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# Assessing Economic, Social, Political and Environmental Issues Related to Mega-projects: A case study of Merowe Dam in Sudan

By

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A thesis submitted to the Plymouth University in partial fulfilment for the degree of

**DOCTOR OF PHILOSOPHY**

Faculty of Science and Engineering
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**June 2019**

# Copyright Statement

# Abstract

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Contemporary global economic development has been undergoing a transition into multiple pathways aiming at sustainable development, poverty eradication and environmental protection especially in energy production to achieve socioeconomic development (Behera, 2006; Dunning, 2006). In developing countries, a shift from traditional development to modern economic development has begun since the 1970s (Amin & Thrift, 1995; Behera, 2006). Many developing countries have used mega-dams as a source of electricity generation and water supply for irrigation, urban and industrial uses. Dams are still preferred as the primary strategy to pursue economic development, which has been reinforced by increasing levels of urbanisation, industrialisation, agribusiness and diversification of income in rural economy (Rigg, 2007; Varma, 2003).

Sudan has embarked on economic development for decades and the need for electricity and water for irrigation is becoming more important over time as the country has experienced political polarisation and rapid transition towards modernisation, industrialisation and urbanisation (Verhoeven 2011). However, in 1990s the country's economy has faltered due to electricity shortages, and stagnation in industrials and agribusiness, which has reduced economic output (Askouri, 2014; Hashim, 2009). Many academics have focused on evaluations of the contribution of mega-projects primarily to economic development in the developing economies. But, less emphasis has been placed on the agency of society, economic

structure, development stage and needs of the economy, its geo-politics, level of institutional development and socio-cultural factors (Dogra, 1992; Ersumer, 1999b; Flyvbjerg, Garbuio & Lovallo, 2009; Varma, 1999; Varma, 2003). Furthermore, in 1990s the processes by which development are governed have changed remarkably. Scholars are debating the conceptual and theoretical approaches concerning actual and potential impacts of mega-projects as a powerful force in shaping development and their position in development theories. Much of the focus has been on the consequences of dams, which increasingly do not have a consensus as a development tool (Behera, 2006; Dunning, 2006).

Therefore, in order to address the gap in the literature, this thesis adopts an approach that combines socioeconomic, human development and social conflict theories to study the influence of mega-projects on the development and communities through a case study of the Merowe Dam located in northern Sudan. A multi-methods approach was used to collect data, including 300 questionnaires in seven locations, in-depth interviews of over 30 participants, participant observations and secondary data.

The results suggest that the electricity produced by Merowe Dam together with the complementary projects implemented by the Dam Implementation Unit (such as educational, health facilities, infrastructures, new settlements and agriculture schemes) have increased social mobility in the region and driven positive economic, social and human development in the Merowe region. However, in the context of social and environmental aspects, the positive outcomes of the project have been overshadowed by social conflicts and mistrust between project authorities and local

communities. This outcome suggests difficult interactions and negotiations between various stakeholders and political institutions. The social conditions in Merowe region are now no better than before the dam, and the environmental effects have been negative in some aspects. However, it should be noted that the arid nature of the region has also played an important role in reducing the negative influence of Merowe Dam on the environment.

On the basis of the discussion of convergences and divergences arising from Merowe Dam, the thesis renders support for similar projects in other developing economies to pursue socioeconomic development. The two key policy implications are: long-term monitoring of the resettlement areas and strengthening of agricultural extension services. The empowerment of local communities in negotiation and consultation processes by establishing independent mechanisms and administrative bodies to oversee the process of future projects in Sudan is also recommended in developing economies facing similar development challenges.

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## List of Abbreviations

| | |
|---|---|
| IMF | International Monetary Fund |
| WCD | World Commission on Dams |
| AHD | Aswan High Dam |
| NGOs | Non-Governmental Organisations |
| DIU | Dams Implementation Unit |
| HDI | Human Development Index |
| HPI | Human Poverty Index |
| UNDP | United Nations Development Programme |
| ADB | African Development Bank |
| GDP | Gross Domestic Product |
| IAIA | International Association for Impact Assessment |
| NCP | National Congress Party |
| MP | Mega-project |
| FAO | Food and Agriculture Organisation |

## Acknowledgements

I would like to give my profound gratitude to my supervisory team, Dr Sanzidur Rahman and Professor Geoff Wilson, for their great support over the last three years. My director of studies, Dr Sanzidur Rahman, has provided me great academic guidance and necessary support in my life. I still remember the first day we met; Dr Sanzidur told me PhD process needs hard work and enduring. His strict academic requirement has always propelled me to work harder and to think harder over the three years. I am also deeply grateful to Professor Geoff Wilson. His intellect and understanding gave me precious guidance and inspiration. He often shared interesting subjects or articles about Sudan with me and invited me to meet with other researcher in fieldwork in Plymouth University. All these details I will remember forever, and deeply appreciate their kindness and support. I am also grateful to my caretakers' supervisors Dr Stephen Essex and Dr James Benhin for their support in completing this thesis especially in the final stages. Their effort and expertise was very significant and without their support, this would not be achievable.

I am also grateful to my colleagues in geography department: Gina Kallis, Magdalini Kechagia, Cara Clancy, Felipe da Silva Machado and Havananda Ombashi. They are very friendly, supportive and provided me encouragement and motivation. I am deeply grateful to Plymouth University and Seale-Hayne Educational Trust for their support, which gave me the opportunity to study in this great educational institution. Many people helped me in fieldwork. Mr Mohammed Al Houry provided me precious help in introducing me to local communities and provided a great deal of important information. My friends at Rakaiz Al Maarfa for Studies and Research provided great research assistance and I wish to thank Abdurabou and Waleed. I also wish to give special thanks to all the respondents to my research for their kindness and patience to accept my interview.

Finally yet importantly, I would like also to extend my thanks and gratitude to my beloved wife Hawaa for her support and patience throughout my fieldwork in Sudan and being away from her for days. I also thanks my family members, relatives and friends in Sudan for their support and help to facilitate meeting with officials and local communities in Merowe.

## Author's Declaration

In no time during the registration of the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee.

This study was self-financed with the aid of Seale-Hayne Educational Trust funded fieldwork and data collection. Relevant scientific and industry seminars and conferences were regularly attended at which work was regularly presented; external institutions were visited for consultation purposes.

**Presentations and institution visit**

Oral presentation: Economic contribution of Merowe Dam in Sudan: An analysis of communities' perception, Opening up Development, Development Studies Association, Open University Milton Keynes 19th June 2019

Oral presentation: Economic contribution of Merowe Dam in Sudan: An analysis of communities' perception, Sudan Sustainable Development Conference, UN International Maritime London 20th June 2019

Oral presentation: Economic contribution of Merowe Dam in Sudan: An analysis of communities' perception, Plymouth University, Postgraduate Research Showcase 03rd December 2018

Oral presentation: "Mega-projects economic contribution, reference to Merowe Dam" University of Khartoum Consultancy Corporation, Khartoum, Sudan. 15th August 2017.

Oral presentation and discussion around research and development studies at Rakaiz Al Maarfa for Studies and Research, Khartoum, Sudan, 11th July 2017.

Academic visit to Dr. Osman M. M. Ali, Institute of Environmental Studies, University of Khartoum, Sudan from 4th -6th August, 2017.

Presentation at HUNCH Seminar, Human Geography Faculty, Plymouth University. 08th March 2017.

Word count of main body thesis: 85094

Signed: _____

Date:_____

# Chapter 1 Introduction

## 1.1 Research background

Mega-projects, such as dams, are believed to support development and contribute positively to national economic growth and social change (Varma, 2003). This perception is especially true in developing economies, where the demand for electricity and water is substantial and growing. Approximately 85.4% of the world's population live there in developing economies. Therefore, at a time when electricity and water demand is high in both developed and developing economies, the expansion of mega-dams as technological solutions to meet such demand is accelerating rapidly around the globe.

Governments of these developing countries are attempting to achieve necessary economic development using all available avenues. In particular, the construction of mega-infrastructures such as dams supports hydropower, educational institutions, and transportation networks (Alexander, 2015; Badruddin *et al.*, 2008; Field & Ofori, 1988; Khan, 2008; Klugman, 2011; Mthalane, Othman & Pearl, 2008; Othman & Mia, 2008; Othman, Dicks & Zhu, 2012; Zeybek & Kaynak, 2008). Development has become an internationally prominent concept since the 1940s, following the Bretton Woods Conference in United State of America in 1944. This conference was influential in supporting international development agenda through the creation of International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IBRD). Many developing countries began to gain their independence in the 1950s, which coincided with community development programmes in many post-colonial countries (Acevedo, 2015; Helleiner, 1996). There are many definitions

and meanings for development but a comment definition according to the Human Geography Dictionary is;

> *"A central keyword of twentieth- century political economy and social policy, which can broadly refer to processes of social change or to class and state projects to transform national economies, particularly in formerly colonised or third world geographies"(Gregory, 2009)p 155).*

Likewise, development approaches vary across countries and contexts (Gregory, 2009; Behera 2006). Participants within development have continued to explore and assess its evolution, especially in the era of technological advancement (Dunning, 2006). In this sense, developing countries were able to take advantage of technological developments and, in effect, were able to 'leapfrog' over stages of development, which the industrialised nations had progressed through in the past few decades (Helleiner, 1996).

The use of technology in the form of 'mega-projects' and the changes that these delivered in development research and practice has been a topical point of debate among scholars for decades. The debate was centred on whether such attempts had transformed societies more positively or negatively (Altshuler & Luberoff, 2003; Behera, 2006; Bhalla, 2002; Lawal, 2006).

Notable scholars, such as, Altshuler (2003), Bryant and Bailey (1997), Flyvbjerg, (2004) and Gellert (2003), strived to enhance their understanding of the impact of mega-projects on development, from both an academic and practitioner points of view. Those scholars argue that mega-project are politically motivated and they concluded that its economic contribution is insignificant. Mega-projects have subsequently been described in many different terms, e.g. large, complex, or major

projects, and most scholars still seem to agree on the term ‘mega’ (Flyvbjerg, Bruzelius & Rothengatter, 2003; Ruuska *et al.*, 2009, ).

> *“A mega-project is a very big project looked at in the context of where it is being planned or built. What is very big? In general, I would say anything above half a billion dollars is a mega project” (Flyvbjerg, 2004) p: 53).*

However, many scholars criticise mega-projects citing the associated social and environmental consequences, especially those projects undertaken by the World Bank (George & Sabelli, 1994; Goldman, 2005; Park, 2010; Woods, 2006). This criticism is because the emphasis was usually placed on the boundless importance of mega-projects to promote social and economic development. The main reasons for supporting construction of mega-projects for socioeconomic and community development is due to the fact that electricity supplies for domestic and industrial purposes are in great demand and is increasing over time (AfDB, 2013; OECD, 2013; Srinivasan, 1994; WTO, 2010).

Mega-projects are one of the most important but most poorly understood areas of development (Gellert & Lynch, 2003). Delays and cost overruns are the norm rather than the exception in transportation, dam construction, defence, power generation and other areas (Sterman, 1992; OGANO, 2015; Flyvbjerg, 2009). These infrastructures draw public debate and political attention due to their enormous impacts; economically, socially and politically, together with their significant environmental impact (Gellert & Lynch, 2003; Lessard & Hayes, 2003; McCully, 2001b; Scudder, 2012; Singh, 1997; Skinner & Haas, 2014).

These ‘mega projects’ are not necessarily uniform in their characteristics or uses, (e.g. airports, bridges, highways, railways and dams), but they do have common

goals and their importance to support economic development is irrefutable (Alexander, 2015). Mega-projects were developed throughout the world, the implementation of these projects should be cognisant of a range of local factors and influences, such as aesthetics, traditions, geographical location and resource availability. Therefore, the effect of mega-projects at regional and local levels depend on the current political-economic state, social and environmental mechanisms and policies (Alegi, 2007).

In previous decades, interest in mega-projects has significantly increased in many developed and developing countries, which has led to increased investments in mega-infrastructure projects ranging from $6-9 billion a year (Alexander, 2015). Despite this increase in investment, some scholars, including Ansar *et al.* (2014) and Flyvbjerg (2009), are convinced that the motive for increased investments in infrastructure is mainly based on the political motive rather than economic development. Furthermore, the emerging of China as pivotal funding source for tackling many of Africa's deficiencies in major infrastructure, e.g., roads, railways, water, energy has increase the total investments in mega-project. The Chinese development aid has also triggered changes to the dynamics of global infrastructure financing (Behera, 2006). China provides a lifeline to some projects in African countries, including Sudan, which were previously considered unrealistic by the World Bank or International Monetary Fund (IMF). However, the reciprocal benefits for China are in terms of trade, resources and, to some extent, geopolitical influence (Behera, 2006).

The debate related to mega-projects in areas of development appears to have positioned itself within economic viewpoints, such as modernisation and free market mechanisms. However, the debate is less centred on alternative viewpoints, such as sustainable development, political ecology or social-conflicts (Nüsser, 2003). Modernity attracted many countries to embrace mega-projects because of their visual development of cities around the world, which has become a driving force in shifting traditional patterns of development towards modernity (Bardhan, 2006). This political and economic shift is driven by advancement of science and technology, which has led to new infrastructures, particularly where large dams for electricity and irrigation are built to stimulate wider economic development (Varma, 2003). Consequently, many developing countries around the world are still attempting to construct mega-dams for energy and irrigation, especially Ethiopia, Sudan, Uganda and Kenya to mention but a few. Around the start of the 20$^{th}$ century, many influential governments around the world began a growing trend of very ambitious projects. These mega-dams were built with the aim of exploiting the world's large river flows to meet the ever-growing needs for electricity and irrigation for the purposes of economic development objectives (Verhoeven, 2015).

Varma (2003) suggests that the Aswan High Dam built in 1960s is essential to economic objectives and these infrastructures have served as important elements in the socioeconomic development in Egypt. He also adds that dams can drive a nation's change and influence the nature of language spoken in the pursuit of energy, for economic development, especially in developing countries.

Mega-project is part of a trend of constructing ‘mega-dams’ which require involvement of multiple global agencies due to their complicated (economic, social political and environmental) processes (Varma 2003). International Commission on Large Dams (ICOLD) (1985) and the World Bank define mega-dams to be minimum of 15 meters in height from the ground or to have a reservoir capacity for more than 3 million cubic meters, or to have specially designed with high novelty (ICOLD, 1985; ICOLD, 1998). This definition is commonly used by respected organisations including World Commission on Dams in their report and discussions about mega-dams globally.

The global debate regarding mega-dams has highlighted areas where these can adequately help to overcome or reduce barriers of economic development, deficiency in electricity supply and/or stagnation in socioeconomic development in developing economies (Varma, 2003). Mega-dams could also be construed as having a negative social and environmental impacts and negligible economic contribution(Flyvbjerg, 2007). It is, therefore, particularly important to analyse the influence of dams in the communities of northern Sudan hosting Merowe Dam and to investigate rural people‘s displacement, relocation, economic perceptions and experiences of this dam (see Chapter 3 and 4).

The history of dams in developing countries can be best explained by reviewing the development of mega-dams in Sudan and Egypt (Aswan High Dam (AHD) due the long history of dam development in both countries. In particular, the (AHD) demonstrates the reality of adverse impacts (i.e. displacement, relocation far from their land, and loss of income, social relationships and culture) on the Nubia region in northern Sudan. Also, the Sinnar and Al-Roseires Dams illustrate the substantial and

positive benefits for agriculture and electricity generation in central Sudan. Both these countries are striving to achieve the goal of self-sufficiency in harnessing electricity and water for irrigation, in order to facilitate socioeconomic development and so modernise their country.

The British introduced dams into Sudan in the 1920's for electricity and irrigation purposes, later controversially, other River Nile basin countries, such as Uganda, Ethiopia and Egypt, followed suit. These dams led to the rapid economic and political changes in development patterns toward gaining energy self-sufficiency and economic development during the past decades and many countries monitored these events (Jalon *et al.*, 1994; McDonald, Bosshard & Brewer, 2009; Pacione, 2005; Power, Dietrich & Finlay, 1996; Rivers, 2013). However, many local and international environment agencies have raised concerns over the current exploitation of resources in developing countries, which are mostly unsustainable and are often damaging to the environment (Acevedo, 2015; Aggarwal, 2006; McCully, 2001b; Singh, 1997; Skinner & Haas, 2014). Therefore, it is contested whether Aswan High Dam in Egypt is a best example for sustainable irrigation development and electricity. However, opinions differ because there are some positive and negative views regarding its effect on communities and contribution to development (Sharaf El Din, 1977).

The projected benefits (and side effects) have provided clear and understandable facts in an answer to the diverse questions raised over 25 years of operation of the Aswan High Dam. Some negative impacts have occurred, as genuinely anticipated, such as the dislocation of population together with environmental damages. Sharaf El Din (1977) suggested that the benefits (sustainable agricultural plans and other

developments) far exceeded these side-effects. However, this claim was contested by Shalash (1982) referring to the social, environmental and economic impact that the dam have had on communities in both Egypt and Sudan.

The world electricity's demand is estimated to reach 5.2 to 9.3 terawatt by 2035 (Statistics, 2011). The key question is: can large hydropower dams meet these demands, given the associated economic, social, political and environmental impacts and challenges? Yet, despite criticisms from many scholars, such as Flyvbjerg, (2009), Ansar *et al*. (2014), McCully (2004) and Singh (1997), the popularity of mega-dams as a means for achieving development remain important and undiminished. This research focused on examining the perceptions of local communities and other stakeholders involved with Merowe Dam in Sudan and, importantly, solicit their views on the benefits and drawbacks of the dam itself. This social evaluation is in stark contrast with many historical researches, which have concentrated on economic assessments and have ignored the perceptions and experiences of communities. Too much attention has been placed on large-scale quantitative data to analyse the economic impact of dams, primarily based on cost and benefit analysis.

Internationalisation of development suggests the division of the world into geographical groups: North and South, based on the stages of economic development, which have created tensions between forces, such as the classification of developed and underdeveloped countries (Gregory, 2009). Therefore, adopting the regional human geography approach by this research supports the ideas and ideology behind the debate on large dams and their future role in economic development discourse as one of the social science branches. This research uses a regional case study to investigate how people perceive benefits or adverse impacts

of the Merowe Dam, based on interviews and an administration of questionnaires to various agents and analysis of secondary sources, in the Merowe region of Sudan. The findings of this study will contribute to current debates on mega-dam as an instrument for driving socioeconomic development in developing economies.

### 1.2 Gaps in literature

Increasingly, there is an acknowledgement of the importance, breadth and depth of the social dimension of mega-dam projects. Yet, the position of development theories regarding mega-dams are unclear in relation to which one is suitable in studying mega-projects. Many of the factors involved in this process, such as economic, social, political and the environment, makes this process very complex. Consequently, this issue leads to the identification of some gaps within the literature regarding mega-projects, especially research on mega-dams, in terms of methodologies applied, areas of focus and theoretical approaches utilised. The review of the literature revealed that such research do not reflect the complexity associated with the delivery of mega-projects, their relations to development and methodologies applied. Specifically, the following gaps are identified:

- Development theories have many gaps. Firstly, these theories struggle to reflect variation and complexity of societies (see Chapter 2). Secondly, the challenges of finding appropriate theoretical approaches to fit this development study (Halperin, 2015; Welzel, 2003). Additionally, many development theories have ultimately failed to recognise the growing numbers of factors involved in development, such as (culture, gender, institutions and legal framework, environment, politics, social norms, resource availability and country economic development stage). Based on literature review of development theories and approaches a key question to ask is:

should mega-projects be linked to any specific development theory or not? As the aforementioned literature review indicates, most traditional and alternatives theories of development are debateable in establishing or linking their relevance to the study of mega-dams as an engine for growth and bringing about social changes.

- Most of the aforementioned mega-project literature (in particular on dams), indicates that the focus has been more steadfast on the examination of only the economic, political and ecological aspects. For example, scholars such as Ansar *et al* (2014), Flyvbjerg (2007) and Gellert (2003) emphasised economic rationality of cost and benefits analysis, with less consideration for social aspects, such as perceptions of the communities and people involved in the project. However, by isolating economic factors from social, political and environmental factors, explaining the complications of mega-projects in relation to development may prove to be difficult. An alternative assessment approach, based on the communities' perceptions that combines such elements as economic, social, political and environmental factors together, may provide a better understanding of how mega-projects affect them and the wider community.

Consequently, there is a significant interconnection among these factors at the broader regional level and its contribution to development per se. There is a distinctive shift in developmental thoughts, moving from a traditional single disciplinary case studies to multidisciplinary approaches and methodologies (Halperin, 2015; Lawal, 2006). Therefore, this research draws on a combination of socioeconomic and human development approaches, as well as those of social conflict theory, in order to ensure and achieve a broader understanding of the contemporary debates on development and mega-dams. The motivation for using

this method is to answer the questions consisting of a complex web of interacting internal and external factors, which are inherent in mega-project development. Historically, human geography has played a crucial role in the language of development, in relation to global forces against regional forces, which play a pivotal economic and political role (Gregory, 2009). The division of the world into geographical locations is another factor in adopting a geographical method to study Merowe Dam, in the wake of regional inequality within developing economies.

The emergence of mega-projects for urbanisation of rural areas in many developing countries, such as Sudan, are aiming to achieve economic development and modernity. Historically, this goal has caused division between the centre and region, with its unique (geographical location, social, economic, political and environmental) characteristics, particular to the Merowe region (Gregory, 2009). As governments, seek to satisfy the basic needs of their citizens and improve their wellbeing, through building mega-projects. These projects often come with a high cost in economic terms, where the society's well-being and, in some cases, political harmony of some citizens or communities are affected, which adds to its environmental burden.

- In response to gaps found in various mega-project literature and development discourse, this study attempts to contribute to scholarly understanding of the assessment of these projects and their substantial contribution to development of the hosting communities. Describing how a mega-dam influences development, this research applied a combination of different socioeconomic, political and environmental variables. Furthermore, because of the implicated social dimensions within mega-projects, conflict was expected, so therefore 'social conflict theory' is applied to understand its extent (see Chapter 2: 2.5).

The complexity of these variables and constraints of one particular method enforced the need for a comprehensive approach that equally combines economic, social, political and environmental dynamics in which to study mega-dams in developing economies. This assessment not only includes the traditional approach of evaluating mega-projects, based on the economic rationality (cost and benefits analysis), but also the community-level of development that deals with other underlining issues, related to daily lives of the common people. The significance of 'micro-level' assessment of this research is to avoid the shortcomings of relying heavily on macro-level and large quantitative data. This approach will provide details on how mega-projects influence development delivery within the community level (Hill, 1986). A macro-level approach based on a quantitative method often cannot explain the 'why' and 'what' questions. However, Rigg (2007) suggests that applying a qualitative approach at a micro-level, which can provide a better understanding of the critical questions of 'why' and 'what'. In addition, community's perception and the micro-process of economic, social, and political aspects, combined with macro-dynamic, of institutions and policy-makers provide exceptional details of socioeconomic change especially in the context of regional development (Rigg, 2007).

### 1.3 Research questions and objectives

The overall aim of this research is to analyse economic, social, political and environmental issues related to mega-projects focussing specifically on the Merowe Dam in Sudan as the case study. To achieve this aim, the research will apply a combination of approaches, such as social conflict theory and socioeconomic and human development analyses. The scope of the study will be primarily concentrated

on the Merowe region of Sudan and results will be generalised in the wider context of Sudan as a whole. The study, therefore, has four specific objectives:

1. To assess the economic contributions of Merowe Dam in the local communities and the region.
2. To examine the social influences of Merowe Dam on local communities.
3. To investigate the role of government and associated policies surrounding the conception, construction and delivery of Merowe Dam.
4. To explore the effects that Merowe Dam has on the environment.

To achieve objective (1), this research assessed the contribution of Merowe Dam on the economic activities in the region, especially focusing on the influence of electricity generation from the dam on irrigation, the agricultural economy, increases in food production, infrastructure and the non-agricultural economy. The data used in assessment of these objectives is drawn from questionnaires interviews and secondary sources. It also examined the influence of electricity generated from the dam on industrial development. Also, both the role of agricultural and non-agricultural economic activities in supporting employment opportunities generated within the region were assessed. These elements were examined through a range of indicators, such as income levels, sources of income and area utilised for farming by the communities. The socioeconomic and human-development theories emphasise construction of large-scale infrastructures to boost economic growth, at multiple scale and level (Castelán, 2002; Varma, 1999).

The study evaluated to what extent such notions of economic development through Merowe Dam construction supports the main facets of community development. The indicators developed to investigate the economic contribution were largely derived and extended from those generally used in socioeconomic and human-development

approaches (e.g., health, education, income) (Becker & Murphy, 2009; Flyvbjerg, 2007; Jaffee, 1998; Loney, 1995; Welzel, Inglehart & Kligemann, 2003).

To achieve objective (2), the study examined the influence of Merowe Dam on the displacement and resettlement of the communities at their new location and the social activities in the region, specifically an examination of the influence of electricity generated from the dam on the daily lives of citizens and services. The impact on health, community relationships, farming including natural resources accessed from the perspectives of the resettled communities were studied. These elements were studied over time through an array of social indicators drawn from questionnaires and interviews, for example: health and education. These socioeconomic and human-development approaches highlight that mega-projects are constructed to improve societies at a multiple-level (Castelán, 2002; Varma, 1999). The study scrutinised to what extent the idea of social improvement through Merowe Dam building is in keeping with the key elements of socioeconomic and human-development approaches. Indicators utilised to study the social development were mainly initiated from primary and secondary and of those commonly used in socioeconomic and human-development approaches and social conflict theories (e.g., communities and resources) (Flyvbjerg, 2007; Jia *et al.*, 2011; Scudder, 2005; Varma, 1999; Welzel, Inglehart & Kligemann, 2003).

To achieve objectives (3 and 4), this research studies the political aspects first and then explores the environmental issues. It also analysed the government's political involvement in the consultation stage, the compensation process, the sources of funding for the project and the environmental issues related to Merowe Dam. These

elements were studied through a collection of factors, such as communities satisfaction and openness within the process, the overall amount of compensation, the duration of the consultation and whether in fact the process has been politicised or not. The socioeconomic approach suggests that mega-projects have a form of political involvement whilst delivering the project, at multiple institutional levels (Kennedy *et al.*, 2011; Lee & Scurrah, 2009; Varma, 1999). The analysis of political and environmental matters were conducted using indicators drawn from primary and secondary data sources (e.g., communities relationships, water supply, ecosystem) initiated and drawn from those commonly used in socioeconomic approach, political ecology and social conflict theories (Flyvbjerg, 2007; Jia *et al.*, 2011; Power, Dietrich & Finlay, 1996; Varma, 2003; Welzel, Inglehart & Kligemann, 2003).

Finally, to achieve objective (5) the findings of objectives 1, 2, 3 and 4 are analysed first to synthesise the results and present main conclusions. The policy implications emanating from the study are discussed in detail.

### 1.4 Structure of the thesis

Chapter 2 provides a literature review, which includes a detailed discussion of development phases, together with the evolution and the wider debates on theories of development. This chapter elaborates on the broader contexts of a mega-project and specifically dams and their impact on economic, social, political and environmental aspects within developing economies.

Chapter 3 discusses the methodology and techniques used in this study. The justification for using the case study approach and multiple methods used for data

collection, such as questionnaires, participant observation, secondary sources and formal interviews (with local people and policy makers), including regional and national stakeholders are discussed. Specific emphasis placed on the positionality and political sensitivity as a researcher from Sudan, mainly on how to immerse myself within the community of Merowe region. How these techniques are utilised in this study is critically evaluated in detail.

Chapter 4 reviews the history, geography, dams and socioeconomic development around the region and the country. This chapter also provides a clear overview on politics and economic history of dams in Sudan and the surrounding region, thereby providing a broader economic and social-political understanding and the overall environmental historical insight about the region as a unique unit.

The following three Chapters (5, 6 and 7) are structured around the four keywords of the research title to discuss the contemporary debate in development in relation with mega-dam projects in developing economies. Chapter 5 provides an in-depth analysis of objective 1, i.e., the economic contributions of Merowe Dam within the case study area. This chapter examines how the electricity produced and water yield supports the irrigation network for agriculture, as perceived by locals. In addition, analysis of Merowe Dam's contributions to farming and non-farming economy for individuals, communities or the benefit to the region are assessed. Other economic fundamental factors, such as agricultural production, employment creation, industrial development and electricity supply in the region, are discussed to fully understand the contributions and how it affects communities and the wider region.

Chapter 6 is based on objective 2, to assess the social influences of Merowe Dam on the communities of the region, especially displaced communities. This chapter discusses whether Merowe Dam provides an answer to the highly contested question of how the dam's authorities deal with displacement of communities, resettlement and major impact on health. Also the chapter discusses the nature of accrued natural resources by analysing farming, water and employment access and availability. Furthermore, this chapter analyses the social conflict between stakeholders and how this influences community relationships.

Based on objectives 3 and 4, Chapter 7 analyses the political influence in conceptualising Merowe Dam project, the consultation and compensation processes. This chapter also provides an overall analysis of political discussions in the wake of funding restrictions, which directly influenced by great concerns over serious issues such as environmental degradation. In the sense of global environmental concern, the chapter evaluates the government's environmental impact assessment. Likewise, the chapter analyses Merowe Dam's ecological impacts on upstream and downstream communities: for example, sedimentation problems, the effects on river systems changes due to flooding and greenhouse gas emissions. The chapter tackles the debate and perceptions on Merowe Dam's role in environmental degradation, based on analysis of the existing literature and primary data.

Finally, Chapter 8 synthesises and summarises the main findings. Then, the chapter provides further discussion on the broader implications of the Merowe Dam case study, followed by key contributions made by this thesis to the existing literature and

draws policy implications based on the findings. Lastly, some recommendations for future research directions is proposed.

# Chapter 2 Literature Review

## 2.1 Introduction

This chapter sets out the contextual literature for this research. Section one discusses the epistemological approaches adopted, ranging from a philosophical perspective in human geography research, to specific theoretical approaches in development studies. It also discusses the place of mega-projects within regional geography. The second section reviews development stages, evolution, wider debates and theories of development in developed and developing economic contexts. The third section discusses the broader context of mega-projects, specifically mega-dam projects and their relation to economic, social, political and environmental aspects of development, within developing economies. The last section synthesises the literature and identifies pertinent gaps in understanding in the topic area under investigation.

## 2.2 Epistemologies and philosophies in human geography research

Conducting this research on developing countries and, in particular, at a regional level of a specific country has led to the consideration of a philosophical approach in human geography for this study. Considering the unique characteristics of the Merowe region regarding natural, human and cultural elements, this research acknowledges the resourcefulness of regionalisation in human geography. It is relevant to study human movement economically and developmentally, especially in the era of multi-disciplinary research.

Philosophy is never isolated or immune from time and place, no matter how abstract it may be. Philosophy can be prophetic, sentimental and may simply act as a

reflection of a culture (Hoggart *et al.*, 2002). Nevertheless, more often than not, it expresses, in idealised and abstract terms, the ideals and aspirations of a society (Philip, 1998). Human geography philosophies may offer a possible explanation of a social reality, event or phenomenon that is largely determined by various interest groups and forces. In particular, the issue of human, socioeconomic development and mega-projects compel the critical question of how to proceed with development, which encompasses diverse social and institutional frameworks (Hoggart *et al.*, 2002). This framework leads to many questions, such as why mega-projects and development are subjected to economic, social, political and environmental challenges and to some form of contextual underpinning. Most academic research is based on specific philosophical positions or standpoints. As Graham (2013) comments, philosophy is as significant to research as grammar is to language, whether we instantly recognise it or not.

These particular areas of research consider theories and approaches that combine social and economic aspects to provide a deeper understanding of mega-project as a phenomenon existing in reality and its relationship with politics and the environment. Based on a philosophical viewpoint, our knowledge about the nature and complexity of mega-projects is limited, despite the fact that, in reality, projects exist. Additionally, human intelligence and capabilities play very important roles in understanding the reality of mega-project. The actions of human agency when combined with the underlining structure of society, economics, institutions, mega-project framework and the decision-making of parties involved, can play a positive or negative role in determining the outcomes of Merowe Dam (Bennett, 2005). These are some of the elements that define development motives and objectives (Tate, 2000).

The logic behind this approach is that mega-project discourse in development contexts is embedded within the broader dynamics of governments towards fulfilling the goal of national and regional needs, for socioeconomic and human development. Most empirical studies suggest that these arrangements are defined by practical trajectories that often inform societal and institutional choices, to improve wellbeing and avoid a given project causing conflict (Graham, 2013; Gregory, 1989). In essence, the roles played by the parties involved and the extent of their involvement help to determine the outcome and the effect of mega-project.

Hoggart *et al.* (2002) argue that epistemology and method are interconnected. From a human geographical research perspective, there are many philosophical approaches which can be applied to this study. However, only realist and humanist approaches have been selected in this research, particularly because the two epistemologies complement each other. Realism as an epistemology can be used to gain a better knowledge of Merowe Dam's economic, social, political and environmental realities (Brewer, 2000). Realism is a suitable epistemology, as it believes in an independent truth, which can be judged by its correspondence to an independent reality. It is true that no knowledge is certain; nonetheless, Merowe Dam as a phenomenon exists and knowledge about it can be judged reasonably and accurately in terms of its likely truth of impacts (Brewer, 2000; Hammersley, 2007).

In contrast, positivist research in social science is based on the perspective of naturalism; that is, the way research is conducted in the natural sciences, which reveals the true nature of how society operates but still might not reveal truth (Johnston, 1986; Graham, 1997). The concept of knowledge for positivists is based on scientific and empirical proposals where hypotheses are tested through

methodological experiments recognised as “hypothetico-deductive” which is irrelevance to this study (Johnston, 1986; Kitchin & Tate, 2000).

Methodologically, deductive research is often associated with the application of a quantitative approach. In contrast, realism and humanism are mainly associated with qualitative methods, such as interviews and observations. This approach is in line with the methodological approach taken in this study on the relationship between Merowe Dam and societies. The idea of autonomy in science is assumed that knowledge is “neutral”, “value-free”, and universal. However, realism identifies that knowledge is affected by context (i.e. it is “*context-dependent*”) experience and culture (Gregory, 1989; Gregory *et al.*, 2011). This perspective provides further evidence that realism and humanism are the most suitable ontological approaches for this study, as qualitative methods of data collection and analysis were adopted. The Merowe Dam exists in reality, yet the content and context are changed by time and space, and an individual’s understanding of it is influenced by factors such as personal experience and cultural influences. This recognition contradicts the notion of knowledge in positivism as objective, value-free and neutral, and independent from social and cultural contexts (Bradshaw & Bekoff, 2001, : 461).

The selection of realism and the rejection of positivism with its narrow empirical viewpoint, which associated with “*structuralist view”* mainly supports structure-oriented studies (Cohen, 1989; Giddens, 1991) and assumes that data and reality are linear and consistent. This selection of realism allows human agency (actors) to play an effective role in describing the impact of Merowe Dam in reality. As Duncan (1982) suggests, based on Giddens’ (1991) work, humanism and realism can play an interactive and reciprocal role within research. Methodologically, Giddens (1991)

challenged the notion that positivism and structuralism must be viewed as opposing approaches. As Johnston (1986: p114) comments:

> *"The aim of Giddens's work is to fuse realist approaches to society, with their focus on the constraints to knowing the full reality, to humanistic approaches, whose emphases human agency are capable of being creative (or destructive), reflective".*

Mega-dams may have major social consequences. Therefore, both realist and humanist approaches are suitable to explore their impacts (Duncan & Ley, 1982). Large-dam impacts exist, especially when humans are involved in defining the outcomes, due to their economic and political interests and the varying values of different social and cultural groups (Jaeger *et al.*, 2013; Nelkin, 1989).

