construction in Africa contributed to debt and impoverishment on the continent because few of the funds for the construction of the dams are retained in the host country (Dor, 1999) – most of the money is used to import equipment and technology from the funding countries and their allies and for the repatriation of profits and salaries of management, technical staff (ibid). This repatriation of funds is exacerbated by loan and interest repayments which tie up recipient countries' financial resources and limit their governments' ability to support other critical development programmes (ibid). Hydropolitics cannot be helpful in large dam development in Africa.

Hydropolitics has since continued to manifest in several ways in Africa. An area where it has found expression is in China's technical and financial support for large African dams. For instance, Sino Hydro's execution of the Merowe Dam project in Sudan with a loan of US$400 million from the Chinese government elicited criticism in an editorial in *Nature* magazine which accuses the Chinese of repeating the past mistakes of previous big dam projects (*Nature*, 2006) with low interest loans to Africa from China's export credit agency, the China EXIM Bank – the world third-largest bank – undermining sustainable development (Bosshard, 2006; Hathaway and Pottinger, 2006). The continued criticism of large dams in Africa into the 21st century by Northern NGOs and other institutions seems to reinforce the hydropolitics and the perception that some Northern countries are subverting Africa's development.

However, China has challenged the criticisms of its international development policy. A Chinese deputy foreign minister, Zhou Wenzhong, said in 2004 that China's policy of non-interference in the internal affairs of other countries is based on the principle that business and politics should not mix (Bosshard, 2006). Jia JinSheng, vice-president of China's Institute of Water Resources and Hydropower Research said that environmental and social issues have become increasingly important in the past five years, but pointed out that the ultimate responsibility for social and environmental concerns rests with the host nations of the projects (*Nature*, 2006). Perhaps Jia JinSheng's most succinct characterisation of China's foray into Africa is that Chinese firms have a competitive advantage over firms from other countries because they complete any infrastructure they undertake in Africa on schedule and at a third less cost than their European and North America rivals (ibid). This implies that Western concerns are based on 'sour grapes' due to the loss of their strategic dominance of Africa now that China is providing it with options in the choice of development partners.

The direction of the geo- and hydropolitics of large dams in Africa of Western countries, China and other yet-to-emerge countries is important to the imperative of African large dams. But the dominance of Western intellectuals and activists in articulating new paradigms of water resources and development based on their geopolitical interests leads Biswas (2004) to argue that some of the paradigm shifts are based on narrow remits of some environmental and social impacts of large dams which are extrapolated into sweeping criticisms of the dams despite the lack of comprehensive post-construction evaluation. The WWF, an international NGO opposed to large dams, concedes that 'opposition to dams is primarily, if not entirely, based on poor rehabilitation and resettlement of displaced people' (WWF, 2006: 1) as an example of the narrow focus against large dams. The lack of comprehensive ex-post studies of large dams makes their objective assessment difficult (Biswas, 2004).

6.4 Global environmental and development politics

The international politics of the environment and development, 'marked by a series of related conflicts and tensions between Northern and Southern nations around issues such as the nature of the global economy, population, and resource consumption, and the significance of sovereignty' (Connelly and Smith, 2003: 219) are said to have an impact on large dam development in Africa. These conflicts and tensions are derived from two views of the global environment (Alker Jr. and Haas, 1993). The first is situated in the 'northern-oriented, interdisciplinary research programme on sustainable development throughout the biosphere, which was primary globalistic focused effort' (ibid: 152). The second view is grounded in the 'overlapping but southern-oriented mixture of research programmes on the sustainable development *across* the biosphere of the nations of the world in ways consonant with the primary developmental interest of less developed countries' (ibid: 152). These different views portray the 'complexity of knowledge and action' (Hays, 2000: 232) and '[bring] to the fore [a] more elaborate context within which to think about environmental affairs' (ibid) and how their accompanying tensions and conflicts affect the contemporary construction of large dams in Africa.

The institutionalisation of international environmental politics through environmental organisations like UNEP, the World Meteorological Organisation (WMO) and others have affected the development of large dams. UNEP's creation and the existence of environmental protection agencies and ministries in various countries resulted from increased concern about changes in the global environment (Alker Jr. and Haas, 1993). These concerns transcended North-South, capitalist-communist and Jewish-Islamic differences (ibid). But Adams (1990: 54) argues that the primary motivation behind UNEP and other environmental initiatives was that Northern countries were 'concerned with environmental and developmental problems of the emerging Third World'. So industrialised countries' environmentalists, who were particularly

against the pollution associated with industrialisation initiated the institutionalisation of global environmental politics (ibid). This means that environmental concerns could be used to undermine development projects in the third world that were perceived as unacceptable by the interest groups and governments of northern countries. This suggests that the development interests of Southern countries are being subverted.

That the use of global environmental institutions and politics determines what is and is not acceptable development is captured in the interpretation of sustainable development which privileges 'inter-generational equity […] over intra-generational equity […]' (Adam, 1990: 103) and emphasises 'future economic and social implication of change in the global climate and ecology which seems to reflect "the agenda of industrial Northern countries"' (ibid). Consequently organisations like UNEP, supposedly impartial and neutral in the collation and presentation of scientific evidence about the global environment, serve as forums within which the perceived negative environmental and social impacts of development, including large dam construction, are articulated and given credence.

The relevance and existence of global environmental organisations like UNEP are justified by a global narrative of environment and development issues initiated and led by West-dominated scientists, academics, governments, aid bureaucrats, consultants, politicians and a hybrid of either one or more of the above groups (Keeley and Scoones, 2003). The narratives are based on writing scientific papers and sound bites of information and statistics usually presented at meetings, workshops, conferences, and through lobbying (ibid). These activities are the 'social and political process surrounding the creation of globalised knowledge that claim to speak about a very large area' (ibid: 40/41). Such processes of global knowledge formation subsequently led to the establishment of international organisations with a mandate to manage the global environment based on Western-designed regulatory frameworks (Keeley and Scoones, 2003). The dominance and influence of Western groups in shaping global environmental narratives and regulatory frameworks contribute to deciding what form of development is appropriate in Africa.

The possible impact of global environmental and development institutions and their governing regulatory frameworks for large dams and other infrastructural project development in Africa suggests that these institutions activities constrain the development of the continent. The regulatory frameworks of the international environmental organisations impose 'conditions developed countries never faced when they went through their highly environmentally destructive industrial revolution' (Leftwich, 2000: 56). It is therefore not surprising that the formation of international institutions based on 'the concept of global resources management' (Biswas and Biswas, 1984: 36) led to the 'institutionalisation of international

cooperation' (Caldwell, 1996: 24) based on 'mutual interests' and 'global interdependence' (Barrow, 1999: 156) and left some developing countries feeling it as 'an attempt to take away from them the national control of resources' (Biswas and Biswas, 1984: 36). It is further argued that Western industrial countries who use the greater share of resources and contribute most of the resulting pollution decline to shoulder the cost of management and pollution they produce (ibid; Choucri, 1993), but expect third world countries to 'find and pay for the solution' (Biswas and Biswas, 1984: 36). This may mean that the conditions required for developing countries to be able to harness their natural resources for development are being curtailed in order to ameliorate past environmental problems created by developed countries.

Another challenge to large dam development in Africa is the formation of international NGOs such as Greenpeace, WRI, WWF, Friends of the Earth (FOE), and the Third World Network among others at the global level (Caldwell, 1996). This is in direct response to the gradual transfer of political and economic power to international forums such as the World Bank, IMF, and WTO (ibid). Hoogvelt (2001) construes the emergence of the above organisations as an 'entirely political project' (ibid: 154) because 'interdependence among states that had been conceived in economic and political terms is now regarded in environmental terms as well' (Choucri, 1993: 2). Hoogvelt (2001) thus argues that the international environmental institutions mirror the

> *[…] transnational business 'culture' of shared norms and values that underpin and interweave with the structural power of transnational capital' which is 'institutionalised in a plethora of organisational forms and practices: within international organisations such as the World Bank and the IMF; in interstate summits; agendas and agreements (for example GATT, and subsequently WTO) and other forms of cooperation between members of international business class, state bureaucrats and members of international organisations; within the administrative bureaucracy of national governments. (Hoogvelt, 2001: 148).*

This implies that global NGOs have vested political and economic interests in pursuing environmental agendas such as highlighting the social and environmental problems of large dam development in Africa.

Furthermore, it is suggested that because of the economic, political and environmental linkage of operations of international institutions it is not surprising that 'agreements regarding natural resources and the environment usually impose obligations or restrictions on actions within the territorial limits of parties' […] modification of or limitations to the doctrine of national sovereignty' (Caldwell, 1996: 32). These limitations further 'incorporate third-world people and the environment piecemeal into globalising capitalist markets in keeping with the needs and interests of capitalist enterprises based in Europe, North America and Japan' (Leftwich, 2000: 56). This is achieved through the 'active regulation and social manipulation of governments so as to adjust their economies and societies to the forces of globalisation'

(Hoogvelt, 2001: 154) because of developed countries' 'conscious bid to extend strategic dominance over the world economy' (ibid: 156). In this regard the confluence of global politics, economics and environmental interests and quest for global dominance impacts on the development of large dams in Africa.

Although the global environmental narratives and institutions are mutually reinforcing they also constrain each other. For instance, the science of the global environmental change that is used to justify the creation and existence of global environmental institutions is contingent on and bound up with 'institutional practices and organisational or political realities' (Keeley and Scoones, 2003: 52). 'Scientific assessments and interpretation of the evidence [are] often of a very conflicting nature' (Choucri, 1993: 29) and are affected by political deliberations. In addition, determining whether a problem definition or offered solution gains influence is dependent on negotiation and bargaining among well-located actors with considerable weight to shape action (Choucri, 1993; Keeley and Scoones, 2003) because the actors have the requisite credentials to marshall concerted strategies nationally and internationally for the management of the global environment (Choucri, 1993). So the global politics of the environment and development based on Western narratives of environmental problems and international environmental institutions are negotiated and bargained over based on questions of responsibility and international justice (Choucri, 1993; Connelly and Smith, 2003). If the negotiations are successful, the resultant global environmental management accords are ultimately legitimised in response to evolving scientific evidence, concerns and corresponding policy options (ibid), implying that the imperative of large dams in Africa is influenced by the global politics of environment and development.

Despite Western dominance in constructing global environmental, political, and economic institutions and development knowledge and narratives, large dams continue to be important to Africa's quest for socio-economic development due to factors such as 'differences and unevenness among states on either side of the growth-development-sustainability ledger – whether generating patterns of affluence or contributing to their management' (Choucri, 1993: 29); uncertainties, disputes and the direction of global politics and the economic and environmental debate in continuing to shape the 'contours of global responses to environmental change' (ibid). Consequently, a common environmental predicament has not been agreed upon, nor is there a consensus on the salience of environmental problems' priority and policy although there is an 'appreciation of the distinctive environmental problems for industrial and developing countries' (ibid: 29), implying that there should be circumspection in assigning specific blame and solutions to environment and development problems based on the construction and dominance of narratives.

There is therefore some resistance on the part of some developing countries to accepting Western-dominated narratives of environment and development wholesale. This has led some Western industrial countries to complain about developing countries' reluctance to engage in environmental deliberations (Choucri, 1993). But developing countries facing short-term problems of poverty, hunger, and diseases perceive longer-term environmental problems associated with industrialisation as remote (Barrow, 1999). The development and environmental priorities of developing and developed countries are different.

It is argued that the complaint of Western industrialised economies against developing countries for not engaging in environmental deliberation is a possible means by which they attempt to wriggle out of responsibility themselves for their rapid socio-economic development (ibid). For instance, while the OECD's CO_2 emissions increased by 2113.4mt–11,205.2 mt to 13,318.6 mt from 1990 to 2004, emissions in Sub-Saharan Africa increased by only 208.3 mt–454.8mt to 663.1 mt during the same period (UNDP, 2007). Yet the OECD wants Sub-Saharan Africa to take more responsibility for CO_2 emissions on the pretext that the continent is most vulnerable to climate impacts (ibid). This means that African countries have to cut back on their socio-economic development interests in order to pay for the cost of past and present Western development.

The imbalance in global trade is also said to affect the imperative of large dams in Africa. Wild and Mepham (2006b: 70) argue that 'global trade rules and the existing policies of some western countries are severely damaging Africa's development prospects and worsening the living conditions and life chances of its many people' although 'agriculture provides two thirds of Africa's employment, half of its exports and over one third of its Gross National Income' (ibid). West-dominated organisations like the WTO have consistently undermined and undercut the comparative and competitive advantage of African agriculture producers in the world market (Oxfam, 2005; Gaunt, 2006; Christian Aid, 2006; Elliott, 2006). 'In spite of the free market rhetoric most western countries provide very substantial subsidies for their agriculture sectors' which 'increase the volatility of agriculture prices and disadvantage African producers in their own and third country markets' (ibid). It is possible that some of the African agricultural produce affected by the trade rules and policies of Western countries comes from land irrigated by large dams.

Trade rules and policies have a significant impact on African economies. According to Taylor (2005) Western nations pay their farmers $350 billion a year in subsidies (nearly $1 billion a day) and OECD countries spend four times the level of their international aid which is US$279 billion a year on subsidies and support for farmers, distorting the global agricultural market by suppressing prices (PANOS, 2006). Furthermore, Oxfam (2003) observes that direct US government subsidies to cotton producers led to a

more than 25 percent suppression of cotton prices. Coupled with cotton subsidies from the EU, it is noted that this has costs Africa about $300 million in revenue, exceeding the debt relief of $230 million approved by the World Bank and the IMF under the enhanced HIPC initiative to nine cotton-exporting west and central African countries in 2002 (ibid). To be more specific, the total cost of depressed prices for Malian cotton in 2001 was $43 million, the same amount as Mali's debt relief from the International Financial Institutions (IFI) under HIPC (ibid). The implication here is that Africa's quest for socio-economic development is subverted because produce from large irrigation dams is unable to generate the necessary economic returns to justify the dam development imperative for Africa.

Tariff escalation and variation is another issue that does not encourage Africa's industrialisation and undermines large dams' performance and future in contemporary Africa's socio-economic development. Tariff escalation – the imposition by Western countries of higher tariffs on processed imports than on unprocessed raw materials – and variations on tariffs on raw, processed, and semi-processed African produce are used to subvert the future of large dam development (UNCTAD, 2003; Wild and Mepham, 2006b). For example, while a tonne of coffee beans from Africa attracts a tariff of 7.3 percent in the EU, 0.1 percent in the USA and 6.0 percent in Japan, tariffs for processed coffee are 12.1, 10.1, and 18.8 percent respectively (UNCTAD, 2003). Similarly tariffs on raw cocoa beans, intermediately processed cocoa beans and cocoa in the final stages of processing are 0.5, 9.7 and 30.6 percent respectively in the EU; 0, 0.2, and 15.3 percent in the USA and 0, 7, and 21.7 percent in Japan (ibid). So cocoa-producing countries like Ghana face 'much higher EU tariffs on processed chocolate than on unprocessed cocoa butter or cocoa powder' (Wild and Mepham (2006b: 70). Western countries contentedly welcome raw unprocessed primary commodities but effectively block processed products (Taylor, 2005). This implies that the performance and future of large hydroelectric power dam-supported industries which are supplied with raw materials from large irrigation dams are unable to compete because higher prices further up the value chain generated from processed goods are lost due to imposed tariff differentials on raw and processed goods from Africa.

The analysis in this subsection has shown that global environmental and economic development politics can have an impact on the future development of large dam construction in contemporary Africa due to the confluence of two key factors; global environmental and development narratives dominated by the developed countries and the formation of global environmental institutions like UNEP and WMO on the premise of building a consensus to deal with the rising threat of global environmental changes, which are increasingly transboundary in nature.

6.5 Social and environmental movements

The imperative of large dams in contemporary African socio-economic development is said to be influenced by the organisational, financial, technical, and political clout of environmental and social movements NGOs, which claim to be concerned about environmental and social problems caused by the environment and development conundrum because 'development needs to be balanced towards environmental objectives' (Hays, 2000: 230). Barrow (1999) traces the beginning of environmental concerns and the crystallisation of environmental activities from the 1750s and the 1960s respectively. The movements for environmental protection, remediation, and preservation were aided by several factors, among which are 'unprecedented economic growth in the […] developed or industrialised world' (Caldwell, 1996: 32), advancements in science and technology, and the expansion and globalisation of information, communication and transportation (ibid). The consequence of these factors is that the environmental and social movements see themselves as the watchdogs of corporate, government and special interest group activities, demanding higher standards of environmental quality due to heightened awareness of environmental deterioration (Caldwell, 1996; Barrow, 1999). This implies that any development activity such as large dams, with their social and environmental impacts, could meet with some form of opposition from some NGOs.

The activities of environmental and social movements are thought to have had a huge impact on the development of large dams at global, national and local levels in the late 1980s. Two factors accounted for this; firstly by 1988 there had been a huge rise in the number of international organisations like UNEP, WMO and IUCN from 37 to 309 and of NGOs like Oxfam, FOE, and Greenpeace from 176 to 4,518 (Barrow, 1999). Secondly politicians, multilateral and bilateral institutions started to support the idea of environmental management by making the environment part of their policy formulation and implementation process (ibid). These two factors led to an international environmental policymaking process which influenced the conceptualisation and implementation of environmental and development regimes, agreements and customary behaviours between international organisations, NGOs and some Western governments (Caldwell, 1996). These are two important factors in how large dams are perceived.

The ability of some NGOs and international organisations to pursue a global policy against large dams by claiming to respond to environmental problems is their capacity to create 'conditions where the "implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge"' (Connelly and Smith, 2003: 231 citing Krasner, 1982: 2). The NGOs' role in shaping large dam policy is enhanced because they act as links between local, national and international activities, since many have tiered local to international structures and command much greater resources in terms of

funding, external and internal expertise than most African countries or corporations (Barrow, 1999; Keeley and Scoones, 2003). Consequently, Africa needs to counter the well-resourced, organised and powerful networks of NGOs whose intentions are to oppose large dam construction in Africa.

NGOs and other civil society groups' opposition to large dams in Africa have gained some legitimacy in the eyes of the public and in the international arena. This is firstly because the NGOs have developed working relationships with international organisations like the World Bank which have a history of support for large dam construction (Caldwell, 1996). Secondly, the NGOs' power and influence enable them to utilise their knowledge and expertise to challenge and sometimes substantially change the course and outcomes of negotiations, conferences and activities of international organisations in which they have either observer status or are active participants, as in the WCD process (ibid). Thirdly, NGOs organise events parallel to official ones, lobby their own governments and embark on media-grabbing publicity stunts to – in some cases successfully – set international agendas on issues of great importance to them e.g. establishing the Commission for Sustainable Development (CSD) after the Rio Summit and the World Commission on Dams (WCD) (ibid).[56] It is these activities that have enabled NGOs to legitimise their concerns about large African dams with the public and international organisations.

However, the legitimacy gained by some environmental NGOs partly through their opposition to large dam construction is said to undermine their operational effectiveness as independent institutions. Their relationship with international environmental and development organisations makes the more established NGOs power-blind because they allow themselves to be co-opted by national governments and international organisations (Caldwell, 1996). As a consequence, it is therefore further argued that the well-established NGOs have adopted a moderate or conventional approach in dealing with governments through established protocols, procedures, dialogue and consultation in a cooperative manner, because their demands are not absolutist and they are prepared to negotiate and compromise to reach agreed solutions (Lewis, 1992; Connelly and Smith, 2003). In their attempt to legitimise their concerns through international forums and organisations their effectiveness in opposing large dams is weakened.

In contrast to established environmental NGOs, other environmental NGOs who also oppose large dams do not have a working relationship with international development organisations. These are usually radical direct activists who are confrontational and uncompromising in their absolutist demands (Lewis, 1992; Caldwell, 1996; Connelly and Smith, 2003). This group believe that it is marginalised in international

[56] Parallel events organised by NGOs include the Global Forum in Rio and The Other Economic Summit (TOES) which usually accompanies G7/8 meetings (Caldwell, 1999).

negotiation processes such as the 1999 World Economic Forums in Seattle, the 2007 Davos Summit and other economic and political negotiations to which the big NGOs have an unprecedented level of access (Caldwell, 1996: 235). It is however important to observe that depending on circumstances, all environment groups adopt an array of tactical approaches in their campaigning (Connelly and Smith, 2003), so direct activism is not limited to those NGOs that claim to lack access to the international policy process. In this context it is difficult to differentiate the various positions of NGOs regarding the large dam imperative in Africa.

However, the bases on which NGOs influence environmental and development policies at the global level is said to be misguided policies which lead them to act carelessly or in an obstructionist manner in their opposition to large dams in Africa (Barrow, 1999). Firstly, the wide variety of activities and justifications within the environmental movements' 'ethical underpinnings are really quite divergent and difficult to reconcile' (Connelly and Smith, 2003: 84 citing Soper, 1995: 254). Secondly, NGOs' activities at the international level are dominated by relatively small North-based groups such as Greenpeace, FOE, WWF, IUCN, etc. (Caldwell, 1996). And thirdly, the lack of commensurate resources for Southern NGOs to effectively participate in the global environmental and development agenda-setting process and access international organisations, conferences and negotiations leads to their marginalisation, which brings into question the truly global nature of the NGO community (ibid). In this regard international NGO opposition to large dams for Africa's socio-economic development in the name of local people might not be a reflection of local people's interests, in which case it lacks legitimacy and may be a smokescreen to mask the NGOs' real intentions, local NGOs are unable to effectively participate in the environment and development decision-making and policy process.

The gulf and differentiation in resource availability between Northern and Southern NGOs seems to produce resource and organisational dominance and serves as a wedge between them. For instance Southern NGOs are critical of the 'sometimes patronising attitude of the dominant NGOs and the manner in which they conceptualise environmental problems that may have specific impacts on the south' (Caldwell, 1996: 235). Chapin's (2004) critique of the relationship between Northern NGOs on the one hand and Southern NGOs and indigenous groups on the other exposes it as dysfunctional because the agenda of the dominant international conservation NGOs like Conservation International (CI), World Wide Fund (WWF), and the Nature Conservancy (TNC) are 'marked by growing conflicts of interest – a disturbing neglect of the indigenous peoples whose land they are in business to protect' (Chapin, 2004: 17). Chapin also argues that Northern conservation NGOs use indigenous groups and Southern NGOs to give an impression of collaboration when in reality they sometimes collude with governments and

corporate businesses to deprive local groups of their own resources in the name of conservation and bioprospecting (ibid). The conflict of interests associated with the activities of international NGOs' identified by Chapin (2004) in addition to criticism by Southern NGOs means that their claim of being the environment and development moral compass of the world or of possessing the 'silver bullet' that can solve complex environmental problems, including those associated with large African dams, in a neat and comprehensive manner would not be farther from the truth (Barrow, 1999).

Policy difference between some NGOs and other international organisations on the renewable status of large dams is also an issue that might affect large dam development for Africa's socio-economic development. For instance, while some international organisations such as World Energy Council (WEC), International Energy Agency (IEA), etc. classify large dams as a renewable source of energy, IUCN, WWF and others think otherwise (IEA, 2002 ; Worm et. al., 2003; Cooney, 2004; WWF, 2005; WEC, 2005). It is these policy differences that led to REN21'S exclusion of large dams from a recent global classification of renewable energy sources while WEC classifies hydropower as renewable (WEC, 2007; REN21, 2008). This lack of a standard and clear definition of what constitutes a renewable energy source exposes large dams to various categorisations depending on the bias and inclination of the organisation involved.

Even among environmental NGOs, divergences in policy priorities and actions sometimes result in tensions and clashes due to different interpretations of what constitutes a renewable and environmentally-friendly energy source. The policy differences between alternative energy advocates and those of wildlife and habitat conservation – both 'claim the mantle of environmentalism' (Connelly and Smith, 2003: 84) – is illustrative. Habitat conservationists, for instance, oppose attempts to site wind turbines because they destroy the aesthetic beauty of coastal areas and landscapes and might affect birds nesting sites and other habitats (ibid). This means that habitat conservationists do not consider wind energy renewable because of its impact on habitats. The contention between renewable energy advocates and habitat conservationists with regard to wind turbines as a renewable energy source highlights the difficulty in characterising the qualities of renewable energy sources and of framing energy sources such as large dams as either renewable or not in the socio-economic development of Africa.

The emergence of environmental and social groups since the 1960s has placed the environment high on the international agenda and transformed the policymaking process, which used to be the sole prerogative of sovereign states and governments. The environmental policy process has also impacted on how certain development projects such as large dams are executed because of the perception of their social and

environmental consequences as a development imperative or as the tyranny of technology, thus putting dams under a constant spotlight. Also, the influence of NGOs is uneven because of the divide between North/South and resource rich/resource poor (such as in funding and expertise) and their different priorities, particularly those concerning Southern environments and developments. These differences in influence have led to strategic, policy and tactical differences among NGOs about how to address environmental and development issues facing Southern countries, but in spite of these the significant power and influence of NGOs are facts that those who believe in the imperative need for large dam development in Africa need to contend with.

6.6 Alternatives to large dams in Africa

This sub-section identifies and discusses some alternatives to large dams in Africa. The focus here is on alternatives for large-scale irrigation, water supply and hydropower dams in Africa.

6.6.1 Alternatives to hydroelectric power dams

Solar, wind, thermal, and geothermal electricity alternatives to large hydroelectric power dams in Africa have been proposed. It is argued that the use of photovoltaic technology utilising Africa's sunlight could expand solar power generation on a commercial scale for Africa's socio-economic development (IRN, 2002a; WEC, 2003; WWF, 2005). In spite of this contention, the present use of solar energy is very limited in Africa because it is expensive to install and operate in comparison to hydroelectric power, as shown in Table 4.3 (WEC, 2003). Because of the cost of installing and operating solar photovoltaic systems the number and capacity of installed solar photovoltaic in Africa are few and insignificant. The African countries with the greatest installed solar photovoltaic capacity are Morocco (3 MWe) and Egypt (2 MWe), and Senegal and South Africa with around 1 MWe each (ibid).[57] Given the paucity of presently-installed solar photovoltaic capacity in Africa due to cost and imperfect technology, among other reasons discussed in sub-section 4.7.1 solar energy cannot at present supplant large hydroelectric power dams as a viable alternative in Africa.

Wind and geothermal energy are other suggested alternatives to large hydroelectric power dams in Africa. The potential capacity of both wind and geothermal energy are not certain but present geothermal usage is concentrated in the Red Sea and Rift Valleys in Kenya with a total installed capacity of 45 MWe – the highest in Africa (WEC, 2003). In the case of wind energy, its potential in much of Africa is largely unassessed and Egypt's 15 MWe installed capacity is the highest (WEC, 2003). This implies that like

[57] MWe refers to 'megawatt electricity with the 'e' being the actual electricity produced from a power source (Wikipedia, 2006; accessed 29-12-2006 [http//:en.wikipedia.org]).

solar photovoltaic energy, geothermal and wind energy are unlikely to take the place of large hydroelectric power dams in Africa.

However, the promotion of wind and geothermal energy as 'sustainable electricity' (Durkin, 2007) as alternative sources to large dams has brought them onto the energy development agenda of African countries. Environmental campaigners and some donors consider that 'Africa and the rest of the developing world should use solar and wind power' (ibid). Consequently, geothermal and wind energy annual outputs were 886 and 535 GWh respectively in 2005, as detailed in Tables 6.2 and 6.3. But wind and solar energy are impractical for dealing with the critical and immediate development issues of Africa (ibid). 'Let me make one thing perfectly clear, if we are telling the third world that they can only have wind and solar power what we are really telling them is you cannot have electricity' (Driessen, 2007). This implies that the aggressive promotion of large dam alternatives could pose a challenge to Africa's socio-economic development.