Mega-projects present either a threat or an opportunity, with the potential for pain or gain to diverse groups such as communities, scientists, public health professionals, environmental activists and governments. These parties are often important stakeholders and may possess different professional principles and pressures, administrative responsibilities, and political opinions - all of which may influence their perceptions of a mega-project and their interpretation of evidence, particularly because they operate from different frames of reference (Jia *et al.*, 2011; Nelkin, 1989).

At the micro-level, human action takes place in the shadow of macro-forces, such as the national politics and macro-economic reality that drive Merowe Dam and constrain or premise the actions of society. The consideration of both the existing reality of mega-project and human interpretation is the central epistemology of this research. These play an important role in identifying the suitable development

theories with which to underpin the exploration of mega-project issues; these are discussed in the next section.

### 2.3 Development stages and underlying theories of underdevelopment (since the 1950s)

The purpose of this section is to critically examine the various stages of development and the underlying theories of underdevelopment which have helped to shape them starting after the Second World War, where the aim was to reconstruct the devastated infrastructure, economies and societies of both developed and developing economies.

Given the current debate on the theoretical position, there is a need for a moderate view with middle position to emerge, which acknowledges scholarly debate around the many factors involved in mega-dam projects and development theory (Pieterse, 2010). Likewise, it is inconceivable to isolate mega-projects and development theory from the wider developmental context. Development views are affected by both political context and social science, in which development theories advanced (Pieterse, 2010). Furthermore, it appears economy is well rooted in development discourse. However, development is a complex process and the economic factor alone cannot explain social change comprehensively.

Questions around what development is attempting to establish, how it evolved theoretically and contextually need to be answered. The answers to these proposed questions are centred in the history of development and how it has evolved throughout the world over time. Historically, development paradigms and theories have evolved over time and have borrowed perspectives from one another. To some

extent, some theories have been replaced whereas others, such as modernisation, have dominated development discourse post-Second World War, which has led to investment in mega-infrastructures such as large dams for irrigation, flood control and electricity generation (Preston, 1996). It is important to examine development history closely to establish how it evolved and relates to mega-projects, especially mega-dams, during the course of their history from their beginning to the present day. Many developing economies pursue development through the growth theory and modernisation, which functioned as the basis of post-colonial development agendas (Friedmann, 1992).

Development is a complex process, connected with many internal and external factors, which play an important role in achieving development goals, but through history and up to the present day, there are differences in opinion on development goals. These complications are a result of variation in development interpretation, the method used for achieving it and the ultimate goals of development over the past decades (Badruddin *et al.*, 2008). In an attempt to appreciate the potential of developing economies, the application of technology has contributed significantly to economic development in its broader sense, and, in particular, to socioeconomic and human development (Badruddin *et al.*, 2008).

Development terms and ideas emerged from diverse strands of intellectual thinking from the 1950s onwards. However, as Mowforth and Munt (2009) suggest, development thinking does not represent or fall into a sequential period, or even contain exclusive exemplification of philosophies within a given period. Consequently, an attempt has been made to identify the main elements involved in

development evolution through history. Historically, development thinking and its studies, as Mowforth and Munt (2009, p.33) suggest:

*"Is marked by infusion and overlap of ideas and counter theories and approaches, all of which tend to work against a historical representation of their emergence"*.

To support this idea, Mowforth and Munt (2009) cite Potter (2002), who summarises the historical overlapping in which theories merged together and sometimes, not only existed in the same period, but also in a contrasting manner. Some attempts have been made to understand how development thinking evolved especially from state's political economic view, particularly in the early stages to current alternative modernisation approach (Mowforth & Munt, 2009). The following sections outline the stages of development, starting from the 1950s to the 1970s and 1980s, in addition to further illustration from the 1990s to the present day.

### 2.3.1 The period between 1950s-1960s

In the 1950s, there was a diffusion of economic development ideas associated with Rostow's growth stages 1) traditional society, 2) preconditions to take-off, 3) take-off, 4) drive to maturity and 5) age of high mass consumption (Mowforth & Munt, 2015; Todaro, 2015.). This era was mainly dominated by economic growth-thinking with modernisation, world system and dependency theories, which were highly regarded in development discourse. There was also the declaration of the American Development Initiative by President Kennedy in 1961, which was followed by the first UN development decade initiative. Similarly, in 1970s Latin American countries launched the counter-dependency theory (Todaro, 2015.). Dependency theory debates suggests that under-development as experienced in Latin America and in another place is direct related to capital intervention, rather than a condition of "lacking" development or investment. This initiative was the beginning of

internationalisation and politicisation of development in the 1950s, following Truman's US Presidential speech in 1947. Furthermore, post-war reconstruction and modernisation of newly independent countries emerging from colonisation led to many countries being declared as underdeveloped. These countries – which were mainly African, Asian and Latin American countries – were subsequently named Third World countries (Mowforth & Munt, 2015; Todaro, 2015.). Many theories emerged because of post-World War II dynamics, for example, modernisation dependency and world system theories, which centred around the rebuilding of societies and the reshaping of the economics of emerging countries (Halperin, 2015; Lawal, 2006). 'Modernisation' is a social process inter-related to economic development and is regarded as a universal form of social improvement (Bernstein, 1971).

For many people, the idea of development is associated with perceptions of modernity, which, in its broader sense, means being modern, new or up-to-date. The notion of modernity positions people in time and place (Willis, 2011). However, as social, economic, political and cultural dynamics change, what is modern in one place and time may not be deemed modern elsewhere. More specifically, modernity has been applied as a term to define a particular form of economy and society, based on the understanding of Western Europe, and more recently, the USA (Willis, 2011).

Economic modernity means adopting a technological application throughout the economy and replicating it in society and cultural domains as well. In contrast, the diffusion of modernity has come with a cost; some associate it with the extermination of cultural practices, as well as the interruption of the natural environment (Bryant &

Bailey, 2015; Willis, 2011; Wilson & Bryant, 1997). Given the position and time factors of the modernisation theory, it is highly predictable that dependency and world system theories are a continuation of modernisation in many aspects (Halperin, 2015; Machida, 2012). The supporters of dependency theory believe that the attitude of societies in developing countries towards growth and modernity can change when they are exposed to developed western societies and, eventually, they achieve socioeconomic and human development (Gwynne & Cristobal, 2014). Critics believe that the theory identifies the reasons many underdeveloped countries remain underdeveloped, but is unable to explain how these countries can initiate and sustain development.

More importantly, the economic experiences of developing economies have caused them to move towards revolutionary industrialisation, nationalisation and state control of production, which can have negative consequences (Poter, 1990; Smith, 1991; Willis, 2011). Even if the dependency theory is accepted at face value, the best course that developing countries can adopt is to be intertwined as little as possible with Western countries, or pursue an *autarky* policy. This pathway means following the model of China, India and Taiwan in the 1970s, whereby they opened their economies and trading to developing countries, which were in similar status with them (Todaro, 2015.).

It is also important to consider the limitations of both modernisation and world dependency theories, as they can misrepresent the social, political, environmental and cultural institutions, as well as the economic structure and characteristic differences of developing countries in relation to developed countries (Halperin,

2015). Moreover, early theories were challenged by the rise of neo-Marxist dependency theory, which led to the rise of an alternative development paradigm in Latin America and some Third World Countries (Poter, 1990; Smith, 1991). Critics of the dependency theory drew attention to global interdependencies, acknowledging development misrepresentation and the misuse of developing countries' resources, which are exploited for further development in developed countries (Willis, 2011). The development perspective of the 1950s is based on the principles of being state-led, guided by Rostw's model and earlier economic development theory principles (Behera, 2006). However, this stage appears to describe development evaluation and thinking as a hegemonic system, that relatively reflects on the economic and political context of a given place and time (Mowforth & Munt, 2009; Mowforth & Munt, 2015).

### 2.3.2 The era between 1970s-1980

The 1970s is the era of the self-sufficient strategy and the so-called decade of alternative development (Mowforth & Munt, 2009). The idea was to localise development and counter the globalisation of development. Furthermore, the Dag Hammarskjold Foundation advocated this approach in 1975, when they challenged the traditional development approach. The argument is that development is neither simple economic growth nor a single universal and generic application (Mowforth & Munt, 2015), meaning that development must meet the needs of the poor in Third World countries (Mowforth & Munt, 2009).

Consequently, in 1974, a group of development experts came together at Cocoyoc in Mexico to form a new agenda for a different development paradigm and to part from

what appears to be the shortcomings of the development agenda of the 1950s and 1960s. The outcome was a declaration that the distinction between priorities related to the '*inner limits'* and those linking to the *'outer limits'* of development (Slim, 1995). The inner limits cover essential needs for humans, such as food, shelter, healthcare and human rights, while the outer limits relate more to the external aspects, such as the planet's physical integrity, the environment and overall population. By examining the distinction from the mega-projects perspective, it is apparent that economic and social elements correspond to the inner limits. The outer limit is in line with the broader concept of development, with more emphasis on the environment. Furthermore, to some degree, the environment and political economies are interconnected, as widely expressed by political ecologist scholars, such as Wilson and Bryant (1997) and Bryant (1992). This distinction is helpful in ensuring that development aims to concentrate on both human development and safeguarding the planet, as the literature suggests the two are increasingly interdependent (Slim, 1995; Wilson & Bryant, 1997).

During this period, development experienced a surge of ideas, such as fulfilment of society's basic needs and welfare in which Non-Governmental Organisations (NGOs) were the main drivers of these approaches (Mowforth & Munt, 2009). In effect, the Cocoyoc meeting in 1972 appears to have set the stage for a breakaway from the 1950s and 1960s development agenda debate the inference of destructive technology on physical environment in term of general consideration of quality of life, economic development and social harmony (Jaffee, 1998).

### 2.3.3 The era of free market in the 1980s

The 1980s period was regarded as the spearhead of the counter-revolutionary era, especially when the USA, Canada, UK and West Germany were governed by Conservatives, where they introduced the neoclassical counter-revolution theory and policy (Todaro, 2015.). However, this idea is debatable, as Mowforth and Munt (2009) suggest that the application of free market principles, where the aim was for growth to trickle down, was also a factor in neoclassical diffusion. To achieve economic development, developed countries adopted a supply-side and macro-economic policy, such as privatisation of public companies. Neoclassical theory supporters believe poor resource allocation, incorrect pricing policies and extreme state intervention in economy and market activities caused economic stagnation in developing countries (Pieterse, 2010; Poter, 1990; Todaro, 2015.). Therefore, both neoclassical and neoliberal theories emphasise the important role that free markets played within open economies and development strategy revolved around freeing markets from state control and regulation. Both theories consider development a product of market force dynamics, rather than the state's strategic plan. Contrary to the above, critics of both theories believe there is scope for state role and global political discussions on economic development (Pieterse, 2010).

The era of the free market driven by neoliberalism and accompanied by economic growth, which causes state-led development programmes to decline, is described by Mowforth and Munt (2009) as the *"lost decade for development".* The Reagan-Thatcher endorsement speeches of free market in 1981 at the North-South Conference in Mexico played a key role in neoliberalism expansion. This conference

resulted in free-market principles becoming the driving force for development in the globalisation era. Mowforth and Munt (2009: p.34) elaborate:

> *"Purified neo-classical discourse produce a representation of development as an inherently universal and increasingly global economic process so much so that globalisation (like sustainable development) has emerged as a tautological word of development".*

Furthermore, Parnwell (2002) adds that, although neo-liberalism has become the central means for economic development, its merit has still been questioned. As a result, neo-liberalism in the form of free markets has brought a profound change to social science, including development studies (Parnwell, 2002; Pender, 2001; Porter, 2000). However, neo-liberalism appeared to face a huge challenge when sustainable development emerged, especially after the Brundtland Report was published in 1987. The report aimed to counterbalance the exploitation and damage caused to societies and the environment by neo-liberalism, especially in developing countries.

Development based on the free market economy has encouraged the development of large-scale infrastructures such as dams, providing the recipes for their continued expansion. As Gray (1999) suggests, that this continuity in the importance of large infrastructure projects shows that the global economies are connected with one another. He also adds that neo-liberalism supported the spread of large-infrastructure through modern technologies, funds and communication by connecting the world in trade, capital, production and information (Gray, 1999). However, Pender (2001) suggests that the free market, when left without state control, may not always adhere to public interest, particularly in the allocation of public resources. Yet Todaro (2015) and Mowforth and Munt (2009) challenge this assumption and suggest that a completely free market can be very efficient. This debate, however, indicates the significant need for state roles in monitoring the way development is conducted,

especially mega-dams due to their social and environmental implications (Pender, 2001). The invented legitimisation of modernisation/neo-liberalism as a development paradigm, which is commonly in favour of mega-infrastructures, has led some political ecologists to be:

> *'Highly sceptical of the merits of the concept of development in general and sustainable development in particular' (Bryant and Bailey, 1997: 4).*

This doubt suggests that sustainable development is still follows neo-liberal theory attributes where privatisation of public owned organisation increasing rapidly and state role in development is decreasing to some degree. Bryant (1997) states that free market systems cannot be both the facilitator and the protector of the environment and, given there is such scepticism, it seems problematic for mega-dam project supporters to deal with these sentiments and become accepted as a development means.

### 2.3.4 The age of 1990s to present day

The 1990s was believed to be the era of a poverty reduction strategy, especially with the initiation of alternative moderation theory. This period was viewed as a change in development thinking towards signifying human welfare and human rights, following the human development report in1990. Mowforth and Munt (2009, p: 35) suggest:

> *"The emergence of new system of social and economic quantification the Human Development Index (HDI) and the Human Poverty Index (HPI) compiled by the United Nations Development Programme and the move towards people focused and participatory approach to development could be considered as the return of alternative development".*

Meanwhile, the Hammarskjold report in 1975 appears to support the pro-poor development paradigm. This report aimed at decision-makers on both a national and an international level in order to influence the direction of development affaires in the world. To tackle the crisis that development facing in 1970s such as poverty of the

masses of the Third World, in addition to most basic needs — food, habitat, health, education — which are not met. However, this approach is considered to restrict economic growth as a foundation for development (Mowforth & Munt, 2009). Most development approaches seemed to be attempting to produce a universal method of development. These paradigms oppose each other and one paradigm displaces another. For example, the linear process based on the modern economics paradigm is displaced by inclusive growth and pro-poor people paradigms (Rist, 1997). This conception appears as a criticism of these methods, but it is rather a criticism of how these methods construct themselves as an ideology, attempted to transform into universal approach for economic development.

To have a clear picture of the 1990s era, it is important to mention the emergence of political ecology and sustainable development, following the publications of the Brundtland Report in 1987 and the Rio Earth Summit in 1992 (Rist, 1997). The agenda 21 from the Rio Earth Summit 1992 is action plan by the UN on sustainable development with signatories from across the world focusing on ecology and environmental issues. However, the idea has been expanded to economic, cultural and social contexts (Mowforth & Munt, 2009; Rist, 1997). To some degree, the ultimate goals of sustainability are to reduce ecological and environmental devastation (Wilson & Bryant 1997) and to support poverty eradication, which appear to be exacerbated by globalisation and the free market supremacy. However, the 'business as usual' attitude towards global economics continues to grow, without taking sustainability into consideration (Mowforth & Munt, 2009). This attitude means that social and environmental devastation and poverty will continue to increase globally, especially in developing economies. As Mowforth & Munt (2009) argue, the

idea of the Third World catching up with First World through international trade increases is a myth because the supremacy of economic growth makes it hard for sustainable economic to be the main theory in development discourse. Rist (1997, p193) suggests that *"sustainable development is an 'enormous nothing"*.

The focus of sustainable development and political ecology theories on ecosystem and the environment means that they have become progressively more influential in development discourse since the 1990s (Bryant, 1992a; Bryant, 1992b; Bryant & Bailey, 1997). These theories offer wide-ranging studies, integrating ecological, social sciences and political economy on topics such as degradation, marginalisation, environmental conflict, conservation and control, environmental identities and social movements (Walker, 2006). Yet, even though political ecology has a rich history and potential to appeal to wider fields of research, it has little influence outside the academic field, especially among intergovernmental organisations. As Walker (2006) states, overall, political ecology has not been remarkably positive in producing an effective counter-narrative. However, despite its extreme understanding of environmental issues, political ecology theory has had relatively little impact on economic and social public discussion outside the academic arena due to its narrative focus on environment.

In this sense, many contemporary theories of economic development that became prominent in the twenty-first century have "*complementary"* elements for different conditions, which are necessary for successful development to take place (Parnwell, 2002; Todaro, 2015.). Todaro (2015) emphasises that these theories often identify the causes of economic and development stagnation, such as dysfunctional or

misuse of economic systems, which drive economic development. Therefore, the beginning of the twenty-first century was a period of alternative development theories, such as socioeconomic and human development which became very important in development discourse (Lawal, 2006, Pieterse, 2010). These theories focused increasingly on the welfare of society and human development and they took greater consideration of the environment in relation to political, economic and social discourses in all frontline development (Pieterse, 2010).

Throughout the history of development discourse, especially from the early twenty-first century to the present day, there has been a trend of changes from one approach to another and the only common ground between these theories is political-economy which reflection their promotion. For example, mega-infrastructures are viewed as a necessity for development on the one hand, and as reinforcing free market ideals and depriving the poor from natural resources on the other hand (Munt, 2009). However, Parnwell (2002, p113) has warned of the danger of mainstream development approaches cancelling each other out in support of alternative models and argues that:

> *"Alternative models of development have tended to opt for the antithesis of the orthodox approaches. Thus, an urban is replaced with an emphasis on the rural and the agricultural, top-down and centralised by decentralised developed and bottom-up initiatives, small scale is preferable to large-scale and universalistic approaches, and so on. In essence, we are presented with another binary, between the orthodox and the alternative. One danger of this is that the very real gains from orthodox development are seriously downplayed in favour of sometimes idealistic and neo-populist alternative visions of the future".*

Halperin (2015) and Welzel *et al.* (2003) describe these shifts and changes in approaches as a 'crisis of theory' to which two reasons are attributed. First, is the absolute variation and complexity of societies. Second, is the challenge in finding a common epistemology for empirical research approaches to the study of

development. Therefore, seeking to establish a theoretical ground and find the right epistemological position is central to this research. In this regard, merging realism, based on the reality of Merowe Dam existing, and humanism, reflecting the human agency influence on the dam delivery at both macro and micro-levels, provides a better understanding and perception of the actors involved in Merowe Dam construction. In effect, this approach also helped to select socioeconomic and human development theories as the main framework, to assess the complexity and outcomes of Merowe Dam. These approaches take into account the complexity of societies and the variation of factors involved in development (for example economic, social, political, environmental). Equal attention was given to the most recent trends in development theories, which coincided with concepts and perspectives from different disciplines (Halperin, 2015; Welzel *et al.* 2003). The aim is to gain a better understanding and find the right combination of theories suitable to address the complexity of societies and the dichotomy underpinning the relationship between mega-projects and development.

Similarly, this research acknowledges that socioeconomics, political ecology and human development are forming the cornerstones of the new emerging development paradigms for many agencies and governments, especially in relation to mega-projects (Behera, 2006). Therefore, it is unwise to ignore their influence in development discourse, especially political ecology. Nonetheless, using political ecology in this research could be problematic for political reasons, such as the state control of all Merowe Dam-related activities and may hinder the research (Clark *et al.*, 1991; Friedmann, 1992). Political ecology is used as a term of reference, but socioeconomics and human development approaches will be studied in depth to gain

a better understanding of how to underpin the relationship between all elements involved, in the development and mega-project discourse.

It is also important to consider the changes that occur over time in development ideology, geography and international concerns. In recognising these changes and the limitations of more traditional theories, development discourse has embarked on an intellectual shift towards greater consideration of human development, the environment, poverty reduction, bottom-up development, a participatory approach and so forth, from the 1990s to the present day (Parnwell, 2002). Bearing in mind the very political nature of pursuing development, as Rigg (2012) suggests, politics in undemocratic countries can pose a huge challenge to communities. Furthermore, it is important for these communities to assert their power, if they are to defend their rights and be involved in development discussions. If the authorities fail to pursue comprehensive and sustainable frameworks of development, communities have a duty to take an active stance in making their voices heard. This approach can also be applied to the current struggles of rural Merowe communities, and the need to protect their rights against Merowe Dam authorities. As Rigg (2012) suggests, societies simply cannot be ruled, influenced or forced, just as they cannot be developed from the top, nor can they be understood from the top.

Development academics, such as Agarwal (2003), Pieterse (2010) and Srinivasan (1994), have acknowledged the importance of alternative models in development debate. Their research recognises the role of `*inner limits'* and '*outer limits'* and builds on Friedman's (1992) ideas suggesting that development is not just about change, but a change for the better, with positive progress on all fronts of society. More importantly, is the continuity of this change in an effective and efficient way,

consistent with the common objectives and goals of the community or society in question. In addition, it must consider people's values and appreciate their capacity. Slim (1995, p.143) elaborates further:

*"But appropriate does not mean old fashioned. Genuine development has an air of originality about it, but it is original not just by virtue of being novel. In the strict sense of the word, genuine development is original because it has its origins in that society or community, and is not simply an imported copy or imitation of somebody else' s development. It is well known that `imitative development' is often doomed to failure".*

Similarly, imitation of development, which is not coming from within the society in question and which is seeking to enforce itself by any means possible, could misrepresent or even destroy that society (Willis, 2011). Slim (1995, p.144) supports this statement and adds:

*"Genuine development, therefore, is not about similitude and making everything the same. Instead, real development safeguards and thrives on difference, and produces diversity".*

There is potential for this trend to occur in a mega-project context and, historically, it has caused many social conflicts (Jia *et al.*, 2011). It also highlights the necessity of indigenous population involvement and representation in development decision-making. To elaborate on this matter of great importance, referred to as "*people involvement,*" several development theorists refer to the word 'democracy' to describe development processes and the empowerment notion, which is applied to describe the achievement of a participatory process. Consequently, this participation leads to the achievement of other key development elements such as choice, control, and access.

Likewise, as Willis (2011) suggests, the idea that the economic growth concept goes hand in hand with human development is debatable. Development must go beyond the single aim of financial gain and also focus on wider socioeconomic and human

development, societal improvement, and sustainability of the environment. Changes have been in development theory and practice, and more emphasis has been placed on issues such as human rights and environmental agendas in development discourse, which is important for socioeconomic and human development (Abrams *et al.*, 1964; Friedmann, 1992).

Some scholars, such as Clark (1991), Friedmann (1992) and Srinivasan (1994), believe the gravity of the quest for immediate outcome has been the reason for many of the world's most unfortunate development initiatives, due to pressure for instant results. This approach led to widespread simplicity and lack of determination for inclusive development in the world's major development institutions, such as the World Bank and African Development Bank over the past five decades. In addition, there have been advancements in technological and economic development, without adequate concern for human relationships and environmental realities (George & Sabelli, 1994; Goldman, 2005; Park, 2010).

According to Slim (1995), human relationships are a key factor in determining socioeconomic development, which leads directly to human development, in the wider context. Therefore, some of the world's development failures are a consequence of imbalanced relationships internationally, nationally and even at a community level. Slim (1995, p.146) further elaborates:

> *"At national and community levels, power relations, gender relations, and ethnic relations play a major part in shaping or distorting genuine development. At an international level, unjust economic relations ensnare poor countries into debt and commodity-pricing traps, while political imbalances prevent many countries from enjoying a full stake in global governance".*

In this regard, much of the aid given by developed nations to developing nations for development is simply a catalyst of mis-development, either because it is environmentally and/or socially unsuitable, or because the offering is an extension of unequal power relations between countries (Clark *et al.*, 1991; Friedmann, 1992). Therefore, having mutual and objective human relationships is a key ingredient for comprehensive development. Likewise, mutual negotiation is required to be at the centre of development relationships to inspire exchange, agreement and partnership at all levels, and to avoid social conflicts between development project authorities and societies.

The debate on whether development brings positive economic and social changes in the world, or increases disparity between countries and communities, is significant to this study. It is also necessary to consider both sides of the argument as some scholars agree on the positive impact of development. Alternatively, others warn of development's negative social and environmental impacts, especially on the question of economic development benefits trickling down to every level of society (Machida, 2012). There is no consensus on development's aim: some think modernity is the main driving force for development or, in other words, the means of catching up with developed countries. However, modernity aims have been under criticism due to its increasing environmental and ecological concern especially in developing countries (Amin & Thrift, 1995; Pieterse, 2010). Similarly, westernised forms of development are less attractive in a time of diversification of culture, which is taking place in many parts of the world (Lawal, 2006).

The need for more mega-projects as a means for development is still debatable, especially because of their economic, social, political and environmental impacts (Ansar *et al.*, 2014). Likewise, dams have been under huge scrutiny regarding their relevancy to economic development, and their economic feasibility has been questioned (Amin & Thrift, 1995). In the wake of current debates regarding the position of mega-projects within development theories and discourse, it seems there is no consensus between those for or against. Therefore, based on global mega-project construction growth, a moderate view should prevail to disassociate it from the shortcomings of development theories. Therefore, it is more beneficial for developing countries to pursue mega-projects when they have the common goal of socioeconomic development (Agrawala *et al.*, 2003).

Having reviewed the work of scholars, such as Ersumer (1999), Varma (1999, 2003) and Agarwal (2003, 2006), one could argue that dams have benefits in many areas, but this research is giving further consecration to the social aspects of the dam project. In addition, there are some similarities between the case of Merowe Dam and the research conducted by Agrawala (2003), Ersumer (1999) and Varma (2003) in Nepal, Turkey and India on dam contributions to economic and socioeconomic development. The work of other writers such as Friedmann (1992), Amin and Thrift (1995), Slim (1995), Parnwell (2002) and Sen (1992) on alternative development theories has contributed towards the selection of suitable development theories, to underpin this research. Socioeconomic and human development theories are selected based on Welzel's *et al*. (2003) three socioeconomic development trajectories to examine the changes Merowe Dam brings to local communities. Furthermore, due to the significant potential for social diminution as an impact of dam

projects, and which may result in social conflict, after reviewing the work of Hård (1993), Jia (2011), Oberschall (1978) and Strulik (2008), social conflict theory is selected to address the conflict that Merowe Dam generated.

The importance of environmental relations with the economy and politics is acknowledged, especially after reviewing the work of scholars such as Bryant (1992 and 1997); Williams (2010) and Wilson and Bryant (1997). Thus, some elements of political ecology theory are appreciated in this research. It is also important to note that this research has recognised the work of Ansar *et al.* (2014), Flyvbjerg (2004; 2009), McCully, (2001), Smith (1968) and Scudder (2012) on opposing the construction of mega-projects, especially dams. However, this research disagree with their views, findings and the methodology used to reach the conclusion. Therefore, a combination of approaches and theories (socioeconomics, human development and social conflict) is used to address this research objectives 1,2,3,4 and 5 (see Chapter 1).

### 2.4 The socioeconomic and human development theories

To gain a clearer understanding of mega-projects' contribution to development, it is important to measure their outcomes against a framework. This study deploys both socioeconomic and human development approaches, as the means of understanding the economic and social changes brought about by Merowe Dam. The motive behind selecting both these approaches and theories is to provide frameworks that allow the researcher to examine the impact on communities in the Merowe region.

As Jaffee (1998) suggests, understanding a social or economic phenomenon is an extremely complex process. This complexity is due to the variation in factors that are involved in a given project (Jaffee, 1998). Therefore, having a clear understanding of how theory shapes peoples' interpretations and perceptions of social events is important (Rist, 1997). In effect, socioeconomic theory is vitally important to address the social and economic changes that occurred in the region due to the construction of Merowe Dam, and its direct implications on human development in the region. As Welzel *et al.* (2003) comment, any economy change in a society may have a profound impact on peoples' livelihoods, positively or negatively, which reflects their human development condition.

Processes of socioeconomic and human development are complex and wide-ranging. This has led to the introduction of many theories, explanations, arguments and assertions. Many theories and approaches claim to explain socioeconomic circumstances, yet they contradict one another (Jaffee, 1998). Socioeconomics as a concept can be applied to individual or group situations, within a hierarchical structure of society. Socioeconomic positions depend upon a combination of elements such as occupation, education, income, wealth, place of birth, residence etc. These elements are likely to be interrelated with human development in a wider context (Welzel, Inglehart & Kligemann, 2003). Sociologists frequently apply socioeconomic and human development approaches to understand certain behaviours within societies (Jaffee, 1998).

Normally, the emphasis of socioeconomics is on the social impact brought about by a change in economic or social circumstance. For example, building a mega-project for economic development, closing a factory, or even opening a new factory, market

manipulation and signing of international treaties (Jaffee, 1998). These may change the economy positively or negatively and have an impact on socioeconomic conditions, leading to changes in the overall quality of life and human development. Economic changes can often take place at the regional and national level. In addition, they may take place at an international level, for example, international trade treaties influence the economy of many countries (Jaffee, 1998). There is also a link between socioeconomic and human development through the changes that mega-projects bring to societies, in terms of welfare and wellbeing (Welzel, Inglehart & Kligemann, 2003).

Furthermore, Welzel *et al.* (2003) identify three main paths for socioeconomic change, which leads to human development in a development context. Firstly, socioeconomic development is associated with changes in many factors (for example technological innovation, productivity, health). This view is supported by many scholars including Lewis (1955); Rostow (1961); Barro (1997); Estes (1998); Rodrik (1999); Hughes (1999); Sen (2001) and Welzel *et al*. (2003). These three paths are relevant in the context of Merowe Dam; as a technology it is having a huge effect on the lives of people in the region economically, socially, politically and environmentally. The second trajectory is based on expanding markets and social mobilisation (e.g. more choices, luxury goods) which bring changes in values regarding socioeconomic conditions. Subsequently, human development prevails as economic activities increase (Welzel, Inglehart & Kligemann, 2003).

The first two processes are linked to social interaction with the market, to some degree, but the third major process is based on societies interacting with state institutions. In respect of this, greater changes have been detected in states with

strong established democracy (Welzel *et al.* 2003). The first and third trajectories are relevant to this research in terms of the changes Merowe Dam as a technology has brought to society and local communities' interaction with DIU. This is also related to the social conflict Merowe Dam caused, especially due to power imbalances between project authorities and affected communities (Jia *et al.*, 2011; Jianrong, 2007). The second trajectory is indirectly related to Merowe Dam, but the dam's economic and social impacts play an important role, particularly in relation to the market expanding through infrastructure, improvement in agriculture, transportation and communication.

Furthermore, in relation to socioeconomic and human development, Marsh (2014), cites Amartya Sen's good welfare economics and the study of poverty in developing nations during 1985, 1987 and 1992, arguing that individual wellbeing can be objectively measured by peoples' access, not only to income and goods (i.e. food, clothing, shelter), but also by *"capabilities"* that enable them to pursue fulfilling lives. In effect, this leads to human development through complementary relationship between the governments and societies to enable people to have *"capabilities"* for functioning (Rigg, 2012). Rigg further elaborates by referring to "*capabilities"* as the ability to have a right to choose which development opportunities are provided by states and having the means to achieve particular outcomes, for example, healthy lifestyles and education (Marsh, 2014; Rigg, 2012).

In fact, the capabilities approach is currently widely regarded as a new paradigm in development studies, and in particular, in human development theory (Marsh, 2014). Marsh, (2014, p.1001) cites Sen who argues:

*"Development should not be measured only by the traditional economic criterion of GDP per capita, but broadened to include "human development," that is, capabilities and the enlargement of people's choices"*.

In addition to economic factors, there is a correlation between economic and non-economic factors in development; for example, quality of life is not always dependent on GDP per capita (Marsh, 2014). This corresponds with Wetzel's *et al*. (2003) three trajectories of socioeconomic development in societies, which support the correlation between socioeconomic and human development and how they complement each other. Wetzel's *et al*. (20030 approach also supports the idea of development based on choice and strong relationships between societies and the authorities delivering development.

The term socioeconomic is very flexible and often used for different purposes. It is often used to refer to the economy more broadly in the study of society (Becker, 1974), but more specifically, it is used by contemporary economists to indicate the behavioural interactions of individuals and groups with social capital and social markets. This has led to the formation of social norms, such as improvement in education and living conditions, which directly lead to human development (Becker & Murphy, 2009; Eatwell & Milgate, 1989). Recent studies indicate that there is a strong relationship between socioeconomic development and social elements such as religion, culture, traditions, and family structure (Eatwell & Milgate, 1989). Moreover, socioeconomic theory is described by Peil (2009) as an approach exploring the common connection between economic studies on the one hand and social attitude, integrity, and humanity on the other.

There is greater focus on social reconstruction and improvement of the human condition, and a multidisciplinary approach is taken, utilising work from sociology, history, and political science (Peil & van Staveren, 2009). Thus, the goal of socioeconomic theory is broadening and economic measurement tools are moving away from a focus on GDP to a more comprehensive approach, measuring factors such as life expectancy, literacy and levels of employment, personal dignity, freedom of association, personal safety and freedom from fear of physical harm and the extent of participation in civil society (Weber, 1958).

In addition to the above, socioeconomic theory has been criticised by mainstream economists, alleging its philosophical principles mainly pursue the self-interests of its advocates, ignoring functional economic relationships. Consequently, they label it as heterodox (Jaffee, 1998). Furthermore, Scott (1998) suggests socioeconomic development is not achievable in countries under dictatorship or tyrannical government. However, Leftwich (2000) has criticised the involvement of international bodies such as the IMF and World Bank and their implementation of Structural Adjustment Programmes (SAP), which he believes are more detrimental than supportive to the socioeconomic condition of the poor. In this regard, neoliberalism as a supporter of SAP has failed to deliver the expected socioeconomic development, because poverty and inequality have increased. As a results of this inequality disparity in socioeconomic and human development between the global North and South has increased, as the South is drawn deeper into the global economy (Leftwich, 2000).

In terms of socioeconomic development from mega-dam perspectives, some have suggested that dam impact is not immediately relative to other infrastructures projects such as services, education and the market place (Scott, 1998). This is in line with Ansar *et al.'s* (2014) and Flyvbjerg's (2007) views of mega-dams as unrealised economically. However, Agrawala (2003), Ersumer (1999) and Varma (2003) predict long-term socioeconomic development benefits of dams, which many developing countries are aiming to achieve. Dams have played a vital role in economy growth and socioeconomic improvement in some areas, causing significant increases in electricity consumption due to industrial expansion, services, agriculture and domestic usage (Becker & Murphy, 2009; Bitondo & André, 2007; Couch, 2002). The socioeconomic condition of any given country is based on electricity availability for manufacturing, civil, commercial and other purposes in society (Kim, 2006). Consequently, technological advancement has made the utilisation of water resources in the world economically viable. However, evidence from mega dams such as the Three Gorges, indicates that the socioeconomic influence of such large construction projects is great and often leads to social conflict (McDonald, Bosshard & Brewer, 2009).

### 2.5 Social conflict theory

Social conflict theory can provide a clear understanding of the relationship between society and project authorities in a development context. In effect, this study is deploying social conflict theory as the means of understanding the relationship between all parties involved in the construction of Merowe Dam. The purpose of this section is to explore mainstream social conflict theories, select the relevant one and apply it to this research. In addition, the section aims to gain a clear understanding

on whether mega-project cause or resolve conflicts. This theory is used to enable this research to achieve a comprehensive understanding of the power struggles between project authorities, NGOs and society. It also aims to provide a better insight into how conflict has developed within different social groups in the area of Merowe and to propose means of resolving it.

Social conflict theory plays an important role in the social sciences. It became prominent in the early 1900s and was a main topic of discussion at the Annual meeting of the American Sociological Association in the 1930s, 1960s and 1970s (Hård, 1993; Jia *et al.*, 2011; Jianrong, 2007; Oberschall, 1978b). The theory generated interest in its early stages and then developed rapidly, while in recent years it has attracted greater interest still. In the era of development, mega-project and globalisation, there are resource scarcities, meaning social conflicts are expected. The emergence of complex issues such as racial problems, terrorism, faith conflicts and economic crises has led to great interest in social conflict theory (Hård, 1993; Jia *et al.*, 2011; Strulik, 2008). Although mega-projects can be a cause of conflict, this research encounter some challenges applying this theory, these are outlined below.

Firstly, social conflict theory focuses on structural changes in society in the broader sense, while mega project is a specific and narrow concept. The conflict is perceived as a principle matter, rather than a set of actual problems and this make it difficult to reconcile the two concepts together (Hård, 1993; Jia *et al.*, 2011; Jianrong, 2007; Oberschall, 1978b).

Secondly, the outcomes of mega-project conflict cannot be generalised with confidence in a broader context. Therefore, the conflict concept should be expanded to cover wider concepts (Hård, 1993; Oberschall, 1978a).

Thirdly, many sociologists suggest social conflict can reshape social norms and provide means for social structure improvement, but this hardly mentioned by scholars to better appreciate mega projects from a social conflict viewpoint.

As Jia, (2011) suggests, social conflict theory is not an entirely established subject or a complete method to investigate particular matters in society. However, this theory can offer a new viewpoint on mega projects, and certainly viewing mega-project from an external perspective is more objective and comprehensive.

The mainstream advocates of social conflict theory are Dahrendorf, (1958) and Coser (1957), but the theory encompasses several views. This research uses the views of Dahrendorf and Coser for reference. Dahrendorf's theory suggests there is an uneven distribution of power in the organisation of society, which is divided into two distinctive groups: the ruler and the ruled (Dahrendorf, 1958). Additionally, Coser's conflict theory suggests that beyond its disadvantages, conflict can play a positive role in ensuring social continuity by opening a new channel of negotiation between the parties to reach mutual ground. Furthermore, in some cases, conflict can prevent the social system from becoming rigid, by supporting flexibility and enhancing the coherence of society (Coser, 1957).

Jia *et al.* (2011) suggest social conflict is linked with mega-project and often it can be a product of conflict or vice versa. Furthermore, Jia *et al.* (2011, p.821) cite Coser (1957) suggesting that conflicts may perhaps be viewed as struggles for value, rare

status, power and resources. Therefore, these types of struggle, may lead the opposing parties to undermine even harm each other.

This struggle implies that conflict exists in all aspects of society. In addition, government failure to deliver appropriate development may lead to further conflict and communities may take action to protect their interests and property (Rigg 2012). The role that conflict plays in society depends on its nature and the social and power structure in place, which may lead to positive or negative conflict. Therefore, by maintaining the core values of society, conflict can help to discover irrational social norms, promote self-improvement and avoid any harm to either party involved (Coser, 1957; Jia *et al.*, 2011). However, the conflict process indicates that not all improvements and contributions to society can be attributed directly to conflicts per se; instead, people learn from conflicts and attempt different solutions, which drives their improvement (Hård, 1993). In effect, during the process of resolution of conflict, society can discover the illogical mechanism or phenomenon and make the necessary changes that help in moving forward (Dahrendorf, 1958). To some extent, social conflict can save society from reaching break point, as Jia *et al*. (2011, p.821) suggest,

*"In fact, conflicts play an intermediary role in the progress of society. So when there are conflicts, it is wise for people to confront it"*.

This intermediary role suggests that social conflict can become the means in which society resolves the dichotomy between agency and structure and introduces a new dialogue, far beyond the mainstream debates about pull and push (Hård, 1993). Hård (1993) suggests there is a relationship between technology, society and conflict. Therefore, technology is formed by social groups in conflict and that technological changes are never a socially neutral process. However, technology is viewed as a

means for establishing and influencing social relations. To some degree, human agents drive mega-project conflicts and the agent's action to some extent is directed by the existence of these conflicts. Therefore, social conflict theory in relation to mega-project involves both structural and agency approaches (Dahrendorf, 1958; Hård, 1993; Oberschall, 1978b). There are many approaches and some systematic models, which aim to help resolve and manage different types of conflict. However, little acknowledgement has been given to mega-projects as useful tools for resolving social conflict (Jia *et al.*, 2011).

It is also believe mega-project causes conflict and the reason is because they are usually driven by political elements and draw attention from different opposing political interest groups, social groups and countries, especially if those countries share the same water source (Jia *et al.*, 2011). Likewise, mega-projects usually have strong social characteristics and are commonly driven by significant social events, environmental events or mega-events (Jia *et al.*, 2011). Furthermore, economic factors and the need to maintain livelihoods can create conflict amongst stakeholders. Mega-projects play a significant role in economic development, particularly in the globalisation era. This role increases the likelihood of conflict, due to the different economic interests of multiple stakeholders (Jia *et al.*, 2011). Jia *et al*. (2011, p.821) add:

> *"People make the construction of a mega project passively to respond to a mega-event, then in some sense, people construct mega projects actively with economic purpose. The intention is obviously because mega projects play an important role in economy recovery and employment promotion, and the fact demonstrated that the construction of mega projects truly is an effective way to resolve the economic conflicts".*

However, in some cases, dams are forced upon societies by authoritarian states, therefore, they become a source of conflict and displacement. Jia *et al.* (2011) developed three propositions regarding mega projects from the perspective of conflict theory as follows:

> 1-Mega-project is a result of social conflict and conflict can be in the form of value, power or resource struggles.
>
> 2-Mega-projects can be the safety valve for society in reducing or removing conflict.
>
> 3-The extent of state power and economic centralisation determines the size of mega-project which is significantly influenced by their social, political and economy status.

The construction of dams as a strategic economic project has achieved impressive success in the past (Agrawala *et al.*, 2003; ICOLD, 1985; Shirley & Kammen, 2015; Zeybek & Kaynak, 2008). However, Ansar *et al*. (2014) and Flyvbjerg (2009) contest this claim and oppose dam construction as strategic development, arguing their construction results in serious social and economic adversity. Furthermore, they highlight the continuous problems of involuntary displacement, insufficient resettlement and rehabilitation. In addition, the absence of transparency and doubtful economic benefits has led to them questioning the integrity of mega-projects (Ansar *et al.*, 2014; Flyvbjerg, Garbuio & Lovallo, 2009). Indeed, these factors have led to extensive campaigns and evoked widespread social opposition against mega-dams in many parts of the world, for example in India, Brazil and China.

The quest for a suitable, safer technological option to provide societies in developing economies with essential electricity and water resources for economic development is an area of intensive debate (Agrawala *et al.*, 2003; Bryant & Bailey, 1997; Ersumer, 1999a; Jia *et al.*, 2011; Varma, 2003). In this regard, opinions are

increasingly polarised, but opposition to dam building has increased, primarily because of some of the more negative economic, social and environmental impacts associated with them. One particular issue is their track record of causing the displacement and resettlement of communities. In fact, around 80% of the displacement is caused by development related mega-projects and 58% is related to water resource projects (Dogra, 1992). The Orissa case in India is a prime example, where 54% of the population have been displaced by water projects alone (Dogra, 1992). Furthermore, recent surveys from ongoing studies suggest that the number of people displaced and affected by water management projects is around 40 million (Dogra, 1992).

Beside their association with involuntary displacement, insufficient resettlement and rehabilitation, it is important to consider the environmental impacts of dams as a source of social conflict in a development context. As Wilson and Bryant (1997) suggest, the interaction between environmental managers, political interest, different social groups, NGO's and government agencies (development and project authorities), may cause intensive social conflict.

This interaction supports Coser's (1957) argument that societal conflict can play a positive role in a development context. Furthermore, Wilson and Bryant (1997) suggest that environmental management is a multi-dimensional process, which acknowledges that:

*"Unequal power relations between environmental managers are reflected in both conflict and cooperation" (Wilson and Bryant 1997. p.98).*

Wilson and Bryant supported by Dahrendorf's suggestion that an uneven distribution of authority and power within society causes social conflict. In addition to the obvious factors that drive social conflict regarding dams (such as negative environmental,

social and economic impacts), there are many different causes of opposition to dam projects. These include a lack of inclusive and open approaches to their assessment (Dogra, 1992; Jia *et al.*, 2011; Jianrong, 2007). There is also a need for a new effective and efficient set of standard procedures, for decision-making on mega-projects, which cannot be ignored. This procedures may lead to a reduction in social conflict and help to resolve economic, social, political and environmental problems, especially those associated with water management (Dogra, 1992). However, with concerns growing around climate change, and increasing demand for food, water, and electricity for economic development, there is potential for more causes of conflict to emerge, beyond those associated with displacement and compensation. Nonetheless, the issue of displacement and other related matters in development, especially mega-dam developments, need to be addressed via an on-going negotiation process, involving conflicting parties, based on reasonable power distribution (Jia *et al.*, 2011). As far as this research is concerned, no matter how socioeconomic development is pursued, there will always be some form of associated social conflict (Jia, 2011 and Agrawala, 2003).

### 2.6 Economic, social, political and environmental issues of mega-projects

The relationship between economic development and mega-projects is an area of great debate, particularly regarding whether the changes are positive or negative. However, recently there has been a shift in focus towards social and environmental aspects, as well as political factors, especially in relation to dam projects (Agarwal, 2006; Ansar *et al.*, 2014; Flyvbjerg, Garbuio & Lovallo, 2009; Jia *et al.*, 2011). Moreover, it is important to pay attention to the interaction of mega-projects with

economic, social, political and environmental forces, in order to evaluate their overall contribution to development (Flyvbjerg, 2009; Jia *et al.*, 2011).

### 2.6.1 Economic issues

Debate around the economic benefits of mega-projects, especially dams, has continued to grow and views have become more polarised. Scholars such as Agrawala *et al.* (2003), Harpman (1999), Kim (2006), Agrawala (2003) and Alexander (2015) have a more positive view and suggest that good infrastructure supports productivity and lowers costs of goods production and transportation directly or indirectly, through increase of efficient and productive activities in the economy. Furthermore, Kim (2006) suggests that infrastructure construction, such as those linked to energy and transportation, are important for long-term socioeconomic development.

The reputation of large infrastructures, especially dams, differ regionally and nationally. The implementation of dams flourished in the 1950s and 1980s, due to their role in water provision for irrigation, flood control and electricity generation for socioeconomic and human development (Agrawala *et al.*, 2003; Alexander, 2015; Allan & Allan, 2003). The fact that countries are able to provide the above services to further their national development objectives, amongst others, helps them to exhibit autonomy, independence and economic, social and human progression (Altshuler & Luberoff, 2003; Badruddin *et al.*, 2008). Two clear examples are the Aswan High Dam (AHD) in Egypt and the Sinnar Dam in Sudan. They have contributed enormously to both countries' economies by providing a stable water supply for irrigation and electricity (Sharaf El Din, 1977).

Irrigation schemes have been hugely important to the development of Sudan's economy since the 1920s. The Sinnar Dam was developed pre-independence, supporting the Gezira Agriculture Scheme, and was introduced by the British to aid cotton production (Verhoeven, 2011; Wallach, 1988). Since independence, there have been important changes to the Sudanese agriculture system because of the profound effect the Gezira project has had (Wallach, 1988). The country has witnessed an increase in the development of dams for electricity and agro-economic development. These include the Roseires and Jebel Aulia dams and the Shereyk Power Station. The Khashim el Girba Dam was constructed to offset the devastating impact that the AHD had on 7,000 Halfawi families, when their homes villages, farms and businesses were submerged by the impoundment of land from the AHD. They were subsequently re-settled in the New Halfa area and their livelihoods restored. These issues surrounding the AHD have overshadowed the success of some dam projects in Sudan, leading many to question their economic benefit (Verhoeven, 2011; Wallach, 1988).

However, the aim for Sudan to become the 'breadbasket' of the Arab world was introduced by president Nimeiri in an attempt to revive and modernise the Sudanese economy. This aim has been supported by export-led growth, leading to increased income, some rural development and reduced foreign debt. Global markets opened up and presented opportunities for Sudan's agricultural economy, particularly the crop sector, to capitalise on the availability of international funds to attract investment (Kleinitz, 2011).

However, by the mid-1980s, Sudan was faced with famine for the first time in many decades along with other challenges, which hindered the accomplishment of these goals. For example, there were inaccurate assumptions around the environment and agro-economy, supporting the breadbasket idea (Bernal, 1997). Calculations regarding a cheap labour surge, 'free' water and new technology leading to increases in production were seriously misjudged. The guidance offered by environmentalists regarding capital-intensive farming draining soils, using up groundwater and being overly dependent on seasonal rains in some areas was overlooked. Most profound though, was the heavy reliance on primary commodities to diversify the Sudanese economy, without using generated funds (Verhoeven, 2011).

Despite these economic, social and environmental setbacks, and the high costs of the hydro-agricultural and hydro-engineering, Khartoum did not abandon the dams' construction programme. It is claimed this turned Sudan into a middle-income country, yet it was deeply disempowering for large segments of the population, due to displacement and the limited access of local poor people to electricity, which was being produced on their land (Verhoeven, 2011).

The earlier stages of dam development in Sudan in the 1920s reflect some of the issues raised by world system theories (Verhoeven, 2011). Nimeiri's era can be explained by moderation theories, where dams were used for energy generation and irrigation, which aimed to help modernise Sudan in many ways (Wallach, 1988). There is strong evidence that the current government is using the dams strategy as a social and political tool, to break international isolation, as well as an economic machine for socioeconomic and human development, by calling this strategy "*the*

*mission of rebuilding civilisation" (Verhoeven, 2011).* According to McDonald (2009) though, this strategy was met with strong opposition from local and international communities. Despite opposition, the government continues with its plan to build many dams in the coming years, beginning with the Merowe Dam, in the hope of achieving economic development (McDonald, Bosshard & Brewer, 2009; Verhoeven, 2011). Scholars such as Ansar *et al.* (2014), Flyvbjerg (2009) and others, are sceptical of the economic benefits of mega-projects, especially dams (Flyvbjerg, 2004; Flyvbjerg, Bruzelius & Rothengatter, 2003). As Ansar *et al.* (2014, p.5) suggest:

> *"We find that even before accounting for negative impacts on human society and environment, the actual construction costs of large dams are too high to yield*".

Ansar *et al.* (2014), Flyvbjerg (2009) and other critics of mega-projects based on a "*structuralist view",* by assuming that data and reality are linear and consistent in which to determine economic and social benefits of dams (Cohen, 1989; Giddens, 1991). In contrast, scholars such as Ersumer (1999), Varma (2003) and Agrawala *et al*. (2003) refute the above argument by suggesting that the development strategy of many countries (i.e. India, Brazil, Turkey and in particular, Nepal) of building small, medium and micro-hydropower units, played an important role in economy diversification, through electricity generation for industrial development (Agrawala *et al.*, 2003). Likewise, dams relieve some of the pressures on environmental degradation (Agrawala *et al.*, 2003).

The majority of studies on mega-projects are based on quantitative statistical analysis, relying on large samples who were asked close-ended questions. Interpretations are based on macro-level viewpoints and provide straightforward conclusions. In addition, arguments do not consider social needs or development

stages, or the cultural, institutional and political contexts at the given time of the countries in question (Welzel, Inglehart & Kligemann, 2003). Without reflecting on the wider context of the projects, the long-term vision for and future expectations of economic benefits from these projects. Therefore, general conclusion was drawn, based on large data sets, and interpreted the dynamic of mega-projects within the society heterogeneously. Arguably, mega-dam projects have brought about numerous benefits, including the electricity harvested for industrial development and water needed for irrigation (Kim, 2006). However, the economic justifications for large-dams and how beneficial they are to hosting communities still remains unclear and is subjective to many factors.

Certainly, mega-dams have and will continue to provide many countries with the means for socioeconomic and human development, despite their associated challenges and criticisms. In Sudan, dams have been the source of developmental inspiration throughout its modern history, as Verhoeven (2011, p.698) states:

> "*High modernist visions in Sudan (Britain and Gezira, Nimeiri's breadbasket) have proved very persistent, and the developmental experiences of China and Malaysia inform today's thinking. In Islamist Khartoum ideas about spreading 'civilisation' and 'progress' endure: Merowe Dam has been called 'the project of poverty elimination in Sudan' by Bashir, while the Dam Implementation Unit refers to the Kajbar Dam as 'mashruiadat bina' al-hadara' ('the mission of rebuilding civilisation')"*

Further evidence for dams benefits is the transformation of the dry areas of the western United States, through water control provided by dams, which proves that where there are water transferring facilities with a stable supply, dry lands can turn from hostile to habitable (Gupta, 1998). Furthermore, Gupta (1998) emphasises the important role dams play by referring to the development opportunities created in the Tennessee Valley Project in the USA. Here, huge strips of land vulnerable to overwhelming floods, were transformed into an industrial hub through flood control.

Despite their social challenges, the construction of mega-dams is increasing and clearly, there is a link between economic and social aspects in mega-projects aims (McDonald, Bosshard & Brewer, 2009). The following section will discuss the social issues associated with dams.

### 2.6.2 Social issues

The social arguments about mega-dams are centred around the supremacy of technology and how dams interrupt the flow of rivers, displacing communities and damaging livelihoods, social cohesion and self-integrity, as well as posing a health hazard to affected communities (McCully, 2004; Scudder, 2005; Scudder, 2012; Smith, 1968).

By viewing dams from a social perspective, there are clearly many issues, and the situation in Sudan is no exception. Indeed, all dam projects in Sudan from Sinnar to the current Merowe Dam, result in the damage of livelihoods and the displacement of entire communities (McDonald, Bosshard & Brewer, 2009). Worldwide, there has been increasing social resistance to dams. This is particularly true in Sudan, where government and dam authorities restrict local communities from demonstration and withhold their right to oppose dam construction. This was met with strong opposition and in April 2006, three people were killed and 47 wounded (McDonald, Bosshard & Brewer, 2009). Furthermore, McDonald (2009) suggests that often, the resettlement of local communities has led to higher population densities, therefore increasing the likelihood of struggles over resources access. Moreover, while WCD (2000a) and McDonald (2009) acknowledge the need for electricity for economic development in developing countries such as Sudan, they also emphasise how managing the social

impact of dams is an extremely challenging assignment. As the WCD (2000a, 2000c) illustrates in its influential report, the effects on local communities are disruptive, long lasting, and often permanent.

However, the problem with some criticisms is that they do not take into account how social, cultural and political conditions vary in different locations. Homogenising the social impact of dams can undermine the many contributions they have made to communities in different parts of the world (Varma, 2003; Verhoeven, 2011). The International Association for Impact Assessment (IAIA) has developed guidelines to help reduce the social impacts of dams, however. Although much of the procedure has been universalised so is not culturally and contextually sensitive, it is still relevant for large-dam project authorities (WCD, 2000a).

Unfortunately, the debate over large-dams is becoming ever more polarised especially in recent years, causing further social conflict (Jia *et al.*, 2011). The polarisation appears to reflect the frustration of those with opposing viewpoints, rather than spurring a useful dialogue between stakeholders around the challenging choices related to managing water, energy and other natural resources (Asmal, 1999).

It is important to explore the relationship between mega-projects and society as it is embedded in socioeconomic development, as Jia *et al.* (2011, p.818) observe:

> *"Interaction between a mega project and social conflict influences politics, economics, environment, regulations and other aspects of society, eventually pushing the society to move on"*

Shirley (2015) suggests mega-projects should be regarded as socio-technological systems, rooted within the socioeconomic setting and co-evolving with socio-political institutions. Mega-dam projects can have a great impact on social elements, both positively (Agrawala, 2003; Kim, 2006) and negatively (Alegi, 2007; Ansar *et al.*, 2014; Fearnside & Barbosa, 1996; Flyvbjerg, 2014; Hennig *et al.*, 2013). Many critics of big infrastructure call The Three Gorges Dam the biggest social catastrophe created by a single project causing displacement in a mass scale (Ansar *et al.*, 2014; Flyvbjerg, 2009). Scholars, such as Flyvbjerg (2004) and Silver (2016), view some mega-projects as separate entities from the social context, as imposed upon society. In addition, they may cause disruption to societies and rapid transformation of their landscapes (Gellert & Lynch, 2003; Shalash, 1982). Arguably, not all mega-projects have had a negative effect on societies, for example, projects such as Deira Island in Dubai based on modernisation viewpoints, mega-projects may have a positive effect socially (Sharaf El Din, 1977). However, Ansar *et al.* (2014) and Flyvbjerg (2009) disagree with this idea and refer to many mega-dam projects as having negative social impacts. This criticism does not refute the argument which suggests that societies in the era of globalisation and modernity are in favour of the visual transformation that mega-projects produce which, for example, have transformed small cities such as Dubai into global cities (Pacione, 2005). The question is, do mega-projects affect societies positively and enhance their wellbeing or not?

### 2.6.3 Politics and environmental issues

Mega-dams are generating controversy and have become the main actor in the drama of ‘hydro-politics’ (Gupta, 1998). This debate is complicated by the vital need for flood control, water supply for agricultural irrigation, electricity for domestic use

and industrial development on the one hand, and the desire to ensure that socioeconomic, human conditions and environmental concerns are considered on the other hand. Therefore, mega-dams illustrate the options and problems of development confronted by many societies across the world, especially in developing countries (Asmal, 1999).

Mega-dams are a form of political intervention, which unavoidably, affect the lives of individuals and social groups, both positively and negatively. However, mega-dam impacts need to be mitigated and transformed by individuals, social groups and structures (project authorities). Subsequently, interventions of any project, no matter how large or small, are subject to construction and decision-making process and are continuously restructured by political and environmental dynamics. Dams generate political and environmental responses, which call for new approaches that consider the needs of local and regional groups, who are fighting to preserve their own social spaces, cultural boundaries and positions within the broader power dynamic (Long, 1992). As a result, mega-dam construction for development causes ongoing power struggles and political negotiation between many countries, groups and actors, often with high expectations of the outcomes (Long, 1992). For example, as Verhoeven, (2011, p.680) suggests:

> *"The focus then shifts from local appropriations to regional and global discourse about resource scarcity and climate change, and their often devastating consequences for vulnerable populations".*

Observing how Egypt's long golden age influenced its control over the Nile, clearly, Egypt's actions produced political uncertainty and power disputes between Egypt, Sudan and Ethiopia, particularly around who was in control over the River Nile. This political instability was heightened by the construction of the Grand Renaissance

Dam in Ethiopian (McDonald, Bosshard & Brewer, 2009; Verhoeven, 2011; Wallach, 1988). The United Nations Conference on Environment and Development in 1992 identified socioeconomics and geopolitics as the key factors causing anxiety around environmental and social sustainability following dam construction (McDonald, Bosshard & Brewer, 2009). In 1972, the United Nations Environment Programme (UNEP) developed an environmental impact assessment tool to address many of the environmental concerns resulting from dam construction, including,

> "*Silt loss for flood recession agriculture, dam sedimentation, riverbank erosion, reduced river valley groundwater recharge, blocking of fish migration and impact on locally endangered species" (McDonald,* 2009 *p: 299)*.

Similarly, Verhoeven (2011) suggests that higher levels of siltation and evapotranspiration related to new dam construction may aggravate water and land conflicts between affected communities. Similarly, Allan (2003) states that mega-dams pose significant challenges, including a paradigmatic change in water resource management, from a supply-led to a control-based approach – for industrial and socioeconomic modernity. Furthermore, as Gleick (2014) suggests, growing anxiety around the environmental and ecological impacts of large dam construction, for example the Merowe and Three Gorges Dams, has led to considerable changes in dam development thinking. From this perspective, mega-projects are viewed as part of the technological *tyranny* of the 21st century, detonating nature as well as social aspects (Goodman & Chant, 1999).

It is clear there is a strong link between politics, the environment, and economic and social considerations within the dynamics of mega-project construction (Bryant & Bailey, 2015; Wilson, 1997). Many scholars, such as Bryant and Bailey (2015) and

Wilson and Bryant (1997) acknowledge this relationship, but the question many scholars ask is how to manage this relationship:

"*In effect, the role of politics in shaping ecology is much greater today than in the past as a result of rapid social and technological changes that render problematic the idea of a 'natural' environment*"( Bryant and Bailey 2015, P: 5).

Moreover, Altshuler (2003), Ansar, *et al.* (2014), Flyvbjerg (2007; 2009) and Fearnside (1996) suggest that historically, many mega-projects are best understood in terms of the political benefit they provide to the actors involved in their promotion. For example, governments in developing countries, especially Africa, and their Chinese alliances, present dam projects as new sources of funding, in order to defend their economic feasibility, at the expense of social and environment factors (Kleinitz, 2011; McDonald, Bosshard & Brewer, 2009). In response to criticism from civil society and NGOs regarding mega-projects' environmental and social impacts, governments in developing economies and their partner, China, claim to pay great attention to local peoples' livelihoods, taking environmental issues very seriously by applying strict environmental assessments and principles (Kleinitz, 2011; McDonald, Bosshard & Brewer, 2009). This example highlights how authorities play down the effects of such projects, by using political language to quieten the voice of critics so that projects can go ahead.

In fact, this political language is most likely the case in most mega-projects; politicians play down the social and environmental impacts and attempt to capitalise on the economic benefits. This approach is even more evident in undemocratic countries such as Sudan (Verhoeven, 2011). Thus, this indicates the need for:

*"An approach that integrates political, economic and ecological issues as the basis for an effective response to contemporary environmental problems and*

*understanding of the political economy of environmental change" (*Bryant and Bailey 2015, p.1*)*.

Yet, the position of politics and the economy is stronger than that of the environment in all types of mega-projects. In particular, dam projects and political ecology represents no more than an attempt to correct the lack of environmental present mega-project development. Above all, means political and policy-makers should taking responsibility for solving the mega-project environmental crisis. There is a fundamental need to appreciate how the status-quo is because of political and economic interests and struggles. Politics and the environment are interrelated, as Harvey (1993) observes, all ecological developments and arguments are concurrently political and economic developments and arguments, and vice versa. He also suggests that ecological arguments are certainly not socially neutral than socio-political arguments, are neutrally ecological. The way ecology and politics interconnect, it becomes somewhat domineering in development discourse and will continue to dominate development matter if an alternative approach that include other factors such as social, culture is found.

Nonetheless, Bryant and Bailey (2015) state that there is an uneven relationship between politics and ecology. Recently, politics has strongly influenced ecology, in fact more so than in previous decades due to swift social and technological changes. It is clear from the above analysis that politics and economic elements take precedence over social and environmental factors, in determining the fate of any given project. These factors appear to reinforce the views of social conflict theory, as Dahrendorf suggests, imbalances in power between different actors in society, means that politicians and funding bodies have the authority and power to have the final say in project decision-making (Altshuler & Luberoff, 2003).

In contrast, social and environmental elements are at the receiving end in mega-project debate with albeit little power, in resolving the conflict. As Coser's conflict theory suggests, conflict can also play a positive role in ensuring the continuity of societies and the reduction of any further conflict, when a mutual ground is established between a project authority and society (Jia *et al.*, 2011). Certain dam projects have been encouraged, in order to help combat droughts caused by climate change, through water management and irrigation projects (Agrawala *et al.*, 2003). Historically, a large proportion of economic development in many Western European countries, particularly Sweden, Norway and Switzerland, has been a by-product of mega dams. This is because they have supported electricity generation, maintained flood control and helped to improve the overall economy. It is still important to consider the ideological and political justifications for large dams and why politicians have continued to support their development.

A review of the mega-project literature in both developed and developing economies shows that Sudan is no exception in the debate around of mega-projects. It seems that the focus is more on economic and ecological aspects; for example, scholars such as Ansar *et al.* (2014); Flyvbjerg (2007) and Gellert (2003) claim emphasise is placed on economic rationality, with less consideration given to social aspects. Therefore, focusing on economic factor alone explain mega-dam complications would be difficult. An alternative method combines economic, social, political and environment factors to provide a better understanding of how these components are influenced by mega-projects. Consequently, these factors are inter-linked at the

national and local level of mega-projects in a development context. It is set against this politically contested background that this research will be executed.

The above illustrates a trend which suggests that the majority of scholars view mega-projects, in particular dams, as politically motived (Flyvbjerg, Garbuio & Lovallo, 2009; Gellert & Lynch, 2003). In contrast, there are diverse opinions among mainstream scholars and intensive debates within schools of thought on the economic, social and environmental issues surrounding mega-projects. Scholars are yet to resolve the debate on the theoretical positioning of mega-projects, therefore, it is wise to conclude, that mega-projects should be viewed as an exceptional developmental situation. Mega-projects should be judged according to the specific needs and requirements of the given country. Currently, dams may be required to play an increasingly significant role in light of debates on climate change, as they are considered a carbon-neutral electricity source (Agarwala, 2006; Agrawala *et al.*, 2003).

Almost all parties involved in the debate around dams have one objective, despite their ideological position and different viewpoints, which is a desire to improve human conditions. Nevertheless, different sides of the debate evidently contradict each other's perspective (Williams & Samset, 2010). The parting-point between the two parties in the dam debate appears to be epistemologically alike as it is deep empiricism, while applying deconstruction methods to dispute each other's viewpoints. Those in favour are less structuralism and those opposing appear extremely structuralised and rely on citing international agency, and local communities' experiences and opinions.

## 2.7 Conclusion

Mega dams and development are much-contested subjects, because of different perceptions around development and the preferred means of achieving it (Ansar *et al.*, 2014). This conflict shapes the main arguments in large-dam and development debates in the light of emerging political-economic, social and environmental challenges, particularly in the wake of climate change and the increasing demand for energy for economic development (Alexander, 2015). This chapter has set the scene of the literature context within which this study can be placed. Firstly, it reviewed debates around three philosophical approaches (realism, positivism and humanism), underlying much human geography research. Realism and humanism were selected as the main philosophical standpoints underlying this project.

Development theories and research approaches that have emerged from the 1950s to the present day were reviewed, and after an in-depth review of the economic, social, political and environmental impacts of dams, some research gaps were identified in the literature. As discussed in Section 2.3, traditional theories in particular have their shortcomings in addressing mega-dam issues as a development method (see Chapter 1 Section 1.2).

After much debate on development theories and further in-depth reviews of social conflict, socioeconomic and human development theories, mega-project association with environmental, social and political problems is clearly indicated in the literature review. In effect, these issues have become a pre-determined framework, which could suggest that the majority of mega-dam projects have had negative environmental and social impacts, and are largely driven by political motives

(Flyvbjerg, 2004; Flyvbjerg, 2009). This research aims to examine these alleged issues in relation to the Merowe Dam. Therefore, to achieve the stated aims and objectives a combination of socioeconomic, human development and social conflict approaches and theories, were used to address the complexities of development and dam-related issues. The discussion around socioeconomic and human development in Section 2.4 leads to the selection of both theories to address the socioeconomic changes that Merowe Dam may impose on the region. Socioeconomic development approach is chosen to help assess the influence Merowe Dam has on communities' status, both positively and negatively, due to the changes in society's status quo that it brings about (economically, socially, politically and environmentally).

Through reviewing the economic, social, political and environmental impacts of mega-projects in Section 2.6, and from an economic perspective, it becomes clear that issues related to mega-dams are highly contested. However, this research area believes mega-dams can have a positive impact economically, by improving socioeconomics through positive changes, leading to human development in areas such as harnessing renewable energy generation for industrial development and also via job creation. Mega-dams have greatly influenced societies in development contexts, as discussed in Section 2.6.

Lastly, reviewing the economic, social, political and environmental impacts of mega-dams has revealed the gaps in each area of study. The most noticeable gaps emerging from this literature are the ambiguity of mega-dams position within development theories' and the use of economic factor alone to study the variation and complexity of mega-project and dams in particular. As discussed in this chapter,

development through projects such as Merowe Dam are understood to bring changes to society, due to many forces and factors involved in their process. Emphasising only one aspect such as economics, cannot produce adequate conclusions nor provide clear understandings of development through mega-dams. As reviewed in Sections 2.4 and 2.6, mega-projects such as dams, drive socioeconomic development in many countries. Various factors are often studied separately to understand the changes mega-projects bring to society. However this research aims to address this changes by studying relevant factors together (economic, social, political and environmental) to gain a better understanding.

# Chapter 3 Research Methodology

## 3.1 Introduction

Chapters 1 and 2 provided a conceptual understanding of economic, social, political and environmental issues surrounding mag-projects. Many scholars accept the conceptual and theoretical debate concerning the actual and potential impact of mega-projects – especially dams – as a means of achieving socioeconomic and human development. However, few have attempted to support their argument by conducting detailed empirical studies of the role and influence of mega-dams at the micro-level of rural communities in developing economies. The aim of this research is to assess economic, social, political and environmental issues related to mega-projects in developing economies using Merowe Dam (located in northern Sudan) as a case study. This chapter sets out the methodology and analytical framework of the research. A mixed-method strategy of quantitative and qualitative methods was applied to a case study approach, providing the rationale for selecting Merowe Dam as a study site. Details of the specific data collection methods and analysis for this project are outlined in this chapter. Ethical matters for this research are also discussed, followed by conclusions. This chapter is organised as follows: Section 3.2 describes methodological approaches in social sciences, Section 3.3 presents the case study, Section 3.4 covers data collection methods and Section 3.5 discusses ethical issues.

## 3.2 Methodological approaches in social sciences

Methodological approaches in social sciences, including human geography, are classified into two groups: quantitative and qualitative methods (Bryman, 2008). Both approaches have advantages and disadvantages with practical and philosophical

differences (Hoggart *et al.*, 2002). David and Sutton (2004, p.43) suggest 'Real innovation in social research will come from those who seek to overcome the distinction, not merely to mechanically repeat the practices and beliefs of one side or the other.' To achieve the objectives of this project, a multi-method approach was applied for data collection.

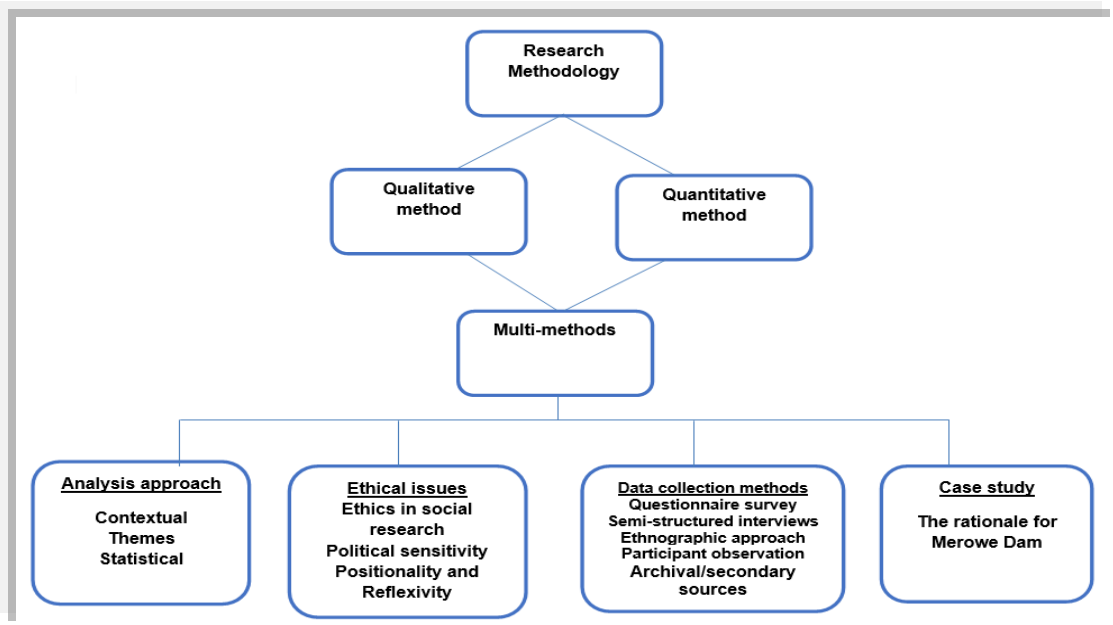



**Figure 3.1 The relation of research methodology**

Source: Author, 2017

A multi-method approach offered a clear benefits for this project for collecting and analysing data (Burns, 2000). This approach involves using the methods available to achieve reliable results and to identify the variation and differences that can lead to enriched explanations of the subject being studied. However, this approach can be time-consuming and costly. In addition, this approach achieves triangulation, which improves the reliability, credibility, and validity of the results. This method is especially useful in mega-project and development research, since the nature of dam projects is a mixture of applied scientific quantitative engineering theories and qualitative human activities (such as critical decision-making, which is subjective to

human behaviour) (Bryman, 2008). The two approaches are introduced in general, followed by the details of this multi-methods approach.