Table 6.2: World geothermal energy, 2005

Region	**Electricity generation**		**Direct use**	
	Installed capacity (MWe)[58]	*Annual output (GWh)*	*Installed capacity (MWt)*[59]	*Annual output (TJ)*
Africa	122	886	0	0
North America	3,956	27,931	0	0
South America	0	0	541	7,814
Asia	3,358	19,636	6,257	83,284
Europe	1,155	7,250	12,703	130,161
Middle East	0	0	266	4,500
Oceania	440	2,709	460	12,639
TOTAL	9,031	58,412	29,668	282,016

Source: WEC (2007)

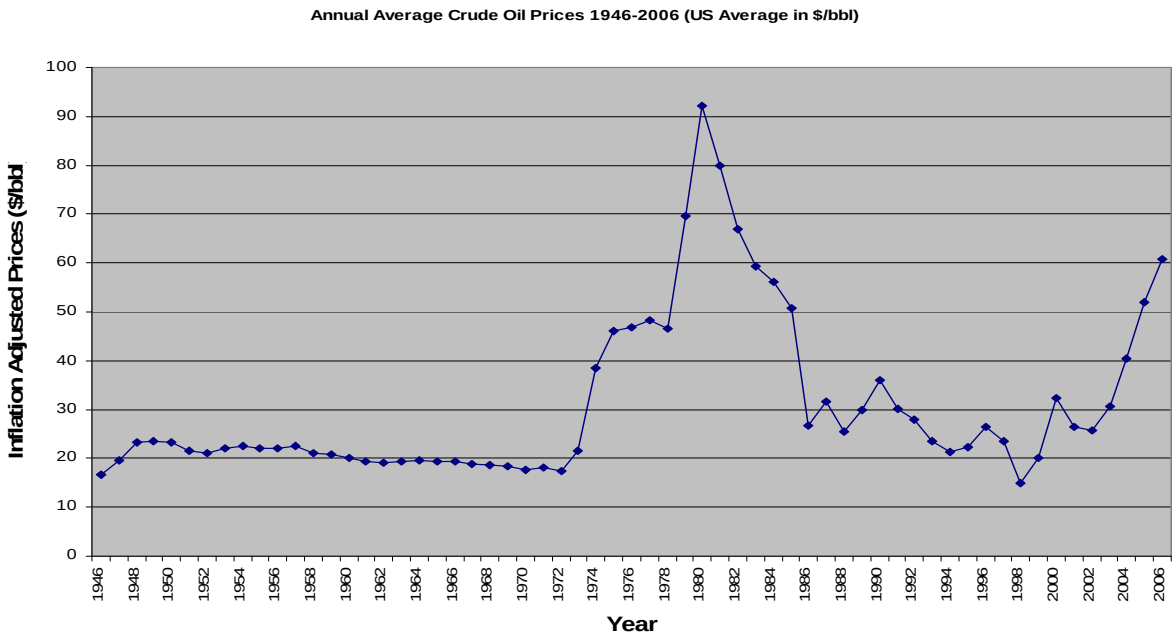
Table 6.3: Global wind energy, 2005: Installed generating capacity and annual electricity output

Region	**Installed capacity (MWe)**	**Annual output (GWh)**
Africa	324	535
North America	9,971	19,840
South America	85	193
Asia	6,952	11,839
Europe	41,078	70,349
Middle East	34	63
Oceania	891	2,810
TOTAL	59,335	105,629

Source: WEC (2007)

[58] MWe: megawatt electricity
[59] MWt: megawatt thermal

The only alternative electricity source of significance that is capable of competing with the 1,888 TWh/yr technically exploitable hydroelectric capabilities of Africa's major rivers is steam thermo-electric generation (WEC, 2003; Smith, 1968).[60] However, its competitiveness in Africa will depend on the unpredictable rising costs of crude oil – currently above US$120/bbl (AFP, 2008) – and predictions that the price could top US$200/bbl within the next 12 months (Money Morning, 2008). Economically weaker countries, particularly African countries, are highly susceptible to fluctuating crude oil prices (see Figure 6.1) but with the potential to exploit hydroelectric power for socio-economic development they could prefer the hydropower option from large dams to thermal power generation.



Source: With data from US DOE/www.economicmagic.com, and www.ioga.com Accessed 12/01/2007. Prices adjusted for Inflation to December 2005 prices using the CPI-U.

Figure 6.1 Inflation-adjusted annual crude oil prices ($/bbl) 1946-2006

[60] Africa's potential for hydroelectricity is largely in central and eastern Africa. Africa has a technically exploitable capability of 1,888 TWh/yr (TABLE 2.6), of which 41 percent (or 774 TWh/yr) is in one country, the Democratic Republic of Congo, thanks to the Congo River. Ethiopia, with its highlands, has a technically exploitable capacity of 260 TWh/yr and Cameroon 115 TWh/yr. Madagascar also has substantial potential capacity at 180 TWh/yr. In terms of installed capacity, Egypt, with its famous Aswan Dam, leads with 2 810 MW, followed by the Democratic Republic of Congo (2 440 MW) and Mozambique (2 180 MW), while Mozambique (11 548 GWh) and Egypt (11 450 GWh) are the leading producers of hydroelectricity (1999 generation data) (WEC, 2003).

6.6.2 Alternatives to Water Supply and Irrigation Dams

The imperative of large irrigation and water supply dams in Africa's socio-economic development is said to be influenced by the appropriateness of their alternatives. The irrigation alternatives are those already discussed in sub-section 4.4. The alternatives for large irrigation dams such as rainwater harvesting, drip irrigation, small-scale informal irrigation, use of sprinklers, floodplain cultivation and traditional water appropriation techniques are more efficient than the formal irrigation provided by large dams because they improve the uniformity of watering plants and reduce the water loss common in some parts of Africa (WCD, 2000a; NEPAD/FAO, 2002; NEPAD, 2002). It is also thought that the competitiveness of the alternatives to large irrigation dams – micro dams, drip, treadle pumps, and sprinkler systems – would be further enhanced if their costs were significantly reduced to about $500/ha or less compared to the $10,000/ha costs of formal irrigation systems, by allowing village artisans to build them using low-cost technologies (WCD, 2000a; Lankford, 2006). The low cost of the alternatives would enable farmers to recoup their initial investment in the shortest possible time and give them the confidence to expand their farm production by reinvesting in more advanced irrigation systems, thus improving their capital and technology base (WCD, 2000a). This means that small-scale irrigation systems could be used as a transition from large dams to large scale irrigation.

Rainwater harvesting (WCD, 2000a; WWC, 2000; Gould and Nissen-Petersen, 1999), the use of water efficient technologies, desalinisation and recycling (Sutherland and Fenn, 2000; WCD, 2000a; Gould and Nissen-Petersen, 1999) offer alternatives to large dams that supply water. However these are incapable of addressing an increasingly urbanised African society. The inability of the water harvesting technique to cater for Africa's increasing urbanising society is attributed to the low level of water supply to rural areas and poor urban communities in Africa, although they could contribute to ameliorating Africa's water problems (WCD, 2000a). However, because of the magnitude of the continent's water problem, the emphasis is on finding new water supply sources (ibid). This implies that these water supply alternatives could be complementary to large water supply dams in Africa.

6.7 Are large dam alternatives a subversion of Africa's development?

The promotion of alternatives to large dams could be perceived as subverting Africa's development ambitions. Those who advocate the alternatives to large dams – particularly alternatives related to electricity generation – base them on the precautionary principle which requires that draconian measures be imposed to prevent any future problems, even if the evidence does not add up and the resultant policies are wrong (Durkin, 2007). Driessen (2007) argues that most policies resulting from precautionary principles usually have 'a disastrous effect on the world's poorest people'. He adds that '[t]he

precautionary principle is a very interesting beast. It is basically used to promote a particular agenda, ideology. It's always used in one direction only; it talks about the risk of using a particular technology – fossil fuels for example – but never about the risk of not using it. It never talks about the benefits of having that technology' (ibid). This means that the promotion of large dam alternatives in Africa based on the precautionary principle is unidirectional because it only addresses the consequences and impacts of the use of technology but not the consequences and impacts of not using it.

The perception of subversion is even more acute when viewed against Africa's development challenges, particularly those related to the health and safety of women and children. According to WHO, '4 million children die each year from respiratory diseases caused by indoor smoke and many million women die early from cancer and lung disease for the same reason' (Durkin, 2007; WHO/UNICEF, 2006). 'Two billion people, a third of the world's population, have no access to electricity so they must burn wood or dry animal dung in their homes and the indoor smoke it creates is the deadliest pollution in the world' (Durkin, 2007). The lack of electricity means that water cannot be heated easily and there is no refrigeration for storage of food and medicine, which leads Durkin (ibid) to observe: 'we in the west cannot begin to imagine how hard life is without electricity. The life expectancy of people who live like this is terrifyingly short and their existence is impoverished in every way'. Shikawati (2007) states: 'If you ask a rural person to define development, he will tell you yes I will know I have moved to the next level when I have electricity. Actually not having electricity creates such a long chain of problems. The first thing is the lack of light so couples have to go to sleep earlier. Because there is no light, there is no reason to stay awake; I mean you can't talk to each other in darkness'. The implication here is that the lack of electricity in Africa causes significant harm to socio-economic progress. Large dam development could help to ameliorate this.

Another dimension that could be interpreted as the subversion of Africa's quest for socio-economic development is the pressure exerted by some western countries and environmental NGOs on African countries not to develop their existing energy resources because of perceived problems of climate change. The energy resources in question are coal, oil, and natural gas deposits (WEC, 2007). 'Africa has coal and Africa has oil but environmental groups are campaigning against the use of these two sources of electricity' (Durkin, 2007). The significance of crude oil, coal and natural gas resources for Africa's development is attested to by the World Energy Council (WEC) in its 2007 survey of energy resources entitled 'Promoting the sustainable supply and use of energy for the greatest benefit of all' (WEC, 2007). Data in the energy survey show that Africa has the second largest proved recoverable crude oil and natural liquid gas reserve in the world as at 2005; about 16,847 million tonnes after the Middle East's 96,935

million tonnes (WEC, 2007) (see Table 6.2 below). Yet the continent consumed only 120.2 million tonnes of the 469.7 million tonnes produced in contrast to the consumption in North America and Europe – the bastions of environmental campaigning – of crude oil and natural gas liquids of almost 40,000 million tonnes, although their combined reserves were about 20,421 million tonnes in 2005 (see Table 6.4). While some Western countries benefit from the use of crude oil and its related products, African countries are denied those same benefits.

Table 6.4: World crude oil and natural gas liquid reserves, 2005

Region	**Proved Recoverable Reserve**		**Production**		**Consumption**	
	(million tonnes)	*(million barrels)*	*(million tonnes)*	*(thousand barrels)*	*(million tonnes)*	*(thousand barrels)*
Africa	16,847	129,914	469.7	9,880	120.2	2,437
North America	7,921	60,521	656.0	13,894	1,000.2	20,363
South America	14,283	102,403	340.6	6,786	218.8	4,425
Asia	10,895	83,890	456.0	9,511	1,069.0	21,570
Europe	12,500	93,704	742.1	15,352	952.5	19 349
Middle East	96,935	742,373	1,206.6	25,099	331.8	6,842
Oceania	263	2,381	26.6	625	33.0	663
TOTAL	**159,644**	**1,215,186**	**3,897.6**	**81,147**	**3,725.5**	**75,649**

Source: WEC (2007)

The above analysis of the limited use of crude oil and natural gas liquid for power generation also applies to hydroelectric power, coal and natural gas. As Shikawati (2007) notes: 'We've been told, don't touch your resources. Don't touch your oil, don't touch your coal'. If Africa should accede to these demands it will amount to 'suicide' (ibid) because the continent is rich in these resources (WEC, 2007). For instance Africa's proved recoverable natural gas reserve is about 14.052 billion cubic metres, yet only about 173 billion cubic metres is produced and 83 billion cubic metres used, as detailed in Table 6.5. Meanwhile Europe, which is the largest producer with a reserve of 973.5 billion cubic metres in 2005, consumed 1,031.5 billion cubic metres of natural gas, more than it produces (see Table 6.5). Africa has 49,605 million tonnes of coal but produced only 249,667 thousand tonnes and used 187,034 thousand tonnes in 2005 (detailed in Table 6.6). This contrasts with North America and Europe's 2005 production of 1,117,890 and 1,042,692 million tonnes, and their consumption of 1,099,160 and 1,134,205 million tonnes of coal respectively (Table 6.6). So if there are genuine concerns about climate change and other environmental concerns about the use of fossil fuels the focus should rather be on the Western countries who continue to produce and use the greater amount of the fossil fuels, not on Africa and other developing countries. Consequently, the lack of intensive exploitation of Africa's coal and natural gas for electricity

generation for socio-economic development, despite the continent's energy poverty, is partly due to environmental campaigns by some West-dominated institutions, NGOs and other activist groups.

Table 6.5: World natural gas reserves, 2005

Region	**Proved Recoverable Reserve**		**Production**		**Consumption**	
	(billion cubic metres)	*(billion cubic feet)*	*(billion cubic metres)*	*(billion cubic feet)*	*(billion cubic metres)*	*(billion cubic feet)*
Africa	14,052	496,290	172.9	6,107	83.1	2,932
North America	8,517	300,775	758.2	26,778	776.6	27,425
South America	6,386	225,505	103.3	3,647	107.1	3,783
Asia	20,965	740,373	471.5	16,654	497.5	17,573
Europe	53,534	1,890 502	973.5	34,380	1,031.5	36,433
Middle East	71,795	2,535,434	311.6	11,004	272.7	9,631
Oceania	1,213	42,813	42.9	1,517	28.1	992
TOTAL	**176,462**	**6,231,692**	**2,833.9**	**100,087**	**2,796.6**	**98,769**

Source: WEC (2007)

Table 6.6: Global coal reserves, production and consumption, 2005

Region	**Proved Recoverable Reserve** *(million tonnes)*	**Production** *(thousand tonnes)*	**Consumption** *(thousand tonnes)*
Africa	49,605	249,667	187,034
North America	250,693	1,117,890	1,099,160
South America	16,276	75,409	33,091
Asia	217,218	3,030,531	3,228,213
Europe	235,137	1,042,692	1,134,205
Middle East	1,386	1,200	14,350
Oceania	77,173	384,096	154,266
TOTAL	**847,488**	**5, 901,485**	**5, 850,319**

Source: WEC (2007)

It is argued that African countries' quest for socio-economic development is being weakened by some West-dominated NGOs and institutions in the context of campaigns against hydropower generation. Hydropower is thought to be a cleaner source of electricity than crude oil, natural gas and coal (WEC, 2007), but Europe is constructing more hydropower plants to produce about 10,072 MW compared to Africa's 5,668 MW as shown in Table 6.7, below. Furthermore, Europe and North America, the bases for the main campaigns against large hydropower dams in Africa, are the biggest users of hydroelectric power in the world with a combined generation of about 1,381,025 MW compared to Africa's 83,735 MW (see Table 6.7 below). By pursuing high-profile and persistent campaigns against large dams in Africa while

still enjoying their significant benefits and engaging in further construction in Europe and North America, opponents of large hydropower dams comprising some West-dominated multilateral and bilateral institutions and NGOs could threaten Africa's socio-economic development ambitions.

Table 6.7: Global Hydropower Capability and Status of Development (All Schemes), 2005

Region	**Gross theoretical capability**	**Technically exploitable capability**	**World Hydropower Plants in Operation**		**Under construction**
	(TWh/yr)	*(TWh/yr)*	*Capacity (MW)*	*Actual generation in 2005 (GWh)*	*Capacity (MW)*
Africa	> 3,884	> 1,852	21,644	83,735	5,668
North America	8,054	> 3,012	164,127	675,555	2,906
South America	> 7,121	> 3,036	123,712	596,518	9,084
Asia	> 16,285	> 5,523	222,697	718,172	85,727
Europe	4,945	2,714	225 ,02	705,470	10,072
Middle East	418	168	7,185	16,864	10,567
Oceania	495	> 189	13,471	40,425	19
TOTAL	> 41,202	> 16,494	778,038	2,836,739	124,043

Source: WEC (2007)

The pursuit of large dam alternatives such as solar and wind energy at the expense of other electricity sources for Africa's development is said not to be in the development interests of Africa. 'Wind and solar power are notoriously unreliable as a source of electricity and they are at least three times more expensive than conventional forms of electrical generation' (Driessen, 2007). Shikawati (2007) asks: 'How many people in Europe and how many people in the United States are really using that kind of technology and how cheap is it? You see, if it is expensive for the Europeans, if it is expensive for the Americans and you are talking about poor Africans, you know it doesn't make sense. Rich countries can afford to engage in some experimentation of other forms of energy, for us we are still at the stage of survival'. This is 'because I don't see how a solar panel can power a steel industry, how a solar panel is going to power maybe some railway train network. It might work to power a small transistor radio' (ibid). 'The idea that the world's poorest people should be restricted to the use of the most expensive and the most inefficient forms of electricity generation is the morally repugnant aspect of the global warming campaign' (Durkin, 2007). Moore (2007) states: 'I think one of the most pugnacious aspects of the environmental movement is the romanticisation of peasant life; the idea that industrial societies are the destroyers of the world'. 'The environmental movement has evolved into the strongest force there is for preventing development in the developing countries' (ibid). Therefore 'one key thing that is in the environmental debate is that there is

somebody keen to kill the African dream, and the African dream is to develop' (Shikawati, 2007). 'I think it is legitimate for me to call them anti-human. Like you don't have to think humans are better than whales or better than owls if you don't want to. But certainly it is not a good idea to think that humans are scum. It's okay for hundreds of millions of them to go blind or die or whatever. I just can't relate to that' (Moore, 2007). These views captured how the activities of some West-dominated organisations, NGOs and donors who oppose large dams and other forms of large infrastructure required for development are perceived.

6.8 Conclusion

The discourse about the large dam development imperative in Africa's future socio-economic development dynamics asks whether they could be supplanted by alternatives deemed more socially and environmentally acceptable; undermined by factors such as the power of international environmental organisations and NGOs, stifled by the global geopolitics of development and project funding; enhanced by governance and cooperation among African states or even a combination of some or all of the above.

In summary, in spite of the challenges that large dam construction in Africa face, the continent's development trajectory favours their continued construction if it is to meet the MDGs, tackle climate variability and achieve its socio-economic development ambitions.

Furthermore, the availability of Chinese funding for infrastructure development – including large dam construction – in Africa has removed a significant hurdle for desperate African governments seeking to develop socio-economically. This singular act of China has significantly enhanced the future development imperative of large dams in Africa and broken the monopoly that Western countries and institutions have hitherto held over the continent. Criticism of Chinese investment in Africa is perceived as a consequence of Western countries', institutions' and NGOs' loss of strategic leverage over Africa's development trajectory in the context of present and past Western/Northern countries' actions in Africa's socio-economic development.

The next chapter presents specific case studies of an established large dam in Ghana, Akosombo Dam, and of one that is proposed, Bui Dam, to provide specific answers to the four research questions of this thesis.

CHAPTER 7
ANALYSIS OF CASE STUDIES OF GHANA'S AKOSOMBO DAM AND THE BUI DAM PROJECT

Dams have been a major feature of Ghana's post-colonial development strategy. To understand the role they have played in an African country's development trajectory, this chapter presents the findings, results and insights of field research on Ghana's existing Akosombo Dam and how its performance may have influenced the planned construction of the Bui Hydroelectric Power Dam. A key purpose of the case studies is to provide more detailed empirical investigation of the benefits and impacts of dams, and particularly to focus on the part played by the WCD framework and the four research questions of the thesis. The analysis of these two large Ghanaian dams is undertaken within the context of the country's political and socio-economic aspirations.

An actor-oriented perspective was used in the field case studies of the Akosombo dam and BHP. The use of this approach is because it is 'informed by the concrete experiences of the particular actor involved in and who stands to gain directly [from it]' (Nyamu-Musembi, 2002: 1), as also to lose from such an undertaking. In this context, the actors identified and interviewed during the field studies such as the resettled communities of the Akosombo dam, those to be affected and resettled by the BHP and others detailed in Tables 2.1 and 2.2 of this thesis. Though there might be disagreement as to the level of participation and consultation of various actors in the Akosombo dam and BHP building process, it thus involves the actors negotiating their way through a 'complex landscape which continually alters shape as a result not just of their own actions but those of others as well' (Gough and Wood, 2004:64). As Villarreal (1992: 248) observed, society is composed of actors who are 'thinking agents, capable of strategising and finding space for manoeuvre in situations they face and manipulate resources and constraints'. Their manoeuvres may sometimes generate an appearance of 'chaos' which Long (1989b: 222), cited in Villareal (1992: 248), argues is 'in great measure the outcome of different ways in which actors deal, organisationally and cognitively, with problematic situations and accommodate themselves to other's interests and design for living'. Some of these issues reflect in the case studies of the Akosombo dam and BHP case studies.

The actor-oriented approach in the Akosombo dam and BHP case studies is also informed by the understanding that 'Economic and political considerations, as well as life experiences and particular every day circumstances are relevant to the way actors tie together, act upon, attribute meaning to, and recreate different elements' (Long, 1992: 20). In this regard, all forms of intervention – including those related to large dams and development – necessarily enter the life-worlds of individuals and social groups affected,

and in this way are mediated and transformed by these same actors and structures. Therefore interventions (both large and small) are on-going processes that are constantly reshaped by the political dynamics and the specific conditions the encounter itself creates, including the responses and strategies of local and regional groups who may struggle to define and defend their own social spaces, cultural boundaries and positions within the wider power fields (ibid).

Accordingly, development interventions such as the construction of large dams like the Akosombo and the BHP are 'an ongoing socially constructed and negotiated process, not simply an execution of an already-specified plan of action with expected outcomes' (Long. 1992: 35). Long (ibid) further posits that one should not assume a top-down process, as is usually implied, since initiatives may come from 'below' as much as from 'above' (ibid) as has been generally assumed for large dams (Pearce, 1992; WCD, 2000; McCully, 2001).

Consequently, the case studies focused on intervention practices in the Akosombo dam and BHP case studies as shaped by the interactions among the various participants, rather than simply on intervention models. Focusing on intervention practices allows for attention to be paid to emergent forms of interaction, procedures, practical strategies, and the type of discourse and cultural categories present in specific contexts as argued by Long (1992). Intervention practices leads to a paradigm centred on actors and a method centred on networks, power flow and strategies (Villareal, 1992). Villareal (ibid: 265) further argues that 'an actor-oriented approach makes a plea for a decisive unpacking of our concepts, a focus on the complexity of power process, and a modest evaluation of 'external' change agent's contributions'.

The actor-oriented approach therefore provided the broad basis and context within which the field case studies research was carried out. The actor-oriented research involved local people, government officials representing their various institutions, NGOs and the media, among others, and the power relations and complexities that exist among them. The constant interaction of the actors, particularly in a democratic environment, informed and gave direction to the development agenda – including large dam construction – of the state. By using this method I captured the interplay among the various groups in the dam debate in Ghana and gained an understanding of the issues in the dam debate that explain their positions by either bringing them together or dividing them.

The case studies show that large dams in Ghana's socio-economic development are more advantageous than other available alternatives. Although survey respondents acknowledged the social and

environmental concerns that result from large dam construction in Ghana, there is near-unanimity about the significant contribution that large dams have made to Ghana's socio-economic development. This perception is due to the survey respondents' positive appreciation of the performance of the Akosombo and other large dams, which is feeding the desire for the construction of more dams in Ghana. The coding keys to respondents in the case studies are shown in Table 7.1 below.

Table 7.1: Coding keys to case studies respondents

Code	Key
A/NS	Akosombo Dam/New Somanya Resettlement
A/NT	Akosombo Dam/Nkonya Tepo Resettlement
A/Yj	Akosombo Dam/Yeji Resettlement
A/Yp	Akosombo Dam/Yapei Resettlement
B/BA	Bui Dam Project/Battor Akanyakrom to be Resettled
B/BN	Bui/Banda Nkwanta to be Impacted
B/Jm	Bui/Jama to be Impacted
B/Bu	Bui Village to be Resettled
IA*	Institutional Actors
Int*	Interview

*Numbers are assigned to some individual respondents to maintain their anonymity.

The place of the Akosombo Dam in the socio-economic development of Ghana is of importance to many respondents, although some of its negative social and environmental impacts were acknowledged. For some institutional and local actors, socio-economic development has to do with the ability to transform the natural resources of a country to serve the needs of society by increasing economic activity, social well-being and provision of infrastructure through the use of technology (IA/001, 2005; IA/002, 2005; IA/004, 2005; IA/010, 2005; IA/012, 2005) to move the nation towards a more desirable state (IA/011, 2005). The success of socio-economic development requires appropriate investment in the relevant sectors (IA/008, 2005) such as education, health, roads, electricity, water, and industries (A/NS:001, 2005; A/NT, 2005; A/Yj, 2005; B/BA, 2005; B/Jm, 2005). To achieve these basic societal needs the strategies and processes for the exploitation and utilisation of resources should be sustainable (IA/021, 2005) in order to generate 'evolutionary results' (IA/020, 2005) in human and natural resources within a specific environment – political, social, environmental, and economic (IA/007, 2005). This reflects an understanding among actors that Ghana's pursuit of socio-economic development should be balanced with a conscious eye to the environmental and social costs because the aim of infrastructure development is to transform human life.

The field data were collected through survey responses from four communities resettled as a result of the construction of the Akosombo Dam; four communities from the Bui Hydroelectric Project (BHP) area (two to be resettled and another two to be impacted on by the project); NGOs; relevant government agencies; interviews with key informants and archive and document searches (see Chapter 2 for detail of Methodology, Tables 2.1 and 2.2 for lists of interviewees and questionnaire respondents and sample questionnaires in Appendices 2.1 and 2.2).

However, suffice me to explain that the representativeness of the four resettlement communities sampled out of 52 in the Akosombo Dam case study is based on the uniformity of the resettlement process (Moxon, 1984) understanding that the challenges the resettlement communities face in the context of livelihood and social facilities and amenities were also similar. Therefore the main issue was to provide regional balance in the sample in terms of their geographical location in the country as discussed in subsection 2.2.6 of this thesis. Consequently, the perceptions of dams express in these communities complemented by those of BHP and other secondary case studies in Africa such as the Sudan's Merowe dam, Egypt's Aswan dam and others discussed in section 5.2 of this thesis are used to generalise the wider situation of large dams across Africa though there might be some differences in emphasis.

7.1 Conditions of dam development in Ghana

The importance of dam building in Ghana is determined by three main factors – rainfall, socio-economic development and politics. Building dams in Ghana is based on the understanding that the country's uneven geographical distribution of water resources will be ameliorated, and agricultural productivity and electricity for domestic, commercial and industrial use boosted (Moxon, 1984). So, the pursuit of large dam construction by the Ghanaian leaders Kwame Nkrumah (Akosombo Hydropower Dam), Hilla Limann (Kpong Hydropower Station), and Jerry John Rawlings/John Agyekum Kufour (Bui Hydropower Project) was in furtherance of the above three factors. Consequently the construction of large dams became part of Ghana's socio-economic development plans and political advancement. An example of how the science of hydrology interacts with politics and socio-economic development policy to shape the development imperative of large dams in Africa was discussed in subsection 4.2.

7.1.1 Ghana's variable rainfall and large dams

The impression of abundant freshwater water in Ghana masks the variability and seasonality of its rainfall. Almost 5 percent of Ghana's total land area is covered by 11,800 km^2 inland surface water (MWH, 1998; EPA, 2004). The water is mainly from three major river basins: the Volta basin constitutes 70 percent of

Ghana's total drainage area[61]; the South-western basin is 22 percent, and coastal river systems are 8 percent) (ibid). However, the inland surface water is not evenly distributed since most of the freshwater sources dry up during the greater part of the year and availability is worsened by rainfall variability and seasonality. Large dams are needed to ensure adequate distribution of freshwater in Ghana.

The uneven distribution of rainfall in Ghana is another reason for large dam development. For instance there is a difference of about 1100mm/annum between the country's mean minimum and mean maximum rainfall (MWH, 1998; EPA, 2004). The mean minimum rainfall in Ghana is 900mm/annum while the mean maximum is 2000mm/annum (EPA, 2004). So large dams could store water to ensure even distribution in parts of the country where there is less available water.

Seasonal variation in rainfall is an additional reason for large dam development in Ghana. Whereas southern Ghana experiences two rainy seasons, with the major season March-July and minor season September-November, there is only one rainy season from May-October in the north of the country (EPA, 2004). Large dams are necessary to capture the resultant run-off from the small amount of rainfall to ensure availability for year-round use.

The combination of rainfall variability and seasonality impact significantly on the socio-economic development of Ghana; in the past they have led to water shortages during the dry season in some parts of the country (ibid). Figure 7.2 shows annual rainfall variability in Ghana over a 100-year period. The data show that Ghana has experienced some extreme annual variations in rainfall. For instance, from the 1970s to 2000 rainfall declined significantly, which as Marc Andreini reports (2005: personal communication) impacted greatly on rain-fed agriculture production but less on large reservoir storage in Ghana. Large dams are one of the mitigation measures to address rainfall variability and seasonality, correct geographical imbalances in water availability and ensure Ghana's water security.

[61] The 174, 866 km^2 Volta River Basin and its five sub-basins the Black Volta, White Volta, Daka, Oti and Lower Volta occupy nearly two-thirds of Ghana's land area of 238,533 km^2 (MWH, 1998).