### 3.2.1 Quantitative approach

Bryman (2008, p.22) defines the quantitative approach as a research strategy: 'Quantification emphasises collection and analysis of data and that entails a deductive approach to the relationship between theory and research, in which the accent is placed on the testing of theories.'

Quantitative researchers predominantly use standardised methods of data collection and data analysis to reach generalisable findings about macro-patterns and social connection (David & Sutton, 2004). The methods used for quantitative data collection include surveys, questionnaires and experiments. Data collection through questionnaires is divided into three types (Parfitt 1997). First is basic information, which can classify people into simple categories. The second type is associated with the behaviour of people, which captured through interview and observation and recorded in the researcher's research diary. The third type is information about attitudes, ideas and the beliefs of people. Questionnaires may also be used for collecting qualitative data (Bryman, 2008). Quantitative data are generally presented in numerical form, often as percentages.

Neuman (1999), David and Sutton (2004), and Bryman (2008) have criticised the quantitative approach for its philosophical foundation and its inability to answer the why question. Furthermore, Bryman (2008) summarises some criticisms of the quantitative approach: first, the measurement process of quantitative research is

designed artificially and may be less accurate and often imposes pre-defined categories which restrict the discovery of new trends. Second, the ‘standardised’ research procedures omit the interaction and connection between research and everyday life. Third, the result often provide a static view of the social world, which downplays the dynamics of human life.

This study draws on the advantages of a quantitative approach: using questionnaires to collect both quantitative and qualitative data. It was employed to collect basic quantitative information about communities downstream (Hamdab and Amri) and upstream (Manasir) from the dam, such as age, education level, number of family members. To address the research objectives, a quantitative approach was used to collect information about economic performance post-Merowe Dam (e.g. employment, industrial development) and social, political and environmental issues related to Merowe Dam. These indicators were elaborated upon using qualitative methods, as described in the following sections.

### 3.2.2 Qualitative approach

The qualitative approach includes a range of methods that offers insight into how the world is viewed, experienced and constructed by social actors. They provide access to the motives, aspirations and power relationships that account for how places, people and events are made and represented (Smith, 2015).

A qualitative approach enables researchers to understand people’s attitudes and the actions and meanings behind their behaviours in real contexts. It can also offer understanding of the process and logic of social events and phenomena, which are

difficult to identify. Qualitative research often answers “why” questions (Bryman, 2008; Tate, 2000).

The qualitative approach includes a series of specific research methods, such as in-depth interviews, ethnography, participant observation and text analysis (Cook, 2005). Unlike the quantitative approach, which focuses on numbers, qualitative methods focus on meanings and human agency with a belief that human life has interconnected meanings that cannot be separated from their meaningful contexts (David and Sutton, 2004). Qualitative research relies on the experiences and wisdom of researchers, because it takes place in the dynamic space of interaction between researchers and target populations (Bryman, 2008; Tate, 2000). Several weaknesses in qualitative approaches have been identified, such as subjective findings and conclusions, often based on personal relationship between researchers and the people studied (Bryman, 2008). Another critique is that the scalability of the findings is often too limited to be generalised to wider scopes (David and Sutton, 2004; Bryman, 2008). Nevertheless, according to Bryman (2008, p.392):

> *‘…it is the quality of the theoretical inferences that are made out of qualitative data that is crucial to the assessment of generalisation” rather than statistical criteria’.*

Qualitative approaches were used in this study to explore underlining issues encountered by upstream (Hamdab, Amri and Manasir) and downstream (Hamdab West, Nouri and Al Degawit) communities throughout the development of Merowe Dam (Cook, 2005). Semi-structured interviews with selective actors involve or affected by the dam was used to help understand the feelings, opinions, and perceptions of people about Merowe Dam. These methods were applied to obtain clear descriptions of how the event unfolded by tracking any unexpected issues through interpretation of the events using difference actors’ views (Biggs & Matsaert,

1999). Historical data of project plan, feasibility study, environmental assessment, compensation and consultation records was also reviewed, which enriched both qualitative and quantitative data with information about the context and environment of Merowe Dam (Clark, 1997). Participant observation allowed the researcher to immerse himself in the environment, while engaging in daily activities with participants promoted discovery of meanings, conventions, behaviour, and the ways participants think. It is important to understand individuals' and groups' claims and counter claims (Hoggart *et al.*, 2002).

In addition to selecting the right methods for this research, it was also important to consider identifying the stakeholders most affected by Merowe Dam's construction. Stakeholder-mapping techniques were used to identify affected stakeholders in the area (Hemmati, 2002). The primary stakeholders are those directly affected by the dam down- and upstream. Those who lived and still living in the area north and south of the dam, where the most affected stakeholders (i.e. resettlement Amri 2 and 3 at new settlements, Hamdab West, Al-Degawit and Nouri downstream, the Al-Kab and Omdwima in the reservoir area upstream). Other primary stakeholders do not live in the area, but are still affected through the loss of businesses or farms, for instance. Secondary stakeholders are those with high stakes in the project, but are indirectly affected by the dam, such as the government and investors (Van de Kerkhof & Wieczorek, 2005). Secondary stakeholders include NGOs, civil society, environmentalists, academics, residents who live near the dam and others who are affected by the dam's polluted waterways and those whose livelihoods are affected, such as fishermen and farmers (Hemmati, 2002). Table 3.1 below shows the

differences between methods used in this research contributing to a rounded picture of the impact of Merowe Dam on communities.

**Table 3.1 Summary of differences between qualitative and quantitative method**

| | Qualitative research | Quantitative research |
|---|---|---|
| **Knowledge type** | Subjective | Objective |
| **Objective** | Exploratory and observational | Generalisation and testing |
| **Features** | Flexible | Fixed and controlled |
| | Contextual portrayal | Independent and dependent variables |
| | Dynamic, continuous view of change | Pre- and post-measurement of change |
| **Sampling** | Purposeful | Random |
| **Data collection** | Semi-structured or unstructured | Structured |
| **Type of data** | Narratives, quotations, descriptions | Numbers, statistics |
| | Value uniqueness, particularity | Replication |
| **Analysis** | Thematic | Statistical |

Source: (Bryman, 2008; Flowerdew & Martin, 2005; Hoggart *et al.*, 2002)

### 3.2.3 Multi-methods approach

As discussed above, quantitative and qualitative approaches are distinct from one another. Most social research will involve both quantity (e.g. measurements) and quality (e.g. classification) (David and Sutton, 2004). It is unreasonable to rely on a single approach so, in social sciences, multi-method approaches have been developed that combine both quantitative and qualitative methods (Neuman, 1999; Hoggart *et al.*, 2002; David and Sutton, 2004; Bryman, 2008). Multi-method approaches are common in the study of economic, social, political and environmental issues of mega-dams and can be detected in different disciplines where mega-dams have been studied across continents (Alexander, 2015; Shirley & Kammen, 2015). These studies include the Hoover Dam of the USA, Mao's Three Gorges Dam in China, AHD in Egypt, West Seti Dam in Nepal, India's Sardar Sarovar, and the Belo Monte Dam in Brazil (Agrawala *et al.*, 2003; Alexander, 2015; Altshuler & Luberoff, 2003; Ansar *et al.*, 2014; Bank, 2001 ; Flyvbjerg, 2009; Fournet, 2015; Khan, 2008).

These studies use the methods – to enhance the quality of data and explanatory power of their research finding. A clear advantage of a multi-methods approach is triangulation, where quantitative and qualitative approaches are integrated to triangulate findings for mutual validation (Bryman, 2008). For example, it is common to use observations or interviews to triangulate the findings from questionnaires (David and Sutton, 2004). Consequently, the multi-methods approach can significantly improve validity. Apart from triangulation, Hammersley (1996) proposed another two merits: facilitation and complementarity. As explained by Bryman (2008), facilitation refers to using one method to enable the other. For instance, researchers use findings from questionnaire surveys to deepen the scope of in-depth interviews. Complementarity means both quantitative and qualitative methods are actively used to support various aspects of the research project. Encouraged by these advantages, this project applied a multi-methods approach to achieve the research objectives. Therefore, both quantitative and qualitative data were collected according to different research questions, and these two types of data were then triangulated to complement each other and deepen the enquiry and reinforce validity (May, 2001).

Specifically, in the case of this research, quantitative data included rural demography, occupation, basic information, land size, energy, agricultural inputs and employment. These data were collected through questionnaires and the findings helped to guide the collection of other forms of qualitative data. Qualitative data was collected from different actors, such as decision makers, government officials, civil societies, NGOs, academics, local farmers, committees and officials. Data on sociocultural factors, such as relationship and community values, were collected through observation and interview (e.g. why do people oppose the dam? Why did some displaced people

decide to relocate, while others stayed or refused to relocate?). This study starts from the assumption that more than macro-level forces influence mega-projects, such as human agency (society) at the micro-level of communities (Long & Van der Ploeg, 1994).

### 3.3 Analytical framework

Designing a comprehensive analytical framework for a qualitative study is as important as for quantitative research (Flowerdew & Martin, 2005). A well-defined analytical framework provides unbiased and reliable results. This framework is define as the indicators that used to evaluate the Merowe Dam impact including statistical and contextual analysis. A combination of defines parameters of evaluation and assists in structuring the results in a systematic way. This combination allowed the researcher to gain insight into a complex issue and learn more about the contextual factors that govern individual experiences and shapes perceptions of Merowe Dam (Hoggart *et al.*, 2002).

Contextual data analysis is a process that seeks to reduce and clarify vast amounts of information from different sources to provide explanation or interpretation (Bryman, 2008). The information may consist of interview transcripts, documents, blogs, surveys, pictures, videos, etc. This research employed contextual analysis for interviews and observations of social (e.g. displacement, resettlement, compensation, loss of livelihood) and political aspects (e.g. decision-making process throughout the live cycle of the dam). The research used statistical software (SPSS V-24) to analyse descriptive and inferential statistics and conduct tests of association among economic, social, political and environmental attributes obtained from interviews,

observations and secondary resource documents. A large thrust was provided on the analysis of the qualitative traits of the research which provided depth and breadth of information across a range of actors and participants on intangible issues such as feelings, meaning and underlying contexts to better explain the 'why' and 'what' questions. Ranges of nonparametric analytical methods were used. Kruskal-Wallis tests were used to compare and contrast mean values of the responses obtained, mainly from questions applying Likert scale of ranks. Cross-tabulation and Chi-square analyses tested the associations between qualitative attributes and the location of the respondents (upstream-relocated, downstream and upstream-resident). Spearman's rank correlation was also used to assess the level of association between variables. These analyses established associations, relationships and degrees of effect of Merowe Dam on economic, social, political and environmental indicators in the selected three districts. The selection of these indicators was based on a literature review and specific to the Sudanese context. Statistical analysis of the questionnaire data was triangulated with interviews and independent and governmental sources to evaluate Merowe Dam's contribution. This statistical analysis was conducted based on key indicators, such as electricity generation, industrial development, agriculture, satisfaction with new houses, compensation, services, health, farming and non-farming economic output.

Contextual data analysis considers the spoken word, context, consistency and contradictions of views, frequency and intensity of comments, and evolving themes and trends (Flowerdew & Martin, 2005). McDowell (2002) emphasises two aspects of analytical framework and both were explored in this research: firstly, the analysis phase includes assessment of the overall data; the second aspect is attending to

both the general view and specific trends, actions and themes (Flowerdew & Martin, 2005). For a full analytical context of this research, the initial step was identifying the units of analysis. This identification required a response to the question of whom Merowe Dam has influenced and what are the areas of impact (Flowerdew & Martin, 2005).

In this research, there were four areas of impact: economic, social, political and environmental. Each area can be sub-divided and analysed in its own right. The analysis of these four areas of impact depends on their characteristics and indicators, which determine the analytical framework adopted. In the Merowe Dam case study, the interest remains on how to process the analysis and reconcile these areas of impact by communities where the project was developed. Consequently, the unit of analysis in this study was focused on the three districts of affected communities by the dam in the region. These three region were selected due their differences in characteristic, nature and degree of impact. Therefore, the result can be contrast amongst them to understand the level of impact in each district. This research has considered the smaller unit of experts to add relevance and significance insight for the overall analytical process (Hoggart *et al.*, 2002).

To reach a valid and credible result, this research has drawn upon predefined and exploratory perspective frameworks of contextual qualitative data analysis (Neuman & Kreuger, 2003). The predefined frames reflected on aims, objectives and themes identified through the literature, such as displacement, environmental matters and political bias. These issues were tested against the data collected from interviews, questionnaires and observation (see Appendix A, C and D).

The exploratory approach encourages consideration and coding of all data, allowing new impressions to shape new interpretation in different and unexpected directions. This approach is referred to as thematic analysis, which involves reading and re-reading the material, while making notes and writing summaries of each transcript to be analysed (Robinson, 1998). The aim is to reduce the information to key themes and topics that can shed light on the research question, by coding words or phrases that capture the core elements of the data to support organisation and interpretation (Flowerdew & Martin, 2005).

## 3.4 Case study

### 3.4.1 Case study approach

Case study is an important approach in social research. Yin (2003: p35) defines case study research as:

*'An empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.'*

Some scholars have suggested that case study can be applied to any type of research, whether quantitative, qualitative or multi-methods (David & Sutton, 2004; Stake, 2000; Yin, 2003). Yin (2003: p35) further comments that the case study 'comprises an all-encompassing method — covering the logic of the design, data collection techniques, and specific approaches to data analyses.'

A case study can be used in many types of research, including any explicit 'unit' of analysis, such as individuals, organisations, events, social phenomena or a period of time (David and Sutton, 2004). Moreover, 'case study' can be applied in a geographical scope such as country, region, district, local community or an even

smaller group (Yin, 2003). This research draws upon a geographically defined case study to examine the influence of Merowe Dam on the inhabitants of the area (economically, socially, politically and environmentally).

A case study approach was selected for its utility in any type of research. The case study approach allows researchers to achieve an inclusive and meaningful insight into life events, such as individual life cycles, organisational and managerial processes, social and economic changes (Yin 2003). When a case study is combined with an in-depth survey, the result is not only descriptive, but reveals unknown effects and reasons. A case study is suitable for research that seeks to answer 'how' and 'why' questions (Stake, 2000; Yin, 2003).

There are still challenges to the case study approach and the clear one is generalisability *(Yin, 2003).* This goal is dependent on the nature of generalisation intended. To ease the dilemma of generalisation, Yin (2003) suggests that case study research is appropriate for theoretical propositions rather than populations or universalisation. In these cases, Yin (2002) elaborates that a case study corresponds with the experiment and does not embody a sample. By adopting a case study, the aim is to expand and generalise theories (analytical generalisation) and not to count occurrences (statistical generalisation). A case study may be conducted in a collective manner, in which researchers jointly study several cases to examine a specific issue. Besides that, a case study is characterised by the type of analysis (e.g. descriptive, explanatory or exploratory case studies) (Gray, 2009; Stake, 2000; Yin, 2003). In human geography, a geographical case study is widely used to outline the space in countries, regions, communities, etc. It is relevant to study human

movement and economic and developmental issues, especially in an era of multidisciplinary studies (Hoggart *et al.*, 2002; Rigg, 2007; Stake, 2000; Yin, 2003).

The development of a case study often follows five stages: development of research questions, research proposals, deciding units of analysis, linking data to proposals, and criteria for interpreting the findings (Yin, 2003). Unit of analysis or case selection is one of the distinctive features of the case study. Stake (2000) and Yin (2003) have discussed the selection criteria for case study extensively. Yin (2009) elaborates on his argument by suggesting that the unit of analysis is the case, which rests upon the initial research questions. For this research project, the regional community has been set as the case based on the nature of the research questions, which focus on the 'how' and 'why' aspects of Merowe Dam in a development context in contemporary Sudan.

For over half a century, Sudanese and other social scientists have attempted to investigate Sudan's developmental transformation through different types of case study (Choplin & Franck, 2016). From a methodological viewpoint, a focused case study, with its in-depth investigation and interpretation, is a powerful tool to understand the complexity of development in Sudan, regionally and nationally, in an era of political and economic change (Choplin & Franck, 2016; Rigg, 2007).

The Merowe Dam has hugely impacted communities economically, socially and environmentally. It has also generated complex implications for various stakeholder groups, with some benefiting and some negatively affected (Verhoeven, 2011). Little research has been conducted on Sudanese mega-projects and it is important to

understand the dynamics in a country in transition ravaged by political and economic uncertainty and war (Verhoeven, 2011).

The rationale of using Merowe Dam as a case study is to provide a specific and in-depth investigation of Hamdab, Amri and Manasir communities and the ways Merowe Dam affected these communities downstream and upstream. The project is tested against social conflict and socioeconomic and human development approaches theories. Using a case study enabled this research to isolate Amri 2, and Amri 3, Hamdab West, Al-Degawit, Nouri, Al-Kab and Omdwima communities from the wider regional population. Why these communities were chosen is detailed below in Section 3.4.2. Applying contextual and thematic analysis can show how Merowe Dam affected the above communities economically, socially, politically and environmentally. Therefore, this case study of specific communities can become a powerful and focused tool for understanding the influence of mega-dams on host communities.

### 3.4.2 The rationale for selecting Merowe Dam case study site

According to Yin (2003), an illustrative or a typical case must be selected for case study. There are philosophies to follow when selecting the right case. As Stake (2000) suggests, variety is appropriate, and a prospect to learn is extremely importance. For regional mega-dam studies, in relation to socioeconomic changes in developing economies, Rigg (2007) and Rostow (1990) have noted the difficulty in finding a typical region. However, Rigg (2007) suggests lessons can be learnt from one case and applied to a wider context.

Concerning the current objectives and research questions, the Merowe region was selected for being a meeting point for different forces and processes (economic, social, state power, environmental and cultural changes) (Rigg, 2007). Secondary criteria include representativeness of historical events in the region, upcoming project activities, and multiple landscapes (see Chapter 4). Other reasons why Merowe Dam was chosen as the study site:

- The dramatic changes in government policies towards international investment in mega-projects.
- The historical context of influential mega-dams in this area, from the Aswan High Dam to the recent Merowe Dam.
- The dam has huge social and environmental impacts and stimulates major ideological, economic and political debate in the regional and global contexts.
- The project was one of the largest mega-projects in the Nile based countries (McDonald, Bosshard & Brewer, 2009).
- The project was at the centre of a political and economic war between countries from upstream to downstream – Ethiopian and Egypt – especially with the recent development of the Grand Ethiopian Renaissance Dam.
- The impact the dam had on water flow downstream, which made this case study very compelling.

The impact of Aswan High Dam (AHD) on the Nubians communities in northern Sudan is a point of intensive debate some critics believes Sudan has not benefited from the dam (McDonald, Bosshard & Brewer, 2009; Wallach, 1988). This research also examined whether lessons were learned from past projects especially in relation to relocation within the region, compensation and consultation process. Historical change has been identified in North Sudan since the AHD and the continuity of these changes socially, economically and politically around the region following a government announcement of plans to develop Merowe Dam and fulfil the country's new energy and economic strategy.

The fundamental idea behind Merowe Dam as a case study is that the area is a unit within the wider context of North Sudan with unique features of economic, social and

cultural borders (Rigg, 2007). The Sudanese rural villages and region have always been a link between the economic, sociocultural and political states nationwide (Rigg, 2007).

In urban and rural geography, case studies at the community level have been used extensively by researchers to study both micro-level and macro-level problems (Robinson, 1998).

### 3.4.3 The rationale for selecting the Amri 2 and 3, Hamdab West, Al-Degawit, Nouri, Al-Kab and Omdwima communities

It is important to recognise the huge impacts that the Merowe Dam has had on upstream and downstream communities, while not ignoring the economic and social benefits it has brought these communities and the wider nation (Agrawala *et al*, 2003; Ersumer, 1999; Shirley, 2015; and Varma, 2003) (see Figure 3.2).

The entire Merowe region was isolated. Communities lived in small farming villages near the banks of the Nile and on islands (Barbour, 1966). Between 30,000 to 50,000, people were affected by the construction of Merowe Dam and its reservoir from 2006 to 2009. This fallout from the dam mainly impacted the Manasir, Hamdab, and Amri communities (through displacement, and loss of culture, livelihoods and palm date trees).

These communities were selected to assess the impact the dam has had on them economically, socially, politically and environmentally. Another aim is to understand the resistance of the Manasir communities towards relocating and whether there are any land rights or social conflicts within relocated groups in new settlements

(Verhoeven, 2011) (see Chapter 4 and 6). The condition of the soil at the new locations' upper terraces is less favourable than those of the soil near the River Nile (Bosshard, 2007). To compensate for what people had lost, larger land parcels were given to them and water for irrigation was provided freely at the new settlement (Bosshard, 2007). It is important to assess the impact on farming at both new and old settlements. Commonly, researchers study the impact of dams on upstream communities and the displacement of people by the reservoir (Jalon *et al.*, 1994; Lessard & Hayes, 2003); this research also investigates downstream communities to study the changes that the new water regime has brought to the Hamdab West, Al Degawit and Nouri communities and how this has influenced farming and the size of land cultivated. This research explores whether there was an increase in irrigation cost associated with a decreased water level. Downstream communities are often impacted due to changes on water flow variation, which affects farm production, fishing communities and ecosystems (Jalon (1994) Lessard (2003)). This focus suggests not only environmental impacts but economic and socioeconomic impacts as well (Power, Dietrich & Finlay, 1996). The selection of the above communities helped this research to identify and assess the socioeconomic change the dam has brought. As Welzel *et al.,* (2003) suggests, any change in the status quo of these upstream and downstream communities, socially or economically, may have profound implications for people's livelihoods, which then reflects on their socioeconomic and human development. Social changes were apparent in the selected communities through diminishing people's relationships, positions, and status because of the relocation. Economic changes included losing sources of income (farms of date palm trees, arable crops, vegetable) which reflects on their socioeconomic and political status. All these factors may become a cause of social

and power conflict between all parties, including the government, based on land claims or access to resources (Jia 2011, Coser 1957 and Gellert 2003). Comparison is made between the communities upstream and downstream on gains and losses.

### 3.5 Data collection techniques

This section discusses specific data collection methods for this thesis. Questionnaires, interviews, participant observation and analysis of secondary data sources were used. These data collection methods introduced different types of data from different sources. The complexity of this research was a key factor for applying various methods to capture of the full picture of thought and information from different stakeholders. These approaches complement each other in reaching reliable and credible results by using diverse sources of data. These methods are introduced in the following sections.

#### 3.5.1 Questionnaire survey

Questionnaire surveys are used as a tool for data collection in social research. Through questionnaire surveys, people are invited to answer or respond to the same structured questions in a controlled order (Gray, 2009). Questionnaires essentially collect three forms of data: data which categorises participants, their conditions and their location; data that reflects participants' behaviour; and data that relates to attitudes, feelings, principles and beliefs (Parfitt 1997).

The value of questionnaire surveys for data collection is clear (Neuman & Kreuger, 2003). Through questionnaires, basic information is collected from every respondent in a normative form, which is important for achieving research objectives. Questionnaires were used to collect data that reflect the nature of Merowe Dam's

impact on upstream and downstream communities based on their location and characteristics. Compared with other research tools, questionnaire surveys have particular advantages and disadvantages, as shown below:

**Table 3 2 Advantages and Disadvantages of Questionnaires**

| Advantages | Disadvantages |
|---|---|
| •Low cost in terms of both time and money. | •Researchers cannot prompt the interviewees. |
| •The inflow of data is quick and from many people. | •Researchers cannot probe the questions. |
| •Respondents can complete the questionnaire at a time and place that suits them. | •Researchers cannot ask many questions that are not salient to respondents. |
| •Data analysis of closed questions is relatively simple, and questions can be coded quickly. | •Don't know who answers the questions. |
| | •Cannot collect additional data. |
| •Respondents' anonymity can be assured and no risk of interviewer bias. | •Not appropriate for some kind of respondents. |

Source: Adapted from Gilham, 2000, and Bryman, 2008.

The questionnaires for this research predominantly contain economic, social, political and environment questions, including:

- Demographic characteristics of the Nile upstream and downstream, displaced and non-displaces communities' respondents and their household members
- Property and land lost due to the project
- Compensation received in relation to losses
- Number of households affected by the project
- Loss of productivity and increase in cost of irrigation for the downstream farmers (see Appendix A)

There are qualitative advantages to using open-ended questions in questionnaires. They provide a chance for participants to offer the research in-depth and extensive answers to understand how events unfolded and affected the communities. Before the formal survey, a trial survey was conducted (Robson, 2011b). Experimental surveys can detect whether the selected methodological tool is appropriate (Straits and Singleton 2011). A pilot survey was conducted, in which respondents understood the entire survey and the questions reliably secured relevant and necessary

information (Robson, 2011b; Straits & Singleton, 2011). This pilot survey was excluded in May 2017 from the main survey. This research employed 20 pilots in target participant communities in the Merowe region where the dam is based. These pilots evidenced that the questionnaires fit the social reality of the case study, but showed some participants were confused by the classifications of study areas on the questionnaire. Based on this, questions that related to each area of study on the questionnaire were categorised.

**Questionnaire survey**

Questionnaire surveys are usually categorised into different types, such as paper and pencil questionnaires, internet questionnaires, face-to-face interviews and telephone interviews (Robinson, 1998; Straits & Singleton, 2011). The purpose of interview-based questionnaires is to provide all interviewees with identical context: each interviewee experiences similar interview stimuli (Gray, 2009). The purpose of this sort of interview is to aggregate the respondents' answers (Bryman 2008). Face-to-face surveys have a high response rate (Straits & Singleton, 2011), and are more realistic when the research was confined to a particular geographic area (Robson, 2011b). Face-to-face interviews have a further advantage in that both open and closed questions can be asked (Robson 2011). The interviews were not time-limited, so more difficult questions could be added. Internet surveys were not possible due to low internet literacy and accessibility in Merowe (Straits and Singleton, 2011).

There are limitations to face-to-face questionnaires, such as interviewers affecting interviewees' responses (Bryman, 2008). Factors such as the age, social background, gender, previous experience of interviewers can affect interview outcomes (David and Sutton, 2004).

**Table 3 3 Summary list of local communities selected for questionnaires**

| Village Name | Participation Methods | Possible dam impact | Village Locality | Participants number |
|---|---|---|---|---|
| **Downstream** | | | | |
| **Hamdab West** | Questionnaires | Socio-economic | Northern State | 33 |
| **Al-Degawit** | Questionnaires | Socio-economic | Northern State | 33 |
| **Nouri** | Questionnaires | Socio-economic | Northern State | 34 |
| **Upstream-resident** | | | | |
| **Al-Kab** | Questionnaires | Socio-economic | Reservoir area | 50 |
| **Omdwima** | Questionnaires | Socio-economic | Reservoir area | 50 |
| **Upstream-relocation** | | | | |
| **New Amri 2** | Questionnaires | Socio-economic | Relocated | 50 |
| **New Amri 3** | Questionnaires | Socio-economic | Relocated | 50 |

Source: Author 2017

However, in this research there no any negatives effect as face-to-face interviews were more suitable than any other sort of questionnaire survey. The education level of participants' in the rural areas of Merowe was low and many of them are uneducated, so it would have been inappropriate to distribute questionnaires. Participants in rural Merowe cannot be reached by email or telephone. Therefore, it was critical for the questionnaires to be completed in the presence of the researcher alongside an interviewee.

Questions covering four areas of impact (economic, social, political and environment) were developed. The research team which encompasse the first, second supervisors and the researcher agreed that questionnaires would be used based on the location and characteristics of the relocated communities in New Amri 2 and Amri 3, the reservoir areas upstream, Al-Kab, Omdwima and from downstream of the Nile Hamdab West, Al-Degawit and Nouri (see appendix A). These communities differ in characteristics and the degree of impact the dam exerted on them. This variability enabled the research to contrast downstream and upstream communities' experiences of Merowe Dam. The researcher and four research assistants (one female and three male) administered the questionnaires over period of 2-month

working afternoon and evening hours. This distribution is due to the nature of the society in which females may not openly interact with unknown males. Questionnaires were delivered to every second household in the seven communities, depending on the community size. This system was used to avoid any basis this way ensured the selection was random and represent the diversity of the participants. The questionnaires were mainly administered during the afternoon and evening to ensure that as many family members were available to proceed with the questionnaire or to arrange a second visit when family members would be available. Once developed, the questionnaires were agreed by the research supervisors and the University of Plymouth Faculty of Science and Engineering Research Ethics Committee.

Computer analysis of the questionnaire data was conducted using SPSS software to establish themes among and variability between districts, which guided the semi-structured interviews (Flowerdew & Martin, 2005). A detailed analysis of the questionnaire data (quantitative and qualitative) and an initial descriptive and analytical interpretation of the results was conducted. The analytical approach used in this research focused on explanations and causality to explore the difficult 'why' questions (Bryman, 2008; Flowerdew & Martin, 2005).

### 3.5.2 Questionnaire sampling

Sampling is an important feature of social science research, in which people, places and events are understood based on evidence from sampled participants, rather than all cases (Robson, 2011b). A sample is a segment of a population, which produces data which is extrapolated to all cases (Bryman, 2008; Robson, 2011). Parfitt (1997:

p67) outlines the importance of the three characteristics of the target population: *'a geographical boundary, a temporal boundary and a boundary defined by population characteristics'.*

The Merowe Dam's development was organised by the government's development body (Dam Implementation Unit), and international lenders and donors, rather than the society, whose input in project decision making was limited.

For the questionnaire survey, interviewing each household and expert would have been costly for time and resources. An appropriate sample was used to deliver this research in practice. Sampling is divided into two forms: probability sampling and non-probability sampling (Parfitt, 1997; Bryman, 2008; Robson, 2011).

**Table 3 4 Probability Sampling**

| **Simple random sampling** |
|---|
| By using random sampling, every entity of the population respectively has the same probability of inclusion in the sample. All the participants' of the population are listed and given a number for random selection. |
| **Systematic sampling** |
| Systematic sampling counts upon a probability sample from a sampling frame. The initial point should be random selection through numbering the starting segment of the list and selecting a number using the random number originator on a calculator. The sampling interval is then added to the number of the randomly selected member to identify sample number two. The procedure is recurring until the required sample has been drawn. |
| **Stratified sampling** |
| The population is assembled into homogeneous groups while their size is known and which must be equally special. A random sampling can be taken in each division, either proportionately or disproportionately. |
| **Cluster sampling** |
| Cluster sampling is a process in which the researcher selects the research units progressively, starting with clusters and then reduces it to smaller groups within them before the concluding sampling units are considered. This method is used mainly when a sampling frame is either unsuitable or not available. |

Source: Adapted from Parfitt, 1997:96, 97; Sarantakos, 2005:160,161.

In probability sampling, the sample can be accepted as representative of the population. In non-probability sampling, statistical implications are barely made, but

specific outcomes from the sample may be significant (Parfitt, 1997). Probability sampling requires a frame for sampling, a list of all participants of the population. Each method has different sub-methods, which are outlined in Tables 3.4 and 3.5 (Parfitt, 1997):

**Table 3 5 Non-Probability Sampling**

| **Quota sampling** |
|---|
| In quota sampling, the researcher decided a quota of the sample to be chosen from particular population groups, decides the criteria of selection and the size. |
| **Convenience sampling** |
| This sampling includes selecting the closest and most convenient individuals as respondents. This procedure is repeated until the required sample size has been reached. This technique is commonly used but less satisfactory. |
| **Purposive sampling** |
| The researcher decides on subjects based on their own judgments. The sample is selected to content the researcher's specific requirements. |
| **Snowball sampling** |
| With snowball sampling, the research started by a few participants from the population and then asks them to endorse more other participants in the population. This is useful when it is difficult to identifying members of the population. |

Source: Adapted from Sarantakos, 2005: 164,165; Robson, 2011:274,275.

Systematic random sampling was selected for this research because it spreads the sample more evenly over the population and is easier to conduct than a simple random sample (Bryman, 2008). This approach was used to collect empirical evidence to establish the baseline required to assess the impact and to crosscheck facts (Flowerdew & Martin, 2005). Systematic random sampling of 10% was selected for the approximately 3000 household, which represent the 30,000 people affected by the dam upstream and downstream. The 3000 household where based on the average of 10 people in a family. It is a custom in Sudan and Northern Sudan extended family member prefer to live in one compound. The communities were chosen purposively, then villages selected randomly, and households within each village randomly selected. The selection was from upstream and downstream

communities and Figure 3.2 shows the study areas. This sampling technique was not used for selecting interviewees only used for questionnaire sampling.

Between May and September 2017, 300 questionnaires were completed in three districts (seven communities) upstream and downstream. A total of 100 questionnaires was allocated for head of the household in each district, with a goal of equal gender representation.

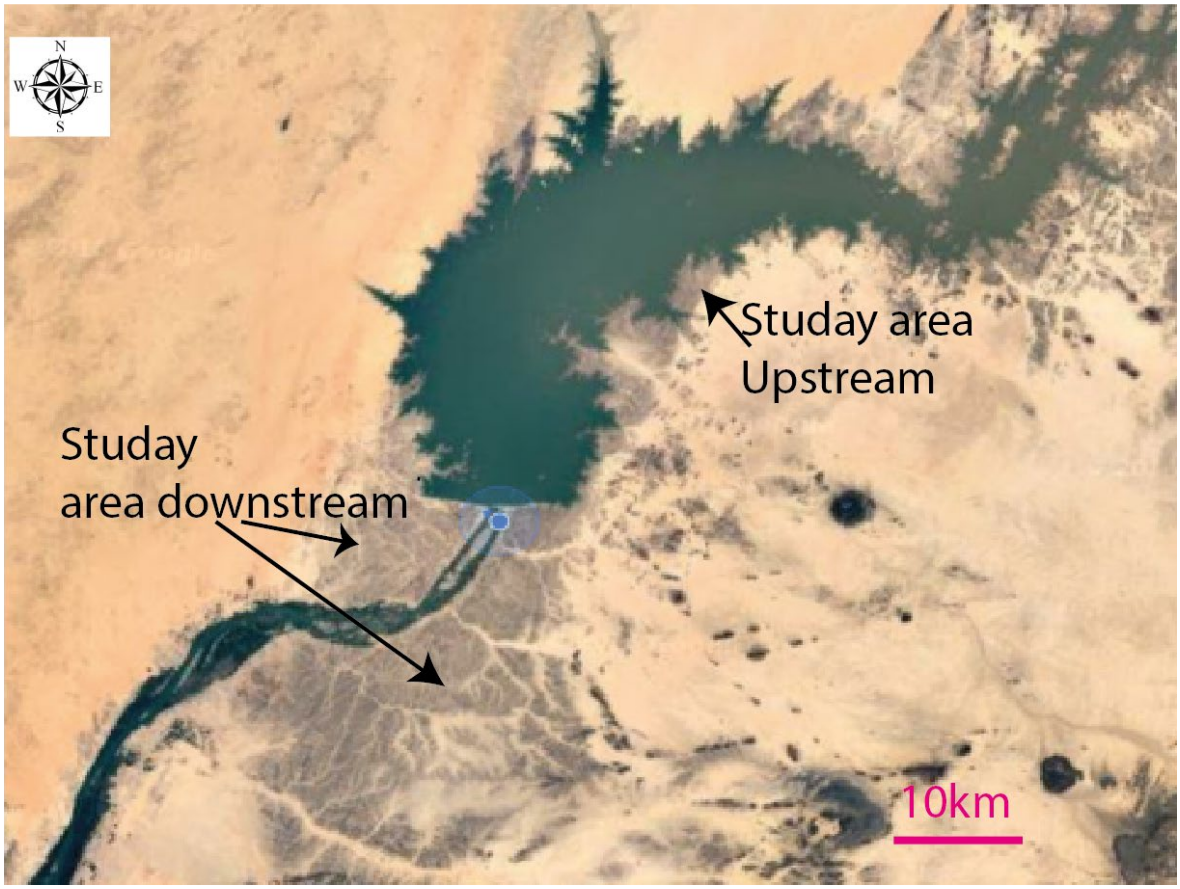



**Figure 3. 2 The areas of communities featured in the study**

Source: Google earth http://mapcarta.com/26375744

Females in rural Sudan play an important role within rural farming communities economically and socially (Bosshard, 2007). Achieving equal representation of women was challenging due to cultural issues: women are not head of the household

and do not openly engage in public affairs in this area. The research recruited some female participants, but not equal in number to male participants.