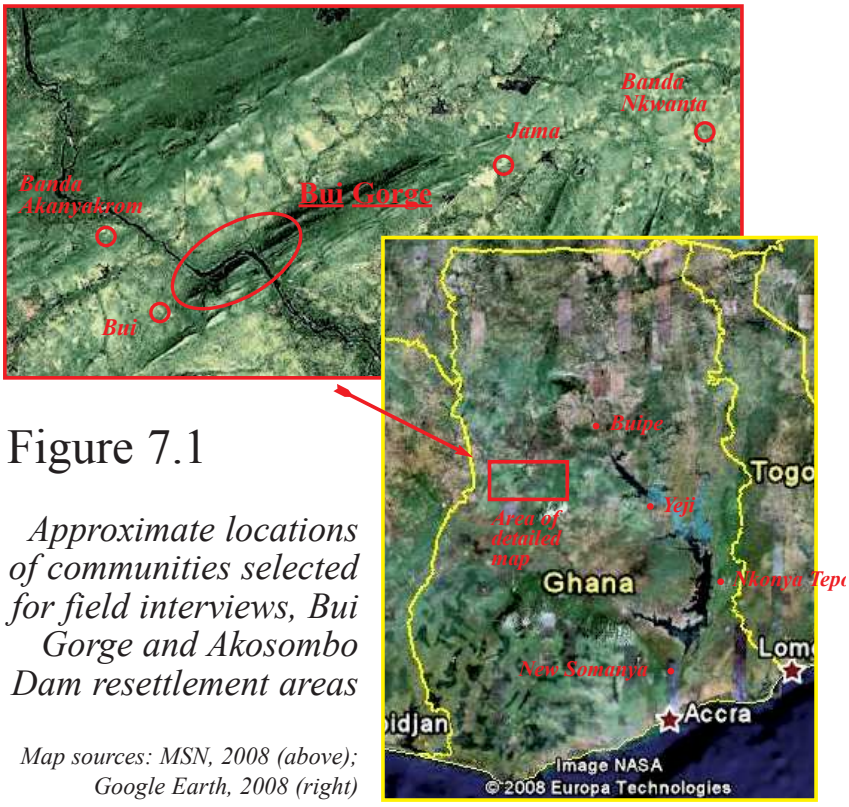
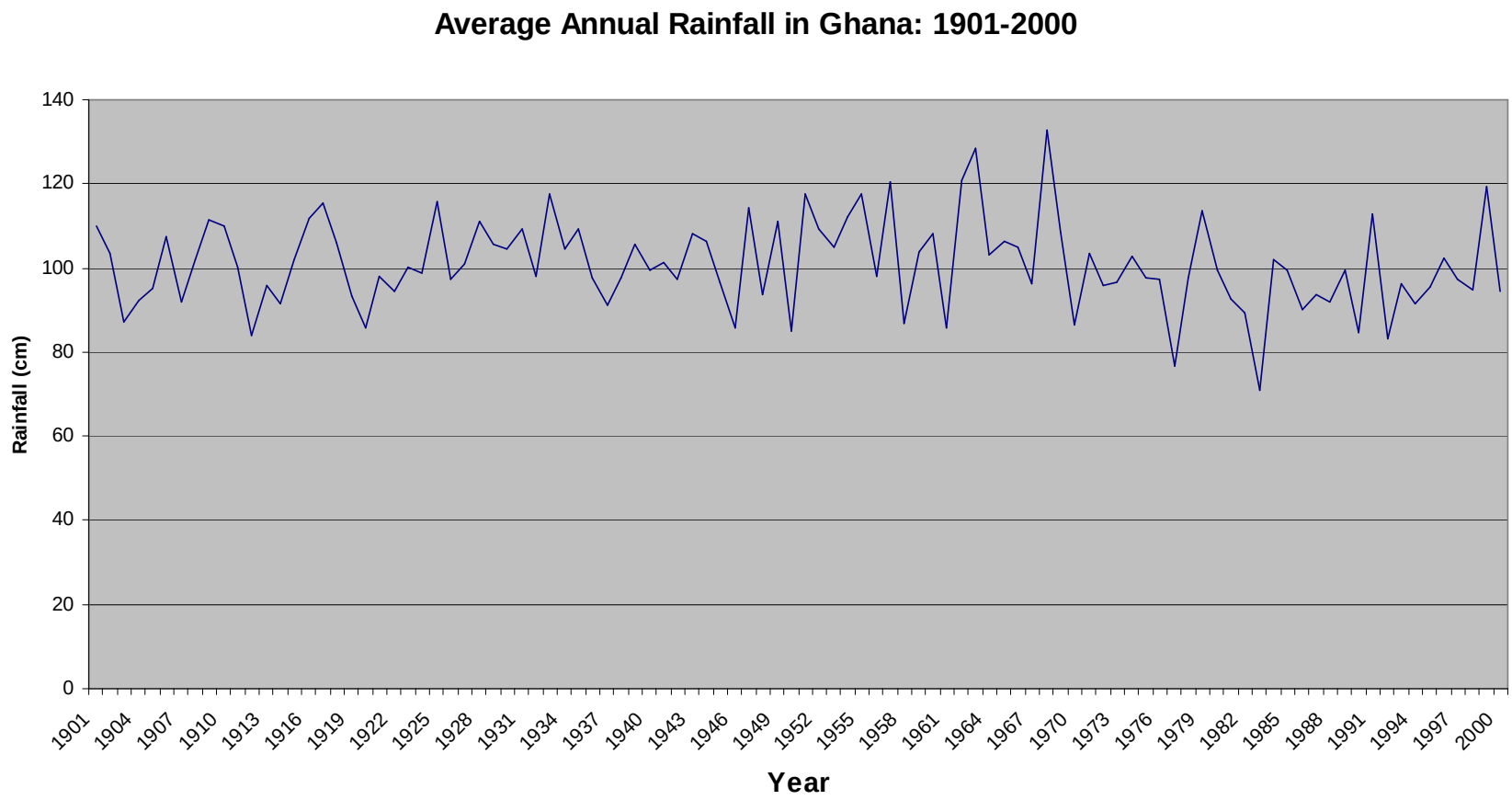


Figure 7.1

Approximate locations of communities selected for field interviews, Bui Gorge and Akosombo Dam resettlement areas

Map sources: MSN, 2008 (above); Google Earth, 2008 (right)

The impact of rainfall seasonality and variability on Ghana's socio-economic development could be significant. About 70 percent of Ghanaians earn their livelihood from agriculture, which is very reliant on rainfall (IA/010, 2005; IMF, 2003). For instance, the 7 million people inhabiting the Volta basin rely on 900-1200mm of rainfall per annum to produce close to 80 percent of the country's staple food requirement (MWH, 1998). Making water available through storage in dams can improve agriculture by expanding the Volta Basin's productivity, which will increase the number of likely beneficiaries from systematic irrigation, sustain the Volta Basin area as the food basket of the country and serve as a bulwark against climate change (IA/003, 2005; INT/18, 2005; INT/07, 2005). This makes large dams in Ghana a development imperative because of their socio-economic and development implications.



Source: Data from Mitchell et al, 2003

Figure 7.2 Ghana's Average Annual Rainfall Data 1901-2000

7.1.2 Large dams and Ghana's socio-economic development

The imperative for large dams in Ghana's socio-economic development is captured in national development plans. The Akosombo Dam was part of 'The Ten Great Years 1951-1960' national development plan designed to rapidly modernise and transform an agrarian economy to an industrial-based one in order to abolish poverty, ignorance, and disease in modern Ghana within a generation (GIS, 1960; BBC 2, 1994). Ghana's progress, said Nkrumah, should be measured by improvement in peoples' health, the number of children in school and the quality of the education they receive, the availability of water and electricity in towns and villages and the happiness people enjoy from being able to manage their own affairs (Dzorgbo, 2001). The 'welfare of our people is our chief pride, and it is by this that my government will be asked to be judged' (ibid: 148). These ideals of wellbeing envisaged by Nkrumah are today the basis of international programmes like the MDGs and are shared by many Ghanaian politicians.

To achieve the goals set out in the above paragraph, the Akosombo Dam took centre stage among the huge infrastructure investments that President Kwame Nkrumah championed. Electricity from the Akosombo Dam, Nkrumah believed, would be the basis for Ghana's industrialisation and economic growth (Kodjo Botsio, 1994: interview with BBC 2). Some of the other infrastructure to be introduced included roads, ports, railways, educational facilities, health services, and the establishment of manufacturing industries, particularly agro-processing ones (GIS, 1960). This vision of the role of hydroelectric power from the Akosombo Dam in actualising Nkrumah's dream about Ghana's development was shared by many of the respondents in this research.

The construction of Ghana's Akosombo Dam is based on Victorian engineering and development philosophy of combined projects. The philosophy of combined projects required a compendium of engineering and development activities that were symbiotically connected to generate economics of scale. The dam was part of a compendium of development activities – railway operations, the extraction and processing of minerals, irrigation for agriculture to turn the Accra plains into Ghana's granary, water transport, and electricity to 'light up every hamlet in Ghana' (Kitson, 1925[62] ; Moxon, 1969; BBC 2, 1994). The World Bank supported the Akosombo Dam because it believed that electricity was the key to industrialisation in the third world (BBC 2, 1994).

[62] Kitson's groundbreaking studies published in 1925, Outline of the Mineral and Water-power Resources of the Gold Coast and The Possibility of the Bui Gorge as the Site of Hydro-electric Station became the basis for other studies about dam development in Ghana.

The combined projects were based on the development of the entire Volta River Basin. Firstly, Kitson (1925) argued that a hydroelectric dam at Ajena, near Akosombo, could enable the extraction of bauxite deposits from the Kwahu plateau, to be converted to aluminium and transported by river via the Afram tributary. A second dam at Bui could electrify a railway in the northern part of Ghana and power the mining of iron ore deposits at Sheini which would be transported on the Volta River system to the port city of Tema for export (ibid). After several failed attempts by Duncan Ross Western African Aluminium Limited (WAFAL) and the British government to actualise Kitson's proposal, Nkrumah proposed the development of the Volta River Basin as part of a comprehensive socio-economic development policy for Ghana (Moxon, 1969; Kodjo Botsio, 1994: interview with BBC 2). Thus the development of the Volta River Basin became the basis of the country's development planning.

The importance of the Akosombo and other dams in Ghana's development led to 21 major studies about the potential of large dams among several other studies of dams on the Volta River Basin and their alternatives. Three reports – the Report on Development of the Volta River Basin by Halcrow in 1950, the Volta River Project Preparatory Commission Report by Jackson in 1956, and the 1959 Reassessment Report on the Volta River Project for the Government of Ghana by Kaiser Engineers Incorporated – were the basis for the Akosombo Dam's construction (Table 7.2 lists the 21 major reports into potentials of large dams on Ghana's rivers). The Ghana Generation Planning Study prioritised the hydropower generation potential of all rivers in Ghana (Acres, 1985). These reports supported large dam construction and laid the foundation for the application of regional planning principles to a British colony in contrast to the usual policy of piecemeal development (Moxon, 1969).

In the development trajectory of Ghana, large dam development was based on utilising science and technology on a grand scale to power a third world country into the industrial age (BBC 2, 1994). This theory of 'techcon' continues to grip the imaginations of politicians and economists (ibid). An example is found in the 2004 manifesto of the opposition National Democratic Party (NDC) of Ghana under the sub-heading 'Industrialisation is the Key' (NDC, 2004: 28). It states: 'Our industrial policy will seek to implement measures that will be science and technology driven to enhance the growth, momentum, and global competitiveness of the industrial sector in general, and the manufacturing sector in particular' (ibid). A deputy science and technology minister in the ruling NPP government also said that science and technology are indispensable in national development efforts (GNA, 2007). Ghana's development could be significantly improved through the application of science and technology.

However, the attempted implementation of the integrated development of Ghana through combined projects with the Akosombo Dam at the centre were unravelled by two significant factors; political instability and the bankruptcy of Ghana's exchequer.

7.1.3 Bankruptcy of Ghana's exchequer and its impact on dam development

The construction of several infrastructures – with the exception of the Akosombo Dam, which was largely donor-funded – for socio-economic development in the early years of independence have impacted significantly on Ghana's finances. A £250 million (the 2006 equivalent of GBP 710 million) reserve at independence in 1957 became a £300 million (GBP 735 million) debt in 1966 (Dzorgbo, 2001) and was partially responsible for several years of financial decline. Another contributory factor to Ghana's debt was the continued decline in foreign exchange receipts for cocoa, Ghana's main export crop, caused by falling world market prices (ibid). Frimpong-Ansah, a former governor of Ghana's central bank, recalled telling Nkrumah and his cabinet ministers that the country was bankrupt (BBC, 1994). This hugely affected the viability of the combined project envisioned for Ghana's socio-economic development with Akosombo and Bui Dams central to the plan.

In spite of the debt incurred by rapid and extensive infrastructure development, Seidman (1978) assesses Ghana's socio-economic development positively. He adjudges that Ghana's physical infrastructure capacity could be the bedrock of its economic growth, which could last for many years with little additional investment (ibid). Some actors interviewed agreed with this view when they said that the infrastructure developed during the early years of independence was at the 'core of Ghana's […] industrial development' (IA/012, 2005) and 'tremendously enhanced its socio-economic development' (IA/003, 2005). So despite the debt incurred by infrastructure, dams are thought to be important to Ghana's quest for socio-economic development.

Hart (1980) disagrees with the assessment of Ghana's post-independence socio-economic development and infrastructure. He notes that by 1962, five years after independence, agriculture still accounted for more than half of Ghana's GNP and the service sector 30 percent. The industrial sector's contribution to GNP was marginal because industries were small-scale and relied on imported raw materials and spare parts (ibid). However, the Akosombo Dam was not operational until 1964, two years after the date of Hart's assessment, and therefore could not make any contribution during the period mentioned.

Table 7.2: Selected studies and reports into dam development in Ghana

Item	**Author(s) of the Studies / Reports**	**Title(s) of Studies and Reports of River Basins and Dams in Ghana**	**Year**	**Remark**
1	Kitson, Sir Albert E.	The Possibility of the Bui Gorge as the Site of Hydro-electric Station; Gold Coast Geological Survey, Bulletin No. 1	1925	
2	Kitson, Sir Albert. E.	Outline of the Mineral and Water-power Resources of the Gold Coast, Gold Coast Geological Survey Bulletin No. 1	1925	
3	Bird, St. John C. et al	Volta River Scheme, WAFAL	1949	Vol. 1-3
4	Sir William Halcrow and Partners.	Final Report on Development of the Volta River Basin	1951	
5	Jackson, Sir Robert .G. A.	The Volta River Project: Preparatory Commission Report (H. M. S. O.)	1956	Vol. 1-3
6	Kaiser Engineers Inc.	Reassessment Report on the Volta River Project for the Government of Ghana.	1959	
7	Technoexport on Co-operation with Hydroproject.	Investigation of the South-western River, First Stage Report.	1962	
8	Zhuk, S. J. Hydroproject.	Bui Hydroelectric Station on the Black Volta River, of Ghana. U. S. S. R State Committee on Power Engineering and Electrification.	1964	
9	Hydroprojekt Praha.	Tanoso and Hemang Development Feasibility Study.	1964	Vol. 1-8
10	Dr. Butcher, D. and Huszar, L.; Tudor G. Ingersoll (Editor).	Bui Resettlement Study	1966	
11	Nippon Koei Co. Ltd.	Preliminary Report on the White Volta Basin Development Project in the Northern Regions of Ghana	1966	
12	Nippon Koei Co. Ltd.	Preliminary Report on Comprehensive Development Project of water Resources in South Western Ghana.	1967	Vol.1 and 2
13	Nippon Koei Co. Ltd.	Report on the Lower White Volta Basin Development Project (Pwalugu Scheme).	1967	Vol. 1 - 4
14	Chambers, R.	The Volta Resettlement Experience	1970	
15	Nathan Consortium for Sector Studies.	Water resources Development in Ghana: General Report.	1970	Vol. 1 and 2
16	Kaiser Engineers International.	Ghana Power Study: Engineering and Economic Evaluations of Alternative Means of Meeting VRA Electricity Demands to 1985.	1971	
17	Acres International Ltd and The Shawinigan Engineering Co. Ltd.	Kpong Hydroelectric Project. Generation Expansion Studies. Sponsored by CIDA.	1975	Vol. 1 and 2
18	Snowy Mountains Engineering Corp.	Bui Hydroelectric Project feasibility Study.	1976	Vol. 1-3
19	Acres International Ltd.	Ghana Generation Planning Study.	1985	
20	Coyne et Bellier.	Bui Hydroelectric Development Feasibility Study Update: Final Report.	1995	
21	BKS Acres.	Bui Hydropower Project. Environmental Impact Assessment: Scoping Report.	2001	

Source: Compiled by Author

7.1.4 Politics and Ghanaian large dams

Large dam development in Ghana is suffused with politics. It is argued that the Akosombo Dam's construction was essential for Nkrumah to achieve his political goals because he 'made some promises for development in his manifesto that needed electric power to accomplish' as part of a broad agenda which was not only economically necessary but also politically prudent in 'fulfilling a destiny' (Alhaji Futa, 1994: BBC 2 interview). The Akosombo Dam did gain Nkrumah some political favour with Ghanaians because he won the election in 1965, a year after the dam was commissioned, and it has since been associated with his name.

The development of large dams in Ghana has since featured prominently in political parties' manifestos during electioneering campaigns to woo voters deprived of an adequate water supply for irrigation, drinking, and hydroelectricity. An examination of the 2004 election manifestos of the two leading Ghanaian political parties NPP and NDC illustrates how dam building is embedded in the political and electioneering process. In the manifestos both the parties indicate their desire to construct the Bui Hydroelectric Project to augment electricity supply (NDC, 2004; NPP, 2004). The NDC pledged 'accelerated work on the construction of the Bui Hydroelectric Project' (NDC, ibid: 45), and that it would 'provide irrigation dams for the numerous communities in the harsh environmental areas in order to facilitate agricultural production and water for livestock in the long dry season' (ibid: 33).[63] The NPP manifesto mentions dam construction and views the Bui Hydroelectric Project as a strategic part of its new initiative to boost agricultural productivity, generate electricity to support the private sector and export, and extend piped water to 1 million people by connecting 100,000 additional homes (NPP, 2004). This demonstrates that large dam services in Ghana are a huge political issue through which politicians seek to gain advantage over their opponents in electioneering campaigns.

Politicians' use of large dams to gain advantage over their opponents is said to be a necessary process of development and politics because politicians either seeking to be elected to represent the welfare of society are likely to pursue highly-visible projects such as large dams to gain popularity and votes, provided they are acceptable to the electorate (IA/021, 2005; IA/001, 2005; IA/014, 2005; IA/021, 2005; IA/020, 2005; IA/005, 2005). The hydro-climatic situation of Ghana discussed in sub-section 7.1.1 makes large dams a potent issue for the electorate of a country needing self-reliance in agriculture production, water supply and electricity generation because these create employment (IA/004, 2005; IA/021, 2005). It is also thought to be appropriate for dam building to have political backing because elected politicians

[63] The areas identified as 'harsh environmental areas' in the NDC manifesto are the Accra plains and the Northern, Upper East, and Upper West Regions where rainfall is low and restricted to a few months a year (NDC, 2004).

have the legitimacy to source and access funds for dam construction (IA/003, 2005; IA/008, 2005; IA/013, 2005). In this regard the link between politics and dams is perceived as desirable because the end result of politics is to serve the interest of the electorate.

Although large dam development in Ghana is influenced by political considerations there are some constraining factors. Decisions to construct large dams may ultimately be determined by the economic and technical aspects of the projects (IA/004, 2005; IA/014, 2005; IA/018, 2005). Therefore 'no politician will undertake any dam project which might affect the political stability of the state' (IA/003, 2005). This means that the politics of large dams in Ghana is contingent on and limited by technical feasibility and economic return.

Differences in political ideology are a dimension of Ghanaian politics that obstructs dam building. For instance, the overthrow of Nkrumah's government in 1966 led to the termination of the Bui Dam's construction by the new government as the Russian dam-building engineers preparing the site for construction were asked to leave the country due to differences in political persuasion between the new government and the Nkrumah-led one (Moxon, 1984). This discontinuation of ongoing and planned projects by new governments for political reasons without critical evaluation of their long-term implications for national development has become a feature of Ghana's political history. The indiscriminate termination of projects has led to the deterioration and decline of the physical infrastructure stock of Ghana while numerous abandoned projects dot the country's landscape. This is akin to throwing out the baby with the undesirable dirty water.

There was however one exception to the discontinuation of projects initiated by past governments with differing political ideologies. The project in question was the $260 million (equivalent to GBP 148 million at the 2006 exchange rate and including resettlement and transmission system costs) 160 MW Kpong Hydropower Dam, initiated by Hilla Limann's People National Party (PNP) administration in 1979 and built downstream of Akosombo to augment Ghana's electricity supply (Hart, 1980). The Kpong project, according to Moxon (1984), was a valiant attempt to keep pace with development and increased electricity demand despite the economic recession and an unstable government. Although Rawlings' Provisional National Defence Council (PNDC) military government overthrew the PNP administration in 1981, the Kpong Hydropower Project continued and was subsequently commissioned in 1982. Its continuation is said to have been bolstered by the perceived independence that the Volta River Authority (VRA) enjoyed in managing hydropower production and future development (ibid). The continuation of the project was adjudged economically and politically prudent because it added an extra 160 MW to Ghana's electricity

capacity to forestall a looming electricity shortage (Moxon, 1984; Energy Commission, 2005). This shows that large dams in Ghana could be less susceptible to suspension by governments of different political ideologies if they are independently planned and executed.

Another issue that affects large dams in Ghana is political instability. Nine governments dominated by either military (National Liberation Council [NLC], Supreme Military Council [SMC]), quasi military (PNDC), or civilian dictatorship (Convention People's Party (CPP), a one party state in the 1960s) demonstrate the severity of Ghana's political instability since independence (see Table 7.3 for details of Ghanaian governments since independence). These governments ruled for almost 30 years of Ghana's 50 years history. It is suggested that Ghana's political instability did not provide an atmosphere conducive for investment in infrastructure and the social facilities required for socio-economic development. Three reasons are advanced for this; 1) focus on short-term planning, 2) emphasis on securing governments' hold on political power, and 3) lack of investor confidence in the country. Thus political instability became the bane of Ghana's infrastructural and socio-economic development.

Although the large dam development imperative in Ghana has political dimensions because politicians use dams to seek favour from the electorate and to achieve development goals set out in political party manifestos, their suspension due to ideological differences and political instability from changes of government undermined the potential for a consistent large dam policy.

7.2 The state verses local people

The large dam debate is an unequal contest between the power of the state and local people affected by dam construction. The premise of this unequal power relationship is derived from the perception that dams are centrally conceived without consultation with those to be affected, leading to the inequitable distribution of dam benefits (Goldsmith and Hildyard, 1986; Pearce, 1992; Adams, 2001; McCully, 2001). This portrays the decision-making process before dams are built as neither accountable nor transparent (Pearce, 1992; McCully, 2001). The unequal distribution of dam benefits and the lack of consultation due to the power relationship between states and local people are arguments that could be used to define large dams as an example of 'the tyranny of technology'.

The contention of lack of participation, accountability and transparency in dam construction because of unequal power relations is examined historically in this sub-section by juxtaposing what happened before and during the construction of the Akosombo Dam in the 1950s and '60s with the more contemporary Bui Dam project in Ghana. By contrasting the Akosombo, which was constructed before the concepts of

participation and ESIAs became the norm in project design and development, with Bui, which is very much situated within the praxis of these contentions, I intend to first discuss whether current dam projects are more participatory, accountable, and transparent than dams developed before the concepts were formalised as project requirements, and secondly analyse the perception of the actual and anticipated equitable distribution of benefits and the dams contribution to national development.

Table 7.3: Governments of Ghana after independence in 1957 to the present

No	Name of Political Party or Regime in Power (Government)	Period of Office	Leader of the Political Party or Regime	Type of Government
1	Convention People's Party (CPP)	1957 – 1966	Dr. Kwame Nkrumah	Democratic Elected Civilian, later one Party Dictatorship
2	National Liberation Council (NLC)	1966 – 1969	Lt. General Joseph A. Ankrah / Lt. General Akwasi Amankwa Afrifa	Combined Military/Police
3	Progress Party (PP)	1969 - 1972	Dr. Kofi Abrefa Busia	Democratic Elected Civilian
4	National Redemption Council (NRC) / Supreme Military Council (SMC)	1972 – 1979	General Ignatius Kutu Acheampong / General Fredrick William Kwasi Akuffo	Military
5	Armed Forces Revolutionary Council	1979 – 1979	Flt. Lt. Jerry John Rawlings	Military
6	People National Party (PNP)	1979 – 1981	Dr. Hilla Limann	Democratic Elected Civilian
7	Provisional National Defence Council (PNDC)	1981 – 1993	Flt. Lt. Jerry John Rawlings	Military
8	National Democratic Congress (NDC)	1993 – 2001	Flt. Lt. Jerry John Rawlings (Rtd)	Democratic Elected Civilian
9	National Patriotic Party (NPP)	2001 – to date	Mr. John Agyekum Kuffour	Democratic Elected Civilian

Source: Author

7.2.1 Participation and decision-making in developing the Akosombo Dam

The Akosombo Dam's construction is said to have been debated by different stakeholders in Ghana, although it was centrally conceived by the VRP as one of several planned dams on the Volta River System in Ghana. Unlike the limited circulation and deliberation that Kitson (1925) and Bird (1949) report (see Table 7.2), the Halcrow (1951) report which was debated in the wholly-Ghanaian legislative body was a watershed in the development history of the country. It was the first time that the peoples' representatives deliberated on a major development programme of the country under colonial rule (Moxon, 1984). The VRP debate formally commenced on April 25, 1952 after the Halcrow report (1951) was presented to the Gold Coast Legislative Assembly by the leader of government business, Dr. Kwame Nkrumah (Hart,

1980).[64] The VRP debate in the legislature was therefore groundbreaking and set the stage for Ghanaians' participation in decision making about large dam planning and development because legislators were supposed to consult and express their constituent's views in the assembly. This contradicts the notion that large dam construction is not participatory or transparent.

It is suggested that the open and transparent nature of the Ghanaian legislators' deliberation of the Halcrow (1951) report about the VRP led to a negotiated outcome. For instance, the legislators' gained a significant concession from the government on a key recommendation in the report: the formation of a VRP Preparatory Commission overseen by a commissioner (Moxon, 1984). The legislators rejected a proposition to appoint a sole commissioner to manage the VRP as a 'one-man show' (ibid: 55) and established a bipartisan committee to supervise the commission's work (ibid). This legislative victory illustrates the vibrancy of the participatory decision making about dams and development in Ghana and further repudiates the notion that large dam planning and building in Africa are not participatory and lack accountability.

The debate about the VRP intensified among the public after Jackson's (1956) and Kaiser's (1959) reassessment reports (see Table 5.1) and an exhibition of the planned Akosombo Dam seen by nearly 2 million people (BBC 2, 1994). The public debates raised concerns about the project's ownership at forums organised by PEA[65] because the VRP Preparatory Commission's [66] proposed ownership structure was unacceptable and suggestions that the country should own majority shares in the project were accepted (Moxon, 1984). Other deliberants expressed fears that the British wanted the dam to entrench their exploitation of cheap aluminium for profit to boost their empire (Moxon, 1984; BBC 2, 1994). Nkrumah was also told that the project would enslave the country to powerful interests beyond its control (ibid). Because every district in the country participated these public concerns were widely reported by the

[64] This was the 1951 final report of Halcrow & Partners (Hart, 1980) which detailed the design and cost of executing the VRP.

[65] The concept of the People's Education Association (PEA) was to broaden debate on developmental issues, including the VRP, in Ghana. PEA as an autonomous body had branches in all regions of the country and organised local discussion groups, lectures and conferences on topical and controversial subjects which were subsequently reported in the media. It was formed by David Kimble, the director of the Department of Extra Mural Studies of the then University College of Gold Coast (now University of Ghana).

[66] The preparatory commissions' public information campaign to educate the public about the implications of the project and gain their support included a representative party of citizens drawn from all over the country, known as the Gold Coast National Committee and forming a special publicity section within the Preparatory Commission. While the Gold Coast National Committee visited aluminium plants in Canada and Britain to gain firsthand experience of what it meant to dam a large river for hydropower generation, the publicity section mounted an aggressive national campaign to explain the VRP to the people of the country and overseas governments.

media, became popular themes for some legislators and did more to gain the support of the chiefs and people of the country for the purposes of the VRP (ibid). These debates about the VRP in Ghana by various stakeholders prior to the construction of the Akosombo Dam appear to reject the notion that local people are not allowed to participate in decision making about dams because they are steamrollered by state power.

This participatory process was affirmed by some respondents during the field survey who said that community development officers and project staff consulted affected people about resettlement locations and compensation packages for crops, houses and land, among broader concerns about land ownership and inheritance (Moxon, 1984; A/Yp, 2005; IA/016, 2005). Even certain views and opinions that VRP planners did not agree with were not only tolerated but considered during the implementation of the project (IA/002, 2005; IA/01,7 2005). For instance, affected communities participated in deciding where they wanted to be relocated and whether to accept cash compensation in lieu of land and buildings (ibid; Moxon, 1984). Even those who did not agree to be relocated by the government were allowed to resettle themselves with the requisite compensation (Moxon, 1984). This further confirms the open and participatory process that led to the Akosombo Dam's construction.