A total of 300 participants were selected using systematic random sampling to ensure comprehensive coverage of all parts of the communities and to avoid geographical, political and socioeconomic biases (Parfitt, 1997). This sample size was statistically sound and a robust formula was used to calculate the equivalent number of households across seven primary sampling villages (see Figure 3.3). The 300 participants were randomly selected based on a grid system, in which each area of study was divided into four groups and samples selected randomly. Each group consisted of four cells arranged in a standard geometrical pattern (Flowerdew & Martin, 2005). Random samples were selected from these cells to obtain coordinate references to determine the impact of Merowe dam on participants. The researcher, with the support of four research assistants (one female and three males) administrated the questionnaires.

### 3.5.3 Sampling Design

The total population is around 30,000 in three districts affected by the dam. This population total was divided into 10,000 for each district, made up of seven villages (three from downstream, two from upstream-resident and two from upstream-relocated). This distribution was used due to lake of official census it was only based on estimation and in order to avoid miss representation the researcher decided to use an even distribution 10,000 for district. The local committee members who deals with Merowe Dam matter indicates that the district population is about 10,000 each.

The sample size (n) of household units in the study area is determined by applying the following formula (Ahmed *et al.*, 2013; Arkin & Colton, 1963):

**Figure 3 3 sample calculation formula**

$$n = \frac{Nz^2 p(1-p)}{Nd^2 + z^2 p(1-p)} .....(3.3.1)$$

Where $n$ = sample size
$N$ = total number of households (1000 per-community)
$z$ = confidence level (at 95% level z = 1.96)
$p$ = estimated population proportion (0.5, this maximizes the sample size)
$d$ = error limit of 6% (0.06)

The above sampling formula (figure 3.3) was used with the values specified to maximize the yield of the total required samples. This approach is used in many studies of mega-projects by researchers and studies, such as the International Food Policy Research Institute (IFPRI) in their research on the Bangladesh Integrated Household Survey (BIHS) (Ahmed *et al.*, 2013; Agrawala, 2003; Allan, 2003). Snowballing or other methods are unsuitable for this research. The 300 sample was decided using mathematical methods formula shows in figure 3.3. Based on the formula the sample calculation is 264.4 but to gain better representation it was completed to 300 samples.

### 3.5.4 Semi-structured interviews

The researcher conducted semi-structured interviews after the questionnaire data collection and initial analysis. Interview topics included recollection of events, thoughts and facts on the economic, social, political and environmental impact of internal and external actors and norms (Bryman, 2008; Flowerdew & Martin, 2005).

This group of actors will include experts in the field of economy, sociology, environment, and politics also politician, policy-makers, government official, academic civil society members, leaders of displaced people and NGOs. The purpose of the interviews was to complement the responses of participants from the seven communities subject to questionnaires (see appendix A). At least 32 individuals were interviewed in Khartoum, or in relocated or original villages, using purposive sampling. Among the interviewee were the two ministers of Water Resources and Electricity and other high profile academics, political analysts, and representatives of the displaced and civil society.

The researcher selected participants using specific requirements, such as their involvement and interest in Merowe Dam, to complement the findings of the questionnaire survey. For example, NGOs and academics provided contrast to the government's claims on economic, social, and environmental impacts. Interviewing community leaders provided insight into their communities' perspectives on the dam, which was difficult to obtain through questionnaire survey. As shown in Table 3.7, expert opinion provided in-depth, unbiased, objective and contrasting viewpoints on the dam's economic, social, political and environmental impacts from different perspectives. Interviews are a means of contrasting, supporting or correcting data from questionnaire respondents (Hoggart, 2002). Such options are important and not available in other forms of data collection, such as questionnaires. Moreover, it complements the questions used in the questionnaire, so semi-structured interviews were used to raise some of the main research issues, such as the economic and social influences of Merowe Dam, in an in-depth and structured way (see appendix C and D).

These issues included analysis of the general perceptions of large dams as a development strategy, their problems and benefits. This analysis included the contributions and relevance of the Merowe Dam in regional and national development, and Sudan's overall development interests since its construction.

**Table 3 6 Summary list of institutional actors interviewed**

| Type of actors | Organisation types | Organisation Main Activities | Numbers of interviewees |
|---|---|---|---|
| Officials | Government | Policies development and implementation<br>Electricity generation<br>Economic, social and environmental policy development. | 9 |
| Academic/NGOS | Education and society welfare | Research, economic, social, political and environmental policy advocacy | 15 |
| Committees leaders | Civil society | Community wellbeing, relocation and compensation issue | 6 |
| Business-men | Private | Dam impact on the local market in term of business expansion | 2 |

Source: Author 2017

Interviews can be categorised into three groups: structured, semi-structured and unstructured (Sarantakos, 2005; Valentine, 1997). Interviewing key stockholders was important, given the complex debate on mega-dams' role in development. Due to their knowledge and experiences on specific actors involved in the project, they have direct access to vital information about the Merowe Dam (Nyamu, 2002). The aim of the semi-structured interview was to understand the respondents' viewpoints rather than generalise about behaviour. Semi-structured interviews contain elements of both structured questions and unstructured discussion/conversation. The extent to which interviews are structured depends on research topics and objectives (Robson,

2011b). Semi-structured interviews are commonly applied in flexible and mixed-method research (Neuman & Kreuger, 2003; Sarantakos, 2005; Valentine, 1997).

Interviews as a method of data collection are used frequently within the social research. One advantages is that interviews are sensitive and person-centred: they offer interviewees freedom to think and express their opinions (Valentine, 1997). Semi-structured interviews were used to understand how interviewees made sense of Merowe Dam, rather than drawing generalisations. In-depth interviews can incorporate multiple methods and are a worthwhile technique to triangulate data (Valentine, 1997). However, semi-structured or in-depth interviews are not free of problems. With interviewer bias, participants might offer the answers that they think the interviewer wants (Valentine, 1997). To produce a reliable and effective in-depth interview, confidential, trusting and honest relationships between the researcher and interviewees should be in the heart of the process (Bryman, 2008). Semi-structured interviews often adopt purposive sampling techniques; as presented in Table 3.6, the sample was directly selected by the researcher to satisfy specific objectives (Valentine, 1997).

To improve response rates, both questionnaires and interviews were conducted face-to-face. Demographic information about the population ensured the results were representative (Czaja & Blair, 2005). The researcher performed computer analysis on the questionnaire data, but interview transcripts were coded and analysed manually. Base on Flowerdew & Martin (2005) idea the researcher developed logical and critical framework to analysis qualitative interview data: first is to read and annotate the transcripts. Secondly, preliminary descriptive categories were identified from the

transcripts, and compared to theoretical and conceptual frameworks identified through a literature review. Thirdly, a thorough examination of these preliminary codes was conducted to identify connections and patterns (see appendix 4). The fourth stage of analysis includes identification of themes by examining clusters of comments made by respondents and researcher notes made during the interview. The final stage was examining themes from all interviews to outline the main themes found in the data which served as answers to the research questions.

### 3.5.5 Participant observation

Participant observation is an ethnographic method used to obtain deeper understanding of research problems by living within the studied communities. It is a key method for qualitative data collection in social research. Cook (1997: p127-128) defines it thusly:

*"Involves researchers moving between participating in a community by deliberately immersing themselves in its everyday rhythms and routines, developing relationships with people who can show and tell them what is 'going on' there, and writing accounts of how these relationships developed and what was learned from them. Observing a community by sitting back and watching activities which unfold in front of their eyes, recording their impressions of these activities in field notes, tallies, drawings, photographs and other forms of material evidence".*

Participant observation is used to appreciate an event or a process with observable activities, and is especially successful when the observer has the time and determination to obtain a deep understanding (Robson, 2011b). Collecting information through observing and listening to participants in their natural environment is central to this approach, which helps researchers understand and discover some meanings and interpretations of social norms, action and behaviours (Cook, 1997 and Gray, 2009).

The researcher lived in Merowe for approximately two months, immersed in the community, moving between villages. This process allowed the researcher to recall memories when he lived in a rural northern community in Sudan previously.

**Table 3 7 the main events and activities conducted during the observation**

| Date | Events |
|---|---|
| 1st June 2017 | Visited Merowe for the first time.<br>Explore the area by walking around.<br>Had lunch with my relatives and had conversation with people there about the dam in general |
| 3rd June 2017 | Visited the market to get more economic sense Merowe.<br>Visited the new hospitals, hotels, tourist sides the new bridge and the new football stadium |
| 5th - 15th June 2017 | Travel back to Khartoum and had series of meeting with government officials and other stockholders to arrange dates for interviews |
| 17th -25th June 2017 | Back to Merowe visiting Merowe Dam and leading engineer at the site gave presentation to me.<br>First visit to explore the villages of Hamdab West, Al-Degawit and Nouri down-stream speak to people to build relationship. Second visit with my relative to meet with my assistant in administration of questionnaire |
| 3rd - 9th July 2017 | Travelled to New Amri 3 and New Amri 2 meeting with friend of my family member who introduce me to people and planed the administration of the questionnaires. Visited the market place, schools, and health facilities and farming scheme. |
| 10th - 20th July 2017 | Travelled to Al-Kab and Omdwima where I met with people and stayed with my assistant in his house we planned how questionnaires administration should be conducted.<br>Visited fames, engage in their activities, and start administering the questionnaire. |
| 20th – 31st July 2017 | Back to Merowe and I got more confidence at this stage in completing the questionnaires, meeting official and local committee leaders.<br>Had focus group meeting with 15+ difference stakeholders at Kehila resettlement |
| 1st – 31st August | I started initial analysing of questionnaires sample and preparing for interview. I started to conduct interview with local officials and committees and them travelled to Khartoum where I interviewed other actors. |

Source: Author

Table 3.8 illustrated the date and events of data collection from the day of arrival, using a diary to record observations. The most significant features of participant observation include full immersion in the observed environment for effective communication and interaction with the subjects (Robson, 2011b; Sarantakos, 2005).

**Table 3 8 Main Characteristics of (Qualitative) Participant Observation**

| Qualitative participant observation: |
| --- |
| Demonstrates a commitment to studying everyday events, which are studied in terms of the way they are experienced and understood by the participants. |
| It is conducted in a natural environment. In effect, observation remains natural and authentic. |
| Observation is intended to investigate social events under all settings, to link data to reality, the people living in it and the way they construct and experience it. |

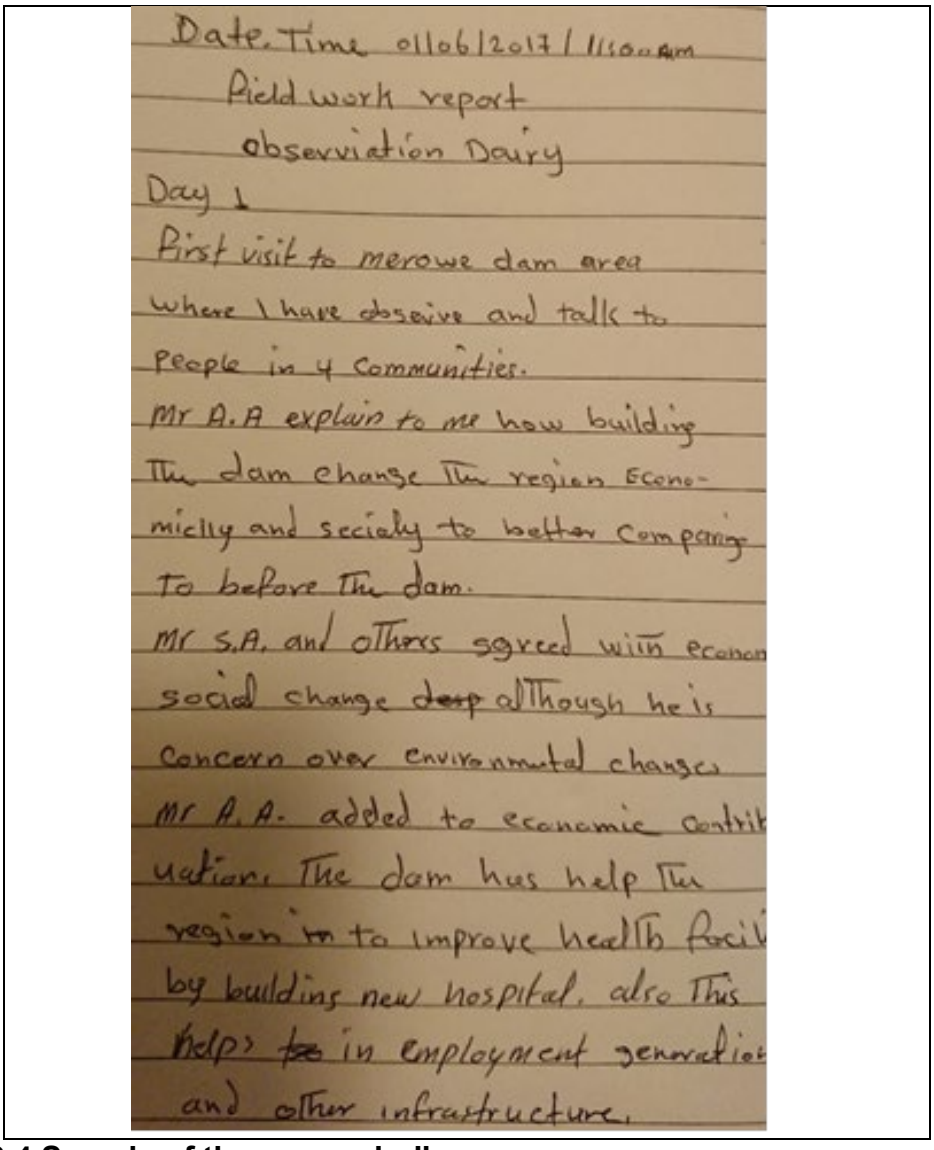
Source: Adapted from Sarantakos, 2005:231

The participant observation possesses provides the researcher with a unique opportunity and advantages, particularly openness, which privilege the researcher. This feature adds an important dimension to the researcher knowledge of area and enrich the research data: the researcher managed to experience the reality of what people were doing instead of what they were saying. Additional advantages gained by the researcher participation include:

- Gaining of first-hand data directly from affected communities;
- Engaged in action with participants offering data when are unable to offer information;
- Helps researchers to collect various types of data
- Allows the researcher to detecting non-verbal behaviour;
- Allows the researcher to build relationships with participants.

Participant observation is not free from bias by the researcher (Robson, 2011b). Participant observation is compiled of three stages: access, roles and writing up data (Cook, 1997). For the access phase, the researcher makes use of existing contacts and explores others (Cook, 1997) (see section 3.6.3). For roles, researchers must be mindful of relationships that develop which may affect the result of observations. The degree of researcher participation differs from non-engaged observation to participation as a fully recognised member of the community (Straits, 2011).

Data collected from observation can be organised in many ways. One approach to constructing research data is a field diary or field notes, to document all action that the researcher has observed or experienced (Hoggart *et al.*, 2002). The field diary is employed through the entire research task, particularly at the beginning, 'when interpretations of events and processes are more tentative' (Hoggart *et al*., 2002: 279). (See Figure 3.4)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Concern over Environmental changes
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region in to improve health facil
by building new hospital. also This
helps ~~to~~ in employment generation
and other infrastructure.

**Figure 3.4 Sample of the research diary**
(Source: Author 2017)

The researcher lived in the area for two months between 1st June and 31st July 2017, and enjoyed existing interactions with the people of Merowe from previous residence and family connections that eased access and observation. The researcher had also previously resided in a remote place in Sudan, El-Ssuki, enhancing understanding and adaptation to the culture and environment.

The role played by the researcher is as non-judgmental listener and as an ordinary member of society. It is vital to maintain a clear positionality to avoid biases or misunderstandings. In rural Sudan, if an unknown person of apparent high standing appears, such as a government official or businessman, local people act in a reserved manner which minimises accurate observation (Straits & Singleton, 2011). This situation was avoided in this research by informing participants of the researcher's status as PhD student conducting a research on the impact of Merowe Dam's in the region (Hoggart *et al.*, 2002). To reduce the likelihood of detaching from the society and to maintain good relationships with participants, the researcher participated in daily social activities to converse and engage with others. This fieldwork involved neither completely detached observation nor fully involved participation (Straits & Singleton, 2011). A balance between an observer and a community member was struck. To avoid full immersion, the researcher reminded himself of his role as a researcher studying how Merowe Dam affected people in the region.

### 3.5.6 Collection of archival and secondary data

Secondary data includes information and material that has been gathered by other people, such as researchers, policy makers and government departments, that is

available for researchers to use. Authorised public bodies, such as governments, regularly collect data, which offers important new information (Clark, 1997). Flowerdew (2005) suggests that government publications and statistics may be misleading, especially in undemocratic countries where there is a likelihood of corruption and deliberate attempts to bias. Contrasting the government data with independent sources, such as NGOs, academics and international institutions, provides a balanced argument. Authorities' statistical data are often used as secondary data in addition to other sources, like business records, personal diaries, academic research and project plans (Bryman, 2008). Archival sources helps the discovery of some hidden structures of socioeconomic elements, their function and relationship within social theories, by employing narratives and analysis (McDowell, 2002). Archives provide coverage of events, and analysis interprets those events within broader social, economic and political contexts.

The archives and secondary sources allow researchers to appreciate, explain and forecast future events through a systematic analysis of the historical data, and provide a geographical, historical, social or economic context for primary data (Flowerdew & Martin, 2005). The above elements depend on the collection of credible information, followed by a process of contrasting, classifying, assessing and interpreting to help researchers find solutions (Burns, 2000). An understanding of historical viewpoints makes explicit the implications of Merowe Dam, which may not have been evident at the time. Evolving perspectives on past events introduce different assumptions regarding historical importance (McDowell, 2002). Analysis of these documents must meet specific criteria, including people's behaviour, logical qualifications and consequences, and statistical or prominence trends (Gottschalk,

1963). The researcher analysis of the documents available shows lack of credibility and accuracy most document related to Merowe Dam especially government-produced analysis do not met this research standard. Above all these documents were not available within strategic government department such as Sudanese Central Bureau of Statistics let alone public. After a significant effort, patience and persistence the researcher managed to obtain part the project feasibility study, environmental assessment, compensation booklet, other social and economic studies conducted by DIU's affiliated institutions and scholars. However, the information these documents contain descriptive information, lack statistical analysis and bias mainly shows the positive impact.

Human geographers have used secondary data for decades for different reasons (Clark, 1997). Firstly, secondary data is significant for geography research topics by guiding and informing the researchers of the area's conditions in the past and present. Secondly, it helps the researcher to contextualise their research (geographically, historically, socially and economically) for the next phase of a case study in collecting primary data (Clark, 1997). There are limitations to the use of secondary data: the value of data may differ for current methods because it is an artefact created by administrators in a method that prioritises and view the world differently from the one used in research (Clark, 1997). Official statistics may contain mistakes and inaccuracies, especially in developing countries, because it is often politicised for a purpose of evaluating governments' performance (Hoggart et al., 2002). This observation suggests a possibility for bias, so researchers must use caution when using secondary data (Hoggart *et al.*, 2002). Secondary data collection is central to this research because it guides the parameters of the study and

constitutes the perspectives and approach that the research adopts. It is also used as a framework for assessing environmental issues in Merowe Dam. A review of the literature led to the decision to undertake this research based on socioeconomic and human development and social conflict theory based on these perspectives and debates on large dams. The contextualisation of the argument involved a literature review which provided a clear understanding of past research and progression in dams' construction and their relation to overall development.

The literature on mega-projects as a whole, particularly large dams and development theories, enabled this thesis to examine the current debate and to contrast it with the empirical finding of this research. It offers answers to whether mega-dam construction is necessary for economic and social development, which constitutes the first three parts of the research title, or based on power and political misuse (Bryant, 1992a). The literature provides material to answer the fourth objective of this research: environmental issues related to large dam. The debate on mega-projects in its relation to development, irrespective of the purpose they serve, is on whether they support or undermine the development needs of countries, predominantly those in the developing countries, which require them for electricity and irrigation purposes to support broader socioeconomic and human development (Agrawala *et al.*, 2003).

**Table 3 9 Archive and secondary data sources for this research**

| Secondary data type | Sources | Usage | Analysis methods |
|---|---|---|---|
| Official statistics on economic development | Sudanese Statistical Yearbook Government websites | General political, socio-economic backgrounds for different geographical areas | Quantitative<br><br>Statistical content analysis |
| Policy document | Development agency | Details of policies implemented regionally and nationally | Qualitative<br><br>Interpretive analysis |
| Merowe Dam feasibility Study | Development department | Economic, social, environmental plan and expect outcome | Both methods |
| Website | Government and NGOs | Contrast view to government viewpoint on critical issue i.e. environment | Qualitative: Interpretive analysis |
| Newspapers(various newspapers focusing on this province, county ) | National and regional libraries | Government's views of rural development Stories from other sources | Qualitative<br><br>Interpretive analysis |
| Official statistic on electricity generation | Power and energy minister | Conurbation to regional and national development | Both methods of analysis |

Source: Author 2017

To obtain background information on Merowe Dam for this research, special consideration was given to technical reports and briefs, consultants' reports, parliamentary proceedings, government policy documents, reports of commissions, the mass media, NGO publications, and studies by the researcher (Flowerdew & Martin, 2005; Hoggart *et al.*, 2002). This research analysed archive documents and secondary data based on content analysis for quantitative statistical data and interpretive analysis for qualitative materials (Flowerdew, 2005; Hoggart, 2002).

### 3.6 Ethical issues

#### 3.6.1 Being ethical in social research

Ethical issues are unavoidably involved in empirical research. As May (2001: p 67) states:

*"Research takes place within a context where certain interests and values often predominate to the exclusion of others".*

The way in which researchers deal with the interaction between the research topics and other stakeholders is important to consider for ethics approval before conducting social research (see appendix B). Ethics is considering the principles of what is right and wrong in social research processes (May 2001). In practice, ethics means conforming to a code or set of guiding principle and a course of action (Robson, 2011a). Ethical issues in social research highlights the moral debate and the responsibility of the researcher (Homan, 1991; Mauthner, 2002). There are many approaches to ethics in social research and one approach is deontology:

*"Approaches to morality are associated with the work of Immanuel Kant. Quite simply, ethical judgments in social research would, from this point of view, follow a set of principles which guide the conduct of research itself" (May 2001: 60).*

One principle associated with deontology is 'informed consent', agreement from the participant to become a research subject (Homan, 1991). Following four points define 'informed' and 'consent' (Homan, 1991):

***Informed:***

1. The subject knows all aspects of what is to occur and what might occur.
2. The subject has the ability to understand this information.

***Consent:***

3. The subject is capable of informed and sound judgment.
4. The agreement to take part is voluntary, without pressure or influence.

For a researcher to obtain participant consent in research, there are four steps, which must be, followed (Robson, 2011:202):

1. Explain the research idea to the participants;
2. Give them time to think about their participation;
3. Make sure that a consent form is available to all participants;

4. Make sure and double-check that all participants fully understand the research, their role in the study, and any effects it may have on them.

It is important for the researcher to consider any consequences of the data after it is published and made available to the public. The identity of all participants must be protected throughout the research, especially at the publication phase. Another issue is the privacy of the participants in social research, especially in an era of accessible information where people are increasingly worried about their privacy (Homan, 1991). The biggest challenge for social researchers is participant recruitment. Any opportunity to recruit comes with the promise to protect privacy. This supports social research and upholds public trust and collaboration in social research (May, 2001).

Participants involved in this research include people from Hamdab, Amri and Manasir communities, government officials, civil organisations, NGOs and experts. These actors have different values, customs, religions, knowledge levels and power positions, with implications for ethical considerations in the research process (Brewer, 2000). Respect towards every participant is fundamental, avoiding bias or discrimination towards any participant based on his or her background. In rural Sudan, different forms of relationship regarding power, family, affinity, kin and religion are ubiquitous. Great respect was paid to this setting and attention was given to how research may affect these relationships. For example, Hamdab, Amri and Manasir communities hold unequal power positions in Sudan at all level comparting to other communities in the region, but all communities in the region deserve equal respect. Privacy is a fundamental right for participants and intrusions were minimised during this research process.

The continuation of confidentiality is an effective approach to protecting the identity of participants. It is an obligation for the researchers to safeguard confidential information that participants have provided (Mauthner, 2002). Many of the Hamdab, Amri and Manasir people were unaware of the significance of guarding their confidential information. Thus, this research protects all information provided by participants. For example, in Sudan, especially in rural areas, people can genuinely declare private information. Information used in this research was carefully selected and protected (Mauthner, 2002). To ensure anonymity of information, any personal or identifiable information about participants in this research are protected and not revealed in any further publication was (Mauthner, 2002).

Researchers are required to inform all participants of the purpose of the research and the interests behind it, to enable them to make an informed decision about being interviewed. In this research, participants agreed to take part prior to involvement and their right to withdraw was fully explained to them. The researcher remained open to participant questions during the research project (Mauthner, 2002).

### 3.5.2 Positionality and Reflexivity

Pursuing truth is a fundamental feature of professional research and a basic expectation by the public. Therefore, honesty in pursuing the truth is a valued quality for researchers (Homan, 1991). The values and beliefs the researchers uphold will affect the pursuit of truth, as Homan (1991: p7) states:

*"Social researchers who feel passionately about inequalities in respect of class, race and gender may be promoted by their concern to devote their energies to researching these problems".*

It was vital to take into account fidelity in recording research findings and reflecting on researcher values and position during the process to reduce the impact of personal prejudices and biases (Flowerdew & Martin, 2005). Subjectivity and bias are critical issues in research and can be avoided by diversifying information sources (Homan, 1991). During fieldwork, the researcher operated the research methods correctly to guarantee the processes being as objective as possible (Hoggart *et al.*, 2002).

Having prior knowledge of the communities was key to finding the balance of roles, being both a scientific observer and a member of the observed. The observer is a position in between two extremes: a researcher and part of the research. The common perception of a researcher's position within participant observation is that of an 'intelligent, sympathetic, and non-judgmental listener' to all participants (Cook, 1997).

The researcher's position is an important point, particularly for research adopting methodologies that involve interaction with people, such as participant observation. In this research, the roles of a Ph.D. student and someone who has relationship with diverse groups of people were objectively balanced. For example I have good relationship with some local committee member, some politician at the region and at the national level. Despite this knowing many influential people both for and against the dam I have to be objective and processional to avoid been bias. Familiarity with the location and having friends and relatives in the area gave the researcher confidence to enter and live in Merowe. To avoid any ethical conflicts, openness and honestly were communicated to participants about the researcher's position and the

purpose of this research. This assurance led to clear understanding and consequently helped to build strong, trustful and honest relationships, which allowed the discussion of various issues related to the research topic to take place in an unbiased and open manner. It was important to consider the ethnic sensitivities, as Sudan contains over 300 tribes and over 100 local languages. It is a country where ethnic and regional tension is embedded in society and frequently surfaces in social events. These tensions are most noticeable in the north of the country, especially where most of the tribes claim Arabic ethnicity (Morton, 1989). This issue might have affected the data collection, especially with the researcher being of Hausa ethnicity, considered inferior by some participants. To avoid these issues, the researcher worked with people from the villages whom locals knew well (Flowerdew & Martin, 2005). The use of this strategy was successful despite some attempts from the DIU representative to influence the researcher and research direction. There is no any backrow and in fact people were so please to see someone from UK and unbiased to conduct a research such important matter Merowe Dam.

The researcher's interest in studying Merowe Dam is purely academic as a continuation of an MSc in Managing Innovation and Projects and a dissertation on the role of knowledge and institutions in the success and failure of international development projects in Africa. It was interesting to witness the of institutional role in the success and failure of a project where the role of DIU led to failure in negotiation and compensation process. As a Sudanese man from the Hausa ethnic group, which differs from the inhabitants of the studied region, might have negatively impacted the research. Unexpectedly, this proved to impact positively, as participants viewed the researcher as a neutral figure without bias toward any parties involved. Arabic is the

main language spoken in Sudan, and English is used occasionally, so data collection was not be affected.

To avoid the influence of personal relationships, boundaries were drawn and opinions are respected (Homan, 1991). For instance, the ethnicity or political affiliation of the interviewer may influence the responses of the participants. The researcher is familiar with the local councillor of Merowe council, who helped to access secondary data. He introduced me to the communities and shared viewpoints with me. The researcher reminded him and myself of the importance of clear boundaries between all participants, including people from communities, interviews, and observation groups (Flowerdew & Martin, 2005).

### 3.6.3 Political sensitivity

Political issues are challenging for researchers conducting fieldwork in nondemocratic countries, especially when conducting surveys, quantitative research and interviews (Tsai, 2010). In Sudan, some research topics are more likely to be politically sensitive, especially when related to economic development or war, for instance (Tsai, 2010). It was difficult to collect unbiased data providing credible quantitative results on population or economic performance. Other challenges included institutional bureaucracy: it was problematic arranging meetings with officials or even finding contact details. The risk of and threat for both researcher and participants from the officials was at the heart of this research. The researcher had several meetings with ministers to obtain permission to access government data and administer questionnaire surveys in the area where Merowe Dam was constructed. Access to governmental and official data about Merowe Dam, especially economic

issues, proved troublesome. It took 30 days to obtain permission after using family and friends to gain access to officials, including two state ministers. The researcher was subject to security clearance by the local intelligence branch, including checks for political affiliation with any group opposed to the dam. The Dams Implementation Unit strongly opposes all research into the dam because of its political and security sensitivity (see chapter section 4.3). After obtaining permission, a member of the DIU accompanied the researcher throughout a visit to Merowe area. This situation did not influence the outcome of data collection from participants' perspective because his role was to facilitate site visitation.

### 3.7 Conclusion

This chapter considered the research methodology of this study. Overall, discussion on methodological approaches in social sciences was reviewed at the outset, then a mixed-method approach combining quantitative and qualitative approaches was justified. The chapter also elaborated on the analytical framework, including details of both contextual and thematic analyses. It then illuminated the rationale of a case study as the research approach and the selection of Merowe Dam as the study site was justified. Significant consideration was given to specific research methods of data collection employed in this thesis. Questionnaires, semi-structured interviews, participant observation and secondary data were introduced in detail. Finally, vital issues of ethics in social research were discussed and then several real ethical values used in this project were discussed in-depth. The economic, social, political, environmental and historical context of the Merowe region data and analysis is presented and discussed in the following Chapters (4-7).

# Chapter 4: Economic, social, political and historical contexts of Merowe Dam

## 4.1 Introduction

This chapter illustrates the economic, social, political and historical contexts of the Merowe region, and so provides the context for Chapters 5 to 7, where economic, social, political and environmental issues related to mega-projects are discussed. The Merowe area is unique in aspects such as social, economic and political history. For example, the cultivation of date palm trees, and specific tribes with distinct cultures and heritage, as shown in Chapter 5 and 6. This chapter highlights the link between the history of Merowe area and the dam. In addition, the socioeconomic, political and economic status of the region are discussed in this chapter and further developed in Chapters 5 to 7. This chapter also provides a broad overview and contextual information about life before the dam, and people's perceptions after the Merowe Dam. This chapter is meant to provide an overview of the region before the dam economically, socially, politically and environmentally. The idea is to enable this research draw a comparison of socioeconomic condition of communities before and after the dam.

## 4.2 The historical context of the Merowe area and Merowe Dam

The area between the first and fourth cataracts was known as Cush, now modern Sudan. The Greeks called the people living south of Egypt Ethiopians (El Makki, 1989; Kebbede, 1997). Later, the area from the Egyptian border to Khartoum became known by the Latin name Nubia (Ezebilo, 2013). The region is rich in gold mines, suggesting that the name was derived from the word *nub* ('gold' in the Mahasi language). There are many languages of Nubia, past and present (El Makki, 1989;

Kebbede, 1997). The first Cushite dynasty, founded some time before the 8th century BC, adopted Napata as its capital city, near modern Merowe (El Makki, 1989; Leach, 1919).

Meroe and Merowe are different places. Meroe was an old kingdom, which stretched from Sudan's northern border with Egypt to the Shendi area, particularly the royal city of Meroe. However, Merowe is a town in the north, near Jebel Barkal, where the Dam has been built (Askouri, 2014; Kleinitz, 2011).

In modern Sudan's administration, the historical Nubian land, home to many northern tribes such as the Danaglah, Mahas, Jalien, Shagiah and Manasir Rubatab, has been divided into two states. The Northern State (Aš *Šamāliya*) is one of the 18 "wilayat" or states of Sudan. It has an area of 348,765 km² and an estimated population of 833,743 based on the 2006 census (Hashim, 2009). Merowe, where the Merowe Dam was constructed, is a town in the Northern State near Karima Town, about 330 kilometres (210 mi) north of Khartoum. The River Nile State (*Naḥr an Nīl*) is the second state in north Sudan. It has an area of 122,123 km² (47,152 mi²) and had an estimated population of 1,027,534 in 2006 (DIU, 2007f; Hashim, 2009). The dam was built in the Northern State and the reservoir extends to the River Nile State, where some of the displaced people have been relocated in two settlements: Al-Makabrab and Kehila (Hashim, 2009). The dam is near the Fourth Cataract of the River Nile, in the Northern State where the Nile has a great bend, passing through the bedrock of the Bayuda Mountain range. It is a fertile strip of land with many villages, where the Nile riverbed supports rich, green cultivated fields (Askouri, 2014).


**Figure 4.1 The two Northern State of Sudan in yellow and River Nile State in blue**

Source: google maps edited by the author

The idea of a Nile dam at the fourth cataract was long-standing. The Anglo-Egyptian authorities planned it a number of times in the early 20th century. It was intended to equalise the fluctuations of the Nile's flow to create the prospect of cultivating cotton and to offer flood control for the lower Nile valley (DIU, 2007f). In 1929, the Anglo-Egyptian Nile water agreement allowed Egypt to have greater control over the Nile. In 1959, after Sudan's independence, the 1929 Nile Water Treaty was reviewed. The new agreement allowed Egypt 94bn $m^3$/yr (billion cubic metres per year of the Nile's

flow) and Sudan 18.5bn $m^3$/yr. Egypt gained an extra 48 bn $m^3$/yr and Sudan gained an extra 14.5 bn $m^3$/yr compared to the 1929 Treaty (Haberlah, 2012).

After Sudan gained independence in 1956, Egypt took control of the flow of Nile water by building the AHD and creating the Nasser Lake reservoir. This independence ended the possibility of building a Merowe Dam and other dams south of the border into Sudan (Verhoeven, 2011). The AHD, completed in 1964, created one of the world's largest reservoirs at the time, with a storage capacity of 168 $km^3$ and a surface area of 500$km^2$, which extended into Sudan. The government of Sudan did not benefit from the AHD or the Treaty, apart from possibility of extending its own hydro-infrastructure base (McDonald, Bosshard & Brewer, 2009; Verhoeven, 2011). The displacement of the Nubian people caused by the AHD was a major traumatic event, which has been ingrained in the historical and cultural memory of the Nubians of north Sudan (Kleinitz, 2011; Verhoeven, 2011). This displacement led to the construction of the Khasm al Girba Dam in Mid-Eastern Sudan to support the resettled Nubians, which caused discontent among the Nubian people, but did not concern the ruling elite in Khartoum at the time. The scars of loss and cultural tragedy of the event has informed current resistance movements to dams proposed on northern people's lands (McDonald, Bosshard & Brewer, 2009; Verhoeven, 2011).

### 4.2.1 The Merowe Dam

Since independence, most governments in Sudan have attempted to revive the plan of building Merowe Dam and others dams in northern parts of the country, especially now that demand for electricity in Sudan has increased rapidly (McDonald, Bosshard & Brewer, 2009). Post-independence decades witnessed extensive activity in this

area, and four feasibility studies on Merowe Dam were produced (Coyne et Bellier, 1979 / Gibb, Merz & McLellan, GB, 1983, / Sweco, SE, 1984 Monenco Consultants Ltd., CA, 1989) (DIU, 2007f). However, insufficient funding and lack of interest from investors held up this project at the planning phase. In early 2000, though, the situation changed profoundly as the country began exporting oil in huge quantities (McDonald, Bosshard & Brewer, 2009; Verhoeven, 2011; Wallach, 1988). Sudan's credit rating improved and brought an influx of foreign investment. China entered the funding arena for mega-projects in Africa, leading to contracts for the construction of what is known today as the Merowe Dam being signed in 2003 (Verhoeven, 2011).

**Figure 4.2 operational Merowe Dam**
Source: ejatlas.org/conflict/merowe-dam-sudan

The dam is around 9km long (5.6mi) and 67m tall. It is concrete-faced on each riverbank. The right bank of the dam is the largest part of the project, 4.3km long and 53m high, and the left bank is 1590m long and 50m high (DIU, 2007f). The main dam is in the left river channel, as well as a live water section in the right river channel. It contains a reservoir of 12.5km$^3$, or about 20% of the Nile's annual flow. The proposed reservoir level is 300m above sea level, with the Nile's level downstream of

the dam at about 265m. The reservoir lake extends around 174km (108 mi) upstream towards the River Nile State (DIU, 2007f)).

The powerhouse is equipped with ten 125MW Francis turbines, each designed for a nominal discharge rate of 300$m^3$/s, and each one driving a 150MVA, 15kV synchronous generator. The developer anticipate an annual electricity yield of 5.5 MWh (20 PJ), corresponding to an average load of 625MW (838,000hp), or 50% of the rated load (DIU, 2007f).

The power grid capacity has been upgraded to utilise the extra electricity generated. As part of the project, 500km of 50 kV aerial transmission line was introduced across the Bayudah Desert to Atbara and continuing to Khartoum, and about 1,000km of 220kV lines laid eastwards to Port Sudan and westwards along the Nile, connecting to Dongola (DIU, 2007f).

According to UI (2007f), the main contractors are:

- China International Water and Electric Corp China National Water Resources and Hydropower Engineering Corp. (China – construction of dam and hydro mechanical works)
- Lahmeyer International (Germany – planning, project management and civil engineering)
- Alstom (France – generators and turbines)
- Harbin Power Engineering Company, Jilin Province Transmission and Substation Project Company (both China – transmission system extension)

The river diversion and work on the physical dams started in early 2004. The left river channel was closed on December 2005, the reservoir filled in mid-2006 and the first generating unit to go live was in mid-2007. The dam was installed in March 2009. At this point, the reservoir was full and all the hydroelectric generation capacity was

online, generating 1250MW, about 50% of Sudan's total production (Askouri, 2014; DIU, 2007f; Hashim, 2009; Verhoeven, 2011).

### 4.3 A political economic history of dams in Sudan

There are close links between the history of hydro-infrastructure projects on the Nile and the political economic power of the ruling elites. The domestic Sudanese political economy has been analysed in a variety of ways (Verhoeven 2011). Politically, the history of hydro-infrastructure construction on the Nile is driven by governing elites to secure their economic and political interests, largely through a top-down, technocratic approach (Verhoeven, 2011). The historical politics of a colonial legacy favoured political economic power based on hydro-agricultural development, which was a dominant trend even after independence. The current government, led by the National Congress Party (NCP), is no exception: dam programmes function as a political economic strategy representing power consolidation. The most important aspect of colonial heritage that has continued as a primary political policy for all post-independence regimes in Sudan is the hydro-agricultural underpinning of political economic power (Verhoeven, 2011).

As noted before following the independence of Sudan from the United Kingdom in 1956, the 1929 Nile Waters Treaty was reviewed in 1959 to allow both Sudan and Egypt greater control and a larger share of the Nile's water. Dam construction in Sudan was revitalised with the building of the Khasm al Ghirba Dam in 1964 on the Atbara River, the Roseires Dam in 1966 on the Blue Nile, and Merowe Dam in 2004 (Verhoeven, 2011). In 1999, the Nile Basin Initiative launched a cooperative of basin nations with one objective: the development of water resources of the Nile in a fair

way to guarantee efficient water management. In 2004, the eight countries of the basin met in Sudan to launch the Nile Transboundary Environmental Action Project, while the Nile River diversion and work on Merowe Dam commenced in early 2004 (McDonald, Bosshard & Brewer, 2009; Wallach, 1988).

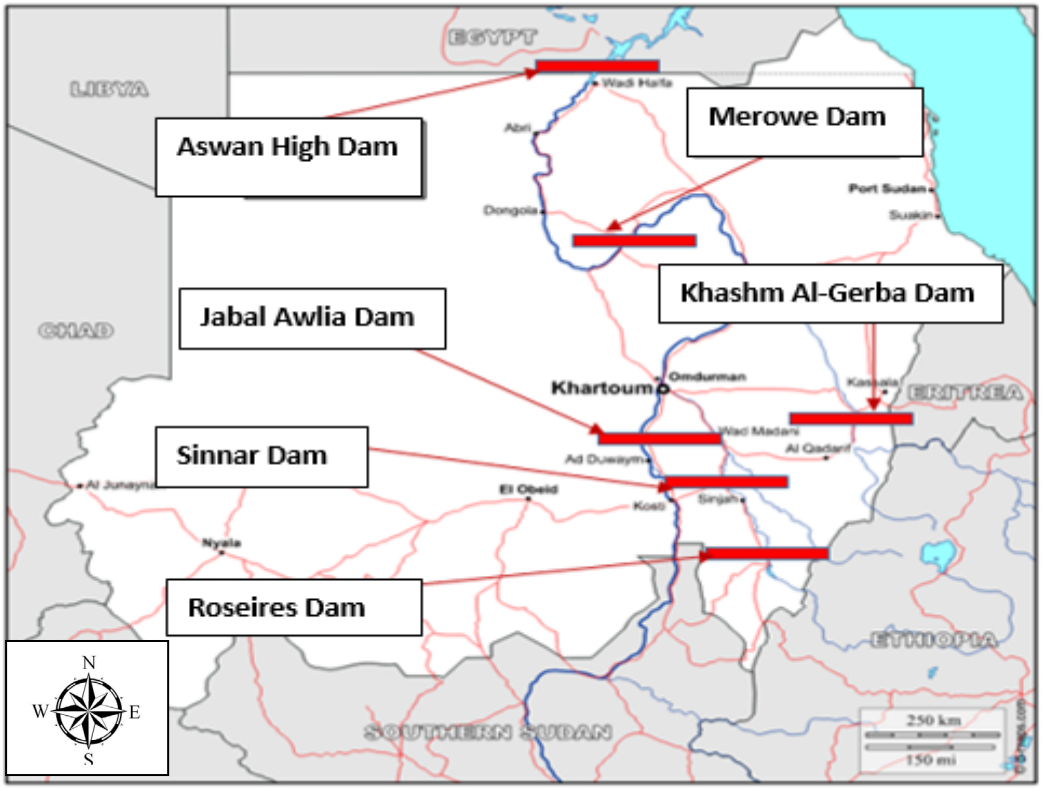



**Figure 4.3 Dam locations in Sudan**

Source: D-maps.com 2017

As Figure 4.3 shows, these dams were constructed for the purposes of hydro-electricity and agriculture for economic development (Kleinitz, 2011; Verhoeven, 2011). Understanding these political dynamic aids contextualising the institutional justification of the Dams Implementation Unit (DIU) formation. The ambitions of the DIU drive the processes and outcomes of Merowe Dam projects, and it has become the state's arm for responding to resistance against dams (Hashim, 2009; Verhoeven, 2011).

The DIU was created specifically for the construction of Merowe Dam. It is unlike any other state institution in Sudan. The DIU is a unique governmental institution with exceptional financial and political power. It was founded in 1999 to execute the plans for Merowe Dam, removing the authority of building dams from the Ministry of Irrigation and Water Resources. It was created under the leadership of a state minister and executive director of Merowe Dam Implementation Unit (MDIU). Later, it became the Dams Implementation Unit, tasked with many water management and dam projects across Sudan, including the Upper Atbara and Setit Dams (Hashim, 2009).

The DIU's power extends beyond dam construction and irrigation and into the construction of other projects, such as roads, hospitals, bridges and airports, agricultural development projects and electricity provision. It arranges funding activities, and controls its own multibillion-dollar budgets. These vast projects are represented in the complementary projects, which ran alongside Merowe Dam (Askouri, 2014). The DIU also became an important player in Sudan's agro-industrial sector, with an important role in the Supreme Council for Agricultural Revival (Verhoeven, 2012).

### 4.4 The socioeconomic history of Merowe area

The Merowe area is a unit within the wider context of north Sudan with its unique social, economic and cultural features (Rigg, 2007). The Sudanese rural villages and regions have always been a link between the economic, political state and socio-culture nationwide (Rigg, 2007). The entire Merowe region was isolated without infrastructure. It encompassed over 100 villages, isolated islands without means of

communication and transportation except donkeys, small fishing boats and very few cars (Askouri, 2014).

The region of Amri, Hamdab, includes all the islands in the Nile between Dar el-Arab and Et-Tereif near the district boundary between the Northern and Nile States, extending to the edges of the reservoir. It is about 150km² wide and is difficult to access, with only rough tracks. Two thirds of it encompass a hostile desert area with hardly any vegetation (DIU, 2007f). The dam is located about 25km downstream, with a new paved road connecting the dam with Merowe city. The landscape along the Fourth Cataract merges into the desert and, in some segments, the riverbanks drop sharply into the river, making agriculture impossible.

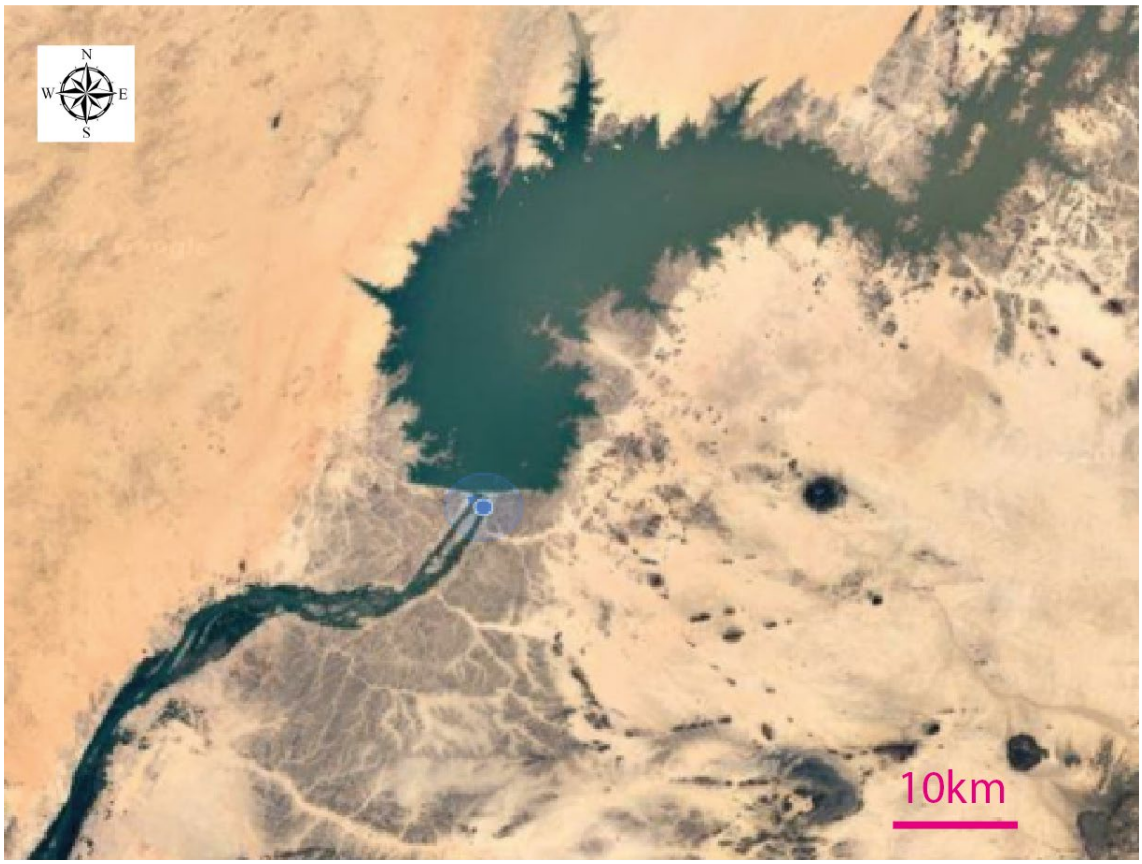



**Figure 4.4 The border between the fertile land and the desert**
Source: google earth-edited by the author 2017

In June, the hottest month of the year, the average temperature reaches 50°C. In January, median temperatures fall to about 20°C (DIU, 2007f; Leach, 1919). The area is only habitable on the fertile strip of land by the Nile; it is well known as a very hostile place for life. Northerners often immigrate to central Sudan seeking a better life, leaving family members behind to cultivate the family land. These communities are mainly self-sufficient (Barbour, 1966) relying on crops, such as beans and millet. The farmers grow vegetables for their own consumption and for trading at regional markets. Their main source of income is the plantations of date palm trees growing in the fertile silt on the riverbank (Barbour, 1966). The communities live in small farming villages by the riverbanks and on islands with very limited services (schools, health facilities) (Barbour, 1966). Between 30,000 to 50,000, people were affected during the construction of the dam and its reservoir from 2006 to 2009. The dam impacted mainly the Manasir, Hamadab, and Amri people upstream (e.g. displacement, loss of palm date trees) (Ezebilo, 2013; Haberlah, 2012) (see Chapter 3).

**Figure 4.5 Old Amri village before it was submerged by the dam**
Source: member of Amri community

These self-proclaimed Arab river tribes of Northern Sudan are known with their cultural ties to the region around the river's fourth cataract. The traditional ways of

cultivation, cultural life and many other traditions are inseparably connected to the riverbank landscape (Haberlah, 2012). The Manasir tribes live alongside Shagiah tribes in downstream villages close to the Nile valley (McDonald, Bosshard & Brewer, 2009). Communities on both sides of the dam maintain close cultural and trade relations (Barbour, 1966). Life on the fourth cataract is traditionally dominated by small-scale agriculture on the alluvial soils, which border the banks of the Nile. Date is the most important crop to the communities, both economically and culturally. Palm trees are cultivated in a narrow band lining the bank of the Nile, lying between the seasonally flooded land of the riverbank and the traditional waterwheel irrigation (Leach, 1919). The strip of palm trees is typically 20 meters wide and its close proximity to the Nile allows the roots to access water from deep underground throughout the year (Haberlah, 2012). Date varieties and uses make its farming a profitable and important business in the region. A mature date tree may produce up to 2-3 sacks of 75kg each and a family may own an average of 20 date palms trees. Date trees are extremely valued economically and deeply connected with cultural pride and belonging, a symbol of cultural respect and social status (Haberlah, 2012). Many traditions and proverbs were spoken at the planting a new date tree, evidencing the significant meaning of date trees to these people. For this reason, it is impossible to put financial value on date trees (Ezebilo, 2013). Economic, cultural and social aspects make selling date trees among these tribes inconceivable (Haberlah, 2012). This restriction was the case a century ago and still stands: no matter how much economic hardship a family may face the sale of date trees or land is a last resort, and should be avoided at all costs.

**Figure 4.6 Date palm tree at New Amri Agriculture Scheme**

Source: author 2017

A local farmer explained the difficulty in pricing a palm tree: ‘A date tree does not have a price, it is as sacred as your sons, and you cannot sell your sons’. This cultural tradition and practice is relevant to the case of the Merowe Dam and the dam authority’s procedure of valuation and compensation for date palms trees lost by construction of the dam (Ezebilo, 2013).

Constructing Merowe Dam on Hamdab land has been discussed since the 1920s within Amri, Hamdab and Manasir communities, in terms of the implications for the life of the people, including issues of displacement and resettlement, with much controversy. Some people were sceptical, deeming the dam to be impossible, while others were passionate about it, and perceive it as the region’s economic salvage (Askouri, 2014; Ezebilo, 2013; Hashim, 2009). In this way, Merowe Dam has a place

in the tradition and folklores of the people and many poems and sayings about Merowe Dam have been recorded, on both sides of the argument. For instance, riverbank farmers of northern Sudan share the verse:

> *We went to the mosque, they told us about the resurrection day!*
> *We turned on the radio; they said the dam is coming!*
> *Neither the dam nor the resurrection day has happened.*
> *My God bring the dam and submerge the land up to Atman Mountain*
> *To displace both those who like and who dislike it.*
> *And Omdurman will be our home,*
> *Lamb meat will be our food*
> *And we will leave the density of Lgman.*

Alternatively, here is a poem that voice discontentment:

> *Oh, our Lord, please stop the dam!*
> *Holy Men read the Fatihah aloud,*
> *Saying: Allah, please, prevent the dam!*
> *Always reciting for the troubled souls,*
>
> *There are blessings here from a long time ago.* (Haberlah, 2012).

Despite intercommunity discussions and debates over Merowe Dam, the people largely felt the dam would ultimately be constructed. However, the majority of people were surprised by the progress made in building the dam. In addition, the bulk of the tribespeople were oblivious to the magnitude of the damage and relocation arrangements. Many kept faith that the process would go ahead smoothly and that they would not be badly affected, and they expected to remain in the region by relocating to higher ground (Haberlah, 2012) (see Chapter 5-7 for findings and analysis).

## 4.5 Conclusion

This chapter has set up the discussion on economic issues related to Merowe Dam, to be covered in Chapters 5-7. It also elaborates on social, political, economic and historical aspects of the riverine tribespeople people in the region. The uniqueness of Merowe region historically and socially, and its position within the geopolitical dynamics of Sudan throughout history, has made it a centre of attention. Socioeconomic and human development and policies in Sudan are controversial subjects, due to regional and ethnic differences in perception of achieving developments. This shapes the bulk of debates in relation to the economic, social, political and environmental issue of Merowe Dam in light of historical and present contexts of the area.

# Chapter 5 The economic contributions of the Merowe Dam to local communities

## 5.1 Introduction

The previous chapter illustrated the characteristics of the Merowe region, providing an economic, social, political and environmental context of mega-dams in both contemporary and historical developing economies. The present chapter explores the economic contribution of mega-projects by highlighting the changes the Merowe Dam has brought to the local and national economy as a case study. This chapter considers the Merowe Dam's socioeconomic contribution to the displaced communities and the region, using Wetzel *et al.*'s (2003) three trajectories of socioeconomic development as a framework to study the first part of the research objectives (assessing economic, social, political and environmental issues related to mega-projects in developing economies). The first two of Wetzel *et al.*'s three trajectories were employed to observe the ways in which the dam improved the socioeconomic status of the local communities through technological innovation, productivity, growth, quality of life, etc.

The primary justification for undertaking large-scale dam infrastructure projects is economic, although other motivating factors including social, political and environmental have been recognised (through displacement, resettlement, decision-making, water supply etc.) (Agrawala *et al.*, 2003; Alexander, 2015; Bhalla, 2002; Bryant, 1992a; Fournet, 2015; Khan, 2008; Kim, 2006). There is debate around the economic contribution of mega-dams (see Chapter 2) (Schultz, 2002; Varma, 1999 ; Wu *et al.*, 2013), particularly their suitability as a means of economic development and how beneficial dams are to local society and overall socio-economy (Altshuler &

Luberoff, 2003; Ansar *et al.*, 2014; Asmal, 1999; Dogra, 1992; Flyvbjerg, 2004; Flyvbjerg, Bruzelius & Rothengatter, 2003; Ogano & Pretorius, 2015; Shalash, 1982; Sharaf El Din, 1977).

The current chapter focuses on specific indicators of Merowe Dam's contributions to local communities' economic development, including irrigation, electricity supply, industrial development, employment opportunities and food production. Electricity also drives industrial development and modern agriculture through the electrification of irrigation, which has contributed to increased food production, employment generation and socioeconomic and human development.

**Table 5.1 Economic indicators used to analysis the data**

| **Economic indicator case study area** | **Main methods used** |
|---|---|
| **Non-farming economic indicators**<br>1 Infrastructure (roads, bridges, hospitals, etc.)<br>2 Access to electricity<br>3 Communication (telephone, internet network)<br>4 Transportation (travelling across the region)<br>5 Sources of income (market/working place)<br>6 Cost of electricity<br>7 Price of assets (business, land, stocks) | **Questionnaire/interview/observation**<br>Questionnaire/interview/observation<br>Questionnaire/interview/observation<br>Questionnaire/interview/observation<br>Questionnaire/interview<br>Questionnaire/interview<br>Questionnaire/interview |
| **Farming and agro-economic indicators**<br>1 Irrigation of agriculture<br>2 Types of farm production (variability of products)<br>3 Quality of farm production (use of technology, science)<br>4 Grazing area for animals<br>5 Land size<br>6 Quality of the soil<br>7 Cost of irrigation<br>8 Price of farm products (date tree, arable crops, etc) | **Questionnaire/interview/observation**<br>Questionnaire/interview<br>Questionnaire/interview/observation<br>Questionnaire/interview/observation<br>Questionnaire/interview<br>Questionnaire/interview/observation<br>Questionnaire/interview<br>Questionnaire/interview<br>Questionnaire/interview |
| **Other economic indicators**<br>1 Electricity supply in the region<br>2 Industrial development<br>3 Domestic use<br>4 Employment generation<br>5 Change in income<br>6 Food production | **Secondary/Questionnaire/interview**<br>Secondary/Questionnaire/interview<br>Secondary/Questionnaire/interview<br>Secondary/Questionnaire/interview<br>Secondary/Questionnaire/interview<br>Secondary/Questionnaire/interview<br>Secondary/Questionnaire/interview |

Source: Author questionnaire 2017

As Chapter 3 highlighted, these indicators have been selected for their collective and complementary roles in supporting dams' contributions to economic development, and their factors as initial objectives for dam construction (Varma 1999; 2003). The above indicators are fundamental to socioeconomic development, which shapes societies through income, productivity, and employment at the micro-level of the household, which supports human development at both local and regional levels. The process of economic development through mega-projects is constituted by both physical elements (e.g. resources) and anthropogenic factors (e.g. socioeconomic and political factors) (Kim, 2006), either of which can influence the performance of a project significantly (Kim, 2006). Kim (2006) suggests that dams' economic contribution is mainly through electricity, satisfying the needs of population growth and agricultural markets at local and national levels. Drivers such as urbanisation and market development also influence agricultural land use (Verhoeven, 2011). Sudanese economic development and agriculture have primarily been driven by electricity availability, urbanisation and international agricultural markets, especially towards (to Arab countries) transportation and irrigation infrastructure (Kleinitz, 2011).

By translating these macro-level economic forces into the local micro-level of rural communities, rural households may provide a clear understanding of dams' role in economic development. Key characteristics can be identified through changes in agribusiness, income, socioeconomic structure and human development (driven by agriculture, growth, employment, increased electricity supply for domestic and industrial use, and increased food production). These lead to economic diversification of rural households (non-farming economic opportunities), rural community infrastructure and market access (including agricultural input and output markets).

These can be viewed as local economic drivers for agricultural production and for developing countries (McDonald, Bosshard & Brewer, 2009).

For the Merowe region in Sudan, the dramatic socioeconomic transformation of the rural space has primarily been attributed to the construction of the Merowe Dam (specifically the substantial increase in employment in agricultural and non-agricultural economies, as experienced by many other developing countries) (Verhoeven, 2011; Wallach, 1988). Furthermore, the transformed Sudanese economy has influenced rural economic diversification, reflected at the micro-level diversification of livelihoods in the Merowe region (Wallach, 1988), driven by a vast amount of non-farm activities, especially services (Wallach, 1988).

The previous chapter revealed the economic status of the region, where agriculture is the main economic and social capital, as a representation of the changing Sudanese rural economy. Additionally, to assist agricultural development and to enhance economic development and rural households' income, the Sudanese government has initiated numerous economic development and service projects alongside the Merowe Dam. Therefore, as discussed above, the drivers that contribute to economic development at the local and national level are prominent and prevailing in rural Sudan.

There are five sections in this chapter. Section 5.2 examines how Merowe Dam supports local communities' economic development: farming and agro-economic, non-farming and employment generation in the Merowe region). Section 5.3 examines influences on agricultural production, specifically on increased productivity and agricultural infrastructure. Sections 5.4 analyses electricity supply for the region,

the nation, and its contribution to socioeconomic and human development through domestic use and industrial development. Section 5.5 concludes this chapter, showing Merowe Dam's economic contribution in the region and considering the benefits for local communities in term of agriculture, income, jobs, electricity supply etc.

### 5.2 Merowe Dam and economic development

In the assessment of economic development issues related to dams in rural areas, different aspects are analysed using questionnaire data and supported by quotes from interviews. This research employs locality and region as independent variables to analyse the economic contribution of Merowe Dam (De Vaus, 2002). Kim (2006) assert that dams and their applications change the socioeconomic landscape of people's lives and prompt economic change, including among displaced people and the surrounding communities. It has, however, also been argued that dams provide positive opportunities for rural areas (Srinivasan, 1994; Verhoeven, 2011; Wallach, 1988). These debates raise questions around the diffusion of economic benefits in rural areas and how rural citizens construct and perceive the economic development in the context of mega-dam socioeconomic and political ecology (see Chapter 2).

The economic contributions of mega-dams are a point of disagreement, due to their apparent overstated benefits and high costs of the project. The critics of mega-dams believe that the benefits are inflated to make it appealing to investors and the public (Pearce, 1999; McCully, 200). However, Varma (1999) is in favour of dams for economic development and points to countries (e.g. Turkey, India) who have benefited economically from building dams. In the case of Merowe Dam, it can be

argued that its main purpose is electricity generation, and irrigation for economic development is a secondary aim, which can be achieved through energy availability. There are other aims, the importance of which differs depending on the viewpoint of the observer. The location of Merowe Dam is unique in respect to many dams in the world; the dam is present at the heart of a desert where water access from sources other than the Nile is very difficult. This geographical factor shows the importance of the Merowe Dam for economic development through water management for irrigation or electricity generation for domestic and commercial use (see Chapter 4). There is some commonality between the Merowe and Aswan Dam with respect to location and the experience of communities in the region. However, the timing, space, and construction circumstances of the Merowe Dam are different economically, socially and politically in many respects (see Chapter 2 and 4). The official standpoint on the aims of the Merowe Dam, according to a ministerial national official interviewee (21) is:

> *To increase energy production in the national grid. I believe Merowe Dam has achieved this by injecting 1250 MW into Sudan's main network, leading to stability and wide coverage in the country, especially rural areas. Development of agriculture is delivering huge benefits to Sudan through Merowe Dam irrigation scheme and the resettlement agriculture scheme for the displaced. The first two projects were in the Northern State at New Hamdab and New Amri, and the other two schemes were at the River Nile State at Kehila and Al Makabrab. Another aim is supporting socioeconomic development through infrastructure development, such as educational facilities, roads, bridges, health facilities, other services, etc".*

The analysis of questionnaire data shows that electricity and irrigation as economic development mechanisms are at the centre of the Merowe Dam's developmental aims. Table 5.2 below indicates that there is consensus on electricity as a primary aim of the Merowe Dam: around 90% of participants cross the districts agreed on its achievement with no significant difference between the three districts. Table 5.2 shows that, for downstream and upstream-residents, the 'yes' *actual* count is

significantly higher than the *expected* number of participants. For upstream-relocated participants, the 'no' *actual* count is more than the *expected* count for 'no' participants and the 'yes' *actual* count is lower than *expected* for 'yes' participants ($\chi^2$ = 1.497, *DF* = 2, *P* = 0.473). This result shows that there no significant differences within the district but suggest that most participants agreed with the electricity production achievement.

**Table 5.2 Electricity generation as the main purpose of Merowe Dam**

| Location | | No | Yes | Total |
|---|---|---|---|---|
| **Downstream** | **Count** | 7 | 93 | 100 |
| | **Expected Count** | 9 | 91 | 100 |
| **Upstream-Resident** | **Count** | 9 | 91 | 100 |
| | **Expected Count** | 9 | 91 | 100 |
| **Upstream-Relocated** | **Count** | 12 | 88 | 100 |
| | **Expected Count** | 9 | 91 | 100 |
| **Total** | **Count** | 28 | 272 | 300 |
| | **Expected Count** | 28 | 272 | 300 |
| | **Chi-Square (df 2)** | 1.497* | | |

Source: Author questionnaire 2017

With respect to the role of electricity in technology development as produced by the Merowe Dam, a DIU official interviewee (23) and local farmer questionnaire participants (5 and 8) argue that:

*"Most of the accompanying projects in the region were founded to support energy production from the Merowe Dam and to improve regional and national economic development" (23).*

*"There's no replacement for a dam except a dam; it is an important project providing stable economic development for Sudan" (5).*

*"The dam has brought investment to the region. It can be used efficiently by building irrigation canals in both side of the dam" (8).*

The questionnaire and interview responses indicate some agreement in perceptions between officials and other participants in relation to electricity purpose of the Merowe Dam. Therefore, the initial analysis of the economic contributions of the Merowe Dam shows a very positive outcome with some variation in the perceptions. Likewise, overall, there is a strong tendency towards agreement that the Merowe

Dam supports economic development in the region through electricity and agriculture; as a university academic interviewee (3) suggests:

> "*When peace prevails, Sudan can be a vital player at the international economic stage through correct policies and use of abundant natural resource e.g. rivers and fertile lands for the agro-economy. For example, Merowe, Sinnar, Al Rousers and other dams have been supporting Al Jazeera Agriculture, Al Rahad, Al Managil and other agriculture schemes yet to be introduced. This is in addition to providing electricity which has a positive contribution on the Sudanese economy".*

The Merowe Dam is intended to support economic development through irrigation for commercial agriculture, one of the vital roles played by dams globally (McDonald, Bosshard & Brewer, 2009; Verhoeven, 2011; Wallach, 1988). This claim is supported by many mega-projects studies, including those on dams (Kim, 2006, Alexander, 2015 and Agrawala, 2003) (see Chapter 2). All the above literature reinforces mega-dams' contributions to economic development. Tables 5.3 supports the claim of economic benefits for agriculture, with significant difference between districts regarding irrigation purposes. Around 60% of participants across the districts have agreed with irrigation as a second important aim of Merowe Dam.

**Table 5.3 Irrigation as the main purpose of Merowe Dam**

| Location | | No | Yes | Total |
|---|---|---|---|---|
| **Downstream** | **Count** | 31 | 69 | 100 |
| | **Expected Count** | 35 | 65 | 100 |
| **Upstream-Resident** | **Count** | 30 | 70 | 100 |
| | **Expected Count** | 35 | 65 | 100 |
| **Upstream-Relocated** | **Count** | 45 | 55 | 100 |
| | **Expected Count** | 35 | 65 | 100 |
| **Total** | **Count** | 106 | 194 | 300 |
| | **Expected Count** | 106 | 194 | 300 |
| | **Chi-Square (df 2)** | 6.156* | | |

Source: Author questionnaire 2017

Table 5.3 shows that, for downstream and upstream-residents, the 'yes' *actual* count is higher than the *expected* number of participants. For upstream-relocated participants, the 'no' *actual* count is more than the *expected* count for no participants and the 'yes' *actual* count is lower than *expected* for 'yes' participants ($\chi^2$= 6.156, *DF* = 2, *P* = 0.046). This divergence is due to benefits gained by downstream citizens in

the form of agriculture infrastructure and upstream-residents benefiting from the cultivation of fertile strips of floodplain land. However, relocated participants are slightly apprehensive about agricultural purposes because of the struggle with water supply, especially at New Amri 2 and 3.

Considering both the Northern and River Nile States rely heavily on agriculture economically, this dependency on agriculture adds more weight to the irrigation aim and increases people's expectations of the dam. However, the literature also suggests some concerns around dams' agro-economic contributions; for example, Ansar *et al.* ( 2014), Flyvbjerg (2009) and others argue that most large dam beneficiaries are well-connected and resourced elites who are able to pay the costs of irrigation and electricity from hydropower (see Section 5.2.2). These assertions imply that large dams have not been economically beneficial to the whole of society.

The majority of participants do not think that there are other purpose of the dam apart from electricity generation and irrigation. Only a few mentioned other purposes in Table 5.4. There is no significant regional difference in opinion regarding other purposes of the dam ($\chi^2$ = 4.087, *DF* = 4, *P* = 0.394). The successful results of Merowe Dam challenges the critics of dams' ability to achieve electricity and irrigation aims.

**Table 5.4 Other purposes of Merowe Dam by districts**

| Location | | Nothing | Economic Development | Human Development | Total |
|---|---|---|---|---|---|
| **Downstream** | **Count** | 60 | 28 | 12 | 100 |
| | **Expected Count** | 67 | 23 | 10 | 100 |
| **Upstream -Resident** | **Count** | 69 | 21 | 10 | 100 |
| | **Expected Count** | 67 | 23 | 10 | 100 |
| **Upstream- Relocated** | **Count** | 73 | 19 | 8 | 100 |
| | **Expected Count** | 67 | 23 | 10 | 100 |
| **Total** | **Count** | 202 | 68 | 30 | 300 |
| | **Expected Count** | 202 | 68 | 30 | 300 |
| | **Chi-Square (*df* 4)** | 4.09* | | | |

Source: Author questionnaire 2017

Furthermore, Castelán (2002) and Varma (1999 and 2003) believe the argument that large dams have made a negligible contribution to economic development to be untrue. Yet Flyvbjerg (2009) believes there is unfairness in the distribution of large dams' economic benefits, in addition to cost overruns and delays in meeting stated targets. However, according to a DIU official, the Merowe Dam was completed within the estimated budget ($2.945 billion) and on time (2001-2009). This statement is not verified by other sources. However, it challenges the claim of Flyvbjerg (2009) and other critics of dams. Furthermore, Varma (2003) suggests that comparing the performance of dams constructed for different purposes against one universal standard is certainly incorrect, as the significance of goods and services delivered by each are different. The present research argues that the universal standardisation of dams' outcomes without taking into account factors such as political, economic, institutional status and the social needs of Sudan evidences the shortcomings of many studies on dams. Also, by using macro-level data as a representation of human agency in such studies is believed to be an imaginary result (see Chapter 2). This interpretation is evidently not applicable to Merowe Dam, due to Sudan's need for energy for economic and human development and where other sources of obtaining energy are seen to be difficult if not impossible (university academic interviewees 5,6,7). In addition, the human agency role is present where participants express their opinion on the needs of electricity for economic development. University academic interviewee (10) further elaborate on this point:

*"The international bodies and NGOs, in their reports about the Merowe Dam, did not consider the context of Sudan and the environment in which the dam was founded. Likewise, they did not take into account social, cultural and legal differences between developed and developing economies, where the need for energy is greater for economic development and basic domestic use."*

To further illustrate the economic benefits of Merowe Dam, it is important to analyse individual, community and regional gains from the dam. Comparing means in Table 5.5 explains the contribution of Merowe Dam to three groups of participants. The means of indicators numbered 0-5 (assigned to Nothing, Infrastructure, Services, Economy, Electricity, and Agriculture respectively) provide remarkable reading into Merowe Dam's contribution to identified groups. The means of responses from the three districts at individual and community level are between 2.50 and 3.37 with standard deviation between 1-2, which indicates the majority of the response are within the means.