However, other actors disagreed with the perception that the deliberative Akosombo Dam process included all stakeholders and was hence successful. According to A/NS:001 (2005); A/NS:002 (2005) and A/NT (2005) they did not participate in any discussion about the Akosombo Dam but were only informed about its construction and compensation payments. They claimed that their involvement was limited to fact-finding about land, building and farm ownership (IA/001, 2005; IA/003, 2005; and IA/004 2005), and they did not agree with the dam planners about their fate (IA/003, 2005). This view contradicts the perception that the Akosombo Dam had widespread support among the chiefs and people.

Two reasons were suggested as accounting for the perception of lack of participation by the people affected in the Akosombo Dam component of the VRP. Firstly the political climate in the Gold Coast during the period of the dam's construction was perceived as hostile, which made the VRP deliberation an intolerant process because the style of the governing party was hardly inclusive (Hart, 1980; IA/005, 005). Conditions were therefore not amenable to transparent debate about issues in either the affected communities or the country (IA/011, 2005; IA/017, 2005). For instance, it was alleged that opposition to some aspects of the VRP in the legislative assembly was practically drowned out by government supporters (Hart, 1980). This suggests that debate about the Akosombo Dam was stifled in order to ensure that its development was unimpeded by project opponents, and it was therefore not participatory.

The second suggested reason for the lack of participation is the question of the public's technical competence to judge the appropriateness of the project. The people of the country did not possess a high enough 'level of technical and social consciousness at the time' to make an informed judgement about the Akosombo Dam, as IA/021 (2005) argued, Therefore the 'decision to build the Akosombo Dam could be described as the usual top-down one' and inconsistent with participation in decision making (IA/018, 2005; IA/008, 2005; IA/012, 2005). This implies that the Ghanaians were incapable of deciding whether or not to accept the dam or to make rational choices about their own future development, and were streamrollered into acquiescence.

But these arguments about the lack of adequate participation due to the unfavourable political climate and the incompetence of the people to make informed decisions are said to be a smokescreen for a number of reasons. Firstly, the claim that there was a hostile political climate does not square with the timescale of the public debate about the VRP, which occurred between 1952 and the commencement of constructing the Akosombo Dam project in 1961 (Moxon, 1984). Secondly, until 1957 the country was under British colonial rule, although the CPP was the dominant political party in the legislative assembly in 1954. Thirdly, the agitation for independence produced an open political climate and made hostility to open deliberation impossible in Ghana. Fourthly, the open political culture continued after Independence in 1957 to 1960, when the country became a republic and subsequently a one-party state in 1964, which ushered in a process of political oppression (Moxon, 1984). As the Akosombo Dam was commissioned in 1964, the timeline negates the argument about a prevailing hostile political climate which stifled open debate and participation in deliberation about the Akosombo Dam construction.

The basis for questioning the competence and knowledge of people participating in the deliberations about the construction of the Akosombo Dam is not evidenced. Older respondents – local actors about 70 years and above – who either witnessed or participated directly in the consultation about the Akosombo Dam indicated that they were not out of their depth in understanding the issues at stake during the consultation process (IA/016, 2005; A/Yp, 2005). Younger respondents, who said they were not participants in the deliberations, said that they were not old enough to be engaged in the consultation process (A/NS:001, 2005; A/NS:002, 2005; A/NT, 2005). Thus the lack of knowledge and incompetence to make decisions about the Akosombo Dam ascribed to local actors does not appear to be supported by available evidence.

7.2.2 Participation and decision making in the Bui Hydroelectric Power Project

Participation in the debate about the construction of the 400 MW BHP was long-running in comparison to consultation over the Akosombo Dam. There are several reasons for the lengthy discussions about the BHP. Firstly, it was a component of the VRP (Halcrow, 1951; Jackson, 1956; Kaiser, 1959) and featured in the education campaigns undertaken by PEA and VRP. Secondly, reports – e.g. SMEC, 1976; Coyne et Bellier, 1995; BKS Acres, 2001 – about Ghana's electricity requirements, production potential and sources kept the BHP in the public and media consciousness, where they have been constantly debated (Anane, 1999a/b; Ankudey; 1999a/b; Okyere and Boadu, 1999). Thirdly, the continuation of the public debate about the BHP is because its possible implementation has been revisited by successive civilian governments; PNP, NDC, and NPP (ibid). This means that the debate is not new to the stakeholders involved in its development.

The debate's momentum increased in 1999 when the NDC government made the BHP's construction a national political, social, and economic development priority (Okyere and Boadu, 1999; Anane, 1999a/b; Ankudey; 1999a/b; Titone, 2001; GNA, 2007a). The current NPP government took the BHP further when the contract was awarded to Sino Hydro of China at an estimated cost of about US$ 600 million, to be paid for with a loan from the Chinese EXIM Bank (GNA, 2007b). The continued pursuit of the BHP has sustained the national debate about its desirability among the Ghanaian public.

Field interviews carried out in selected communities to be affected by the BHP showed that local actors have a positive perception of the debate and consultation process. Some of these actors said that their opinions and expectations about the dam had been sought at different times (B/BA, 2005). In some of these communities, discussions were held about their concerns in the district capital, at open forums in the forecourt of the chief's palace, at meetings with opinion leaders, censuses of both people and houses and constant interviews (B/BN, 2005; B/Jm, 2005). They were informed about the negative and positive implications of the dam and allowed to express their views (B/Bu, 2005; B/BN, 2005; B/BA, 2005). One contributor at a village forum said: 'we spoke freely about the dam and what we thought about it [and we believed] nothing was hidden from us' (B/Bu, 2005). The opposing views and concerns of stakeholders, according to IA/002 (2005), are carefully studied and possible mitigation measures planned to address them in the project design and implementation. The four communities in the BHP area sampled for this research believe that the consultation process will be ongoing until the dam's construction is completed (B/BA, 2005; B/BN, 2005; B/Bu, 2005; B/Jm, 2005). This implies that the affected people have confidence in their participation in the BHP consultation process based on the perception that their views,

interests and concerns about the BHP are genuinely being sought by the planners and incorporated into the final design and implementation.

Because no public hearings and forums were held prior to or during the field data collection stage of this research some institutional actors comprising members of local offices of international environmental NGOs such as FOE and the Green Earth Organisation (GEO) were critical of the BHP consultation process. These actors claimed that the scope of the consultation was limited (IA/004, 2005) and left affected people ignorant about government intentions (IA/010, 2005). This raises questions about the intensity of the consultation and involvement of local people in building a consensus for the BHP construction (IA/011, 2005; IA/015, 2005; IA/003, 2005), which is seen as desk-top planning which stifles deliberation and transparency in the consultation process among relevant stakeholders (IA/008, 2005; IA/003, 2005). This suggests that the BHP deliberations cannot be said to be participatory or transparent unless conducted through public hearings and forums, which are assumed to be more effective.

The public hearings and forums required by the local offices of the FOE, GEO and other environmental organisations took place in the country as the consultation and debate about the BHP led to the organisation of the first Ghana Dams and Development Forum[67], at which it was acknowledged that the dam planners/government had earlier consulted about the BHP in Accra the national capital, Banda Ahenkuro in the Brong Ahafo Region, Banda Nkwanta in the Northern Region and had held group discussions with potentially affected people (Boateng, 2006). These discussions about the BHP raised several concerns among which were requests for electricity, schools, health facilities, and road construction; the continuation of farming when the project starts; choice of type of house and where to be resettled; and concerns about the hippopotamus population (ibid). The organisation of the Ghana Dams Forum and other consultations appear to show that the BHP planning process is participatory.

The availability of historical data about the BHP is said to have made it easier for the debate to focus on issues of significance to participants during the BHP forums and public hearings. Owusu-Bennoah (2006) observes that 'many of the potential problems of the BHP were identified because there were preliminary detailed researches undertaken to establish the pre-impoundment environmental, socio-economic and hydro-meteorological states of the basin.' These have provided necessary baseline information for the

[67] The Ghana Dams Forum was set up with proportionate representation from six institutional categories namely: ministries, departments and agencies; national operators and the private sector; local-level institutions; dam-affected communities and traditional structures; local NGOs; and the media and research organisations (National Coordinating Committee, 2006).

identification of potential negative impacts of the BHP construction, a basis on which to debate these impacts and the formulation of mitigation measures (ibid). Owusu-Bennoah adds that the construction and operation of the Akosombo Dam has provided many important scientific, socio-economic, environmental and institutional management lessons which are useful for the better and sustainable management of the BHP and future dam construction for hydropower generation, drinking water supply and irrigation (ibid). The BHP discussants had a great deal of information (see Table 7.2) from which to make informed judgements about the appropriateness of the project.

It is also suggested that due to the thoroughness of the debate and the data on the BHP, the National Coordinating Committee (2006) of the Ghana Dams Forum issued a communiqué which did not reject the BHP but rather highlighted four issues necessary to enhance its operation. These are: 1) improve financial, technical and legislative institutional capacity – critical to sustainable dam development and management; 2) ensure communities are informed and sensitised about the project and involved in every stage of the project planning, implementation, monitoring and maintenance; 3) immediate and adequate compensation payment, address outstanding Akosombo and Kpong Dam compensation and make considerate resettlement plans; and 4) continued support for research into the BHP's impacts. These four issues are thought necessary for the BHP to operate efficiently while forestalling past problems associated with the Akosombo and Kpong Dams.

The preparation of the BHP ESIA in 2006 involved more public hearings and forums. The public hearings included one with about 120 participants from organisations and institutions with vested interests in the Bui Dam (ERM, 2007a). There were also four meetings with representatives of women, chiefs, teachers, fishermen, farmers, and health workers from all the villages to be affected by the dam project to discuss its potential impacts and suggested mitigation measures (ERM, 2007a). The outcome of the consultation is said to have been taken into account in preparing the Environmental and Social Management Plan (ESMP) (ERM, 2007b) and the Resettlement Planning Framework (RPF) for Bui (ERM, 2007c). The ESIA, completed in January 2007, appears to reflect the consultations and public discussions about the dam with all relevant stakeholders (ERM, 2007a).

As a result of the ESIA some measures were proposed to deal with concerns about compensation, resettlement problems, and the benefits of the project. These, suggested by the ESIA, include the formation of a community support programme (CSP) and a Bui National Park Management Plan (BNPMP) including a watershed management plan (ibid). While the CSP is designed to support local communities in maximising their opportunities and to lessen the negative impacts of the project, the

BNPMP is to help to manage the impact of the project on the national park and coordinate mitigation measures for the habitat, species, land and reservoir management activities within the ESMP (ibid). The Bui Development Secretariat is said to have assured local people and other actors that the recommendations of the ESIA will be fully implemented (Int/5, 2005). [68]

However, there is scepticism about the full implementation of the BHP ESIA based on the understanding that 'the laws, regulations and the decision-making process for planning and implementing dam projects in Ghana exist on paper' (Gordon, 2006) because 'large projects are political decisions and as such it is the Government (sometimes the President) in power which would determine the process' (ibid). In this regard 'dams are no different from any other infrastructure project' as 'advice from technocrats in the Ministry and opposition from Conservation groups, is really not heeded' (ibid). 'The bottom line is whether or not the funding for the project has been secured' (ibid). So there is no guarantee that decisions made about the BHP based on the ESIA and stakeholder consultation and participation will be implemented by the government (ibid). The presence of doubt about the implementation of the ESIA and consultation outcomes is both troubling and good. It is troubling because it shows the lack of confidence in the government and its institutions about the outcomes of a process they have initiated, but good because the government and its institutions are aware that they have to earn the confidence of the public as their actions are under scrutiny.

It can be deduced from the discussion in the last two subsections that participation and consultation on the Akosombo Dam and BHP have long historic roots which date to the VRP in the 1950s and the construction of the Akosombo Dam. Although there may be disagreement about the scope and range of participants, depth of participation and level of transparency in the consultation process, the consultation with and participation of local and affected people in debates about the Akosombo Dam and BHP's construction is evidenced because the local people perceive dams as critical to local and affected people's livelihood and socio-economic development of Ghana. There appear to be contradictions between the evidence discussed in this sub-section about consultation and participation by actors in Ghanaian dam building and the widely-held view that local people and civil society groups do not participate in the decision making process for large dam construction.

[68] The BDS was established to oversee BHP's planning and development. This includes determining prospective investors, development partners, funding, evaluating bids, designs, and interest in the BHP (Int/5, 2005).

7.2.3 The Akosombo Dam's contribution to development

The socio-economic benefits of the Akosombo Dam at the national level appear not to be in doubt because there is unanimity among respondents to that effect. But there is a mixed perception about the dam's socio-economic benefits for locally affected people. To place the discussion about its socio-economic contribution to Ghana's development in perspective, some of the areas examined were water supply, irrigation, financial income, fisheries, lake transport, knowledge transfer, electricity, and improvements to social life. This segregation helped to identify the winners and losers in the construction of the Akosombo Dam and highlights the complexities of attempting to define these and the benefits and problems of large dams in clear-cut terms.

The Akosombo Dam is said to be the 'livewire of Ghana' for 'without its power nothing will evolve' (B/BN, 2005) in the country because it has encouraged the development of industries (ibid) and provided opportunities for self-employment and progress (B/Bu, 2005; and IA/019, 2005). 'The provision of electric power was of immense benefit to the development of Ghana' (Burke Knapp, former senior vice president of the World Bank, BBC 2, 1994). The Akosombo Dam's electricity made Ghana 'one of the most industrialised countries' (IA/004, 2005) in West Africa apart from Nigeria and Cote d'Ivoire, which has over 50 percent electricity coverage, the highest in Sub-Saharan Africa (IA/016, 2005). Almost 60 percent of Ghana's economy relies on mining, manufacturing, and commercial sectors - major sources of employment for Ghanaians - which utilised more than a third of the electricity generated in the country in 2003 (about 2629.38 GWh of the 6822.20 GW/h) (GSS, 2003; Energy Commission, 2005; NDPC, 2005). These perceptions suggest that the Akosombo Dam has helped Ghana to achieve some of its socio-economic development objectives.

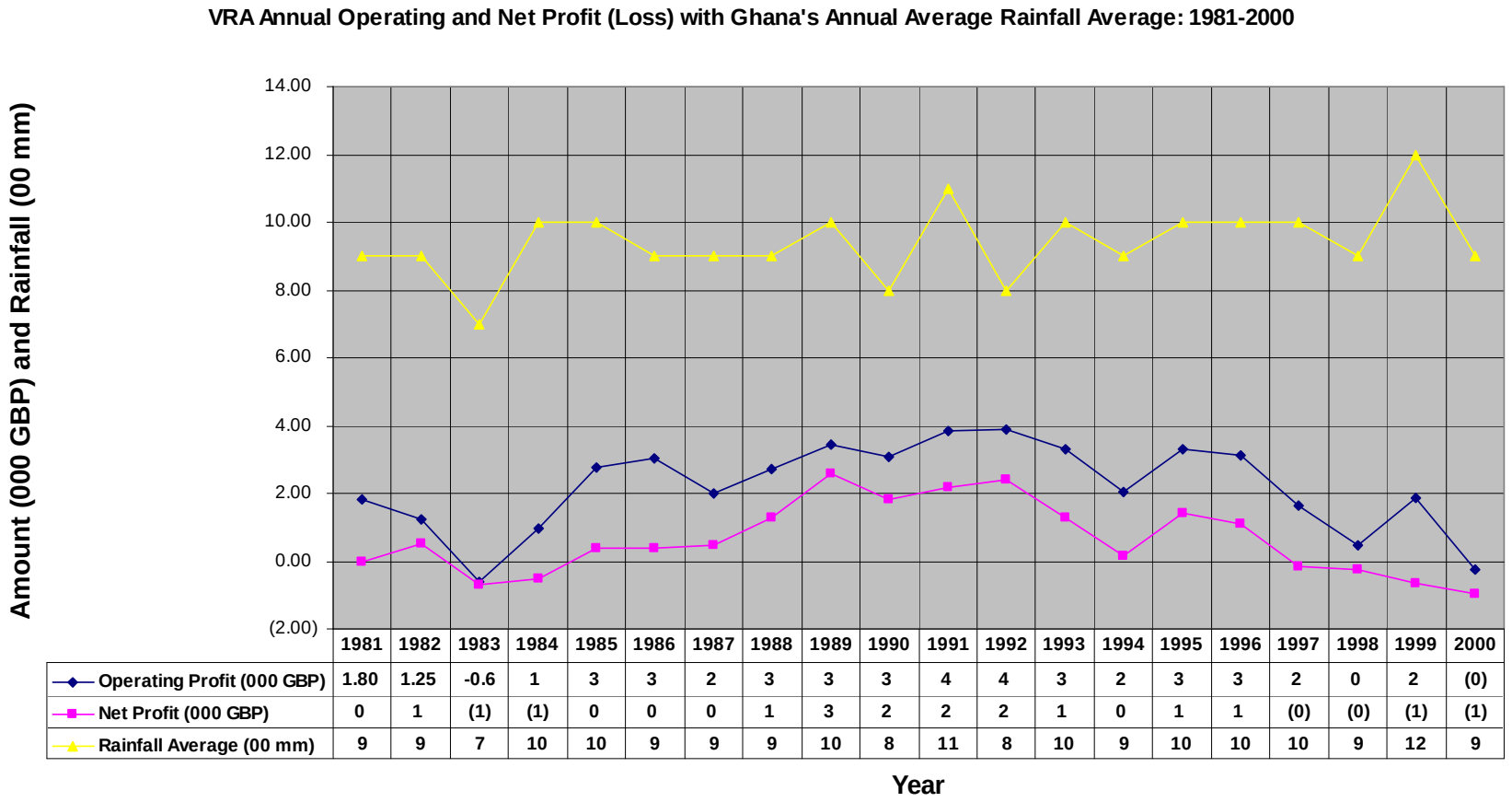
The financial performance of the VRA based on operating the Akosombo Dam is thought to be successful. Financial data analysed from VRA annual reports from 2003-2006, presented in Figure 7.3, indicate that operating profit was positively sustained from 1985 to 1999, with net profit positive from 1985 to 1996, although there were yearly variations. One issue that determines the variation in the VRA's yearly financial performance is rainfall variability. As Figure 7.3 shows, in 1983 operating and net profits were approximately -£600,000 and -£700,000 respectively (VRA, 2003). This negative return was due to severe droughts in 1981/82 which affected the Akosombo reservoir's water level and thereby the dam's operation. Subsequently rainfall variation impacted the financial performance of the VRA because there is a correlation between rainfall and the Akosombo Dam's operation which has a bearing on financial return, as demonstrated in Figure 7.3. For instance, low rainfall in 1987, 1990, 1994, 1998, and 2000 led to lower profitability. Lower yearly profits therefore coincide with poor yearly rainfall, so the level of the VRA's

yearly profit or loss is partly contingent on the magnitude of yearly variation in rainfall. This implies that the Akosombo Dam has 'met the projected benefits as it was very profitable' (Int/7, 2005).

Another factor that is said to have impacted on the VRA's financial performance is the decision to supplement the electricity from the Akosombo Dam with thermal electricity generation using the financial resources generated by hydropower 'to support thermal power generation' (Int/7, 2005). Thermal power was introduced as a result of increased demand for electricity in Ghana and as a backup to offset fluctuations in the electricity supply due to low rainfall (ibid). So with regard to Figure 7.3 it is argued that particularly from 1997 to 2000 the net loss in comparison to operating profit was due to the VRA's part-financing the thermal power station construction from 1997 to 2000 and its operation from 2001 (ibid). This means that but for the investment in thermal electricity generation the net profits would follow the pattern of previous years.

The lake created by the Akosombo Dam is said to have led to increases in fish yields and fishery-related activities in the upper catchment of the Volta Basin. Artisanal fishing in the lake accounted for 90 percent – 73,000mt of 82,000mt – of all fish harvested from inland waters in Ghana in 2003 (Sarpong et al 2005). This almost doubles the FAO (1991) estimated lake fishery potential of 40,000 mt/year. Braimah (2001) estimates the value of fish caught in the Volta Lake at about $22.4 million (in 2006 the equivalent of about £12 million). The high yield and value of fish in the Volta Lake is a demonstration of the benefit of the Akosombo Dam to fisheries development and livelihoods in Ghana.

The Akosombo Dam lake fishery provides employment for thousands of Ghanaians. An estimated 300,000 people benefit from fishery activities (Integrated Development of Artisanal Fisheries (IDAF) in 1993 (Anon, 1993; IDAF, 1993). Of this number, 17,500 planked canoes are used by 80,000 fisher folk with another 20,000 fish processors and traders operating from about 2,000 fishing villages (Sarpong et al 2005). The fishing industry has created opportunities for other auxiliary jobs like carpentry for building and mending boats and canoes; traders in fishing gear such as outboard motors and fishing nets; dealers in fuels and lubricants, and outboard motor mechanics (Kofi Abban, 2005: personal discussion). This socio-economic activity around the lake is a further demonstration of the benefits of the Akosombo Dam development to Ghana.



	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Operating Profit (000 GBP)	1.80	1.25	-0.6	1	3	3	2	3	3	3	4	4	3	2	3	3	2	0	2	(0)
Net Profit (000 GBP)	0	1	(1)	(1)	0	0	0	1	3	2	2	2	1	0	1	1	(0)	(0)	(1)	(1)
Rainfall Average (00 mm)	9	9	7	10	10	9	9	9	10	8	11	8	10	9	10	10	10	9	12	9

Source: Data from VRA Annual Reports 2003 – 2000 and Mitchell et. al. (2003)

Figure 7.3 Volta River Authority (VRA) financial performance and its correlation to Ghana's annual rainfall

The poverty profiles of 34 fishing communities further illustrate the development benefits of the Akosombo Dam. Beginning with fishing community employment indicators based on availability of employment opportunities, share of the population currently economically active, working conditions, frequency of work-related accidents, and child labour, it emerged that all the villages with the exception of one indicated a 'general state of well-being insofar as employment-related aspects of poverty are concerned' (Pittaluga et. al., 2003: 20). A growing number of people, including those who had lost their previous jobs in the agriculture sector, are being absorbed into the fisheries sector, with 37 percent of the communities surveyed showing a considerable increase in employment opportunities (ibid). The impact of the Volta Lake on livelihood improvement and reducing the poverty of fishing communities is further confirmation of the Akosombo Dam's importance to Ghana's socio-economic development.

It is suggested that the Volta Lake of the Akosombo Dam has also encouraged the expansion of small- to medium-scale irrigation farming in Ghana. Subsistence draw-down farming and increased use of water pumps and other forms of irrigation are now common along the Volta Lake's shore (Pittaluga et al, 2003). Where hitherto the Volta's tributaries ran dry limiting farmers to only one crop a year, the Volta Lake ensures the availability of water which farmers use to irrigate dry season crops (Shirazu, 1999). Agyenim-Boateng (1989) argues that farming provides alternative income for fishing communities and correlates with the level of fish stocks in the Volta Lake. This opportunity for small- and medium-scale irrigation and the correlation between agriculture and fisheries in the livelihoods of local communities indicates that Ghana's Akosombo Dam is of benefit to the country.

Another benefit derived from the Akosombo Dam is earnings from the export of hydroelectric power to Ghana's neighbours, Benin, Togo, La Cote d'Ivoire and lately Burkina Faso. In 2003, about $2 million (about £1.2 million) was earned from the supply of 604 GWh of electricity to these countries (VRA, 2003). Ghana earned income by aiding the socio-economic development of its neighbours and its own regional development.

The expansion in bulk transport choices due to the Volta Lake is another benefit derived from the construction of the Akosombo Dam. The lake serves as an alternative to road transport between the north-eastern and south-eastern parts of the country (Moxon, 1994). The Volta Lake Transport Company (VLTC) hauls bulk freight from north to south between commercially-important areas like Yeji and Kpando Torkor in the Volta Region; Makango and Buipe in the Northern Region and Afram Plains in the Eastern Region (VRA, 2003). The gross revenue from 50,000 mt of commercial cargos of cement, petroleum products, shea nuts and foodstuffs such as maize and yams in 2003 was about $763,418.75

(£340,000) (ibid). The annual average of lake cargo catered for from 1994 to 2003 is estimated at about 80,000 mt (ibid). The haulage of goods across the Volta Lake provides a choice of bulk transport in Ghana in competition with others like road transport.

The Volta Lake is also used as a source of potable water by some cities and towns in Ghana. Roughly 60 to 70 percent of Ghana's available potable water in cities like Tamale, Bolgatanga, Koforidua, Accra and Kpandu comes from the lake (GWC, 2005; personal communication). The Kpong Waterworks, located downstream of the Akosombo Dam, supplies about 40,000 cubic metres of drinking water to the cities of Accra, Tema and other outlaying areas (VRA, 2003). The lake and other major rivers make it possible to supply drinking water to about 70 percent of Ghana's urban population and 30 percent of its rural population (MWH, 1998).

The importance of hydroelectric power from the Akosombo Dam to the provision of social amenities such as education and health in Ghana is said to be immense. To IA/007 (2005), the electricity available at the schools he attended from primary school to university was very beneficial to him and his colleagues. Electricity for health facilities, for storing perishable goods, the use of electronic media and operation of modern domestic equipment like refrigerators and cookers enhance social life (A/Jm, 2005; IA/013, 2005). 'Performing funerals, naming ceremonies of newborn babies, wedding celebrations and other key activities in the social lives of Ghanaians can now be undertaken late into the night because of electricity in both urban and rural areas' said IA/018 (2005). For rural people there is prestige in being connected to the national grid (Int/6, 2005). In the context of improvement to social life the Akosombo Dam is an imperative to the Ghanaians.

The Akosombo Dam's construction led to the transfer of management and technical skills concerned with hydropower operation to Ghanaians. Currently members of the governing board, management executives, technical and administrative staff of the VRA are Ghanaian nationals (VRA, 2003). Some of these staff have been involved in the Akosombo Dam project from its planning to its operational stage (Moxon, 1984). Notable among those who have assumed key management positions in the VRA are Casely-Hayford, E. A. Kalitsi, and Amatefio (ibid). Casely-Hayford and Kalitsi ultimately became chief executive officers of the VRA in the 1980s and 1990s respectively (ibid). As a result of their experience of managing the hydropower sector, some of the VRA personnel were involved in the construction of a second dam at Kpong and are now involved in the construction of the BHP (Int/5, 2005; Int/19, 2005). So the Akosombo Dam is of significance to Ghanaians because of transferred management and technical skills in hydroelectric power operations.

In spite of all the important benefits of the Akosombo Dam mentioned in this subsection, the lack of fulfilment of a comprehensive integrated project as initially envisaged by the VRP, particularly mining and processing bauxite to further enhance the viability of the Akosombo Dam, seems to disappoint many. 'It was a huge setback for the entire project and a defeat for the VRP scheme' (Kodjo Botsio, interview with BBC 2, 1994). Two contradictory reasons are given by two Kaiser lawyers, Cutler and Sullivan, for not pursuing the integrated project. While Sullivan (1994: interview with BBC 2) said that the cost of the bauxite component was the main reason, Cutler (ibid) said that they 'were concerned that if we located all our bauxite and power necessary for integrated aluminium operations in Ghana it might be possible for the government to nationalise it and take it away from us'. Whatever the real reasons, Kaiser was not interested in using Ghana's bauxite deposits, which shocked the Ghanaian project negotiators (BBC 2, 1994). This is an indication that not all the benefits envisaged from large dams are realised due to the complexity and uncertainty involved in their construction.

Based on the discussion of the development imperative of the Akosombo Dam in this subsection, it can be deduced that large dams modernise, diversify and provide other economic opportunities for the people of the countries which construct them.

7.2.4 Equity in benefit distribution from large dams in Ghana

Members of the communities resettled as a result of the Akosombo Dam's construction have a perception that benefits from the dam are inequitably distributed. Although they were provided with potable water, clinics, schools, and roads before and during the Akosombo Dam construction (Moxon, 1984), these facilities fell into disrepair over the years for lack of maintenance and became inadequate due to pressure from population growth (Int/16, 2005). However, the resettled communities were not provided with electricity until 2000/2001 (ibid). So the sampled resettled communities – New Somanya, Nkonya Tepo, Yeji, and Yapei – felt that they had been neglected by central government and the VRA, whose activities are focused on urban areas (IA/014, 2005) and large industries like VALCO which consume the greater proportion of the electricity that the dam generates (IA/018, 2005). So communities who have sacrificed their land and lost their livelihoods to the dam but live close to the lake lack drinking water and electricity (IA/004; IA/008, 2005; IA/014, 2005). Because electricity and water are two critical requirements for development, it is claimed that economic activity in the area is low, with impoverishment high among the people of the resettled communities (A/NS:001, 2005; A/NS:003, 2005; Int/012. 2005). A/Yp, (2005) said: 'Since we were first settled here there has not been any significant improvement in our lives or in the

provision of social amenities', summing up the sentiments of the resettled communities about the inequity of benefits shared from the Akosombo Dam.

This perception is compounded by conflicts and tensions due to the influx of immigrants into some of the resettlements who are exploiting some of the opportunities provided by the Akosombo Dam like fishing and other related activities mentioned in subsection 7.2.3. One of the bases for the tension is that the migrants think that the resettled land belongs to the government and so they do not need permission to settle there (Int/17, 2005). As such it is argued that the migrants do not respect the local customs, traditional norms and taboos which apply to fishing or farming on particular days, they desecrate sacred groves by harvesting wood for domestic use, destroy lakeside forest and some commercial trees like shea butter trees (A/NT, 2005). It is in this regard that Scudder (2007) observes that the employment, poverty reduction and livelihood improvement benefits of the Volta Lake do not accrue only to local and affected people because some are captured by immigrants. The importance of projects such as the Akosombo Dam attracts experienced migrants with greater access to capital and stronger political connections than the resettlers and host communities (Scudder, 2007; personal communication). The tension between migrants and settlers does not provide a conducive atmosphere for socio-economic development of the resettled areas because it sometimes leads to open conflict which impacts on the Akosombo Dam socio-economic benefits.

The inequity in the sharing of benefits and the problems with migrants have led some members of the resettled communities to regret and long for their former settlements, remembering them as more suitable and comfortable: 'We had much more wealth in our former settlement, which we lost to the dam, than we were given' (A/NS:010 2005). This wealth is said to have consisted of economic trees like coffee, shea nut, palm and cocoa trees, timber, livestock and the use of naturally abundant non-timber forest resources (A/NS:002, 2005; A/NS:005, 2005; A/NS:007, 2005; A/NS:015, 2005; A/NT, 2005; A/NS:004, 2005). These 'economic trees can not be grown now because the water table in the new settlements is too high' (A/NT, 2005), which has led to the 'destruction of many livelihoods' (Int/12, 2005). These are some of the issues that some resettlers used to compare their past and present circumstances, arguing that they were better off in their old settlements before the Akosombo Dam was built.

The type of house provided for resettlers in their new settlements is another perceived difference in resettlers' wealth between their old and new settlements. It is argued that because family systems and structure were not considered before the settlements were designed, living conditions are difficult

(A/NS:009, 2005; A/NS:004, 2005). This implies that the resettlement houses provided are unsuitable and the land is inadequate in comparison to their former settlement.

The changed circumstances of the resettled people have had a significant psychological and emotional impact on them (see detailed discussion on this topic in section 4.3). It is claimed that wealth variation and resettlement housing hastened the death of their forefathers, elders, and leaders because they were traumatised (A/NS:008, 2005; A/NS:010, 2005; A/NT, 2005). 'We are worse off than before' (A/NS:010, 2005) because 'we were free in our former place and enjoyed life' (A/NS:011, 2005) but 'now we are suffering' (A/NS:012, 2005). These reflective sentiments by some of the respondents show their dissatisfaction with the benefits they have derived from the Akosombo Dam and its impact on their livelihoods.

However, some remedial measures have been undertaken in recent years to address some of the problems in the resettled communities. All the respondents in the resettled communities surveyed acknowledged some improvements in infrastructure and social amenities like access to electricity, potable water, roads, new schools, new clinics and improved employment opportunities (A/NS:007, 2005; A/NS:005, 2005; A/NS:009, 2005; A/NS:015, 2005; A/NS:016, 2005; A/Yj, 2005; A/NS:016). Access to electricity now extends to more than 60 percent of the country, covering regional and district capitals and communities of 500 and more people (IA/011, 2005; IA/013, 2005; IA/016, 2005; IA/007, 2005; IA/016, 2005; IA/020, 2005). This late attempt to address the longstanding problems of the resettled communities demonstrates the government's continued commitment to them.

Funding for infrastructure and social amenities development in the resettled communities comes from two main sources. The first is the Resettlement Fund set up by the VRA in 1996 into which a yearly deposit of US$500,000 is made towards infrastructure provision for those affected by the Akosombo Dam (Int/16, 2005). Projects are assessed for funding and executed after the communities make a decision to that effect (ibid). The second source of funding is a Chinese concessionary loan of US$1.5 million which has enabled the connection of about 73 resettlement communities and nearby towns to the national grid from 2000 to 2003 (ibid). These two sources provided the bulk of funding for the infrastructure and social amenities improvements mentioned in the last paragraph.

But the availability of electricity and other infrastructure is said to be too little and to have come too late to make a significant difference to life in the resettled communities. For instance some members of the communities claim that their electricity has been disconnected as they are so poor that they are unable to

pay their bills (Int/17, 2005; Int/12, 2005; A/NT, 2005). The disconnection of electricity for non-payment of bills in one instance nearly led to a demonstration by a community, so the VRA granted a waiver to defaulters to diffuse the situation (Int/12, 2005). As a result of the delayed development in the resettled communities there is lingering bitterness among some community members against the VRA for the perceived neglect of their concerns for such a long time.

Compensation payments are another issue that those affected by the Akosombo Dam still contend with 44 years after its construction. Complaints abound from some resettled people about non-payment of compensation for crops, buildings, livestock and land (A/NS:001, 2005; 002, A/NS, 2005; A/NS:008; A/NT, 2005; A/Yj, 2005; A/Yp, 2005; Int/12, 2005; Int/17, 2005; IA/014, 2005). This has soured relations between the government, represented by the VRA, and the affected communities due to disagreement about what is to be compensated, who has been compensated, and for what.

To decipher and understand these disagreements it is appropriate to itemise what qualifies for compensation. Firstly; crops, including economic trees, and land including land used for economic activities like farming were to be compensated for after appropriate valuation (Halcrow, 1951; Jackson, 1956; Kaiser, 1959; Moxon, 1984; Scudder, 2005). Buildings were generally excluded from the compensation package because most settlers agreed that the government should build new homes for them in their new settlements (Moxon, ibid; Scudder, ibid). Those whose lands were acquired for resettlement were also entitled to compensation (Jackson, 1956; Moxon, 1984; Int/15, 2005). This suggests that the items for compensation were clearly identified and agreed on to avoid confusion.

In spite of this agreement however there are disputes about whether compensation has been paid and whether the amount paid was adequate. For instance, some families and communities said that no compensation had been paid to them, and others claimed that the amount was inadequate (A/NT, 2005; Int/12, 2005; Int/17, 2005). Evidence from the Land Compensation Commission of Enquiry (LCCE) (1980) shows that families in 34 communities of the 52 have been paid full compensation for their land, and all the resettlement communities, with the exception of some families in one, have been fully compensated for their crops (LCCE, 1980). The outstanding land compensation for the 18 other resettled communities is related to conflicts between communities, families and individuals over ownership and boundaries (Int/15, 2005). For instance, claims and counterclaims between the Krobos and Akyems families over parcels of land purported to belong to the Akyems, and conflicts among multiple claimants to land at Senchi, all in Ghana's Eastern Region (ibid), were cited as examples of why compensation payments for land were outstanding in some of the communities.

Allegations of repossessed resettlement farmlands by some of the original landowners compound the problems of counterclaims and conflicts behind the delays in payment of compensation. The repossession is said to be due to the alleged non-payment of compensation by the government for those farm lands (LCCE, 1980; Int/12, 2005; Int/15, 2005). This further complicates the administration and delivery of compensation packages to those who rightfully deserve them.

Another difficult issue is compensation for land flooded to create the Volta Lake. The inability of the government to pay compensation for this is a cause of great unhappiness among the resettled communities (Int/12, 2005; Int/17, 2005). Such land was not formally acquired for the dam project at its inception (Int/15, 2005) because traditional chiefs and local authorities were encouraged to 'donate' their land for the Akosombo Dam project in a 'voluntary/compulsory' manner based on the socialism espoused by Nkrumah (ibid). This implies that the chiefs and traditional authorities were coerced into acceding to Nkrumah's demands. However, this claim is countered on the ground that Nkrumah's socialism came into effect after the dam was constructed (Moxon, 1984).

The state legally acquired the lake's flooded land in 1968 and the legal instrument for the acquisition in 1974 at the behest of the chiefs and traditional authorities, who demanded compensation which is yet to be paid (ibid). As of 2005 an estimated 3 trillion Ghanaian cedis – about £170 million or US$300 million – is needed to compensate for this land (ibid). Such a sum is said to be currently beyond the VRA's ability to pay (ibid). However, the resettled communities hope to claim it some day or wait for the lake water to recede and for the dam be decommissioned so that they can reclaim their land (Int/17, 2005). This means that the real financial cost of the Akosombo Dam is still not known.

The compensation costs of the Akosombo Dam have significantly dwarfed the total amount earmarked for compensation. Halcrow (1951) estimated the compensation package at US$3 million (GBP 1.6 million at the 2006 exchange rate), which, although accurate at the time was neither amended later by Jackson (1956) nor by Kaiser's (1959) subsequent reviews of the VRP. The bases for not reviewing the compensation package upwards were firstly fear of increasing the project cost; secondly an assumption that the resettlers' were capable of rehabilitating themselves once the basic structures for the new settlements were provided; and thirdly, any extra amount needed for compensation was to be borne by the VRA and the government (Moxon, 1984; Int/15, 2005; Scudder, 2005). The final costs of the project did not reflect the full complement of the compensation package.

It is said that the amount needed for compensation was met from savings from the project construction costs (Int/15, 2005), but the burden of footing the entire extra compensation bill is borne by the VRA, because as operators of the Akosombo Dam there is a close connection between their activities and the resettled communities who consider it responsible for every outcome of the Akosombo Dam project (Int/15, 2005). Also, as the VRA initially handed out compensation from 1968 to 1971 government adopted a hands-off approach to compensation regarding the Akosombo Dam (ibid).

The Akosombo dam changed the ecological balance between the Volta River and its floodplain, which significantly altered the livelihoods of downstream communities. Tsikata (2006) argued that basic livelihood activities, such as lucrative creek fishing by men and highly profitable clam digging by women, were literally wiped out. Tsikata (ibid) posited that programmes meant to assist the people of the floodplain were the first to suffer budgetary cuts and that even attention to downstream losses remains ineffectual, resulting in the non-implementation of recommendations of a 1996 government study on people's losses from the Volta dam project (ibid). Tsikata (ibid) further reasoned that community losses were ignored in the early years of the Akosombo dam because economists did not pay much attention to non-market and environmental losses and, therefore, were not included in project accounting, thereby significantly reducing the employment and education capacity of the communities.

Furthermore, there were huge environmental and health costs associated with the construction of the Akosombo dam. Rahaman et al. (2004) observed that the natural environment of the area was significantly, and indeed, permanently altered, converting a river ecosystem into a lake ecosystem. Floods to the downstream floodplains were reduced, which led to the virtual collapse of agriculture and fishing (Rubin et al., 1998). Farming along the Volta was structured around the rise and fall of the river but the damming put an end to the natural cycles that had deposited nutrient-laden silts along the floodplains. Damming led to a drastic curtailment in subsistence agriculture production and animal grazing (Gorman and Werhane, 2008). The reduction in floods led to a reduction in the dispersal of mangrove seedlings while the collapse in fishing and agriculture led to an increase in mangrove cutting for fuel wood by the local communities (Rubin et al., 1998). Also water-borne diseases such as bilharzias, river blindness, malaria, and urinary schistosomiasis became public health concerns because they are common among the inhabitants of surrounding villages (Rahaman et al., 2004; Gorman and Werhane, 2008). Prior to construction of the dam, urinary schistosomiasis only affected approximately 1 to 5 percent of the population, but by 1979 the disease had become the most prevalent in the area affecting some 75 percent of the lakeside residents (Gorman and Werhane, 2008).

Despite the above enumerated issues, particularly those related to resettlement communities' problems with compensation for property, inequitable distribution of benefits, problems with immigrants and psychological and emotional issues due to resettlement, the Akosombo Dam is still thought of as imperative to Ghana's socio-economic development. The words of one opinion leader encapsulate local actors' position regarding the Akosombo Dam and summarises their concerns: 'The dam itself is good for development, but the treatment of the local people is the problem' (Int/12, 2005).

7.3 Ghanaians' perceptions of the Bui Hydropower Project

The favourable perception of Ghanaians about the construction of the BHP seems to further demonstrate large dams' importance to the country. Juxtaposed against some of the negative experiences of resettled people affected by Akosombo Dam discussed in subsection 7.2.4, this study anticipated that local actors to be affected by the construction of the BHP in the four sampled communities – Jama, Banda Nkwanta, Bui and Bator Akanyakrom – would either reject the project outright or at least give it their qualified support. Instead these actors perceived the BHP as a socio-economic instrument for transforming their society and the country. This perception is even shared by some local actors affected by the Akosombo Dam, institutional actors and other key stakeholders, implying that in spite of the many identified problems of the Akosombo Dam, dams are perceived as having a significant role to play in Ghana's quest for socio-economic development.

The favourable perception of the BHP is based on the high expectation of local communities, particularly those to be affected by the BHP's construction, of the benefits the project will bring to the area. The transformations expected are the development of infrastructure, e.g. roads, schools, health facilities etc., which will open up the area to the rest of the country because it is currently isolated (B/BA, 2005; B/BN, 2005; Int/5, 2005); employment (B/BA, 2005; B/Jm, 2005); better accommodation through resettlement; increased fisheries yield, improvements in farming and wellbeing (B/Bu, 2005); and improved earnings from farmers' produce because of the influx of people and access to a wider market (B/Jm, 2005). These expectations are linked to how the youth in the area are inspired to greater personal ambition (B/Jm, 2005; B/Bu, 2005). It was argued that the presence of different expertise and skills during the construction and operation of the BHP would enable the youth of the area to 'see other people and have role models' (B/Bu, 2005). Some of these expectations are evidenced by the economic activities the Akosombo Dam has generated as discussed in subsection 7.2.3 and supported by some of those affected by the Akosombo Dam: 'Others need to benefit as we have benefited from Akosombo' (A/Yj, 2005). The favourable perception of the BHP by the local communities to be affected by its construction is partly contingent on

the anticipated benefits that they think they and their communities will derive from it and the benefits that the Akosombo Dam is said to have produced.

The favourable perception of the BHP among those to be affected is also based on the belief that it will contribute to the development of the country by complementing Akosombo in meeting the demand of the growing population for electricity (B/BN, 2005; B/BA, 2005). Despite their 'bad experiences' (A/NS:009, 2005), some Akosombo Dam-affected communities support the notion that the BHP will benefit them because more electric power will be released to augment what is produced at Akosombo, particularly during peak periods, and will help the country to develop (A/NT, 2005; A/Yj, 2005; A/NS:003, 2005; A/NS:009, 2005; A/NS:010, 2005; A/NS:016, 2005). This implies that local actors perceive the BHP favourably because it will be both locally and nationally beneficial to Ghana.

Some institutional actors also view the BHP favourably based on its positive national socio-economic implications. Constructing the BHP is needed because it will help to meet the electricity and food requirements of Ghana's increasing population and industrial development (IA/021, 2005; IA/002, 2005; IA/013, 2005). It is argued that Ghana needs to supplement its existing energy facilities because its current energy arrangements are inadequate to meet the large-scale requirements of the next 20 years (Energy Commission, 2005; IA/007, 2005; Int/18, 2005). The BHP is said to be the single largest affordable, sustained and reliable source of cheap power available to the country (Int/18, 2005; Int/7, 2005; IA/007, 2005; IA/002, 2005) which will provide Ghana with energy security for the next 20 years (Int/2, 2005; IA/004, 2005; IA/016, 2005). It will alleviate the current pressure on the Akosombo Dam (IA/014, 2005; Int/5, 2005) because it will service the electricity needs and enhance distribution in northern Ghana (IA/014, 2005; IA/007, 2005; IA/021, 2005). This means that constructing the BHP is a necessity for Ghana's socio-economic development.

Some of the above favourable perceptions of the BHP are supported by feasibility and other related studies of its viability and Ghana's electricity requirements. For instance, the inclusion since 1999 of thermal energy in the electricity generation mix has made electricity use expensive because demand for electric power has long outstripped supply from the two hydro generating plants, Akosombo and Kpong (Energy Commission, 2005). In an earlier study, Acres (1985) (see Table 5.1, item 19) forecast the possible deterioration of the foreign account balance of the VRA because of differential cost escalation of imported fuel to meet the increased use of electricity from thermal plants after 2003. This forecast by Acres in 1985 has turned out to be true as the finances of VRA have since been in the red because of the introduction of thermal electricity into Ghana's energy mix. The introduction of a new hydroelectric

generation plant will restore the foreign exchange balance (Acres, 1985). So the 400 MW BHP is the project of choice (Coyne et Bellier, 1995; SMEC, 1976) to meet the forecast demand for domestic and export markets (Acres, 1985) and increase Ghana's electricity generation capability by about 17 percent (Coyne et Bellier, 1995) to drive economic development and enable a higher standard of living (Energy Commission, 2005). This implies that the BHP could provide cheap electricity for public consumption and the socio-economic development of Ghana.

The development of agriculture is another rationale behind constructing the BHP. Agriculture is 'the bedrock of the economy' (IA/003, 2005). In the BHP area about 30,000 hectares of land have been identified as suitable for irrigation with water from the BHP reservoir and the natural flow of Black Volta tributaries downstream of Bui (Coyne et Bellier, 1995). The size and design of the irrigation schemes are expected to be small to medium in size, each covering 300 hectares and scattered among various communities (ibid). The development of these irrigation schemes will be staggered over a period to avoid large initial investment in main adduction canals and to minimise the loss of energy generation from Bui, Akosombo and Kpong Dams (ibid). It is said that provided these irrigation schemes are 'planned and implemented appropriately' (IA/003, 2005) the BHP area 'can be turned into the food basket of the country' (Int/18, 2005). People within the Guinea Savannah Ecological Zone (GSEZ) of the Northern and Brong Ahafo regions whose primary occupation is farming crops and livestock are hampered by unreliable and unpredictable unimodal rainfall and could expand on their farms through irrigation to address local and national food security problems (IA/010, 2005; IA/017, 2005; IA/014, 2005). Thus the BHP could help to achieve food security and aid in Ghana's quest to meet its MDG targets by 2015.

The implication of the BHP contributing to the expected increase in agricultural productivity in Ghana is enormous. Firstly, increased food production will probably reduce the more than US$125 million spent on 253 to 780 mt of rice imports per year (GNA, 2006). Secondly, the expected 30,000 hectares to be irrigated by the BHP will significantly increase the existing 6,374 hectares of Ghana's estimated 346,000 hectare potential for full control irrigation development based on soil and water availability in the country (FAO, 1997). This expansion could help Ghana to achieve its target of US$1,000 GDP per capita per annum to become a middle-income country by 2015 as outlined in the country's Poverty Reduction Strategy Paper (PRSP) (IMF, 2003; Int/18, 2005).

However, not all actors are enthusiastic about the BHP's development due to perceived social and environmental concerns. One reason for concern is the experience of the resettled people of the Akosombo Dam (IA/015, 2005). Others are the possibility of wildlife and habitat loss within the Bui National Park

(BNP) due to the flooding of about 21 percent of its area; erosion and sedimentation of the river and its banks; the effects of changes to river flow on fisheries; potential proliferation of water vectors and aquatic weeds; the socio-cultural and economic impacts of resettling about 2,500 people; the biophysical, socio-economic and cultural implications of the probable influx of guest workers during construction; and public health issues (EMS, 2007a; BKS Acres 2001). So the BHP's 'tyranny of technology' is premised on the perception that its negative impacts might create problems (IA/011, 2005) that are not easy to mitigate (IA/010 (2005).

For instance it is argued that some rare species of flora and fauna will be destroyed by the construction of the BHP (Anane, 1999a; Titone, 2001; IA/014, 2005). Of particular concern is the possible extinction of the hippopotamus, which, IA/004 (2005) claimed, the BNP was established to protect because part of their habitat – that closer to the Bui gorge – will would be submerged by the dam's reservoir (Anane, 1999b). This is perceived as a paradox because of incompatibility between the objectives of the BHP and the BNP (IA/008, 2005), which IA/010 (2005) attributed to 'planning confusion' in the country. In this context it is suggested that the BHP is not an appropriate source of electricity for Ghana because of its location in the BNP and the unquantifiable impacts on its ecology and biodiversity.

However, other actors do not subscribe to the arguments that constructing the BHP will damage the biodiversity and ecological sanctity of the BNP. 'A little more water in the park is not in itself destructive' (IA/005, 2005) and might even be ideal because the creation of the park was to preserve the site of the future development of the Bui Dam (Int/20, 2005; IA/016, 2005). The BHP might transform the BNP and make it more economically viable than it is now (Int/20, 2005; IA/003, 2005) because the environment, wildlife and ecosystem in the national park will be enhanced by the expanded area of water for wildlife use, particularly for the hippopotamus (Ankudey; 1999a/b; IA/021 2005; Int/21, 2005). The BHP will make the BNP a more attractive prospect for tourism because the roads and accommodation provided will make it more accessible and habitable to tourists and the local population (Int/20, 2005; Ankudey; 1999a/b). Thus the BHP could transform and enhance the BNP.

Furthermore, it is argued that the provision of cheaper electricity for the people of Ghana far outweighs the significance of the BNP, although any negative impact on it is considered a loss to the country (IA/002, 2005; IA/001, 2005). All the communities sampled in the BHP were unanimous that the BNP was of no benefit to them because they did not have access to its resources, as it is a strict conservation area and 'limits our economic activities' (B/BA, 2005). Anyone found in the BNP without authority is shot at, and many people have either been killed or prosecuted for attempting to hunt wildlife or gather

wild plants and fruits for domestic consumption (ibid). As such the BHP will 'serve the nation and the communities better than the park' (B/BN, 2005). B/Jm (2005) said that the BNP would not have existed if the BHP were constructed earlier. B/Bu's (2005) apt observation that 'in development something will have to be destroyed for something good to come out of it' sums up the view that the BHP is imperative to Ghana's socio-economic development.

Based on stakeholders' perceptions of the BHP it is argued that Ghana is 'better informed to formulate and implement adequate and effective mitigation measures to deal with potential environmental and social problems because of lessons learnt from the Akosombo experience (IA/004, 2005; IA/008, 2005). So it could be pragmatic if actors in the large dam debate accept that their impacts are uncertain and evolve over a long period, because ideas about them are currently mostly based on assumptions and defy accurate predictability.

7.4 Alternatives to large dams in Ghana

Actors in Ghana's large dam debate are divided over whether there are benign alternatives to the BHP which can adequately provide the electricity required for socio-economic development. This subsection analyses the appropriateness of alternatives to BHP identified by Ghanaian actors.

Some suggested alternatives to the BHP – solar, wind, mini/small hydro and nuclear power and thermal energy with gas from the West African Gas Pipeline Project (IA013, 2005; IA/002, 2005; IA/014, 2005; Int/9, 2005; Int/1, 2005 and Int/6, 2005) – are no different from the global and African large hydroelectric power dam alternatives already discussed in sections 3.4, 4.7 and 6.6 of this thesis. It is argued that some of these can achieve the same or even greater benefits for Ghana with little or few of the social and environmental problems associated with the BHP (A/012, 2005; IA/003, 2005).

However, some actors contested the appropriateness and significance of the aforementioned alternatives to the BHP. Firstly, they argued that the costs of generating electricity from these alternatives are prohibitive (Int/18, 2005; IA/016, 2005; IA/008, 2005), as shown in Table 4.3. Secondly, the alternatives cannot generate other perceived positive benefits in the areas of agriculture and fisheries like the BHP, as discussed in section 7.3 (B/BA, 2005; Int/19, 2005; Int/21, 2005). So based on the cost and the lack of associated benefits they would provide, these alternatives are incapable of substituting for the BHP as sources of electricity generation for Ghana.

Some actors also criticised the limitations of the BHP alternatives, which are consistent with some of the criticisms of hydropower dam alternatives discussed in section 3.4 and 4.7. Taking wind power as an alternative to the BHP as an example, its combined generation potential in Ghana is about 200 MW, which is too little for the country's immediate requirements compared to the 1000 MW produced by new hydroelectric power generation (Int/18, 2005; EC, 2005; Acres, 1985). Also wind technology is not well-developed (BKS Acres, 2001). Thus wind power generation could not be a credible alternative to the BHP.

Small hydropower generation is another alternative which is said to be incapable of substituting the BHP as an alternative electric power source. Although small hydro power continues to feature in Ghana's electricity generation plans (GNA, 2006), studies of 22 potential small hydro power sites concluded that 50 percent of them dry out completely and most of the rivers have their economic potential reduced considerably by pollution and siltation (Dernedde and Ofosu-Ahenkorah, 2002). These studies outcomes, in addition to the possible impact of small dams discussed in section 3.4, could undermine the government's intention to construct 16 small hydro dams to supply electricity to remote rural areas in the country (GNA, 2006). Consequently small hydro dams may be able to serve as alternatives to the BHP in Ghana.

Solar power is said to have great potential in Ghana because of the country's tropical climate. But this potential is undermined by its inability to store electric power, the exorbitant cost of production and imperfections in the technology (Int/18, 2005; Int/13, 2005; Int/3, 2005). It is estimated that the 'cost of generating a KW/h of electricity with solar power is more than 60 cents/KWh' (Int/21, 2005), which is 'way beyond the capacity of Ghanaians to pay' (Int/18, 2005). Clearing land in order to site panels is considered 'environmentally harmful because of the amount of vegetation and biodiversity destroyed for solar to generate huge KW/h of electricity and its unknown long-term impact on the ecology' (Int/13, 2005). Thus generating electricity from solar panels could not replace the BHP.

Electricity from thermal sources is one option identified as capable of competing with the BHP in meeting the country's electricity requirement (ERM, 2007a; BKS Acres, 2001; Acres, 1985). However this is said to be sensitive to crude oil prices because Ghana has no proven source of fossil fuels and must rely on imported crude oil and gas, which are expensive for the Ghanaian economy to procure (Acres, 1985; BKS Acres, 2001; IA/003, 2005; IA/021, 2005; Int/19, 2005). The inability of the country to operate the two main thermal plants to full capacity (Aboadze and Takoradi) is linked to the cost of crude oil (Int/19, 2005; Int/3, 2005). The 'costs of electricity generation from the thermal plants is about 7 to 8 cents per

KW/h at current production level, reducing to about 6.5 to 5 cents/KW/h at full capacity' (Int/21, 2005). It is argued that natural gas from the proposed West Africa Gas Pipeline (WAGP) may further reduce the cost (ibid). In terms of capacity, therefore, thermal energy is an alternative to the BHP but not in terms of electricity-generating costs.

The possible use of thermal energy and gas from WAGP to generate electricity raised a number of concerns. Firstly, perceived insecurity in the WAGP source country (Nigeria) and potential security problems in the countries through which the WAGP gas pipeline transits before it reaches Ghana (Nigeria, Benin, Togo) raise concerns about Ghana's energy security. For instance Nigeria and Togo are seen as unstable countries to which Ghana's energy and national security cannot be entrusted (Int/19, 2005; Int/21, 2005). Thus Ghana's energy security concerns do not make gas-fired thermal energy an appropriate alternative to BHP.

The second concern is the social and environmental impacts of pipes laid to transport gas from Nigeria to Ghana through Benin and Togo to generate electricity from the thermal plants. The gas pipes laid overland, in the sea and along the coast would have short to long-term unknown social and environmental implications (Int/21, 2005). It would affect coastal ecosystems, displace some coastal communities and there would be potential for gas leakage and impacts on the general livelihoods of the coastal population (senior officer at Ghana's Ministry of Energy, 2005). Because of this concern about the possible social and environmental impacts of WAGP, a VRA engineer (2005) referred to WAGP's potential as an alternative to BHP 'as unthinkable'. This implies that thermal energy with gas sourced from outside Ghana is not perceived as an appropriate alternative to the BHP.

Another concern about thermal energy is that its use has increased Ghana's emissions of GHGs. The increased use of thermal energy to generate electricity as part of Ghana's energy mix has amplified the discharge of carbon dioxide (CO_2), sulphur dioxide (SO_2) and nitrogen oxide (NO_x) because more light crude oil and diesel are used than before (Energy Commission, 2005). While in 2000 the total CO_2, SO_2 and NO_x emissions were about 449.44 million kg, 0.67 million kg and 1.23 million kg respectively, their emission levels increased to 1372.32 million kg of CO_2, 2.06 million kg of SO_2 and 3.74 million kg of NO_x in 2003 when thermal generation was increased in the country (Energy Commission, 2005). CO_2 emissions in Ghana between 1990 and 2004 increased by about 6.5 percent from 3.8 Mt CO_2 in 1990 to 7.2 Mt CO_2 in 2004 (UNDP, 2007). The increase in CO_2, SO_2 and NO_x in the country and their implications for climate change and the health of Ghanaians mean that thermal energy is inappropriate.