**Table 5.5 Merowe Dam benefits for individuals, communities and the region**

| Location | | Benefit for individuals | Benefit for communities | Benefit for the region |
|---|---|---|---|---|
| Downstream | Mean | 3.290 | 2.410 | 1.990 |
| | Std. Deviation | 1.274 | 1.379 | 1.673 |
| Upstream-Resident | Mean | 3.170 | 2.610 | 0.890 |
| | Std. Deviation | 2.113 | 2.192 | 1.524 |
| Upstream-Relocated | Mean | 3.370 | 3.260 | 1.310 |
| | Std. Deviation | 1.461 | 1.667 | 1.440 |
| Total | Mean | 3.277 | 2.760 | 1.397 |
| | Std. Deviation | 1.652 | 1.809 | 1.609 |
| | N | 300 | 300 | 300 |

Source: Author questionnaire 2017

This further suggests a strong tendency towards a positive economic developmental contribution. Likewise, the aggregate means of districts at community level is 2.70 and individual level is 3.27, with standard deviation of 1 to 2. However, at the regional level the mean is lower. This lower means is an indicate that participant mainly focus on the issue that affected them directly and not aware of the regional impact. Interestingly, upstream-relocated participants scored high mean in both individual and community level (3.37, 3.26).

This explains the role played by the accompanying projects in improving the socioeconomic status of citizens in the region, especially relocated communities, subsequent to the dam construction.

**Table 5.6 Merowe Dam benefits communities gained across districts**

| Location | | Nothing | Infrastructure | Services | Economic | Electricity | Agriculture | Total |
|---|---|---|---|---|---|---|---|---|
| Down-stream | Count | 12 | 16 | 18 | 30 | 21 | 3 | 100 |
| | Expected Count | 23 | 5.7 | 8.3 | 13 | 35.3 | 14.7 | 100 |
| Upstream -Resident | Count | 38 | 1 | 4 | 6 | 21 | 30 | 100 |
| | Expected Count | 23 | 5.7 | 8.3 | 13 | 35.3 | 14.7 | 100 |
| Upstream-Relocated | Count | 19 | 0 | 3 | 3 | 64 | 11 | 100 |
| | Expected Count | 23 | 5.7 | 8.3 | 13 | 35.3 | 14.7 | 100 |
| Total | Count | 69 | 17 | 25 | 39 | 106 | 44 | 300 |
| | Expected Count | 69 | 17 | 25 | 39 | 106 | 44 | 300 |
| | Chi-Square(*df* 10) | 155.778*** | | | | | | |

Source: Author questionnaire 2017

Further to the means comparison test (Table 5.5) on benefits of Merowe Dam, the analysis in Table 5.6 shows significant statistical differences between districts on benefits gained by the participants in downstream where the *actual* count of infrastructure, services and economic is higher than *expected* count but agriculture and electricity have lower actual count. In contrast, upstream-residents' *actual* count in agriculture and nothing are higher than *expected* count but lower in the rest of benefits. In upstream-relocated participants' electricity, *actual* count is much higher than *expected* count but the actual count of other benefits are much lower than the expected counts ($\chi^2$ = 155.778, *DF* = 10, *P* = < 0.001). The analysis indicates how downstream and relocated are the greatest beneficiaries from accompanying projects, health and educational services and electricity, which is also evidently clear in individual and community responses. However, upstream-residents mainly benefit from agriculture using fertilised floodplain land at the expense of limited access to services because they choose not to relocate and live independently from the state's systems at the reservoir shore. The individual benefits in the cross-tabulation analysis are significantly different between districts ($\chi^2$ = 138.697, *DF* = 10, *P* = < 0.001). Moreover, there are strong similarities between individual benefits and

communities' responses to benefits indicators (Nothing, Infrastructure, Services, Economy, Electricity, and Agriculture).

Figure 5.1 provides further explanation on how these means unfolded. Electricity achieved between 35% and 80% in all districts, more than other variables such as infrastructure, economic, services and agriculture (between 5% to 38 across the districts). This result can be explained by the fact that the region had no electricity before the dam and now almost the entire region has access to electricity, especially the relocated.

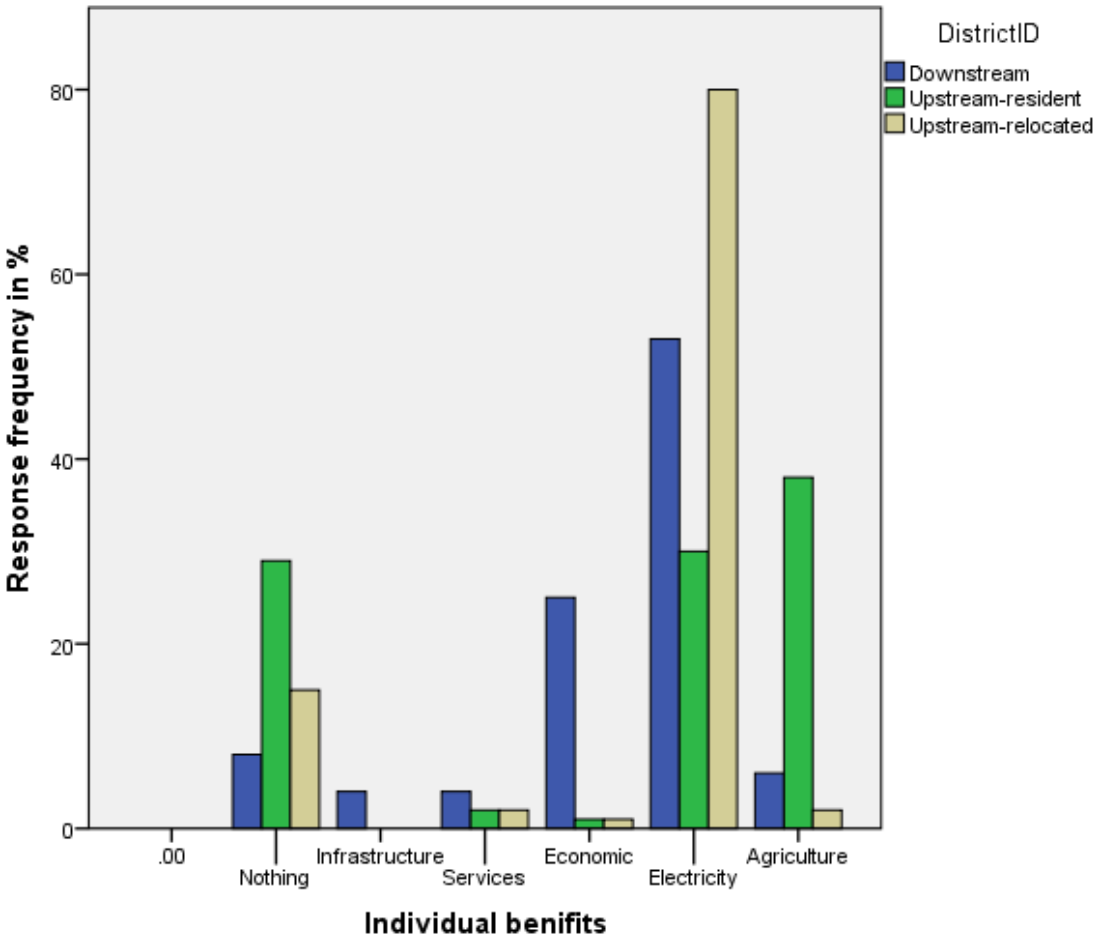



**Figure 5.1 Merowe Dam benefits that gained by individuals**
Source: Author questionnaire 2017

However, in contrast, the percentage of participants who gained nothing from the dam is between 10% and 35%; therefore, the positive contribution is clear for many

observers who knew the region before the dam constructed. The change in socioeconomic status is clear at the local level of areas surrounding the dam in many aspects. This finding is because of the variables highlighted by the participants in this research, which have positive contributions on economic development and improve living standard through services, infrastructure, electricity, etc.

The debate on the Merowe Dam's contribution to local and national economy is not an exception in respect to the global debate on dams' role in supporting economic development. Table 5.7 of participants' opinion illustrates how they perceived Merowe Dam and to what extent this debate unfolded. It is clear that there is a significant degree of variability in participants' perceptions within districts. Table 5.7 shows downstream participants perceive the dam to have an 'economic contribution' and to be 'very good for development', where the *actual* count is higher than the *expected* number of participants. For relocated and upstream-residents, the 'failure' perception *actual* count is more than the *expected* count of participants and the 'economic contribution' and 'very good for development' *actual* count is lower than *expected* for participants with positive perceptions ($\chi^2$ = 43.205, *DF* = 8, *P* < 0.001).

**Table 5.7 Participants final opinion on Merowe Dam**

| Location | | No answer | Economic contribution | Electricity contribution | Very Good for regional development | Failure | Total |
|---|---|---|---|---|---|---|---|
| **Downstream** | **Count** | 13 | 47 | 3 | 27 | 10 | 100 |
| | **Expected Count** | 8 | 32 | 5 | 24 | 31 | 100 |
| **Upstream-Resident** | **Count** | 8 | 25 | 6 | 24 | 37 | 100 |
| | **Expected Count** | 8 | 32 | 5 | 24 | 31 | 100 |
| **Upstream-Relocated** | **Count** | 2 | 25 | 7 | 20 | 46 | 100 |
| | **Expected Count** | 8 | 32 | 5 | 24 | 31 | 100 |
| **Total** | **Count** | 23 | 97 | 16 | 71 | 93 | 300 |
| | **Expected Count** | 23 | 97 | 16 | 71 | 93 | 300 |
| | **Chi-Square (*df* 8)** | 43.205*** | | | | | |

Source: Author questionnaire 2017

However, by combining overall participants' responses and excluding 7.7% of no answer, it might be concluded that the positive perceptions outweigh the negative perceptions. This finding indicates the degree to which perceptions are diversified and the underlying factors that contribute to this debate. It is clear that the dam's social, cultural, environmental, political and economic effects on downstream participants are lower than upstream. In addition, downstream participants have witnessed the construction of many accompanying projects (e.g. hospitals, roads, colleges). By contrast, for upstream participants, in addition to displacement, which has a great effect on people, the resettlement agriculture scheme is not functioning well because of irregular water supply for irrigation. Another factor is the sentiment of injustice in compensation, which led to dissatisfaction and led many to perceive the dam as a failure.

This sentiment is visible throughout the majority of upstream participants' responses and these are some direct quotes of the local participants with respect to economic benefits, as local farmer questionnaire participant (61, 108 and 109) states,

"*I gained benefit in the form of infrastructure (e.g. schools, hospital, farmlands), but there are still irrigation problems"*.

"*It is a good project for developing the country, and I do not oppose it, but it should be based on clear conditions and the consultation of local people with full compensation being paid"*.

"*It is not as it was planned. No canals on both sides of the reservoir, and agriculture was neglected".*

In order to gain a better understanding of the extent to which Merowe Dam has contributed economically to local, displaced communities and surrounding communities in the region, it is important to assess the evidence included in Sections 5.2.1, 5.2.2 and 5.2.3. This analysis means focusing on economic factors alone, which seem to be positive, and disregarding the other factors such as social,

environmental and the political influence the dam may have on local communities, which are discussed in Chapter 6 and 7. This discussion provides the broad understanding of Merowe Dam's contribution to socioeconomic and human development in the region and to establish to what degree it causes any social conflict.

### 5.2.1 Farming and agro-economic indicators

Agriculture remains the core source of income and employment in Sudan, hiring around 60% of Sudanese and making up a third of the economic sector (Verhoeven, 2011; Wallach, 1988). Northern States are no exception; they also rely heavily on agriculture economically. Even though Sudan has a strong agricultural orientation, oil production drove most of Sudan's post-2000 growth. Real GDP growth was estimated at 2.8 % in 2011 (Verhoeven, 2011). Due to oil loss to South Sudan, the growth of both industrial and service sectors fell into the negative in 2012, while only the agriculture sector witnessed growth in both years (Askouri, 2014). In the agricultural sector, the government has tried to diversify its cash crops; however, cotton and gum Arabic remain its major agricultural exports. Livestock production also has immense potential, particularly camels and sheep exported to Egypt, Saudi Arabia, and other Arab countries. One aim of Merowe Dam and accompanying projects is to resolve the problems of irrigation and transportation, which remain the greatest constraints in Sudan for more dynamic agro-economy.

The literature suggests that a huge share of water stored in dams' reservoirs used for irrigation of crops and plantations and the flooded lands provides greater opportunities for seasonal irrigation (Varma, 1999). Varma (2003) adds that,

generally, many dams are constructed to utilise natural resources, but electricity and irrigation are the main purpose of the water harvested. Dams have played a greater role for decades in Sudan, bringing productivity to under-cropping land and adding extra areas of agriculture, helping in the green revolution through high yielding crops and application of fertilisers, and providing food security in the wake of growing population (Wallach, 1988). This context lends support to the empirical evidence here, which clearly indicates that the majority of large irrigation reservoirs' performance in cash and important crop production and financial returns appear to be significant depending on feasibility of irrigation schemes. As local official interviewee (8) states:

*"I believe from experience that large irrigation dams bring prosperity and wealth"*.

*"Wheat and other crop produce at Merowe Dam have increased from 4 to 15 sacks per hectare and farmers' incomes and irrigated land have increased significantly due to increase in land size from 1 to 6 hectares per family" (DIU official interviewee 24).*

*"This reflects an overall increase in production and irrigated land in the region, which reaches 930,000 hectare from 12,000"*. Furthermore, local farmer interviewee (7) adds, "*I believe electrification of irrigation drives the cost of irrigation down which results in income increase"*.

It is important that mega-dams' irrigation schemes be systematic and economically driven and managed efficiently for the benefits of income and productivity increase and sustainability (Varma, 2003). The example of Brazilian, Indian and Turkish large irrigation dams appear to demonstrate this through good practice, which led to dams' contribution to economic development (Varma, 2003). About 678 large Turkish dams illustrate the economic benefits, by creating a revenue worth $4 billion yearly for the national economy (Ersumer, 1999a).

In Sudan, the primary sector of agriculture is marked by low productivity because of insufficient application of science and technology. Furthermore, Varma (2003) and Ersumer (1999) believe diversifying cash crops and the use of modern methods of

agriculture has greater influence on productivity. Food and Agriculture Organisation (FAO) lend support to Varma (2003), Ersumer (1999) and this research where their reports shows significant increase in agriculture output including (aquatic organisms including fish, molluscs, crustaceans and aquatic plants) from early 2000s (Anton, 2017). This increase could indicates the positive impact Merowe Dam has on agriculture and fishery production as shown on the Figure 5.2 below.

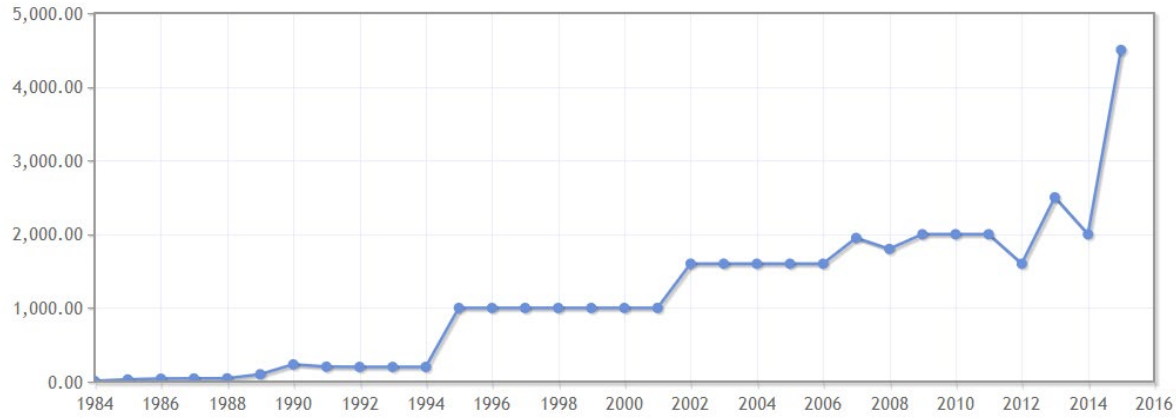



**Figure 5.2** ***Aquaculture and fishery production***

Source: https://www.indexmundi.com/facts/sudan/fisheries-production

This research has recognised the important role played by greater irrigation areas in increasing productivity and income in the Merowe irrigation schemes; however, it is not the only factor determining the increase in productivity. Hence, in the context of this study's results, the statistical analysis in the cross-tabulation of Table 5.8 highlights that income increase is significantly dependent on land size increase. This analysis shows a positive correlation between land increase and income increase, suggesting that income increase is dependent upon land increase. The cells indicated in green shows that land increase *actual* count is much higher than the *expected* count of income increase. However, the cells shaded in purple shows that no land increase *actual* count is much higher than the *expected* count of no income increase, while no land increase *actual* count is much lower than *expected* count of income increase ($\chi^2 = 87.796$, $DF = 1$, $P < 0.001$).

**Table 5.8 Relationship between land and income increase due to Merowe Dam**

| | | | No income increase | Income increased | Total |
|---|---|---|---|---|---|
| Land size after Merowe Dam | No land increase | Count | 120 | 30 | 150 |
| | | Expected Count | 80 | 71 | 150 |
| | Land increased | Count | 39 | 111 | 150 |
| | | Expected Count | 80 | 71 | 150 |
| Total | | Count | 159 | 141 | 300 |
| | | Expected Count | 159 | 141 | 300 |
| | | Chi-Square (*df* 1) | 87.796*** | | |

Source: Author questionnaire 2017

Many participants have expressed this view. For example, a local official interviewee (8) stated that:

*"The new settlement agriculture projects system is completely different; we use modern scientific methods in all agricultural stages. From choosing the crops and seeds to the dates of agriculture, irrigation and the amount of compost to be used, everything is prepared by the Agriculture Research Authority. Of course, in these agriculture projects, such a method is a qualitative transformation in the way of conducting agriculture, not a custom by the displaced communities. We introduced new crops which previously unknown to the farmers. Additionally, in the past the famers owned small pieces of land and sought to grow a crop that provided great return in a short time. However, after the resettlement agriculture scheme, the farmers have large plots and the opportunity to diversify agricultural crops. For example, they never tried cultivating tomatoes, potatoes or onions, not because the farmers didn't know them before, but because the farmlands were narrow and did not have sufficient irrigation and now all these factors are available".*

This statement argues that the Merowe Dam has provided a strong and stable platform for agro-economic development in the region, in the form of electrification of irrigation systems and infrastructure for transporting goods and products to markets across the Sudan and exporting. These benefits have also led to an increase in irrigated land size and adoption of modern agriculture systems with the support of the Agriculture Research Authority; which send the right message to investors to invest extensively, especially the main target Arab investors. Evidently, there is a sense of faith within many participants on the Merowe Dam's support for economic development, especially through agriculture. As a local farmer stated:

*"The dam is a big blessing from God. If used efficiently Sudan will develop economically through agriculture" (Local farmer questionnaire participant 20)*

### 5.2.2 Other agricultural economic factors

Having established the positive correlation between increases in irrigated land mass and income, it is important to examine other farming-economic indicators to understand the economic contribution of Merowe Dam in the region. The Merowe Dam might contribute to the local economy through farming, but the contribution might differ across the district groups (downstream and upstream, both relocated and resident). A Kruskal Wallis analysis of a Likert scale of 8 farming-economic indicators (scored 1 to 5) tested the level of agreement or disagreement (with 5 as the highest level) on whether Merowe Dam positively contributed to local farming-economy or not.

**Table 5.9 Ranking of farming relating economic indicators by districts**

| Location | | Irrigation | Type of products | Volume of products | Grazing areas | Land size | Quality of soil | Cost of irrigation | Price of products |
|---|---|---|---|---|---|---|---|---|---|
| Downstream | Mean | 3.270 | 3.220 | 3.210 | 3.130 | 3.630 | 3.490 | 3.200 | 3.060 |
| | Std. Deviation | 1.254 | 1.168 | 1.076 | 1.116 | 1.228 | 1.141 | 1.181 | 1.062 |
| Upstream-Resident | Mean | 1.850 | 1.850 | 2.130 | 2.020 | 2.450 | 2.980 | 2.280 | 2.190 |
| | Std. Deviation | 1.266 | 1.123 | 1.253 | 1.082 | 1.410 | 1.517 | 1.443 | 1.323 |
| Upstream-Relocated | Mean | 1.970 | 1.880 | 1.990 | 2.300 | 2.780 | 2.350 | 1.990 | 2.120 |
| | Std. Deviation | 1.193 | 0.956 | 1.049 | 1.219 | 1.151 | 1.201 | 1.141 | 1.028 |
| Total | Mean | 2.363 | 2.317 | 2.443 | 2.483 | 2.953 | 2.940 | 2.490 | 2.457 |
| | Std. Deviation | 1.392 | 1.258 | 1.251 | 1.231 | 1.358 | 1.375 | 1.360 | 1.219 |
| | N | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Kruskal-Wallis T | Chi-Square(*df* 2) | 61.53*** | 74.30*** | 56.49*** | 43.76*** | 39.74*** | 34.08*** | 46.03*** | 37.84*** |

Source: Author questionnaire 2017

There is a significant level of agreement that the dam has made a positive contribution to farming-economic development through irrigation, types and volume of products indicator with significant statistical difference between the districts than other indicators (Table 5.9). Other indicators show a significant level of difference between districts. The level of agreement that Merowe Dam's contribution to farming-economy in the region is significantly different. To elaborate further, Table 5.9 provides insight into the participants' responses in the comparison of means table for Merowe Dam's agro-economic contribution. The means for downstream participants show a strong tendency towards agreement that the Merowe Dam has made a

positive contribution to farming-economy by scoring highly in all indicators (3.060-3.630) with a *standard deviation* between 1-1.25. These results explain the economic contribution that the dam has made to downstream participants through modern agriculture and infrastructure, which support agro-economic development. However, both districts upstream show inclination towards a negative contribution to farming-economy to some degree by scoring low in some indicators (1.850-2.890) with a standard deviation between 1-1.50. This finding is because of an irregular water supply for irrigation for upstream-relocated participants, and upstream-residents score poorly because they do not have an agriculture scheme, as they are not relocated. However, remarkably, both upstream districts score highly on the land size and quality of soil. However, the upstream-resident district scores even more highly on quality of soil (2.980), which is because of the large strips of fertile soil formed by the annual flood. The flood makes the soil salt free and regenerates its fertility with regular sedimentation (local farmer participants 125, 138, 139). In respect to upstream-relocated participants, land size is a result of resettlement agriculture schemes, which has provided them with large areas of land, unlike the upstream-resident district, but at expense of soil quality. However, relocated and downstream participants might benefit from land size, the use of modern agriculture, infrastructure and the Agriculture Research Authority support. Overall, an evaluation of the total means for all districts indicates a different picture, where the means are between 2.31-2.95 with a *standard deviation* of 1.21-1.39. This finding indicates some moderate/neutral tendencies, which might signal a positive or less hostile perception of the dam's agro-economic contribution. Furthermore, the table of means shows that downstream participants may benefit from the dam more than those upstream. The reading of all indicators evidently suggests that there is no significant difference

within the means between 3.0-3.63, and standard deviation are 1-25, which shows that the responses cluster around the same mean with a mainly positive perception of the farming-economic contribution of Merowe Dam. The means of grazing areas (3.130) downstream is high and lower upstream-residents however, the relocated scores higher ($\chi^2$ = 61.533, *DF* = 2, *P* < 0.001). The chi-squares and the effect sizes are different across the indicators on the table (5.9) ($\chi^2$ = 61.533)/(*N-1* = 300-1) =21%). Furthermore, the level of effect size is 21% and the variability depends on the district of the respondents (Table 5.9). This change in size may increase the farming of livestock, which was understood by Northern Sudanese farmers, as local farmer interviewee (7) stated:

"*The increase in land led to an increase in livestock, due to availability of grazing areas and feeding grass and this led to increase in our income"*.

Furthermore, local official at the agriculture scheme interviewee (8) commented:

"*Certainly there is diversity in agriculture and livestock is one area that witnessed increase after the dam. Northern farmers are familiar with livestock, but due to limitations in land, there was little interest. But now farmers have sufficient land. The farmer who had 5 sheep now has 50. There are around 18000 lambs, 17000 goats and 3000 cattle in the Al-Makabrab scheme alone, and now northern farmers export across Sudan"*.

In this sense, based on interviews, the farming economy has had some success despite some low mean scores on some indicators upstream, such as irrigation, type and volume of product. These data show the inconsistencies and variation in responses, especially to open-ended questions in the questionnaire, which were sometimes used as a means of political protest against the dam because of displacement.

Likewise, some economists in Sudan argue that heightening the Rousers Dam and cutting two surface irrigation canals economically is much more efficient than building

Merowe Dam. The observers believe the heightening is the best form to support the economy though vast fertile land in central Sudan. However, officials and some Sudanese economist argue that Merowe Dam provides much needed electricity for the country in addition to agro-economic development. Yet, local committee member interviewee (12) believes solar energy is cheaper, more efficient and available in abundance, especially in the desert of Darfur and Northern Sudan. This research acknowledges that Merowe Dam has some shortcoming in agro-economic contributions (e.g. deficiency in water supply, delay in electrification of irrigation system, lack of training in modern farming). As university academic interviewee (14) adds:

*"In terms of electricity, infrastructure and services, the dam was successful. However in agriculture there are some deficiencies and the agriculture schemes of Manasir, Hamdab and Amri have many problems, especially irregular water supply for irrigation and agriculture has not flourished as it should"*.

Many local participants and interviewees mentioned regularity in irrigation as a principal problem because of delays in electrification of the water supply system. However, other local participants and interviewees went further, suggesting that the dam has a negative influence on agriculture and productivity. As a local Committee member interviewee (12) suggested:

*"Our production of farming produce and livestock before Merowe Dam was sufficient to the region, however, since moving to new locations, our livestock is reduced because of the environment and shortages of animal feed. In the past, we had less land but our productivity was very high in wheat and onions compared to the new location".*

Furthermore, many local participants expressed concerns over distance between their farms at the new scheme and their homes, unlike the old settlement where the farms were very close. This dislocation may reduce productivity due to time spent

getting to work and loss of women's support in farming. Local farmer questionnaire participants (297 and 275) have backed this claim by suggesting:

*"It is financially and morally expensive because I cannot be at the farm regularly."*
*"Very exhausting, too far for my wife, and less productive".*

In addition, the literature has no shortage of criticism in this respect. McCully (2001) and Singh (1997) argue that most irrigation areas in India and other African and Asian countries are ruined by waterlogging and saline. Other criticisms suggest that intensive irrigated farming of cash and export crops may lead to stagnation in local food crop production, as well as low prices of agricultural produce in international markets. However, with increases in global population, the demand for agricultural produce will increase and then eventually the prices will rise (Ersumer, 1999). This interpretation suggests that large dams' contribution to productivity is not negligible and overstated as these critics understood. Furthermore, as this research shows, the price of farm produce means 2.20-3.0, with overall mean of 2.45 in (Table 5.9) provides a greater degree of optimism, especially in the downstream district. This point challenges the argument of the large dam critics in relation to the low price of farm produce. Equally, considering these criticisms of Merowe Dam, some observers and expert (such as academic and environmental interviewee 9, 25 and 26) argue that these criticisms are irrelevant to the Merowe region because of the desert climate and the nature of the soil, high level of heat and vibration in the region. As university academic interviewee (9) elaborated further:

"*Waterlogging should be good for the area because it recharges the ground water. In general, it is good for agricultural crops like wheat, beans and other arable crops, which are not affected by water in large quantities. Unlike some types of date plants, production of which may reduce because of humidity and large amounts of water. However, it may cause aeration, which seriously affects the root system of crops and plants and reduces productivity".*

In addition, university academic interviewees (25 and 26) argued that salinity depends on whether the water stored at the reservoir comes from saline areas, carrying with it quantity of salts deposited in the lake and then the ground is salted. This salinity does not apply to the River Nile, even if it found it would have little effect. Also, the means of the quality of soil, types and volume of products at the three districts especially downstream indicated a positive perception toward these indicators, unlike the negative perceptions of critics of large dams. The interpretation of Table 5.9 is in line with the opinion presented by the interviewees in respond to these critics. In fact, the irrigation schemes are very far from the lake and there is lack water supply for regular irrigation, even if waterlogging were found, would be useful due the level of draught in region. In fact, people in the region have seen the benefit of increased water levels in the ground, which reduces the cost of excavating wells (local farmer interviewee 30). To have a full understanding of the agro-economic contribution of Merowe Dam, it is important to combine it with non-farming economic factors, which complement the farming-economic factors for economic development in the region.

### 5.2.3 Non-agricultural economic indicators

The economic and social status of the Merowe region before the construction of the Merowe Dam depended primarily on trade and agriculture. As discussed in Chapter 4, the region has no infrastructure, which support the linkages between the agro-economy of rural households and other diverse areas of non-farming activities. With respect to rural economies, non-farm income enhances agricultural output value or income through the electrification of irrigation, transportation of product to markets, and communication (Davis, 2009). The above indicators have significant impact on

driving productivity, prices and incomes, which result in an improvement in the socioeconomic status of rural communities (Davis, 2009). Therefore, as this research argues, the Merowe Dam and its supplementary projects support rural economic diversification; which virtually signifies the type of integration required between the agricultural and non-agricultural economic factors at the individual and community levels. As the literature suggests, it is believed that the rural economy is not only taking advantage of non-agricultural activities, but is increasingly relying on it (Davis, 2009). The contribution of mega-dams to other areas of economy is a controversial matter because the focus is primarily on electricity generation and irrigation. Therefore, there is no shortage of criticism of large dams in the literature For example, McCully (2001) dismisses mega-dams' contributions to other areas of the economy, and disputes the concept of flood control, arguing it is a myth because floods have actually worsened in some case. Furthermore, Singh (1997) has suggested that the alleged contributions of water supplies from large dams to towns, cities, and increased fishery catches from reservoirs is negligible. Singh (1997) believes that the alleged benefits are based on the interests of the dams' promoters. However, this research argues that, in respect to the rural non-agricultural economy, Merowe Dam has clearly contributed to many areas significantly. Local farmers' questionnaire participants (6 and 17) support this viewpoint by suggesting:

*"The Merowe Dam helps the region economically through a stable supply of electricity and fishing opportunities for local people".*

*"The region has seen huge economic development across sectors, especially services and trade"*

The concept of constructing Merowe Dam as a package with many economic developments supporting infrastructure projects has opened a whole new paradigm of economic development at the regional level. This idea has played a big role in

driving other areas of the economy to develop (e.g. services, small manufacturing and business, metal workshops, construction and tourist sector).

Having observed the agro-economy and its vital role in rural economic development. It is important to analysis the non-farming economic indicators, as they complement agro-economic factors. Examining some of the non-farming indicators provides better understanding of the full extent of Merowe Dam's economic contribution in the region (see Table 5.1). The Merowe Dam as a technology may have influenced the socioeconomic status of displaced and local peoples through both non-farming and farming economic factors. The non-farming economy is one of the areas targeted to support local economy through infrastructure, transportation, communication, electricity, etc. However, the contribution of each indicator might differ across the district groups (downstream and upstream, both relocated and resident). By deploying a Kruskal-Wallis analysis of variance among non-farming economic indicators (see Table 5.1), it is possible to test the level of agreement and disagreement amongst the respondents on whether Merowe Dam has contributed to the local non-farming economy (subsequently influencing socioeconomic development) or not. The analysis consider technology as a form of infrastructure, and transportation, communication and electricity as innovations that enhance productivity as in the first trajectory of socioeconomic development (based on Welzel *et al.*'s (2003) three trajectories on socioeconomic development). Therefore, other non-farming indicators, such as sources of income and price of assets, play the role of second trajectory: feeding into the farming economy, enhancing overall the local economy by diversifying the sources of income, and increasing prices of assets. These factors lead to a widening of market access and improved socioeconomic

status of people in the Merowe region (Welzel, Inglehart & Kligemann, 2003). The third trajectory, discussed in Chapter 7, is the role of institution in facilitating socioeconomic development through the construction of Merowe Dam and its accompanying projects. To test the influence of these indicators, it is important to analyse the participants' responses in this study. Therefore, a Kruskal-Wallis analysis of a Likert scale of infrastructure, electricity, communication, transportation and source of incomes indicators (scored 1, 2, 3, 4 and 5) with 5 as the highest level of agreement was conducted. The analysis shows there is significant evidence of agreement within the districts on the non-farming economic contribution of infrastructure, electricity, communication, and transportation of the dam more than the price of assets and cost of electricity with significant statistical different between districts (Table 5.8)

**Table 5.10 Ranking Non-farming relating economic indicators by districts**

| Location | | Infrastructure | Electricity | Communication | Transportation | Source of income | Cost of electricity | Price of assets |
|---|---|---|---|---|---|---|---|---|
| Downstream | Mean | 3.660 | 4.060 | 3.740 | 3.860 | 3.300 | 2.890 | 2.800 |
| | S. Deviation | 1.103 | 1.071 | 1.097 | 1.073 | 1.185 | 0.994 | 1.054 |
| Upstream-Resident | Mean | 2.010 | 2.320 | 2.170 | 2.410 | 1.920 | 1.990 | 1.800 |
| | S. Deviation | 1.337 | 1.601 | 1.443 | 1.478 | 1.285 | 1.314 | 1.082 |
| Upstream-Relocated | Mean | 2.620 | 2.690 | 2.630 | 2.700 | 2.070 | 2.260 | 2.050 |
| | S. Deviation | 1.285 | 1.383 | 1.353 | 1.360 | 0.977 | 1.116 | 1.048 |
| Total | Mean | 2.763 | 3.023 | 2.847 | 2.990 | 2.430 | 2.380 | 2.217 |
| | S. Deviation | 1.417 | 1.557 | 1.460 | 1.453 | 1.308 | 1.206 | 1.140 |
| | N | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Kruskal-Wallis T | Chi-Square (*df* 2) | 67.97*** | 67.92*** | 60.62*** | 55.27*** | 67.76*** | 33.05*** | 44.64*** |

Source: Author questionnaire 2017

To gain a better understanding, Table 5.10 compares the means and shows significant differences on the means of these variables. Infrastructure, electricity, communication and transportation score highly (between 2- 4, with standard deviation between 1-1.50) especially at downstream district ($\chi^2$ = 67.965, *DF* = 2, *P* = <0.001). Furthermore the level of effect size is 22% and the variability is dependent on the district of the respondents ($\chi^2$= 67.965)/(*N-1* = 300-1) =22% (Table 5.10). This

indicates the positive influence of these indicators on the overall process of socioeconomic development. Many local farmers agreed with this positive influence of the dam and local farmer questionnaire participant (5 and 52) argue that:

*"There are improvements in socioeconomic and human development, especially due to the accompanying projects".*

*"The Merowe Dam brought many infrastructure projects to the region like roads, bridges, hospitals and Merowe Technology College".*

Evidently, infrastructure such as roads, bridges and airports have a positive contribution economically by easing the movement of goods and people across the region and to other part of the country. This infrastructure leads to increased tourism in the region because many historical sites are present in the area, most importantly Jabal Al-Barkal. Infrastructure plays a vital role in the formation of the annual International Barkal Festival, and the Merowe Dam has become a tourist attraction for locals as well as for people across Sudan. By combining the above with the founding of the Merowe Museum, where archaeological salvage and artefacts of Kush Kingdom were gathered, provides further evidence of the socioeconomic and economic development with a tourist industry that could increase income and jobs in the region.