Nuclear energy is a BHP alternative capable of meeting Ghana's electricity needs, although it is not featured as an alternative electricity source in the 2005 Strategic National Energy Plan (Energy Commission, 2005) because the Danish government, which sponsored the study, is anti-nuclear power (Int/8, 2005; Int/9, 2005). Electricity from nuclear power is recognised as a potential long-term solution to the country's electricity problem (Acres, 1985). It is not as location-specific as dams so could be sited anywhere in the country, and involves technology transfer, produces zero emissions of GHG and is a more reliable electricity source than hydro or thermal energy (Int/8, 2005; Int/9, 2005). It is argued that because Ghana produced electricity from nuclear power on an experimental basis for more than a decade under the auspices of the International Atomic energy Agency (IAEA), it should expand on nuclear electricity generation to ensure the energy security of the country and also for export to other countries (ibid). In terms of capacity, nuclear power is an appropriate alternative to the BHP.

The impetus to develop nuclear energy for electricity generation is supported by a presidential commission report which suggests that it could be the solution to Ghana's electricity problems in the future (*Daily Graphic*, 2007). This suggestion is boosted by the knowledge that Ghanaians are not averse to the use of nuclear energy (Int/8, 2005; Int/9, 2005) But 'international concern for safety (i.e. Chernobyl) and nuclear proliferation (Pakistan, India, North Korea, and possibly Iran) have made it difficult to pursue' (ibid). However, concerns about safety and proliferation should not deter Ghana from pursuing nuclear energy (Int/9, 2005) because Japan and Chernobyl, which faced nuclear disasters, are still constructing nuclear plants[69] for energy generation (ibid). As it was aptly put by one respondent; 'If your child should die in the process of fetching water for you to drink, do you stop drinking water as a result of the death?' (Int/9, 2005).

The analysis of BHP alternatives has shown some of their limitations and why they may not be currently considered appropriate in assisting Ghana to meet its electricity requirement for socio-economic development. 'Meeting the developmental needs of the country is the priority' (Int/3, 2005), and should 'depend on what the national agenda seeks to achieve' (Int/7, 2005). The pursuit of industrial growth for socio-economic development requires the right kind of energy (Int/18, 2005). The BHP is therefore seen as the appropriate and necessary power source that Ghana's economy can currently support to develop (IA/003) and which should in turn support the country's continued economic development (ERM, 2007a) to ensure job creation, security of supply and lower carbon dioxide emissions consistent with sustainable development.

[69] The numbers of nuclear plants being constructed in Chernobyl, Japan, and Russia are 4, 4, and 3 respectively (Int/9, 2005).

7.5 The North/South divide and the role of NGOs in the Bui Hydropower Project

Opposition to the BHP by some international NGOs and their local offices in Ghana due to concerns about social, environmental and economic equity is perceived unfavourably by some Ghanaian actors. 'The agendas of the World Bank and the Northern countries are the same since they want the South to continue to depend on them' (IA/Int6, 2005). Int/19 (2005) added: 'I have the feeling that some of these NGOs and Western people want Africa to be a wild place so that they can pursue certain agendas.' 'They want Ghana and for that matter Africa to be underdeveloped so that they can come and see us in our backwardness' (Int/19, 2005). This suggests that campaigns by some NGOs and their local affiliates against the construction of the BHP are perceived as driven by ulterior motives and not genuine concern about social, environmental and economic equity for local and displaced people.

Chapin (2004) appears to support the notion of ulterior motives when he argues that the pro-environmental campaigns are not based on an altruistic belief in equity and social justice for local people but for the sole purpose of environmental protection and nature conservation. This seems to be the situation with the BNP because for almost 40 years from 1971 to 2008, when the BNP was gazetted as a strict conservation area, no single NGO, local or international, was concerned about social, environmental and economic equity or the social justice invested in any development which could have either helped to improve the tourism potential of the BNP or the socio-economic development and livelihoods of the people who formally subsisted on park resources but were denied access after gazettement (Int/20, 2005). As observed by an official of the Ghana Wildlife Division of the Forestry Commission: 'We have not been able to get money to develop even Dwija National Park (DNP) with area of 3500 km^2 where the dam [Akosombo] has already been completed, so we do not understand what the NGOs are about when they talk about the importance and significance of the BNP' (ibid). LA:B/Jm (2005) is particularly annoyed that FOE and other NGOs have 'campaigned against the dam at Bui while they enjoy the benefits of electricity in their homes and then visit the BNP to view the animals with their friends'. 'I got a letter from one white guy who said that the BNP has some rare species of butterflies, and I replied why didn't they preserve the butterflies in their own country' (Int/19, 2005). These sentiments of Ghanaian actors about the campaign against the development of the BHP seem to confirm Chapin's (2004) argument that conservation NGO campaigners are more concerned with ecosystems and the ecological integrity of the environment than with the livelihoods and development of local people.

Some NGOs and Western countries' opposition to large dams due to the perception that they are not participatory is questioned by some Ghanaian actors. Every custom and culture has its own understanding

of what participation is and should therefore not be judged by the standards of others which have gained formal usage and roots in the last 50 years in some countries (IA/005, 2005). It is further argued that Western champions of participation do not themselves always and unconditionally accept the outcomes of decisions resulting from participation in decision-making because some countries like the 'US can afford to disregard international concerns about the environmental cost of development because they have the financial means to go it alone' (IA/7, 2005, citing as an example the Bush administration's withdrawal from the Kyoto Protocol in 2001). So developing countries can also ignore environmental issues that are perceived as inimical to their development provided they can generate resources for their development internally (ibid). In this regard Int/20 (2005) advised NGOs to look at individual large dams and assess what management programmes are appropriate to minimise the environmental and social impacts because 'there are no hard and fast rules on how things should be done' but added that 'if an NGO is anti-dam, no matter how you involve them they will still be anti-dam' because 'every NGO has its own agenda […] and can decide what to do'. This suggests that some NGOs and Western countries have vested interest which they have to protect.

The essence of some Ghanaian actors' feelings about Western NGOs subverting Ghana's development because of their opposition to the BHP is captured by Lewis' (1992: 250) statement that the 'environmentalism challenge must be more than to criticise society and imagine a blissful alternative.' So for NGOs the challenge 'entail[s] working with, not against society at large […] to devise realistic plans and concrete strategies for avoiding ecological collapse and for reconstructing an ecologically sustainable economic order' (ibid). This could be done by 'carefully guiding the path of technological progress' (ibid: 251). In the case of large dams and their alternatives, the environmental community can decide with the wider society 'which alternatives offer the best hope for ecological salvation' (ibid).

7.6 Conclusion

Ghana's foray into large dam construction has historically been motivated by several factors; variable rainfall, socio-political development, nation building and economic development. Although there is disagreement about whether the goals of industrialisation, social transformation, and national prosperity for which the Akosombo Dam was constructed have been met, there is some consensus that without its development the country might be economically, socially, and perhaps politically worse off than it is today. It also emerged from the field study that by and large dam construction in Ghana has been participatory. It is significant to note that affected people in the Akosombo resettlement could and did negotiate in the decision-making process about their resettlement and other issues in the 1950s. This could also be applied, with significant improvements, to the BHP case. In addition there is scepticism among

local people and other actors about the alternatives promoted in the context of electricity generation and Ghana's development ambitions. Thus the opposition to large dams such as the BHP in Ghana of some Western-backed NGOs, countries, and multi- and bilateral institutions gives the impression that they do not want the socio-economic development of Ghana.

It can be deduced from this chapter that in spite of some environmental, social, and economic concerns about the existing Akosombo Dam and the proposed BHP, large dams are well perceived in Ghana. The continuation of this positive perception could spur the development of more large dams in the country provided the technical, economic, political, and social conditions dictate that they are necessary when compared with and analysed against available alternatives. The treatment of the roughly 2,500 people to be resettled by the construction of the BHP and the performance of the BHP in enhancing living standards in local communities and nationally will be key factors in determining the future of large dams in Ghana.

The next and final chapter of this thesis presents my concluding thoughts about large dams and development. It discusses the development imperative, the tyranny of technology and the question of the subversion of African countries' development raised in Chapters 3 to 7, to ascertain their theoretical and policy implications for large dam development in Africa. Based on these implications the chapter proposes theoretical and policy frameworks for future large dam construction in Africa. The chapter ends with a conclusion and recommendations for areas for further research.

CHAPTER 8

DEVELOPMENT AND LARGE DAMS: CONCLUDING THOUGHTS

This thesis was inspired by the contestations about the social, economic, political and environmental impacts of large dams, particularly in Africa. My research has aimed to unpack the contentions about large dams through an analysis of case studies of past performances of large African dams, the future development challenges of contemporary Africa and how large dams' past performance and future development challenges such as climate variability/change, the MDGs and increased crude oil prices combine to influence the perception of them in contemporary Africa. A key rationale for this focus on large dams was that they have featured in past development programmes in Africa and other developing countries and continue to appeal to development planners in Africa and elsewhere.

The perceptions of dams express in the two Ghanaian field case studies; Akosombo dam and the BHP complemented by the secondary large dams case studies in Africa discussed in section 5.2 of this thesis are used to generalise the wider situation of large dams across Africa. Consequently, based on analysis of the contested issues around large dams in the context of their past performance and contemporary Africa's development challenges, I posit the following in response to the three main issues in the thesis title:

1. Large dams are imperative to Africa's contemporary development because in some cases they have been proved to aid the socio-economic transformation of some of the countries in which they are sited, e.g. Ghana's Akosombo Dam, Egypt's Aswan Dam and Zambia's Kariba Dam, in spite of their variable outcomes. Furthermore, the performance and viability of alternatives to large dams are as yet unproven;
2. Technologies including large dams and their alternatives have some negative impacts because it is difficult to internalise all possible benefits and costs and their impacts are long-term and unpredictable;
3. In some cases opposition to some large dams' construction subverts Southern countries' development because the large dam discourse is dominated by and based on Western/Northern countries' construct of the political, environmental and socio-economic development narrative and the appropriate balance or interface between them.

Although large dams have some negative socio-economic and environmental impacts, these are not the exclusive preserve of large dam technologies and so their construction in Africa can be prudently pursued as they have in some instances contributed significantly to the socio-economic development of some African countries in spite of efforts by some Western/Northern dominated organisations to curtail their development because of their perceived negative social and environmental impacts. The basis for these assertions is discussed in section 8.2 of this chapter.

The thesis has highlighted the complexities of the large dam discourse caused by their status as highly contested structures with huge benefits and costs in the countries in which they are built, as demonstrated in Chapters 3 to 7. A summary of these chapters is presented in section 8.1, followed by a detailed justification of the three above points in section 8.2. The framework used for large dam assessment in this thesis is appraised to determine whether it was the appropriate tool for the analysis and propose areas for improvement. Such is the complexity of the large dam discourse that the theoretical and policy implications (sections 8.3 and 8.4) derived from this study and based on the thesis are context-specific. In the subsequent subsections of this chapter, 8.5 discusses the contribution of this study to the understanding of large dams and development; and 8.6 presents an appraisal of the study prefacing my recommendations for future studies and conclusions in sections 8.7 and 8.8, respectively.

8.1 Summary of thesis findings

Evidence from this study has established that large dams are built primarily to ensure that the utilisation of available water resources of African countries is maximised for socio-economic development, although other reasons like political prestige also apply. The thesis has also shown that large dams used to maximise socio-economic development have had variable outcomes. For instance, the Aswan Dam in Egypt, the Akosombo Dam in Ghana, and the Kariba Dam in Zambia have contributed significantly to the development of those countries (Latif and Rashid, 1973; Osman, 1999; Shenouda, 1999; Soil Incorporated, Chalo Environmental and Sustainable Development Consultants, 2000; WCD, 2000; Biswas, 2002; Scudder, 2003; Scudder, 2005; Tortajada, 2007). But other large dams intended to enhance socio-economic development have been disappointing, particularly the Manantali project in Senegal and the Muela Hydropower Station in Lesotho, due to serious environmental, social, and, in some instances, economic problems (McCully, 2001; Tromp, 2006). This mixed socio-economic development outcome means that large dam construction to utilise African water resources does not necessarily generate positive results.

The national political dimension of large dams has implications for their benefits and socio-economic performance. Although the political prestige of large dam infrastructure and their connection with the political leaders who bring them to fruition, such as Nasser's Aswan Dam and Nkrumah's Akosombo Dam is undeniable (Pearce, 1992; Biswas and Tortajada, 2001; McCully, 2001), the likelihood of political/elite gain and capture always seems to lurk in the shadows. This possibility of the political elite capture of large dams' development benefits undermines their socio-economic achievements because its

leads to equity problems. Thus the distribution of benefits from large dams can be skewed in favour of the politically well-connected, which affects dams' socio-economic performance.

As a consequence, large dam construction has continually been contested between critics and supporters. On one hand critics such as Goldsmith and Hildyard (1984), Pearce (1992), McCully (1996), Singh (1997), Dubash et. al. (2001), WWF (2001), Hathaway (2005), and Scudder (2005) argue that large dams should have no place in contemporary development practices because there are more acceptable alternatives like solar, wind, geothermal etc. energy and that their historical association with important environmental and social problems such as downstream erosion, waterlogging, salinisation, resettlements etc. and the non-participation of local people and civil society in the decision-making process leading to their construction makes large dams unacceptable. On the other, large dam supporters like Gupta (1988), Ersumer (1999), Varma (1999), van Robbroeck (1999), Bartle (2001), IHA (2002), Schultz (2002), ADB (2005), Ausubel (2005), ICOLD (2005), the World Bank (2006a/b & 2004) and Biswas (2006, 2004 & 2002), contend that the environmental and social impacts of large dams are blown out of proportion in relation to the huge challenges of world hunger, poverty, disease and general underdevelopment which they have helped to assuage, particularly in the global South. It is these differences in the perceptions of large dams which continually stoke the debate about their appropriateness.

It is instructive to note that in the context of differences of perception about large dams' appropriateness for socio-economic there is progress in the attempt to find common ground through commissions and forums, notably the WCD process and the World Water Forums (WCD, 2000; DDP, 2001; WWC, 2002/2001). However, moving beyond overcoming the differences between critics and supporters still seems unlikely due to their entrenched positions. Some critics' stance with regard to large dams is that they do not meet the tenets of sustainable development (Cooney, 2004; Emerton and Bos, 2004; IRN, 2005/2007; McCully, 2004; McCully and Wong, 2004 WWF, 2006/2005/2003 etc). This is in spite of improved efforts by large dam planners to mitigate the social and environmental impacts of all new large dam projects through ESIAs and the inclusion of local/affected people, civil society groups and NGOs in the decision-making process, as evidenced by the field study of the BHP in Ghana discussed in section 7.3 and other related subsections of this thesis (Linaweaver, 2002; Mason, 2003; ERM, 2007a/b/c). This is one of the reasons why there is no significant progress in formulating a post-WCD water resources development paradigm.

The contentions about the imperative or otherwise of large dam development are increasingly played out in tropical regions and particularly in Africa, where large dams are among the socio-economic

development strategies adopted by governments. The dams are sometimes supported by multilateral and bilateral institutions to meet the energy, food and drinking water requirements of the continent and provide a basis for socio-economic and industrial development. But because the dream of industrialisation and food self-sufficiency aided by large dams has eluded Africa in the past and left it at the margins of the global economy, the justification for large dam development is questioned (Pearce, 1992; McCully, 2001; WWF, 2006 etc).

The mixed performance of large dams in Africa's socio-economic development is partly attributed to competing global geo-political, financial, national, regional and international interests, as discussed in sections 6.2 to 6.5. It is these competing interests that impact on large dams' performance and development in Africa.

Despite criticism of some African large dams, they are believed to have played a huge role in some African countries' development. For instance, the Aswan Dam in Egypt played a highly important role and contributed phenomenally to the socio-economic development of the country in spite of much criticism, as discussed in subsection 5.3.2 of this thesis (Biswas, 2002; Scudder, 2005/2003; Tortajada, 2007). In this first field case study of Ghana's Akosombo Dam, it is acknowledged that without it Ghana's economic, social, and perhaps political circumstances might be worse than they are today, as discussed in subsection 7.2.3.

The case studies of Ghana's Akosombo Dam and the Bui Hydropower Project (BHP) have established that local people and other interest groups in Ghana participated in the decision-making process that led to the construction of the Akosombo Dam and the pursuit of the BHP's construction. This is particularly evident in the BHP case study, where all the sampled communities affirmed that they have consistently been consulted and are aware of the ramifications of the BHP construction, as discussed in subsection 7.2.2. In the case of participation in the decision-making process for the construction of the Akosombo Dam, the evidence is less clear. This is because the available literature on the process leading to the Akosombo Dam's construction, discussed in subsection 7.2.1, indicates that the participatory process was comprehensive based on parliamentary debate, the VRP's tour of the country to explain the dam's purpose and garner support for its construction, and the independent public forums organised throughout the country by the People's Education Association (PEA) to discuss the dam project (Moxon, 1984).

The views of the sampled communities were divided about the participatory process for two reasons. Firstly, there was a significant time lag of about 50 years between the perceived participatory process and

the field study, so it is possible that respondents' views might have changed, influenced by their experience of perceived neglect over the years of their resettlement. Secondly, much older respondents of about 70 years and above remembered consultations and discussions about the Akosombo Dam, which agrees with the claim in the literature about participation in the decision-making process. However, younger respondents said that the participatory process did not take place. In spite of respondents' different views about participation in the decision-making, the evidence from the older respondents and the literature is that large dam construction in Ghana was a participatory process, particularly for those who were likely to be affected, and this contributes to why both the Akosombo Dam and the BHP are generally positively perceived by both local and institutional actors in Ghana.

There is significant scepticism among some local people, institutional actors and others about the appropriateness of the suggested alternatives to large dams in the context of Ghana's and Africa's development ambitions. The alternatives proposed for energy, irrigation, flood control and water supply, detailed in Table 4.2 (WCD, 2000a; McCully, 2001; REN21, 2005; Flavin and Aeck, 2006; Jowitt, 2006) and promoted as appropriate for Africa and other developing countries' socio-economic development, are not thought to be suitable, as discussed in sections 4.7, 6.6, 6.7 and 7.4. This implies that they are not considered capable of aiding Africa in dealing with its development challenges.

Several authors cited in this thesis raise a number of concerns about the costs and environmental impacts of large dam alternatives. For instance Driessen (2007), Durkin (2007), Moore (2007), Shikawati (2007), WEC (2007) and others are very critical about the promotion of solar and wind power as sources of electricity because of their costs (see Table 4.3) and unreliability and the neglect of other sources of energy which were readily available and cheaper. Others, such as Egre et. al., (1999); Strupczewski, (1999); van Robroeck, (1999) and Ausubal, (2005) argue that the alternatives to large dams have their own environmental impacts which far exceed those of large dams. Even the alternatives to large dams built for flood control, irrigation and drinking water supply discussed in subsection 4.7 are thought to be inadequate to deal with Africa's development challenges and so large dams are needed (NEPAD/FAO, 2002; WEC, 2003; Biswas, 2004/1997; World Bank, 2004; Djurfeldt et. al., 2005; REN21, 2008). The economic viability of large dam alternatives and their environmental neutrality has not yet been proved.

This scepticism about large dam alternatives also applies to alternatives proposed for the BHP in Ghana. In reports by Acres (1985), the Ghana Energy Foundation (2002) and the Ghana Energy Commission (2005) the construction of the BHP is seen as the best existing option for electricity generation in the country because the available alternatives cannot provide the energy that Ghana requires based on a long-

term energy option assessment for socio-economic development (ibid). In addition some actors (Int/18, 2005; IA/016, 2005; IA/18, 2005; B/BA, 2005; Int/19, 2005 and Int/21, 2005) argue that the alternatives to dams do not have the other multipurpose benefits like fisheries, tourism etc. associated with large dams. So alternatives to the BHP like solar and wind energy are not acceptable to some Ghanaian actors.

The doubts about the large dam alternatives being promoted in Africa have generated some mistrust about the intentions of some donors, West-dominated institutions and environmental NGOs. IA/Int6 (2005) and Int/19 (2005) believe that those who persistently promote large dam alternatives are in pursuit of some hidden agenda which could undermine Ghana's and other Southern countries' development, because not all large dams options for electricity, water supply, irrigation and flood control are objectively considered before alternatives are imposed on countries like Ghana. Based on this summary of the evidence in the empirical chapters of this thesis, the pressure on developing countries to forgo large dams in favour of untested alternatives gives an impression that some West-backed NGOs, Northern countries and multilateral and bilateral institutions are deliberately subverting Ghana's and other African countries development.

Another issue that supports the perception that Northern countries are subverting Southern countries' development is the criticism levelled against China for providing aid for the development of African infrastructure. The most serious aspect of this is that China is criticised for purportedly doing what the West has long done in Africa – providing tied aid, supporting dictators who abuse human rights, imposing conditionalities etc (Ramos, 2004; Kaplinsky, 2006; Rocha, 2006; Tjønneland et. al., 2006; Davies, 2007) as discussed in section 6.2.

An analysis of the criticisms and arguments, contrasting them with past and present Western practices (ibid) (see detailed discussion in section 6.2), places China's investment activities in Africa in perspective and shows that Chinese investment in Africa is broad, wide-ranging, welcomed by African governments and in many instances mutually beneficial to their socio-economic development objectives (ibid). As a result of this analysis the basis for criticising China's investment in Africa puzzles many in Africa and the Chinese and strengthens the perception that some Western/Northern countries are keen to subvert Africa's development dream.

For instance the thesis has established that the availability of Chinese funding for infrastructure, including large dams in Africa, has removed a significant hurdle for some African governments seeking to development socio-economically (ibid). The terms and conditions of loans and aid from China for the

development of infrastructure in Africa are more considerate than those of Western countries and the project costs are lower, with significantly less delay than West-funded projects experience (ibid). Consequently, Chinese aid and loans for infrastructure significantly enhance the future development options for large dams and other large infrastructure in Africa by breaking the monopoly of Western countries and institutions which hitherto had uncontested control of Africa's development aid and investment after the end of the Cold War. Thus the criticism of Chinese investment in Africa is perceived as emanating from the loss of strategic control over African government and development agenda by Western countries, institutions and NGOs.

The thesis' key findings have also provided a number of insights, three of which are discussed here. Firstly, environmental and social impacts are not exclusive to large dams, because their alternatives also have environmental and social impacts of their own, as discussed in sub-sections 3.2.7, 3.4, 4.7, 6.6 and 7.4, which are not usually highlighted by those who promote them. The impacts of large dams and their alternatives are contested and depend on the perspective of the individual or group making the claim.

Secondly, evidence from the field study has established that the public consultation and participation in decision-making, particularly of people to be affected by large dams, has been a long-existing process. Arguments that large dams in Africa are often not participatory or consultative because they are centrally conceived and implemented (WCD, 2000; McCully, 2001) are not wholly supported by this research. However, legitimate questions about stakeholders' participation in African large dams concern proper record-keeping of the entire participatory process because of the changing expectations of participants who might later claim that they did not participate in the decision making process, as in the case of some Akosombo Dam respondents discussed in subsection 7.2.1 of the thesis. Also record-keeping will enhance monitoring and evaluation and participatory governance more generally, because it will better ensure that there are mechanisms to guarantee that outcomes of the participatory process are adhered to. This issue of changed expectations means that criticism of large dams based on lack of participatory decision-making should be based on records kept and not only perceptions and memory.

Thirdly, it has emerged in this study that powerful groups such as environmental NGOs and other social movements that are critical of the decision-making process regarding large dams are themselves not subjected to the tenets of transparency and accountability. These environmental NGOs and social movements cannot present themselves as popular representatives of the opinions of the local people they purport to serve as it is they are who determine their own agenda (Chapin, 2004), unlike democratically-elected governments, which are periodically subjected to a renewal of mandate based on past performance

and their party manifesto. By presenting their manifesto – which may include large dams as part of government policies to be implemented – to the electorate for approval, governments are expected to uphold the electoral mandate reposed in them. This contrasts with environmental NGOs' programmes, which are not popularly mandated in the places where they operate and are thus lacking in 'democratic ethos' (Dowie, 1995: 8). In many cases the NGOs' programmes conflict with and undermine local interests (Chapin, 2004 and Lewis, 1992) because they are mainly driven by a vision of a 'healthy, bountiful, and sustaining environment' (Dowie, 1995: 7) in the present and the future.

Irrespective of the contested issues about the large dam development imperative, the tyranny of technology or the subversion of Southern countries' development raised in this summary, the evidence in this thesis suggests that large dams are a development imperative because they have the edge over available alternatives in the provision of multiple services like irrigation, flood control, electricity, and water supply, which are essential for Africa's long-term socio-economic development and its quest to overcome hunger, disease, and poverty. As a consequence, based on the available evidence large dams – as both a technology and a development tool – are competitively more advantageous as a stand-alone project than the proposed alternative technologies – wind and solar power, etc. – and can also be complemented but not substituted by them.

8.2 Key empirical findings and their general implications

The implications of the major empirical findings of this thesis are many. However, because the thesis set out to answer four specific research questions, they are limited to these questions. These are: 1) What have been the ideological and economic justifications for large dams, and what role have they played in meeting Africa's development objectives? 2) What are the alternatives to large dams and how credible and competitive are these alternatives for the present and the immediate future? 3) Can large dam projects proceed in an era of devolved, participatory governance and inclusive decision making when such projects are invariably centrally conceived and implemented? 4) If large dams are to have a future in Africa, what analytical frameworks can assess their long-term viability? How can the limitations of EIAs and SIAs be overcome to include a more political dimension? The major empirical findings and their implications are analysed below.

8.2.1 Justification for large dams, delivered development objectives and benefits

The justifications for large dams discussed in sub-section 4.1 are based on Africa's desire to modify and transform the delivery of water supply, irrigation, flood and electricity services to meet the needs of growing populations and to spur socio-economic development (Biswas, 1991; Altinbilek, 1999; White,

1999; ICOLD, 2001; World Bank, 2004). This is necessary because of restricted access to water, energy, and food brought about by the geophysical and hydrological characteristics of rainfall variability, floods, variable river flow and poor soil water retention, particularly in Africa (AWV, 2000; IHA et. al., 2000; OECD/IEA, 2002; UN/WWAP, 2003; Biswas, 2004; DOE/EIA, 2004; Falkenmark and Rockstrom, 2004; WHO/UNICEF, 2005; UNESCO et. al., 2006; UNIDO, 2006; World Bank, 2006). The construction of some large dams such as the Akosombo, Kariba and Aswan Dams have been vindicated because they have helped to transform the Ghanaian, Egyptian and Zambian economies and delivered some significant benefits (Biswas, 2002; Scudder, 2005/2003; Tortajada, 2007).

However, the delivered benefits from large dams are questioned on the grounds that they are generally overstated and are not equitable because only relatively few people, composed largely of the urban middle classes and elites, benefit (Pearce, 1999; McCully, 2001), as discussed in section 3.2.8. Large dams' benefits come with costs to both up- and down-stream ecosystems and people who are generally poor and vulnerable (ibid), although dams also include successes like the Aswan Dam in Egypt, the Akosombo Dam in Ghana and the Kariba Dam in Zambia; thus dams have a duel impact; positive and negative.

The negative and positive impacts of large dams vary from one dam to another and could provide a learning curve as to how to improve the positive and minimise the negative. As one respondent observed, because of the social and environmental problems of the Akosombo Dam, Ghana is now 'better informed to formulate and implement mitigation measures to address environmental and social concerns for the BHP out of the lessons learnt from the Akosombo' (IA/008, 2005; IA/004, 2005; and IA/008, 2005). Past lessons learnt from large dams can significantly help to improve the performance of future dams.

8.2.2 The ability of alternatives to large dams to meet Africa's development needs

Alternatives to large dams have been proposed due to some of their environmental and socio-economic problems. These alternatives are micro dams, run-of-river hydro-systems, shallow wells, low-cost pumps, water-conserving land management and rainwater harvesting among several others (WCD, 2000; McCully, 2001; Jowitt, 2006). However, evidence in this thesis shows that the alternatives to large dams cannot meet the development needs of Africa, although they might contribute to improve the efficiency of large dams and eliminate the construction of unnecessary ones. Therefore it is more appropriate to view the suggested alternatives as complementary to large dams.

The long-term environmental impacts of most large dam alternatives – solar, wind, and geothermal – are not known. This uncertainty is due to the possibility that they may emerge in the future as technological

tyrannies which could affirm David Brower's contention that 'all technologies are assumed guilty until proved innocent' (Pearce, 1992: 134/5; Mander, 2004). Furthermore, and in comparison with their alternatives, large dams are said to offer low-cost and cost-effective technology that provides multiple benefits and high-impact solutions consistent with national development goals (World Bank, 2006).

However, it is appropriate that large dams should be used in tandem with further research and trials of the proposed alternatives to understand their long-term socio-economic and environmental impacts. Doing so will prevent a situation where the alternatives now hailed as technological breakthroughs are later maligned as economically imprudent, environmentally unsound and socially unacceptable, as is currently the case with large dams. So large dams and their alternatives need to be critically assessed based on the purpose for which they are required to ensure that they are the most cost-effective, affordable and easily-maintained facility (Donkor, 2003) to meet the socio-economic development challenges and ambitions of Africa and other developing countries.

8.2.3 Participation in decision making and large dams

Effective participation in the decision-making process about large dams by locally affected people and the general public is said not to be possible because dams are centrally conceived and implemented projects. Consequently, the large dam decision-making process is neither transparent nor accountable (Pearce, 1992; McCully, 2001). Although this might be true in some cases, analysis of field evidence from this study contradicts this notion. The field evidence shows that there was a considerable level of participation in the decision-making process for the construction of the Akosombo Dam and the BHP. In the case study of the Akosombo Dam detailed in sub-section 7.2.1, participants included those likely to be affected, the general public and the legislative assembly, although the concept of participation was not widely in vogue or required in development practice at the time. This means that the decision-making process about the Akosombo Dam was voluntary and deliberate to allow people to contribute their input into the project, therefore giving them a sense of ownership. The field evidence and other reports about the BHP discussed in subsection 7.2.2 show that the participation and consultation of local people in the decision making process is a long-term commitment by the BDS so that their concerns are factored into the development and operation of the dam.

However, support garnered from potentially-affected communities and the general public through participatory decision making and consultation over large dam construction are questioned by large dams' opponents. It is argued that local and potentially-affected people are not knowledgeable enough to adequately capture the implications and complexities of their support for large dams. This argument on

one hand questions the ability, knowledge and competence of local people to make decisions for themselves regarding their support for large dams.

But when the same local people and participants oppose large dams they are hailed as heroes who want to preserve their environment and way of life because they are very knowledgeable and competent and understand the complexities of large dams and the implications that their construction will have on their livelihoods. This approach to dealing with the outcomes of the deliberative and participatory process of large dam decision-making is both contradictory and duplicitous.

The contradiction expressed in the above paragraph sometimes generates tensions among various groups because the process of participation in decision making is not standardised. According to Linaweaver (2002), the tensions in the participatory processes and their outcomes are related to the determination of what constitutes appropriate consultation; is it the length of the consultation process? a complete survey of all stakeholders? or both? (ibid). Another question asked is how much dissent warrants a costly project redesign or even complete suspension (ibid) as experienced in the Bujagali case. The general implication here is one of ambiguity and the granting of disproportionate weight to Western over African values and perceptions of participation which affects the management and development of African resources for the continent's socio-economic development.

The differences between Western and African perceptions, values and cultures underscore the difficulty of attempting to transplant or superimpose one over the other. In this regard Linaweaver (2002) suggests that ESIA consultations in Africa and the global South may be ineffective in comparison to those in the global North because of incompatible political and cultural arenas. He therefore proposes that the World Bank, NGOs, and borrowing governments may be better served if the Bank *decreases* (emphasis in original) its external accountability by 'handing over' (Chambers 1994, p.1255) the EIA process to local regulatory agencies of the borrowing governments, due to the inadequacies of the EIA process in theory and practice, and so avoid the North-South gridlock in development. This gridlock has led to the emergence of values and cultural fault-lines which have caused disquiet among some of the African population who think that Northern countries deliberately want to undermine Africa's development by imposing conditions which they did not meet themselves when they were at the same stage of development.

On the whole the empirical evidence from the case studies of the BHP and Akosombo Dams on participation and the process of decision making has shown that large dam construction can proceed in

this era of devolved and participatory governance, and the decision-making process can be inclusive, even although large dam projects may be centrally conceived and implemented.

8.2.4 Large dam's viability, inclusive decision making and the political dimensions of large dam construction

The empirical evidence collected in this study has shown that in some instances large dams are imperative to the socio-economic development of Africa in spite of their perceived negative social and environmental impacts. The five-point statements used to partly determine the environmental, social and political dimensions, economic viability and inclusive decision-making in the large dam debate, as discussed in section 1.2 of this thesis and examined in the context of the field evidence, are an important factor in arriving at this position. The five points used to analyse the large dam debate and field evidence are:

1. *Dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable.*
2. *In too many cases, an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment.*
3. *Lack of equity in the distribution of benefits has called into question the value of many dams in meeting water and energy development needs when compared with the alternatives.*
4. *By bringing to the table all those whose rights are involved and who bear the risks associated with different options for water and energy resources development, the conditions for a positive resolution of competing interests and conflicts are created.*
5. *Negotiating outcomes will greatly improve the development effectiveness of water and energy projects by eliminating unfavourable projects at an early stage and by offering as a choice only those options that key stakeholders agree represent the best ones to meet the needs in question. (WCD, 2000a: xxviii)*

These statements raise a number of issues which are discussed below.

On the first point, the thesis evidence agrees that 'dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable' (WCD, 2000a: xxviii). The Aswan, Akosombo and Kariba Dams attest to this, as discussed in sections 8.1 and 8.2.1 of this thesis. With regard to the Aswan High Dam, Fahim (1981) observes that 'unlike other water control systems, this single, multi-objective project is of unusual importance for the population of a country'. This observation can also be applied to both the Akosombo and Kariba Dams.

Concerning the second point, the thesis has established that there are many cases where an unacceptable and unnecessary price has been paid in terms of people displaced, impacts on communities downstream, taxpayers and the natural environment to secure the benefits of large dams (WCD, 2000a). No single dam examined in this thesis did not have either one or another form of negative social and environmental impact, as detailed in Table 5.2 and discussed in section 5.3. The notable dams with perceived serious environmental, social, and economic problems were the Muela, Merowe and Manatali Dams. This means that although large dams in Africa are a development imperative, they have the characteristics of the 'tyranny of technology' because of their social, environmental and sometimes economic costs.

Evidence from the thesis shows that the equitable distribution of benefits from large dams is an issue that plagued all the dams analysed, as discussed in subsections 7.2.4 about the Akosombo Dam and 5.3 for the Aswan and Kariba Dams and as noted by the third point. It is this perceived 'lack of equity in the distribution of benefits' that has 'called into question the value of many dams in meeting water and energy development needs when compared with the alternatives' (WCD, 2000a: xxviii). This suggests that the equitability of distribution of the benefits of the alternatives to large dams is comparatively higher than those from large dams and should therefore be pursued.

However, the assumption that the distribution of the benefits of large dam alternatives is more equitable is not wholly supported by evidence from the study. Firstly, there is evidence to suggest that a significant number of local people have benefited hugely from large dam fisheries, irrigation, tourism and other auxiliary activities, as discussed in sections 5.3 and 7.2.3 of this thesis about the Akosombo, Aswan and Kariba Dams. The equitable distribution of large dams' benefits varies from dam to dam and is also contingent on individual initiatives within the catchment of the dam's operational area. It is such individual initiatives that are needed for Africa's socio-economic development.

Secondly, no evidence was found in this study to indicate that the alternatives studied could distribute benefits more equitably than large dams. The evidence rather showed that the alternatives discussed in sections 4.7, 6.6, 6.7, 7.4 and 8.1 are incapable of providing the services that Africa needs to tackle its socio-economic development challenges. So the alternatives cannot be said to provide more equitable distribution of benefits than large dams in Africa.

The last point used to analyse large dams contests that 'negotiating outcomes will greatly improve the development effectiveness of water and energy projects by eliminating unfavourable projects at an early stage and by offering as a choice only those options that key stakeholders agree represent the best ones to

meet the needs in question' (WCD, 2000a: xxviii). The thesis' analysis of the case studies of some large dams – Akosombo, Kariba, Aswan, BHP and the Bujagali Project – show that they are the best water and energy options available agreed to by stakeholders to meet the needs in question. However, it also emerged that some large dams failed to generate the expected benefits – e.g. the Manantali, Gireza and Muela Dams. This means that although negotiated outcomes do improve large dams' effectiveness, there are some instances when the anticipated outcomes are not met.

However, the applicability of the five-point statements to assessing large dams' long-term viability, the decision-making process and the political dimension, and to ensure their effectiveness and efficiency in contemporary Africa's future development is contingent on two factors. These are firstly, a liberal political system and secondly, a flexible yet consistent monitoring and evaluation regime.

A liberal democratic political system: The construction of large dams to modernise African economies and bring about social transformation is not in itself a bad idea. However, the execution of such projects can be better served if they take place within a liberal democratic political system where planners 'negotiate with organised citizens' (Scott, 1998: 5). This is because in such a system the development programmes of governments are subject to scrutiny by the legislature and by civil society groups to 'spur reform' (ibid). In this regard two things are required: firstly, democratic institutions need to be firmly grounded in Africa, a process that has gained momentum in the past decade. For instance, the well-known large dams in Ghana were constructed in a liberal political environment by democratically-elected governments where civil society, a free media and parliamentary representation thrived: Nkrumah's CPP in the case of the Akosombo Dam, Limann's PNP and the Kpong Dam and Kuffour's NPP and the BHP.

Secondly, the growth of vibrant and independent indigenous civil society groups and NGOs is a necessity. But their priorities should not be unduly influenced by outside interests, as discussed in sections 6.4, 6.5 and 6.7. This might remove the impression that Western/Northern dominated organisations are subverting African countries' development because the influence and resources – funding, expertise etc. – of NGOs and civil society groups are uneven depending on their geographical location and their emphasis on different priorities, particularly those concerning Southern environments and development needs. So the effectiveness of the long-term viability, the decision-making process and the political dimension of large dams could be enhanced by a liberal political system in contemporary Africa.

In spite of the presence of democratic institutions and an independent civil society to give legitimacy to large dams and enhance their viability and the decision-making process, in the ultimate analysis

democracy is about the will of the majority. This means that provided large dams' services are acceptable to the majority of the public they need to be constructed irrespective of resistance, scepticism and opposition to their development, which subverts the will of the majority by the vocal minority.

2. *A flexible yet consistent monitoring and evaluation regime*: The monitoring and evaluation of large dams are generally not adaptive enough to capture both unintended loses and unexpected gains, making it difficult to analyse their overall impact. This requires the periodic monitoring and evaluation of large dams' performance. The monitoring and evaluation regimes adopted should be flexible enough to take on board both positive and negative issues not initially anticipated in the project design by the costs benefits analysis and ESIA. Such monitoring and evaluation regimes could enhance the institution of swift remedial action to ameliorate undesirable consequences through the experience and insight gained by long-term monitoring and evaluation, and allow for surprises (Scott, 1998). Such performance appraisal could include several concerns about large dams raised in this thesis.

These concerns are: efficiency (economic performance and delivery of expected benefits), discussed in sections 4.2, 4.5, 5.3 and 5.5; equity (appropriate conflict resolution, resettlement, compensation, access to benefits, and opportunities for the disadvantaged) as found in sections 4.2, 5.4 and 7.2; sustainability (evaluation of benefits relative to the environment and social impacts, capacity of the state to maintain infrastructure and maximise delivery of benefits), discussed in section 4.2, 4.4, 4.6; and the global trade regime (trade barriers, tariffs, and subsidies which militate against the comparative and competitive advantage of products and services generated either directly or indirectly from large dams in Africa), as discussed in sections 6.4 and 7.2.4. An adaptive and continued monitoring and evaluation of the sustainability, efficiency, equity of African large dams and the impact of the global trade regime on their output could provide information for policy changes to improve their performance.

8.3 Theoretical implications of the research

The theoretical implications of this thesis are many, but two are of outstanding importance. One is derived from the conceptual goals of sustainable development, large dams and modernisation/neo-liberalism presented in Table 8.1, as well as their permutations in three forms. These are: 1) sustainable development and modernisation/neo-liberalism; 2) large dams and sustainable development, based on the viability, inclusive decision-making and political dimension of large dams development; and 3) modernisation/neo-liberalism and large dams.

Although there are different definitions of sustainable development, the Brundtland Commission's definition, 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987) is widely used. Differences about its vigour have led to a dichotomy between weak and strong sustainability. Rogers et. al. (2006: 28) observes that 'weak sustainability requires that the sum of all capital be constant or increasing over time', implying 'the possibility of substitutions among human made capital, human knowledge, and natural capital'; whilst strong sustainability requires that social, natural and human capital increase over time. The argument about whether natural capital can be substituted for another form of capital such as large dams is the 'root of arguments between the proponents of weak and strong sustainability' (Ikeme, 2000).

In the context of the theoretical implications of this study of large dams and development sustainability, either weak or strong, operational development maximises 'economic, social, and environmental benefits' (Rogers et al. 2006: 46) and is understood in the context of passing on to future generations a 'generalised capacity to produce' (Ikeme, 2000). So sustainable development is based on the 'unlimited albeit imperfect substitution of physical and natural capital, maximisation of personal utility of consumption' and equity for 'intergenerational and intragenerational distribution' of benefits in the 'absence of statistically definable uncertainty and surprises' (Toman, 2006: 453). In this regard large dam projects are sustainable principally because societies ultimately 'make trade-offs as to how consumption-rich and environmental-poor or consumption-poor and environmental-rich they wish to be' (Toman, 2006: 458), as is evident in the construction of Egypt's Aswan Dam, Ghana's Akosombo Dam, Zambia's Kariba Dam and many others.

There are other issues that might affect the trade-off continuum in the development trajectory of large dams in Africa. For instance, the increased understanding of the relationship between economic growth, inequality, and natural resources management and protection (Stiglitz, 1998) implied in the concept of sustainable development and the post-Washington consensus suggests a 'more nuanced understanding of development' (Onis and Senses, 2005: 277). The post-Washington consensus understanding of development broadened from a solely market-based system to include the key components of sustainable development – governance and participation (Stiglitz, 1998; Onis and Senses, 2005; Parkins, 2007). In this regard Stiglitz (ibid) observes that the acceptance of the interrelationship between, growth, inequalities, participation, governance and environmental protection presents opportunities for 'developing complementary strategies' and 'win-win policies' which Parkins (2007) believes sometimes leads to 'interventionist policies'. This implies that large dams can thus play an important role in achieving both modernisation/neo-liberal and sustainable development goals based on complementary and symbiotic

strategies and policies to address issues such as participation, equitable distribution of benefits and environmental remediation.

However, Stiglitz (1998) cautions that 'concentrating solely on win-win policies' to deal with distributional equity, environmental remediation and participation might 'ignore important decisions about win-lose policies' based on 'trade-offs and hard choices' about future priorities such as building large dams which could ultimately 'benefit the entire society', although initially the 'potential trickle down' might not necessarily be rapid or comprehensive. This is evident in most of the case studies analysed for this thesis. For instance, while it was initially thought that the beneficiaries of the Aswan, Akosombo and Kariba Dams were the elites, it emerged that there is a much broader beneficiary base than previously thought (discussed in subsections 4.4.4, 5.3.1, 5.3.2, 7.1.2 and 7.2.3 of this thesis). This means that the full compendium of large dams' benefits is only captured after years of their operation through new efforts in monitoring and evaluation, as discussed in subsection 8.2.4.

Stiglitz (1998) also argues that 'while participation is essential, […] it is not a substitute for expertise' because the dissemination of expert knowledge can result in effective participation in formulating effective policies. So it is possible to proceed with the construction of large dams even in the face of significant opposition from sources thought to be less informed about societal needs. This is because large dams may have been constructed out of the necessity to meet specific needs in the pursuit of development. In this regard large dams which are not subjected to participatory processes or which employed limited participation in the decision making because of their perceived development imperative fall into the category of those constructed based on expert knowledge.

Based on this study it is deduced that the goals of sustainable development, large dams and modernisation/neo-liberalism overlap, although their emphases vary slightly, as shown in Table 8.1. These variations in emphasis do not accentuate their differences but are rather complementary, thereby making the theoretical distinction between modernisation, sustainable development and large dams conceptually impractical. Therefore the contention that large dams are not consistent with sustainable development and should be replaced by sustainable alternatives to provide electricity, irrigation, flood control and water supply services (McCully and Wong, 2004; Emerton and Bos, 2004; Cooney, 2004; IRN, 2005/2007; McCully, 2004; WWF, 2006/2005/2003 etc.) cannot be said to be the only solution to the perceived problems of large dams in contemporary Africa and the global South.

Table 8.1: The development objectives of sustainable development, large dams, and modernisation

	Sustainable development objectives	**Large dams objectives**	**Modernisation/neo-liberalism objectives**
1	To provide for the sustenance of present and future generations	- same as sustainable development -	- same as sustainable development -
2	To safeguard the use of natural resources for future generations	Provide the socio-economic base for the use and sustenance of future generation	- same as large dams -
3	Lead to the protection and conservation of the environment	Enhances the conservation and protection of natural resources	Lead to less dependence on natural resources

Examining the concepts of sustainable development and modernisation/neo-liberalism resulting from this study as outlined in Table 8.1 shows that there are similarities. For instance, providing water, energy, and food from large dams to ameliorate the problems of hunger, disease and poverty in Africa and among some of the worlds' growing populations not only spurs socio-economic development but also provides for the sustenance of present and future generations by establishing a socio-economic base leading to less dependence on natural resources as production processes are modernised. In this context modernisation and neo-liberalism have significant benefits for the achievement of sustainable development goals.

The study has also established that the theoretical differences between large dams and sustainable development, based on their development objectives are minor (Table 8.1). Both seek to provide immediate and long-term benefits for present and future generations in the areas of water, food, and energy. By so doing, natural resources might be safeguarded for future generations through conservation or protection, which is the goal of sustainable development. Large dams could in some instances enhance the conservation and protection of natural resources because they can provide an ideal environment for the conservation, protection, or regeneration of natural resources, as most have buffer zones to protect them, as argued by Varma (1999) in subsection 4.4.1 with regard to the Idukki Hydropower Project in Kerala, India, which provides water for wildlife already existing in nearby forest areas and has even attracted new species of birds and animals to the reservoir area. The Akosombo Dam construction also led to the creation of the Dwija National Park, and the need to protect the Bui Dam site from human encroachment and settlements led to the creation of the Bui National Park. Both are strictly protected areas rich in flora and fauna (Int/20, 2005). In this regard the development imperative of large dams is not theoretically different from sustainable development, as both potentially enhance natural resources and biodiversity.

Sustainable development concepts should transcend the scale or magnitude of projects, as the concept of sustainable development is not limited to only small-scale projects. This study has shown that small-scale projects are as susceptible to environmental and social problems as some large-scale ones, as discussed in subsection 4.7.1. Judgement of large dams' sustainability should not be based on their scale but on their impacts, functions and outcomes compared to their alternatives.

The normative underpinning of sustainable development is based on future generations having access to resources for development. But this has not been empirically evidenced either in this study or in development history: nothing suggests that past development undertakings and the utilisation of resources by developed countries has either denied or diminished future generations' ability to pursue their own development interests. It is in this context that Rogers et. al. (2006: 26) state: 'It is a truism, certainly in the western, industrialised nations, that generally each generation is better off than the last one'. Throughout the development trajectory of the industrial countries over the centuries, new generations have had more options and greater capacity to be well-off than past ones (Solow, 1991). Thus a fundamental basis for the pursuit of sustainable development does not hold up to historical fact.

Furthermore, available evidence indicates that the massive development advantage of developed countries has led to easy access to health, food and energy, among several other social amenities and benefits. This enabled those who did not need to participate in creating the wealth they presently enjoy to focus their attention on the aesthetic beauty of nature which they seek to protect through environmental romanticism and activism (Barrow, 1999). In contrast it seems inconceivable that people in Africa and other developing countries, who are suffering from high levels of disease, hunger, poverty and general underdevelopment, will make a leisure trip to a nature or wildlife reserve to experience their beauty and the rich variety of their flora and fauna. This difference in the perception of people of developed and developing countries regarding well-being and the environment is captured by the environmental Kuznets curve through the extrapolation of rise in personal income and structural changes in an economy to concerns about and in some case demand for environmental well-being (Stern, 2004; Stern, 2006; Common and Stagl, 2005). Better economic conditions induce a different perception of environmental goods and services.

8.4 Policy implications

Within the context of the case studies of large dams in this research three policy implications are outlined. These are: 1) equitable distribution of benefits; 2) compensation; and 3) resettlement. Equity is the first significant policy issue of large dam development that needs to be addressed. Communities affected by dams should be the first to benefit from the services – electricity, flood control, drinking water and

irrigation – for which the dams are constructed. For instance, analysis of the views of those resettled due to the construction of the Akosombo Dam reveals that they do not think they have directly benefited from the dam enough because they waited for 40 years for electricity, although they recognised the Dam's positive impact on Ghana's socio-economic development. Benefits from large dam services for those directly affected could be enhanced by the provision and maintenance of other social facilities and amenities like clinics, schools, and roads to boost the overall development of the resettled communities. This would improve the acceptability of large dams among resettled people. The first beneficiaries of large dam services should be those most directly affected by their construction, to ensure fairness and equity.

In tandem with directly benefiting from large dams and the provision of social amenities, resettled communities should be equipped with the skills and knowledge to be able to maximise the potential and new opportunities that the dams provide. Specifically, improving the capacity of resettled local and host communities' skills is especially important because large dam projects attract immigrants, who are said to be more resourceful at exploiting reservoirs' benefits at the expense of resettlers and hosts as they have access to more capital and experience and stronger social networks and political ties (Scudder, 2007; personal communication). Resettled and host communities need a capacity-building programme in a policy framework that will prepare and enable them to compete favourably with immigrants for the direct and indirect resources and benefits of large dams both during and after their construction.

The second policy issue is payment of compensation to those whose property is acquired or lost due to large dam construction. Two ways are proposed to ensure that those entitled to compensation benefit from it. Firstly, a mechanism for prompt payment of compensation for assets and property lost to the dam is a *sine qua non*. Secondly, the compensation package for assets like land could be a stake in the operations of the large dam project, or the land commandeered could be leased to the project on a long-term basis in the event that equity is not a prudent option.

In the first instance, that of prompt compensation payment, it is necessary that all data delineating ownership of property and land are well-documented before beginning any large-scale development project. The availability of such a database will ensure that assets like land to be compensated for are rigorously examined and are consistent with such records to avoid claims and counterclaims to ownership among settlers and between resettlers and government officials about who has been compensated and for what, as occurred in the Akosombo Dam case. Prompt delineation of property ownership and payment of

compensation for crops and buildings could eliminate inaccurate records, the involvement of multiple agencies in claim processing, perceptions of corruption, multiple claimants and litigation.

Converting resettled people's assets like land into equity in large dam projects could serve three main purposes. Firstly, it might ensure intergenerational equity in the distribution of benefits from the project, which compensation payments for assets, if effectively implemented, cannot guarantee. Disputes about whether all, some, or no compensation has been paid for land and other assets to some resettled people in the Akosombo Dam 40 years after its construction and other dams might not be a problem if such assets are used as equity in the dam project. Also, the asset-to-equity swap will ensure that one generation does not have the prerogative of deciding how to utilise the compensation paid. Often compensation paid in cash to the head of the family or clan is inappropriately managed or invested, and in some cases misused, and following generations are either denied the benefits of the compensation paid for family/clan assets or misinformed that compensation was not paid, thus generating unnecessary tension between the government and resettled people and perpetuating myths of non-payment of compensation for large dam projects. So as shareholders – i.e. the resettled people – in the large dam project, future generations will be entitled to some form of income from dividends paid as a result of profit made in the course of operating the dam.

But in the event that it is thought imprudent to have equity in a large dam project because of uncertainty about the project viability by local people and their advisors, but in contrast to large dams developers who conclude otherwise and would like to procede with the dam project, assets such as land could be leased to the project for the entire duration of the dam's operation, with the lease renegotiated periodically to account for the appreciation of the assets, inflation and depreciation. Thus resettled people and subsequent generations whose assets are used for large dam projects would be assured a constant source of income for the entire lifespan of the project.

Secondly, equity in or lease of land to a large dam project might ensure that the interests of resettled people are seen as paramount and balanced with the interests of the dam in decision making about its management. As shareholders, resettlers are likely to have representative(s) on the governing board of the dam. Thirdly, the eventual decommissioning of the dam would release some of the land – depending on the conditions of the equity or lease – for the local communities to repossess and use for other purposes. The possibility of repossessing land leased out would be less likely if compensation is paid for land acquired by either the government or the dam owners. This means that resettled communities could have

some leverage over the dam project and its operation, thus encouraging accountability and transparency in the dams' management.

Long-term commitment to monitoring resettlement impacts and correcting them are important policy issues that need to be instituted. Monitoring could ensure that the planning and implementation of resettlement programmes achieve the desired effects. The importance of this is captured in the many resettlement failures articulated by Scudder (2005) and other literature discussing case studies of African dams and of large dams in general. Resettlement is treated as a one-off activity instead of an ongoing process which produces constant surprises and requires continuing evaluation to mitigate the negative but support the positive surprises. In this regard commitment to the long-term monitoring of resettlements would be a significant policy shift in the interest of dam-affected people and their socio-economic development and well-being.

8.5 Contribution of this study to knowledge about large dams and development

This thesis contributes to the large dam and development narrative. By adopting a case study and a historical and actor-oriented method of inquiry, it has examined evidence that challenges the global and local assumptions about large dams and development. The evidence in the thesis is important for the contextualisation of new research into large dams and their implications for development. The large dam development discourse is informed by many theories and assumptions inherent in the paradigms of modernisation/neo-liberalism, sustainable development, participation in decision making, politics, cultures and values, and the role of civil society groups and NGOs. This means that the concepts of the large dam development imperative, the tyranny of technology or the subversion of Southern countries' development cannot be separated from theoretical assumptions and development paradigms.

Within the context of the empirical evidence deduced in this thesis there are three key areas in which I believe the study contributes to existing knowledge about large dams and development. These are as follows:

1. Participation in large dam decision making: The study has proved that participation in large dams has been practiced in the past, as evidenced in the Akosombo Dam case study, although at the time it was not theoretically or conceptually envisaged as part of the project development process. In this regard the idea and practice of participation is derived from an institutionalised cultural and traditional value cherished and inherent in society rather than being a formally constructed process. This challenges the assumption

that large dam developments are not participatory because they are centrally conceived and implemented (McCully, 1996; WCD, 2000a).

2. An analysis of the characteristics of different groups in the large dam debate has shown that the groups were motivated by set objectives, challenging the notion that environmental NGOs are objective and impartial parties in the large dam debate that articulate the views and interests of marginalised and powerless local and indigenous people. In addition the thesis has shown that tensions exist between South- and North-based NGOs due to differences in their emphasis on the definition of development and environmental problems, resources, access and sovereignty. As a consequence some NGOs cannot claim to represent the economic, environmental and social concerns and interests of vulnerable local people because some of their activities are a rhetorical smokescreen to mask their main agenda of environmental conservation and protection (Chapin, 2004).

3. The thesis has also provided a clearer understanding of the role of global, national and local political interests in large dam construction, in particular the politicisation of dam development by both citizens and politicians as part of the democratic political process of electioneering. Politics is mainly about development in Ghana and most developing countries, where citizens expect the execution of tangible development projects and programmes in their communities and the country as a whole. As a result, politicians seeking a mandate to lead the country outline their visions and intentions, which may include large dam construction, in their election manifestos. Also the continued global geopolitics of large dams has been highlighted in the context of Western countries' criticism of Chinese investment in African infrastructure, including large dam construction.

8.6 Study appraisal

Within the remit of the research objectives and questions this thesis has succeeded in adequately addressing the research goal. In the pursuit of the research it is my belief that the research objectives and questions have been thoroughly dealt with. However, it would have been appropriate to apply an in-depth analysis of the ESIA process to assess its limitations and strengths regarding large dam construction based on general evidence from the empirical chapters 3 to 7. In these chapters I deduce that the ESIA process is loaded with a value system which is culturally and politically constructed in the name of scientific evidence but bereft of a local or national political dimension which is necessary for any development undertaking is the world. But the analysis of large dams ESIA process was not possible because it will require a thesis of its own to capture the intricacies and nuances of the ESIA process.

Based on the thesis findings about large dams and development in Ghana, the application of an actor-oriented approach to the field case studies of the Akosombo dam and BHP was the best methodological framework. The thesis findings were informed by the concrete life experiences of the resettlement communities and other actor involved in the Ghanaian dam debate because they either stands to gain directly from it and/or to lose because their particular every day circumstances are relevant to the way they tie together, act upon, attribute meaning to, and recreate different elements as argued by Long (1992) and Nyamu-Musembi (2002). The field studies and the results highlighted the complex Ghanaian large dams landscape which continually alters shape because of resettlement communities actors own actions as well as the actions of others actors like government and NGOs (Gough and Wood, 2004).

The dissatisfaction of some actors to the livelihood conditions of the resettlement communities of the Akosombo dam especially in the areas of compensation payment and provision of sustained support after resettlement and the fears about how those of BHP will be treated as well as the acknowledgement that the Akosombo dam has contributed significantly to the development of Ghana and expectations that the BHP will do the same shows that the actors are able to disaggregate benefits and lose of large dams in Ghana to different sectors of society.

The activities of the People's Education Association (PEA) discussed in sub-section 7.2.1 and the BHP findings about the local actors expectations of the project and for themselves also confirms Villarreal (1992) observations that society is composed of actors who are 'thinking agents, capable of strategising and finding space for manoeuvre in situations they face and manipulate resources and constraints'. So in great measure the outcome of the Akosombo dam and BHP reflected the different ways in which actors deal, organisationally and cognitively, with problematic situations and accommodate themselves to other's interests and design for living (Long, 1989b cited in Villareal, 1992).

The actor-oriented process brought to the fore the political dynamics and the specific conditions that created responses and strategies of resettled and affected communities and other actors as they define and defend their own social spaces, cultural boundaries and positions within the wider power fields (ibid). For instance, it emerged that those local communities to be affected by the BHP are pushing politically for the dam project to commence and have high expectations about their future prospect which affirms the argument that development interventions like the BHP are 'an ongoing socially constructed and negotiated process, not simply an execution of an already-specified plan of action with expected outcomes' (Long. 1992: 35).

As the actor-oriented research involved local people, government officials representing their various institutions, NGOs and the media, among others, and the power relations and complexities that exist among them, it provided the broad basis and context within which the field case studies research was carried out. Consequently, the outcome and process was successful because the constant interaction of the actors, particularly in a democratic environment, informed and gave direction to the development agenda of Ghana in its pursuit of the Akosombo dam and the BHP and their importance to the country's socio-economic development.

8.7 Recommendations for future research

This thesis about large dams and development in Africa has brought together and explored a whole gamut of issues pertinent to the topic. However, some issues have emerged which I could not address due to time and financial constraints. Consequently three areas for further research, which are of significant importance if the application of the findings in this thesis are to be widely used with confidence, are proposed:

1. It would be very interesting to see the results of more in-depth cross-country studies of large dams in Africa from the perspectives of the various stakeholders and actors that integrate the socio-economic, environmental and political dimensions of large dams as I have done for the Akosombo Dam and the BHP in Ghana. More such studies would give a much broader view of large dams. It would be interesting to see whether their outcomes reinforce the findings presented in this study.

2. More research and analysis of the ESIA process for large dams is required in order to determine and clearly map out the political and cultural limitations of ESIAs in Africa.

3. It is essential for research to continue into the implementation of the BHP in Ghana. This will provide long-term, comprehensive data and analysis of the BHP's socio-economic and environmental performance and impacts. The availability of such long-term data and analysis will make it much easier to contextualise large dams' performances and determine their long term viability in Africa's development planning.

8.8 Concluding remarks

This study has explored the significance of large dams and their alternatives in the socio-economic and political development of Africa, in the context of the present debate about their social and environmental impacts. To achieve the objectives of the thesis, the analysis of large dams was carried out through a historical process and case studies of dams in Africa. The thesis has argued that large dams' performances

and impacts are context-specific and vary from one dam to another, and thus they should be adjudged as such. Consequently, the thesis argues that large dams will continue to be featured as part of the solution to the water, electricity, flood control and food needs for the development of Africa is the most cost-effective, efficient and reliable method of achieving development objectives in the long term.

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APPENDICES

Appendix 2.1

Survey Questionnaire 1

Institutional Actors

Contribution and Problems of Large Dams to Development

Introduction

The purpose if this interview is to solicit your opinion and perception about large dams and their role in the development of a nation, particularly Ghana. This will be looked at within the context of the Akosombo dam and the proposed Bui dam project. This interview into large dams is part of research towards a Doctor of Philosophy Degree at the University of East Anglia. I therefore thank you for sparing some of your time to discuss this topic with me.

N:B. Please do feel free to use extra sheets to answer the questions and not be constraints by the spaces provided.

Section 1

Interviewee History

1. Name of Respondent: ----------
2. Title of Respondent: (please circle one) Professor; Dr.; Mr.; Mrs.; Ms.; Miss.
   Others (specify) ----------.
3. Gender: (please tick) a) Female ---------. b) Male: ---------.
4. Position: ----------.
5. Job Description: ----------
6. Name of Organisation: ----------
7. Type of Organisation: (please tick one):
   a) ----- Government;
      (i) ---- Wholly Government Owned.
      (ii)---- Joint Government and Private Sector.
   b) ----- Civil Society/NGO's;
      (i) ---- Community/Local Based Group.
      (ii) ---- National Based Organisation.
      (iii) --- International Organisation.
   c) ----- Private sector;
      (i) ---- Multinational Corporation.
      (ii) --- Nationally Based Company.
   e) ----- Multilateral Institution.
   f) ----- Bilateral Institution.
8. Type of Activities:
   a) ----- Policy formulation.
   b) ----- Policy implementation.
   c) ----- Both of the above.
   d) ----- Others (please specify) ----------.
9. Areas of Engagement in Development (tick as many as applicable):
   a) ----- Economic.
   b) ----- Social.
   c) ----- Political.
   e) ----- Environmental.
   f) ----- Human Rights.
   g) ----- Others (please specify) ----------.

Section 2

A. Perception of Large Dams as a Development Strategy and Alternatives

1. What comes to your mind when large dams are mentioned in the context of development? ----------
---

2. Do you think large dams have a role in the development of a country?

a) ----- Yes.

b) ----- No.

3. If yes, how? and if no, why not? ----------
---4. What are the services and conditions that you believe necessitates the construction of large dams? ----------
---
---

5. Are these conditions and services still relevant today?

a) ------ Yes.

b) ------ No.

6. Do you think there are alternatives to large dams that can address these conditions and services?

a) ------ Yes.

b) ------ No.

7. If yes, what are some of these alternatives? ----------
---

8. Are these alternatives being pursued?

a) ----- Yes.

b) ----- No.

9. If no, then in your opinion why are they not being given the necessary consideration? ----------
---

10. What is your perception of the role or involvement of other actors (NGO's, local people and civil society groups) in the development large dam projects? ----------
---

Section 3

B. Akosombo Dam

11. How important is the Akosombo hydroelectric dam to the development of Ghana?

a) ------ Very Important.

b) ------ Moderately Important.

c) ------ Not Important.

d) ------ No Idea.

12. Do you think the construction of the Akosombo dam was necessary?

a) ----- Yes.

b) ----- No.

13. Can you explain your choice of answer to the above question? ----------
---

14. What is your understanding of development? ----------
---

15. With this understanding, do you believe the Akosombo dam has contributed to the development of Ghana since its construction?

a) ------ Yes.

b) ------ No.

16. If yes, in what way has it contributed to development; and if not why hasn't it done so? ----------
---

17. Has the Akosombo dam been beneficial to you in any way?
a) ------ Yes.
b) ------ No.
18. Can you explain your answer to the above question? ----------
---

19. Do you think there could have been alternatives to the Akosombo dam?
a) ------ Yes.
b) ------ No.
20. If yes, what are the alternatives; but if no, why do you think so? ----------
---

21. In your opinion, are the benefits the Akosombo dam generates equitably distributed?
a) ------ Yes.
b) ------ No.
22. Can you assign reasons for your answer? ----------
---

23. Rank these perceived problems associated with large dams as you think they pertain to the Akosombo hydroelectric dam in order of seriousness (importance) by ticking an item as applicable.

		Very Serious Problem	A Moderate Problem	Not a Problem
1	Displacement and resettlement of local people			
2	Spread of Waterborne Diseases (e.g. bilharzias)			
3	Effect on Aquatic Species (fisheries)			
4	Loss of Riparian Habitats (wildlife, forests and land)			
5	Water Logging and Salination			
6	Reservoir Induced Seismicity			
7	Erosion and Sedimentation			
8	Structural Problems (safety, ageing and failure)			
9	Destruction of Archaeological Sites			
10	Increase in Evaporation			
11	Impact on Downstream Ecosystem and people			

24. Do you think the perceived problems identified are being addressed?
a) ------ Yes.
b) ------ No.
25. If your answer is yes, in what way are they being addressed? ----------
---

26. On hindsight, do you think the decision making process that led to the construction of the Akosombo dam were both inclusive and transparent enough?
a) ------ Yes.
b) ------ No.
27. Can you further elaborate on your answer to the above question? ----------
---

28. On the whole, what is your overall assessment of the Akosombo hydroelectric dam after 40 years of operation?

a) ------ Very Successful.
b) ------ Moderately Successful.
c) ------ Not Successful.

B. The Bui Dam Project.

29. Do you think Ghana needs more large dams?
a) ------ Yes.
b) ------ No.
30. Explain your choice of answer to the above question? ----------
---
31. In this regard do you think the proposed construction of the Bui dam is necessary?
a) ------ Yes.
b) ------ No.
32. Can you assign reasons for your answer? ----------
---
33. In your opinion will the Bui dam make a significant contribution to the development of Ghana?
a) ------ Yes.
b) ------ No.
34. Can you explain the choice of answer in 33 above? ----------
---
35. Do you think there are alternatives to the Bui project?
a) ------ Yes.
b) ------ No.
36. If yes, can you name some of the alternatives? ----------
----------37. Do you think the alternatives have been given serious considerations?
a) ------ Yes.
b) ------ No.
38. Was there a consultative process regarding the Bui dam project?
a) ------ Yes.
b) ------ No.
39. Was the consultation transparent and inclusive?
a) ------ Yes.
b) ------ No.
40. Can you explain your answer? ----------
---
41. Do you think the Bui dam project was a result of consensus of stakeholders against the alternatives?
a) ----- Yes.
b) ----- No.
42. What do you think about the site of the Bui hydroelectric project in the Bui National Park? ----------
---
43. What do you think of on-going stakeholders (civil society) involvement in mega projects and ability to steer projects?
a) ----- Good idea
b) ----- Bad idea
c) ----- No idea
44. Can you give reasons for your answer above? ----------
---
45. Who do you think are the key decision makers in large dam development? ----------
----------.
46. Why is their role important? ----------
----------.

47. What is political influence and how do you perceive it? ----------
---------.
48. Do you think political influence play a role in decision to construct large dams?
a) ----- Yes.
b) ----- No.
c) ----- No idea
49. Can you further elaborate on your answer above? ----------
---
THANK YOU FOR TAKING SOME OF YOUR TIME TO ANSWER THE QUESTIONS.

Appendix 2.2

Survey Questionnaire 2
Actors (local and others)

Contribution and Problems of Large Dams to Development

Introduction
The purpose if this interview is to solicit your opinion and perception about large dams and their role in the development of a nation, particularly Ghana. This will be looked at within the context of the Akosombo dam and the proposed Bui dam project. This interview into large dams is part of research towards a Doctor of Philosophy Degree at the University of East Anglia. I therefore thank you for sparing some of your time to discuss this topic with me.

Section 1

A. BASIC BACKGROUND INFORMATION
1. Name of Village / Community / Settlements: ----------
2. Name of Respondent: ----------
3. Gender of Respondent (please tick):
   a) ----- Male
   b) ----- Female
4. Age of Respondent in years (please tick one):
   a) ------ 20-29
   b) ------ 30-39
   c) ------ 40-49
   d) ------ 50-59
   e) ------ 60-69
   f) ------ 70-79
   g) ------ 80-89
   h) ------ 90-99
   i) ------- 100-109

5. Profession of Respondent: ----------
B. EDUCATIONAL LEVEL
1. ----- No (formal) education
2. ----- Some primary education
3. ----- Completed primary education
4. ----- Some secondary education
5. ----- Completed secondary education
6. ----- College education
7. ----- University education
C. LITERACY LEVEL (in local language)

1. ----- Can read and write
2. ----- Can only read
3. ----- Cannot read

Section 2

A. The Akosombo Dam

1. How important do you think the Akosombo hydroelectric dam is to the development of Ghana?
a) ------ Very Important.
b) ------ Moderately Important.
c) ------ Not Important.
d) ------ No Idea.
2. How important is it to the development of your community?
a) ------ Very Important.
b) ------ Moderately Important.
c) ------ Not Important.
d) ------ No Idea.
3. In this case do you think the construction of the Akosombo dam was necessary?
a) ----- Yes.
b) ----- No.
c) ----- No idea.
4. Can you explain your choice of answer to the above question? ----------
---
5. What is your understanding of development? ----------
---
6. With this understanding, do you believe the Akosombo dam has contributed to the development of your community since its construction?
a) ------ Yes.
b) ------ No.
c) ------- No idea.
7. If yes, in what way has it contributed to development; and if not why hasn't it done so? ---------
---
8. Has the Akosombo dam been beneficial to you in any way?
a) ------ Yes.
b) ------ No.
c) ------ No idea
9. Can you explain your answer to the above question? ----------
---
10. Have you and/or your community been negatively affected by the construction of the Akosombo dam?
a) ----- Yes.
b) ----- No.
c) ----- No idea.
11. If yes, can you describe how you have been negatively affected? ----------
---
12. Were you given some form of support?
a) ------ Yes.
b) ------No.
c) ------ No idea.
13. Can you tell the nature of support if your answer is yes, but if no what reason was given for the lack of support? ----------

---------- 14. If yes, then can you remember which organisation(s) or institution(s) where involved in supporting you or your community? ----------
---
15. Do you think there could have been alternatives to the Akosombo dam?
a) ------ Yes.
b) ------ No.
c) ------ No idea.
16. If yes, what are the alternatives; but if no, why do you think so? ----------
---
17. In your opinion, are the benefits the Akosombo dam generates equitably distributed?
a) ------ Yes.
b) ------ No.
c) ------ No idea.
18. Do you think you and/or your community have had a fair share of the benefits?
a) ------ Yes.
b) ------ No.
c) ------ No idea.
19. Can you assign reasons for your answer? ----------
---
20. Was there a period of consultation before the construction of the Akosombo dam?
a) ----- Yes.
b) ----- No.
c) ----- No idea.
21. If you answer yes, what was the nature of the consultation? ----------
---
22. In your opinion was the time element of the process of consultation adequate?
a) ----- Yes.
b) ----- No.
c) ----- No idea.
23. Can you explain your answer further? ----------
---
24. Do you think the consultation process (if any) was inclusive enough?
a) ------ Yes.
b) ------ No.
c) ------ No idea.
25. In what way was the consultation process inclusive? ----------
----------26. Rank these perceived problems associated with large dams as you think they pertain to the Akosombo hydroelectric dam in order of seriousness (importance) by ticking an item as applicable.

		Very Serious Problem	A Problem	Moderate Problem	Not a Problem
1	Displacement and resettlement of local people				
2	Spread of Waterborne Diseases (e.g. bilharzias)				

3 Effect on Aquatic Species (fisheries)
4 Loss of Riparian Habitats (wildlife, forests and land)
5 Water Logging and Salination
6 Reservoir Induced Seismicity
7 Erosion and Sedimentation
8 Structural Problems (safety, ageing and failure)
9 Destruction of Ancestral and Archaeological Sites
10 Increase in Evaporation
11 Impact on Downstream Ecosystem and people

27. Do you think the perceived problems identified are being addressed?
a) ------ Yes.
b) ------ No.
c) ------ No idea.
28. If your answer is yes, in what way are they being addressed? ----------
---

29. On the whole, what is your overall assessment of the Akosombo hydroelectric dam after 40 years of operation?
a) ------ Very Successful.
b) ------ Moderately Successful.
c) ------ Not Successful.

<u>B. The Bui Dam Project.</u>

30. Do you think the proposed construction of the Bui dam is necessary?
a) ------ Yes.
b) ------ No.
c) ------ No idea.
31. Can you assign reasons for your answer? ----------
---

32. In your opinion will the Bui dam make a significant contribution to the development of Ghana?
a) ------ Yes.
b) ------ No.
c) ------ No idea
33. Do you also think it will be of benefit to you and/or your community?
a) ----- Yes.
b) ----- No.
c) ----- No idea

34. If your answer is in the affirmative, in what way will it be beneficial to you and /or your community? ----------

35. Have you and /or your community been consulted on the proposed construction of the Bui dam?

a) ----- Yes.
b) ----- No.
c) ----- No idea

36. In what form was the consultation? ----------

37. At what stage were you and /or your community consulted? ----------

38. Is the consultation process transparent and inclusive?

a) ------ Yes.
b) ------ No.
c) ----- No idea.

39. Can you explain your answer? ----------40. Are you and /or your community supportive of the construction the Bui dam?

a) ------ Yes.
b) ------ No.
c) ----- No idea.

41. What is the current state of consultation?

a) ------ Ongoing.
b) ------ Ceased.
c) ------ No idea.

42. Do you think there are alternatives to the Bui project?

a) ------ Yes.
b) ------ No.
c) ------ No idea.

43. If yes, can you name some of the alternatives? ----------

44. Do you think the alternatives have been (or are being) given serious considerations?

a) ------ Yes.
b) ------ No.
c) ------ No idea

45. Do you think the Bui dam project was a result of consensus of stakeholders against the alternatives?

a) ----- Yes.
b) ----- No.
c) ------ No idea

46. What do you think about the site of the Bui hydroelectric project in the Bui National Park? ----------

47. Will you and/or your community be adversely affected by the construction of the Bui dam?

a) ----- Yes.

b) ----- No.
c) ----- No idea
48. If you answer is yes, what kind of adverse impact are anticipated? ----------
---
49. Do you think adequate preparations are being made to lessen the impact and support you and/or your community through this period?
a) ------ Yes.
b) ------ No.
c) ------ No idea.
50. If you answer yes, in what way? ----------
----------51. Do you have any misgivings about the adverse impact?
a) ------ Yes.
b) ------ No.
c) ------- No idea
52. If yes why and if no why not? ----------
---
53. Do you think the benefits will outweigh the negative impact of the dam construction?
a) ----- Yes.
b) ----- No.
c) ----- No idea.
54. Can you explain your answer? ----------
---
55. Would your community be interested it continues participation in the dam project through management and auditing of performance?
a) ----- Yes.
b) ----- No.
c) ----- No idea.
56. How should this level of participation be done? ----------
---
THANK YOU FOR TAKING SOME OF YOUR TIME TO ANSWER THE QUESTIONS.

APPENDIX 5.1

LARGE DAM PROJECTS BEING DEVELOPED OR IN ADVANCE STAGES OF PLANNING IN AFRICA.

1. In Angola some 150 hydro plants are to be built, this excludes mini and micro plants of less than 2 MW. While a project to transfer water from the Cunene river to the Cuvelai (in the same river basin in the south of the country) has recently been approved. Funding to the tune of $3.5 million is being arranged from the Finnish Government.

2. Benin is constructing a 50 meter high dam on the Mono River at Adjarala near the border of Benin and Togo. The dam will have a hydropower capacity of 100 MW. Three other medium-scale hydroelectric plants are planned for development in the country. These are Ketou (72 MW); Olougbe (42 MW); and Assante (36 MW).

3. There is a national strategy to develop 20, 000 hectares of new irrigated land in Burkina Faso. An international meeting of lenders and donors was held in January 2006 to support the strategy. Also a 60 MW capacity hydro dam planned at Noumbiel is at the feasibility study stage.

4. Burundi has planned to have an additional 225 MW of hydropower capacity. These include the Mulembwe, 12.5 MW; Mpanda, 10.4 MW; and Kabu 20 MW. Even though future development of dams will seek to address issues of electricity and water supply financing constraints is a limiting factor.

5. The Government of Cameroon in agreement of ALCAN, an aluminium producer will construct a 50 m-high, 51 MW hydro plant at Lom Panger to support ALCAN electricity requirement is at a detailed design stage and will by constructed by 2010. In the next ten years the following hydro plants have been planned for the country. These are the Nachtigal; 280 MW, 50 meters high dam is at detailed design stage and is expected to be completed by 2017. Song Dong; 280 MW dam is at the preliminary study stage and also expected to be completed by 2017. Bini a Warak; 75 MW dam is also at the feasibility study stage and the expected completion date is 2011.Memve'ele; 210 MW dam will be built on BOT basis and a developer is being selected.

6. In Congo the proposed the development of the 46 meters high Imboulou dam. Other to be developed by the private sector are Sounda, 1000 MW; Chollet, 600 MW; and Liouesso, 21 MW.

7. The Democratic Republic of Congo has plans to develop two major hydro plants in the medium term: Inga 3, which will have a capacity of 3,500 MW and Ruzizi 3 with about 82 to 250 MW. The pre-feasibility of the for Inga 3 has been completed with financing being sought for the project, while in the case of Ruzizi 3 project, studies has long been completed in 1972. Also under long term consideration for development is the Grand Inga scheme (39,000 MW) with feasibility studies completed. Another project proposed for development in the long term and for which all studies have been completed is the Busanga hydropower plant of 224 MW.

8. Cote d'Ivoire proposes to construct the 20 m-high, 270 MW Soubre hydro project, meanwhile the 35 m-high, 165 MW Buyo hydropower dam is under construction.

9. In Egypt an additional 75 MW of hydro power is planned of which 40 MW will be from the Assuit barrage project scheduled for completion in 2008. The Ataqa pumped-storage power station with a planned generating capacity of 2100 MW is another project under consideration. The Naga Hamadi barrage is set for completion in 2008.

10. Three hydro projects with a total capacity of 1180 MW are under construction in Ethopia. These are Tekeze, 300 MW; Gilgel Gibe II, 420 MW and Beles, 300 MW. Other large hydro projects confirmed as

committed are: Gilgel Gibe III, 1800 MW; Halele, 340 MW; Werabesa, 280 MW; and Chemoga, 150 MW. In addition to these the Ministry has developed a five-year strategic plan to conduct feasibility studies of more than nine multi-purpose national and regional hydro schemes with a possible capacity of 6000 MW.

11. The estimated $600 million 400 MW Bui project to be constructed on the Black Volta River in Ghana has been planned for mid-2007. The facility will have a generating capacity of 400 MW and possibly provide power exports to Burkina Faso, Cote d'Ivoire and Mali.

12. In the Republic of Guinea three hydro plants are currently under construction. These are; the $200 million, 105 MW Kaleta dam, the £775 million, 508 MW dam at Souapiti, and Fomi the 90 MW, $300 million. Apart from the last dam which is a multi purpose project, the first two are for hydropower only. Four other hydro systems are planned for the next ten years. These are; Amarta (665 MW), Morisanako (100 MW), Koukotamba (281 MW), and Sambangalou (120 MW).

13. Kenya is constructing 440 MW hydro capacity, with feasibility studies completed for the Low Grand Falls hydro project, planned for completion in 2010.

14. Financing has been approved for design and construction to commence for the Metolong dam after detailed feasibility studies. The LHWP has planned a number of dams for which pre-feasibility studies has been conducted. These dams are the Mashai, Tsoelike and Ntoahae for water supply for Lesotho and to South Africa. Another feasibility studies for Lowland Water Supply Project has been completed and awaiting construction after financing arrangement has been made.

15. In Madagascar preliminary design of four hydro plants: Lohavanana, 120 MW; Volobe, 90 MW; Antetezambato, 180 MW; and Antafofo, 160 MW.

16. A new 48 m-high dam has been designed to meet water demand of about 27,000 m3/day. A further 365 MW of hydro power is planned in the country. These are the Lower Fufu hydropower project (90 MW), on the South Rukuru/North Rumphi rivers in the north of the country.

17. The 140 MW Gouina project on the Senegal River in Mali is going ahead as a BOT/BOOT scheme. The power will be shared by the member countries of the OMVS. The World Bank has agreed to fund the 59 MW Felou run-of the river scheme, with the US Trade and Development Agency recently extending a grant to study the proposed 13 MW Markala hydro scheme. The 34 MW capacity Kenie project is being planned to be built on BOOT basis with Stucky Consulting Engineers of Switzerland. Though more hydro capacity is planned no definite construction date has been set.

18. Four large dams are currently under construction in Morocco. These are the 120 m-high Sidi Said irrigation and water supply project, the 70 m-high irrigation and water supply Wirgane dam to alleviate water shortages in the city of Marrakech with US$ 20 million support from the OPEC fund, heightening the Sidi Mohammed Ben Abdellah (SMBA) embankment dam to increase water supply to coastal areas between Rabat and Casablanca, and the 80 m-high dam at R'mel to supply water to the Mediterranean port city of Tanger.

19. In Mozambique, more than 2000 MW of new hydro dams is planned over the next eight years. China is to fund the 1350 MW Mpanda Nkuwa dam and hydro plant on the Zambesi river, while the US Trade and Development Agency is funding studies for two new schemes: the 120 MW Quedas plant, and the 60 MW Ocua project. Other potential projects are: Boroma, 444 MW; Lupata, 654 MW; and Alto Malema, 80 MW.

20. Namibia has plans for 620 MW hydro capacites. This will include a medium size peaking plant at the Baynes or Epupa sites on the Kunene river. The proposed Epupa project could provide 350 MW but will require financial aid and the agreement of South Africa to purchase power for it to be feasible.

21. In Niger feasibility studies of the 125 MW, 30 m-high Kandadji dam on the Niger river for water supply and hydropower has been completed.

22. Nigeria has plans for 4850 MW of hydropower, namely the Zungeru dam, 950 MW and the Mambilla dam, 2000 MW of which construction commenced in 2006.

23. In Senegal one large dam is planned on the Gambia river, at Sabmangalou, a village in southern Senegal. The hydro project is being studied with funding from the AfDB. The 200 MW Manatali hydro plant in Mali has now been commissioned.

24. The South Africans are constructing a number of dams, these are the 21 m-high Bellair dam, the 43 m-high Nandoni dam, the 72 m-high Berg river dam is scheduled for completion in 2008. Also the 1330 MW Braamhoek pump storage project is planned for development over the next eight years. In the long term, the 1000 MW Steelport and 1000 MW Table Mountain pump-storage schemes are those being considered.

25. The Sudan is continuing construction of the 60 m-high, 1250 MW Merowe dam. There are also plans to construct the 300 MW Kajbar hydro projects.

26. In the Kingdom of Swaziland about 10 dams are planned for irrigation and water supply.

27. Tanzania continues to show interest in the 358 MW Ruhudji, 222 MW Rumakali, 120 MW Kihansi II, and the 1400 MW Stiegler Gorge. Out of this lot, the Ruhudji will go ahard by 2010, and the Rumakali scheme by 2023.

28. Two projects are under construction for irrigation and water supply in Tunisia. These are the 55 m-high Zerga dam in northern Tunisia and the Kebir water transfer scheme which incorporates the Kebir and the Moula dams. There are also plans for a 70 m-high, 300 MW Barbara pumped-storage plant.

29. The 250 MW Bujagali scheme is now on course. In the long term, the 150 or 200 MW Karuma/Kamdini hydro projects to be built on a BOT or BOOT by Norpak is scheduled for commissioning in 2011-2012. other long term hydro projects are the 228 MW Ayago North, 234 MW Ayago South, and 315 MW Kalagala dams.

30. In Zambia a memorandum of understanding (MoU) has been signed with Farab International to build the Itezhi hydro plants on the Kafue river which is to be completed by 2008. Another MoU has been signed with Sinohydro Corporation of China to build the Kafue Gorge Lower hydro plant which is due for completion in 2009. Two other plants planned for the next ten years are the 1800 MW Batoka gorge to be developed between the boarders of Zambia and Zimbabwe, and the 210 MW Kalungwishi dams.

31. The long awaited Kunzvi dam to supply water to Harare region is on going with Chinese assistance in Zimbabwe.

For NBI members increased power trade will facilitate integration, development and cooperation (WEC, 2003). As a result 22 projects[70] identified are being studied to select economically viable ones for

[70] The 22 projects identified are: the Ruzizi 111 hydro project - future supply to east DRC, Rwanda and Burundi; the Rusumo Falls hydro project - future supply to east DRC, Rwanda and Burundi; the east DRC-Burundi-Rwanda grid;

implementation as regional power projects (generation and interconnection), ultimately creating a fully fledged Power Pool for the Nile Basin (ibid).

Source: Compiled by Author with data from International Journal of Hydropower and Dams (2006).

transmission between Rwegura and Kigoma; interconnection east DRC-Rwanda-Burundi grid and Tanzania grid; identification of isolated areas in north and west Tanzania for supply from Uganda; benefits/ranking of Tanzanian hydropower candidate projects for increased export; power transmission between Tanzania and Kenya; market based trade Uganda-Kenya; benefits/ranking hydropower of Ugandan candidate projects for increased export; increased power transmission capacity between Uganda and Kenya; unit cost of generation - Ethiopian candidate hydro-projects; benefits of multi purpose use of reservoirs – Ethiopia; power transmission between Ethiopia and Sudan; power transmission between Ethiopia and Kenya; power transmission between Ethiopia and Uganda; regional value of Merowe hydro-project; hydro-potential in south Sudan for export to the region; hydro-potential in south Sudan for export to Egypt; power transmission between Ethiopia and Egypt; power transmission between Sudan and Egypt; basin-wide assessment of dispatch, control and communication capabilities (WEC, 2003).