Likewise, transportation also has a significant positive contribution by providing easy access to the region. Before the dam's construction, it took four days to reach Merowe from Khartoum, but now, with luxury high-speed buses operating in the region, it takes three to four hours. Communication provides the region with a vital component for business and education using internet and mobile phones, unlike before the dam's construction, when the communication network was limited if it

existed at all. Local committee member interviewee (4) elaborates on this point by adding:

"*There is a big shift in the region from having no electricity, no means of communication or even televisions and we now have communication devices and all the technology which we use for education to be at the level of the rest of the country and world. We have become more developed and willing to learn".*

The means of sources of income and prices of assets have scored highly among downstream (2.80-3.30) and upstream-relocated (2.05-2.07), with lower scores among upstream residents. Evidently, this finding suggests that there is some correspondences with the first trajectory of socioeconomic development through infrastructure, electricity and communication.

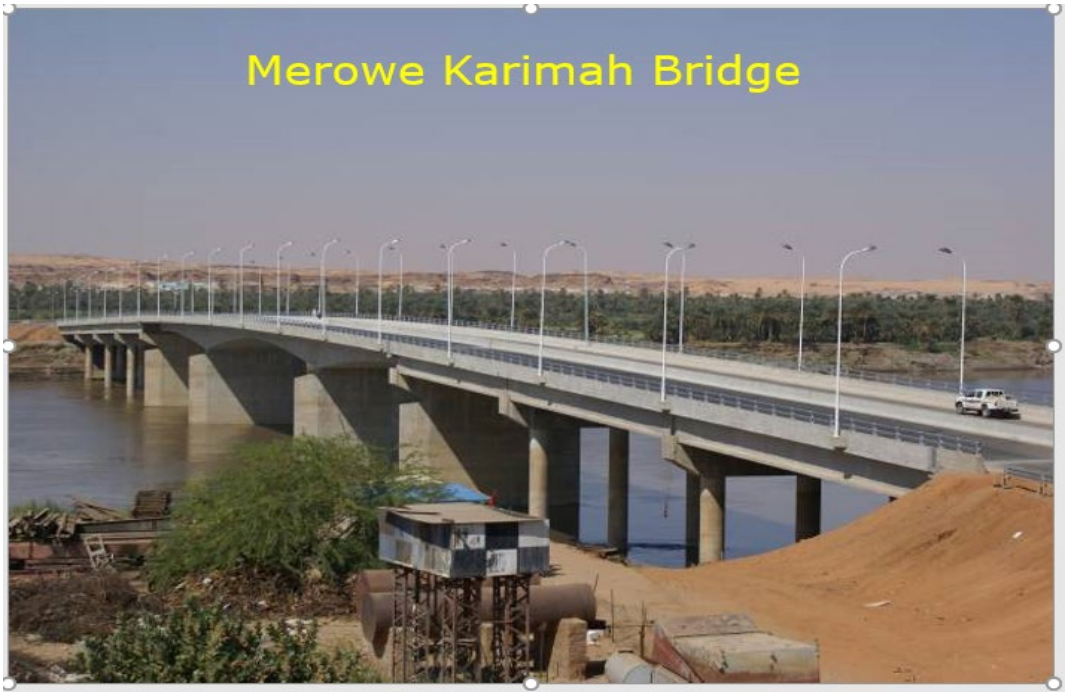



**Figure 5.3 Merowe Karimah Bridge**

Source: DIU 2017

This infrastructure led to a widening of sources of income and increases in asset prices through the expansion of the market as local businessperson interviewee (5) suggested:

"*The dam has had a positive influence on the market of Merowe. It has expanded immensely in all aspects, including numbers of shops, types of shops, customers and jobs. Even the way houses are built has changed from traditional materials like clay to very modern, stable building materials such as concrete. House rent and prices*

*have increased rapidly; for example, bare land price increased from 25,000 SUP to 100,000 SUP and the price of farm land has increased from 20-50SUP to 200-250SUP per hectare"*.

In addition, the availability of electricity, which scored high means among downstream and relocated participants (2.67-4.0), has added a new element to the region by creating new small workforces, such as carpenters and welders' workshops. This diversification of the economy led to a major shift in the type of household furniture available. In addition, it opened up a new market and created new jobs, especially in those trades are unfamiliar to locals.

In respect to socioeconomic changes in the region, local committee member interviewee (4) added that:

*"A project that does not increase the population density in the region will not succeed, even if it has all the services available. The Merowe Dam attracted people from all regions of Sudan: workers, employees, investors and traders. This is the most important element driving stability, reducing migration from the region and providing better living standards for the displaced and locals".*

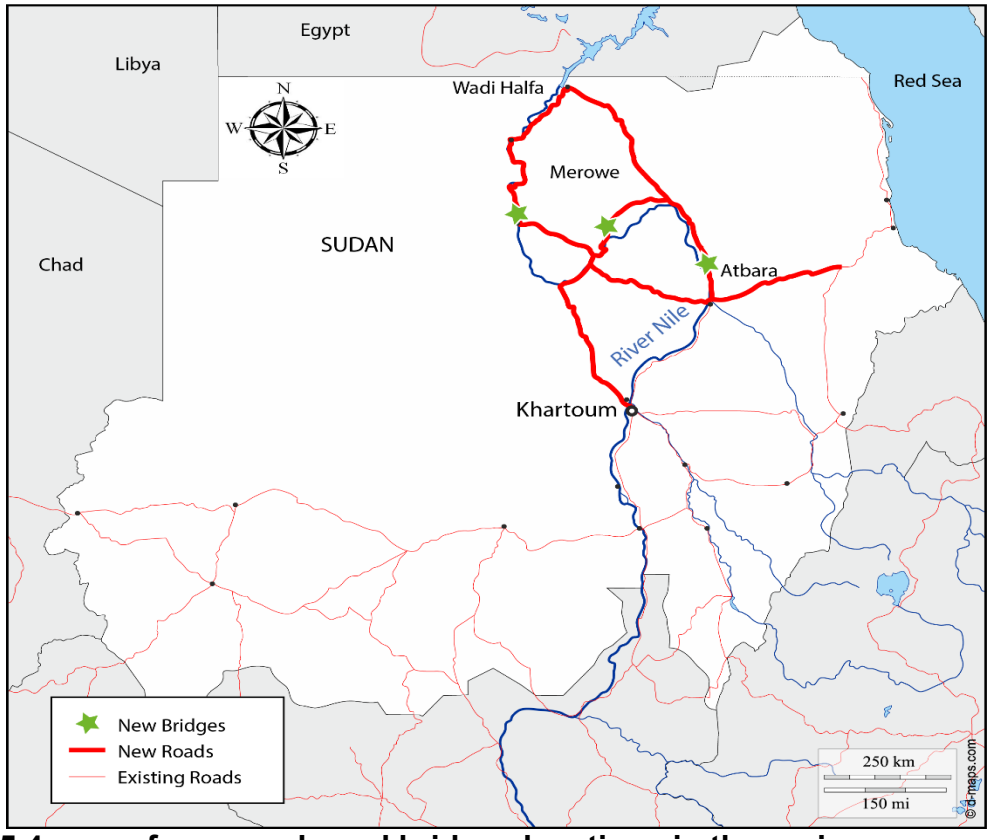



**Figure 5.4 map of new roads and bridges locations in the region**

Source: Google Map-edited by author 2018

With regard to the price of assets and farming produce, according to local committee member interviewee (4), before the dam, the price of a sack of dates was about 500SUP and is now 1800SUP, indicating a high increase in price. In addition, productivity has increased from between 40 and 100 sacks to around 300 sacks annually for some farmers. One local committee member noted:

> "*The level of personal income has changed dramatically. In the past, our income meant buying no more than necessities. Even meat was a luxury, but now we have more variety of food and goods from all over the country and we can afford it. This is not only for the displaced people but also for the entire region" (Local committee member interviewee 4)*.

This research recognises the influence non-farming economic indicators may have had on the improvements in agriculture and other areas of business in the Merowe region. This improvement is evident in the form of services created and the links provided between cities through roads and bridges, in addition to the localisation of health and education services. The above analysis allows this research to observe the changes in socioeconomic status of people in the region through the Merowe Dam and its accompanying projects. This point on the positive role played by infrastructure projects in supporting human development through improving socioeconomic status of the displaced and local people of the region is covered in Chapter 6. To understand Merowe Dam's economic contribution to the region, it is important to evaluate employment and food production in the region, detailed in the succeeding Sections 5.2.3 and 5.3.

### 5.3.4 Employment generation in the region

The agriculture sector is the main provider of employment in the region and accounts for the majority of employment in Sudan. The development of the agriculture sector through Merowe Dam is central to Sudanese employment because about four fifths

of the workforce depend on it directly or indirectly (UNDP, 2006). In Sudan, there are four areas of employment: first is agriculture, which remains the foundation for sustained employment generation and economic growth in Sudan after the separation of South Sudan; second is the mining sector of oil and gold; third is the industrial sector, which remains relatively stagnant; and the fourth is the service sector, which continues to offer a very important source of income for a wide section of the workforce, although its growth has been slow in recent years (UNDP, 2006). Surprisingly, the agriculture sector has decreased in terms of productivity and employability. Therefore, one of the Merowe Dam's aims is the diversification of income and employment sources in the region (DIU, 2007f). The Merowe Dam and its accompanying projects seem to represent at least three of the sectors that provide employment in Sudan.

While the services sector is becoming larger and offers slightly higher incomes than agriculture, shifting labour into it from agriculture is unlikely as productivity levels in services are not as high as in agriculture. However, services sectors and tradesmen are starting to develop in rural areas because the industries are not developing fast enough to absorb the number of unemployment (UNDP, 2006). Although the industry sector has witnessed some growth in productivity – especially food process – it only provides employment to a minor segment of the workforce. The most overwhelming increase is in the female employment rate, from 18% to over 28%, due to the increase in services and food processing industries, especially in urban communities (UNDP 2006). This rise in female employment has empower woman economically by gaining some independency, in which it has other social, cultural implication especially in regards to equality and men donating family finance. The Merowe Dam

redesigned the employment landscape in rural Sudan by providing electricity as a main driver of socioeconomic development. The availability of electricity allows many services to flourish and the region to become attractive to business. These factors are intended to support employment generation in the region. Furthermore, the new resettlements agriculture scheme is designed to support the displaced to continue their agricultural activities and support employment generation. Therefore, a Kruskal-Wallis analysis of a Likert scale of employment generation indicators is conducted to test the level of agreement and disagreement with the contribution level of Merowe Dam at the 3 districts (scored 1, 2, 3, 4 and 5, with 5 as the highest level). The test shows significant statistical differences between the districts. Accompanying the Kruskal-Wallis test with a comparison of means across the districts provides insight into the participants' responses on the Merowe Dam's support for employment. Table 5.11 shows that downstream participants have scored the highest mean (2.99) within the 3 districts (with a standard deviation of 1.15), however both districts upstream scored within 2.00 (with a similar standard deviation of 1.14 and 1.24).

**Table 5.11 Ranking employment generation by districts**

| Location | Mean | Std. Deviation | N |
|---|---|---|---|
| Downstream | 2.990 | 1.159 | 100 |
| Upstream-Resident | 2.010 | 1.243 | 100 |
| Upstream-Relocated | 2.090 | 1.147 | 100 |
| Total | 2.363 | 1.261 | 300 |
| Chi-Square (*df* 2) | 38.91*** | | |

Source: Author questionnaire 2017

This finding indicates not only statistical differences between the districts, but also shows significant differences in perception of employment contributions of Merowe Dam. Downstream participants have some inclination towards a positive employment contribution, which can be explained by growth in job opportunities through a significant increase in service projects (hospitals, schools, colleges, etc.) in addition to an expansion of Merowe's market and fishing opportunities, which provides a whole new industry for all districts. Many participants, observers and officials place

emphasis on the employment opportunities created by the construction of the Merowe Dam ($\chi^2$= 38.906, *DF* = 2, *P* = <0.001). Furthermore, the level of effect size is 13% and the variability depends on the district of the respondents ($\chi^2$= 38.906)/(*N-1* = 300-1) =13%. For example, local farmer questionnaire participants (8 and 5) stated*:*

*"Yes, I benefited from Merowe Dam in terms of transportation, communication and employments; however, it would be better to use fish locally instead of marketing them outside the region"*

*"The Merowe Dam helps in creating new job opportunities and improving living standards through building infrastructure e.g. roads, bridges, etc".*

On one hand, downstream participants seem to agree and have gained some employment. However, on the other hand, upstream districts – especially upstream-resident participants – appear to disagree with the employment contributions of the dam. The low reading of means is contradicted by open-ended questions and interviewees' answers in many areas; however, some participants have explained why this might be. For example, local farmer questionnaire participant (1) states:

*"Yes, I gained some benefits e. g. electricity and transportation. However, employment opportunities are not distributed fairly across the region".*

Relocated and upstream-resident participants have expressed their dissatisfaction in respect to employment by suggesting an unfair distribution of opportunities. Other relocated participants acknowledged the dam provides employment. However, displaced people should have priority in job allocation:

*"I wonder if the displaced people are positively discriminated against in employment, not that we are only given marginal jobs"* (Local committee member interviewee 12).

Dams have been criticised in the literature, especially their contribution to areas other than electricity and agriculture. However, employment is not of the areas in the spotlight. Although currently there is no literature, which explains the employment situation in relation to dams, other criticisms do not diminish the contribution of

Merowe Dam towards employment in the region, especially in agriculture schemes and other areas such as fishing, services and even self-employment opportunities in the region. Resettlement agriculture schemes have provided a significant number of job opportunities. DIU official interviewee (16) elaborated further:

*"There are over 400 people employed by Merowe Dam. 350 are from local communities, representing all aspects: accountants, engineers, mechanics, electricians, drivers and labourers. In addition to civil servants in the areas, the majority are local, especially teachers and nurses."*

A Local committee member interviewee (4) suggested:

*"There are increased job opportunities in the accompanying projects, such as Al Nile Poultry Company, which is located at New Amri. This project employs huge numbers, around 400 labourers, and now even women have job opportunities. However, in the past, women were only housewives or worked at the family farm".*

Furthermore, concerning the employment of locals in the agriculture scheme, local official interviewee (8) added that around 80% of the staff in Al Makabrab agriculture scheme are from the displaced people (120-130 out of the 145 are displaced persons, which accounts for about 80%, with the remaining 20% coming from the surrounding areas). According to university academic interviewee (13), the Merowe Dam has turned the Northern States from a harsh, arid region to an attractive area for workers from all corners of Sudan for various work such as fishing and agriculture, where water for irrigation is available despite the dam being designed for electricity generation. The Merowe Dam has, directly or indirectly, provided employment opportunities in the region. The whole region has been revived economically by the creation of job opportunities in agriculture, health and education, and even the owners of groceries and slaughterhouses are selling more of their goods (interviewee 13). Having witnessed how Merowe Dam projects have provided employment opportunities for locals, it is important to study how the increased availability of jobs

in agriculture supports the increase in food productivity in the region, especially in the agriculture sector, which is the main employment provider in Sudan.

### 5.3 Increase in food production in the region

Currently, irrigated land occupies roughly 330 million hectares (around 20% of world's cultivated land), but is responsible for around 40% of crop output and employs nearly 30% of populations spread over rural areas (Alexandratos & Bruinsma, 2012). With the large population growth expected in the coming decades, irrigation must be expanded to increase food production capacity. Sudan and the Northern States are no exception in respect to food needs, especially for arable crops such as wheat and corn. It is estimated that 80% of additional food production by the year 2025 is needed to come from irrigated land (Alexandratos & Bruinsma, 2012). In this regard, Merowe Dam and its irrigated agriculture schemes are in the spotlight to produce food at a higher level not only for local consumption but also for export to satisfy the Arabs' needs for food.

Even with the widespread measures to conserve water by improvements in irrigation technology, the construction of more reservoir projects will be required. Because of the importance of agriculture in sustaining livelihoods of the poor, the World Bank (2008) World Development Report was devoted to Agriculture and Rural Development. The sector has therefore, been placed at the centre of the development agenda of the Millennium Development Goals in order to eradicate extreme poverty and hunger (Ahmed *et al.*, 2013; Wu *et al.*, 2013). According to DIU official interviewee (22) in respect to Merowe Dam and its accompanying project, the project:

*"Aimed at transforming the communities from rural to modern agriculture. To increase agricultural production in the region and transform communities into integrated*

*socioeconomic units, such as the Aljazirah Agriculture Scheme, to meet the needs of agricultural production in the region and across Sudan"*.

The literature is filled with examples of agricultural schemes that played an active role in economic transformation through high farming productivity and making agriculture an important driver of growth. In respect to increased production and variation of food, the Director of Merowe Dam Area Authority for Agriculture Development said:

*"Agriculture schemes in the region have witnessed not only increased production but also variety in the type of crops and products has increased (aerated rice, corn, peanuts, soybeans, sorghum and sunflower)"*.

These quotes confirm that there is an acute need for Merowe Dam to increase food production in the region to support the high levels of demand for food in Sudan, due to a lack of sufficient production in other agriculture scheme in the country.

Numerous studies have found that the agriculture schemes associated with the dam have been instrumental in increasing food available for local consumption and export, which leads to growth in most developing countries (Ersumer, 1999a; Pearce, 1992; Schultz, 2002; Varma, 2003). There is a connection between increased food production and agricultural growth in supporting overall economic growth (Schultz, 2002). In the case of the Merowe resettlement agriculture schemes, even small differences in agricultural productivity have had strong impacts on the rate and pattern of overall economic growth. Evidence of a Green Revolution in Asia and Latin America strongly suggests that agriculture can be an engine of growth early in the development process and a significant power for poverty elimination through food production and income increase (Castelán, 2002).

In the case of Sudan, and particularly the Merowe area, notably from Khartoum up to the Northern States, the area has witnessed a huge development of small modern farms producing various vegetables, crops and citrus fruits. The critics of dams

supporting increased food production, such as McCully (2001) and Singh (1997), suggest that, despite this inspiring economic performance, agricultural transformation has been slow and growth relatively weak. Singh (1997) stated that product yield is still far below potentials, agricultural modernisation is feeble and deteriorating, and the state of the agribusiness industry is still in its early stage in many developing countries. Although there has been some success stories in many areas of Merowe, it is fair to say that food production did not spillover to most areas in Sudan. This lack of diffusion of benefits is due to many factors, such as lack of funding and investment in agricultural sectors. For example, in Merowe Dam, there is a plan for two irrigation canals on both sides of the reservoir to irrigate two well-designed agriculture schemes in vast fertile lands in the Northern States of Sudan. Regarding the question of whether Merowe Dam played a role in increasing food production in the region, many interviewees and participants have agreed with the statement 'Merowe Dam is behind the increases witnessed in local food production'. Local committee member interviewee (4) confirmed:

"*There is a significant increase in agricultural production with the help of Agriculture Development Authority in Merowe. Its mission is to support local farmers to use modern agriculture and grow high quality food produce. Consequently, now we are growing potatoes, which were not familiar to us previously, and other crops such as corn. Potato production has exceeded all expectations and we produce more than the Netherlands".*

The role of Merowe Dam in increasing food production is not limited to agriculture, but extends to increases in fishing catches at the lake and commercial fish farming in the region. The majority of Northern people are not accustomed to fishing and the number of fishermen/anglers is very small compared to people in the southern regions of Sudan. However, after the construction of Merowe Dam, there was a shift in attitude towards fishing, as university academic interviewee (13) suggested:

*"As a result of Merowe Dam, the amount of fish has increased significantly. In the past, fish were exported from South Sudan, but now fish come from three places: the Merowe Dam Lake, the Aswan High Dam Lake, and the White Nile Area. Fish (40SUP per-kilogram) is now cheaper than chicken (50SUP per-kilogram), beef (80SUP per-kilogram). Fish is available due to increased fishing productivity at Merowe Dam Lake, in addition to connecting the area by paved road to Khartoum, rendering the distance between the dam and Khartoum only five hours instead of four days".*

Remarkably, the number of restaurants providing fish meals in Merowe region and Khartoum in particular have risen sharply, and the famous Awadiya for Fishes "Awadiya Samak" restaurant and many others are testimony to the food increase not only in the Merowe region but across Sudan. This growth contrasts with the criticism which suggest that dams are support the increase in food production and fishing catches as stated by McCully (2001) and Singh (1997). However, there is a lack of quantitative data to back up these claims and counterclaims, and this lack of data is a custom in all areas of research in Sudan. Securing water and electricity throughout the region and therefore allowing food production to increase, is supported by Varma (2003) and with emphasis on the importance of the infrastructure in supporting productivity by facilitating modernity.


**Figure 5.5 famous Awadiya for Fishes Restaurant**

Source: Google 2018

To some extent, improvements in food availability and affordability supports poverty elimination, which allows the socioeconomic status of Merowian to change, shifting their attention to other areas, such as education, home improvement and even

purchasing luxury goods with extra disposable income. By doing so, the second trajectory of socioeconomic development is fulfilled through market expansion. Evidently, this market expansion is the case in the Merowe region following the construction of Merowe Dam and its accompanying projects. In order to analyse food production in rural areas of Merowe, it is important to examine successful sections of the settlement agriculture scheme and government commercial agriculture schemes in the region.

### 5.3.1 Resettlements agriculture schemes and commercial faming

It is generally believed that rural communities, especially in developing countries, have long been reliant economically on farming; likewise, the livelihood of rural developing countries is less diverse (De Vaus, 2002). As an agriculture-based economy, Merowian communities' food production is central for sustenance as well as for household income. Merowe resettlement agriculture schemes for the displaced communities of Amri, Hamdab and Manasir are aimed at supporting the continuation of agricultural activities within these communities.

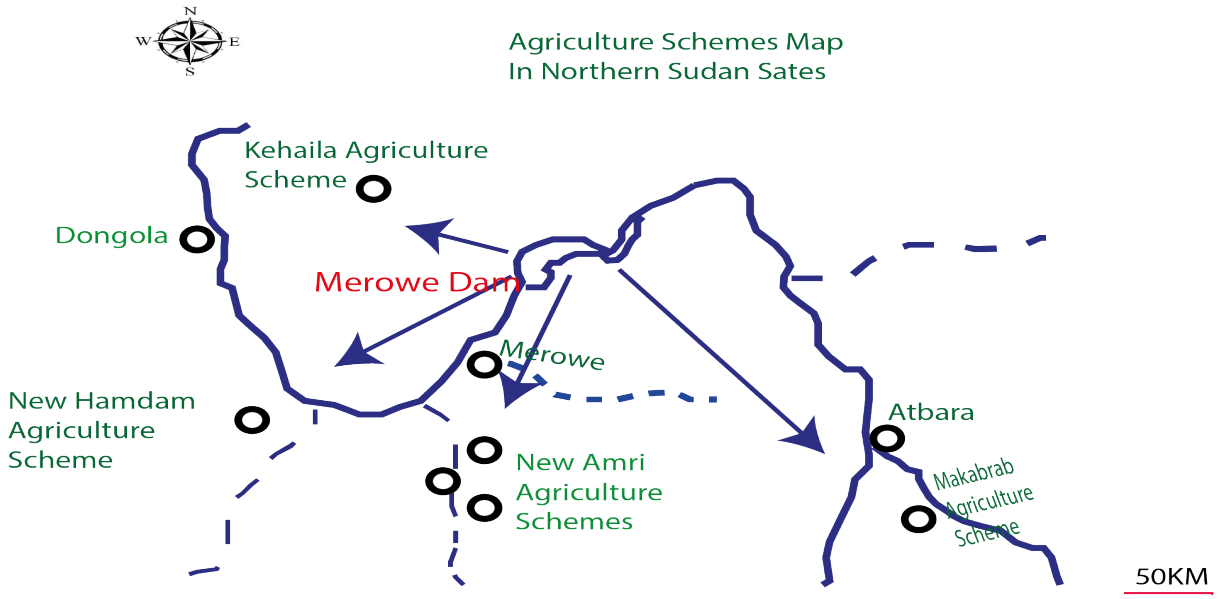



**Figure 5.6 The locations of agricultural schemes**

Source: Author adapted from Google, 2018

This section explores the contributions of these projects to food production for the communities and the region. Furthermore, the section observes the Agriculture Development Authority's role in supporting these schemes to produce sufficient, sustainable and effective food productions.

**Figure 5.7 Sample of farms at resettlement and commercial scheme**
Source: DIU and Author 2017

Agriculture is the most important economic activity and the population of the Merowe region is famous in the field of agriculture. Despite the small arable area, productivity is very high. Wheat production reaches 90 sacks per-acre and sorghum 30 sacks per-acre (Askouri 2014), a high production when compared to the rest of the Sudan. The most important produce is wheat, sorghum, fennel, onion, tomatoes, broad beans and dates. Livestock is another farming economic activity and the area is famous for having Zawari sheep, which dominate the markets of Merowe, Kareema Tengasi and Nouri. The questionnaires and interviews in this research have provided enough evidence in relation to increased food production in the region. Most of the participants in this study have identified the resettlement agriculture scheme as a source of increased food production in the region. Table 5.12 shows the size of each

scheme and the main crops cultivated; which shows the increase in land size, which is one of the important factors for increased food production in the region.

**Table 5.12 Distribution of resettlement agriculture schemes**

| Items | Hamdab Scheme | Amri Scheme | Manasir Scheme | Kehila Scheme |
|---|---|---|---|---|
| Irrigated area (acres) | 13670 | 24320 | 37104 | 44298 |
| Cultivated areas (acres) | 7000 | 12800 | 21000 | 13186 |
| Crops cultivated | Wheat, Clover Cumin, Sorghum Onion, Orchards | Wheat, Clover Cumin, Sorghum Onion, Orchards | Wheat, Clover Sorghum, Orchards | Wheat, Clover Sorghum, Orchards |
| Average productivity Per-acre | 12 Sack of wheat | 15 Sack of wheat | 10 Sack of wheat | 15 Sack of wheat |
| Other investments | Livestock and fish farming | Livestock and fish farming | Livestock and fish farming | Livestock and fish farming |
| Numbers of labour | 35 | 117 | 149 | 108 |

Source: DIU edited by Author 2017

Having identified land increase as one reason for increased food production, local farmer interviewee (7) acknowledged the increase and added:

*"Food production has increased, depending on individual effort: whoever works hard has increased production. The increase in land through the scheme is the main factor in productivity increases. Before the dam, a family owned 4-6 acres, but now every single person in the family owns 6 acres. Irrigation is another reason for food production increases, despite some irrigation problems we encountered in the summer. I believe the electrification of the irrigation system will increase productivity even further".*

In addition to resettlement schemes, the Authority of the Merowe Dam Area for Agriculture Development also runs its own farms for commercial produce and research purposes. The scheme is irrigated through surface irrigation, irrigation canals running from the Nile and some pivot irrigation systems. The role of electricity is important in running pumps that fill the canals with water and run the pivots. The supporting services for agricultural production are meant to administrate and support agricultural inputs of winter and summer seasons. These inputs include seeds, land preparation, fertiliser and pesticides, through systems run by graduate agriculturists.

This evidently helps food production to increase in the region as the scheme officer mentions:

> *Of course, increased land and support services have huge influences on food production. For example, the quantity of tomatoes produced in Manasir area is huge. Tomatoes are produced in the winter and are available for export to the rest of the country because of their success in the region. The agriculture schemes are playing an important role in providing the country with agricultural produce, especially in wintertime (animal feed, tomatoes, fish, meat, chicken, potatoes" (local official interviewee 8)*

Certainly, Merowe Dam as a means of supporting food production through irrigation schemes has benefited from the same success of many dams' irrigation schemes, as mentioned in the literature, including the Aljazirah scheme and others in Sudan. These successful schemes were made possible through key developments of surface irrigation during the nineteenth and early twentieth centuries (Ersumer, 1999a; Varma, 1999; Verhoeven, 2011). Other significant factors supporting this success story relate to the use of other inputs, such as high-yielding varieties (HYV) seeds, fertiliser, better infrastructure accessibility and, most notably, state support for massive groundwater development and productivity support services. Therefore, the role of the Authority of the Merowe Dam Area for agricultural development, according to the Authority's Director:

> *"Is an important stabilising factor (or perceived stabilising factor), playing an important role in projects post-resettlement, which supervise the planning and implementation of agricultural activities in the region" (Authority Director 2017).*

Electricity and water supplies for irrigation in the form of storage systems under major projects provide significant stability in agriculture. The Authority provides stable guidance, which plays a crucial role in increasing food production in the region through its pivot irrigation scheme by cultivating around 9752 acres using 72 pivot irrigation systems. This irrigation leads to increased production of animal feed clover for export to Saudi Arabia, wheat, potatoes, corn, peanuts, sunflower, sesame and

guar, in addition to the research and tests of many crops, including citrus fruit and fish farming (Authority Director 2017). Furthermore, university academic interviewee (13) believed:

> *"Irrigation schemes are achieving their goals in agriculture. Some farmers have entered into fish farming and its production is growing very well. Even the farmers who do not have the financial capability have entered into partnership with others from outside the region for fish farming".*

Increases in agricultural output because of irrigation schemes has helped to keep food prices down. Historically, the price of food products fell. For example, between 1970 and 1986 in India the price fell by 20% compared to the price of other products (Ersumer, 1999a; Varma, 2003). Contributing factors to such a reduction come from all sources of agriculture and are not limited to irrigation schemes only. However, irrigation schemes associated with the dam have had a great influence on price reduction because of high productivity. In relation to Merowe Dam, this improved productivity may have had a positive impact on reducing poverty and improving citizens' socioeconomic status, or it may have had a negative effect on farmers' socioeconomic status because of a reduction in their income. However, this second effect may not be the case because a reduction in food cost means a reduction in living cost. This reduced cost frees up some disposable income, which can be used to improve people's socioeconomic status through education, health, household appliances, etc. In respect to socioeconomic development, all the above factors feed into socioeconomic improvements. Having enough food and jobs is crucial in rural Sudan; as well as access to education and health, which are provided through Merowe Dam's accompanying projects. However, the following section on electricity is a cornerstone in sustaining the process of socioeconomic development of citizens of Merowe region and surrounding areas (see Section 5.4).

## 5.4 The Merowe Dam contribution to electricity supply and access at regional level

### 5.4.1 Introduction

Hydroelectric power plants vary in size from a few hundred kilowatts to some hundred megawatts, but a few large plants have a capacity of around 10,000 megawatts, providing electricity to millions of consumers (Agrawala *et.al.* 2003). Globally, hydroelectric power plants have a joint capacity of 675,000 megawatts that produces over 2.3 trillion kilowatt-hours of electricity annually, producing 24% of the world's energy (Shirley & Kammen, 2015). With the world's energy demand for domestic use and industrial development soaring higher each day, the need for more production is significant, especially in developing economies. Electricity generated from dams is by far the largest source in Sudan. This section covers electricity production in Sudan and its use domestically and industrially for socioeconomic development in the region. The Merowe region had limited access to electricity before the dam's construction. In addition, this section examines the level of access to electricity in settlements and surrounding communities in the region.

### 5.4.2 The state of electricity production in Sudan

The majority of Sudanese electricity comes from dams, including 30 megawatts from Sinnar, 280 megawatts from Rousers, and 47 megawatts from others (DIU 2007a). Hydropower provides by far one of cleanest sources of energy as well as unique options to manage the power network by its capability to swiftly respond to peak demands. By using power produced during the night, while demand is low, it can then be used to push water up to the higher reservoir. That water is then used during

the highest demand time to yield electricity. Nowadays this method forms the only economic mass storage available for electricity (Shirley & Kammen, 2015). Many countries in the world, especially developing economies depending on dams for electricity, for example, dams provide over 91% of total electricity used in the Democratic Republic of the Congo, Norway and Brazil (Shirley & Kammen, 2015). Hydroelectric power delivers approximately 80% of the electrical power in Sudan with the rest being generated from other sources. From 2009, the hydroelectric plants of Merowe Dam provided between 50% and 60% (1250 megawatts) of Sudan's power (DIU, 2007a).


**Figure 5.8 New Merowe electricity transmission line**

Souce: DIU 2017

Figure 5.5 show the extent to which Merowe Dam has helped the increase in Sudan transmissions lines. Figure 5.7 below shows the increase of electricity production that Merowe has brought to the national grid.

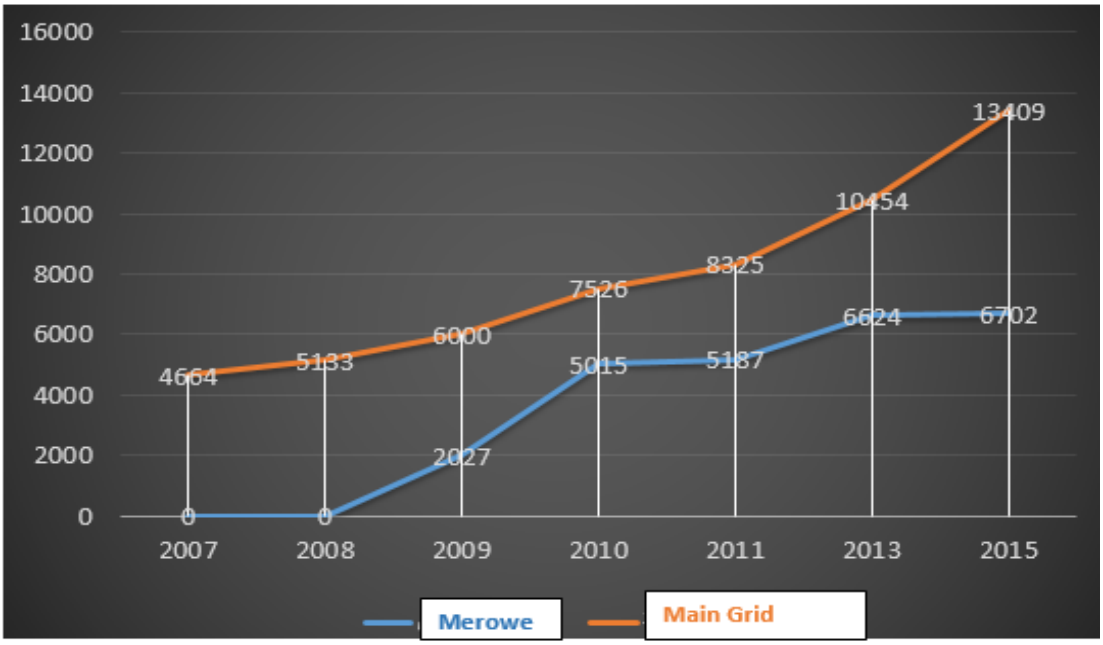



**Figure 5.9 electricity production in Sudan Merowe Dam and other sources**

Souce: DIU 2017

There is strong evidence of consensus within the districts, especially downstream and upstream relocated, regarding the electricity contribution of Merowe Dam in the region and the country as whole. The majority of the participants' responses in questionnaires and interviews suggest belief that Merowe Dam has become a central feature of the modern energy plan in Sudan. As DIU official interviewee (23) stated:

*"Since the official opining of Merowe Dam, its addition of electricity to the national network has been equivalent to the electricity produced from all stations in Sudan (water and thermal). This confirms the public and national benefits the dam has added and it reflects on the residential, agricultural and industrial sectors in Merowe region and the country as whole"*

As the literature suggests, this electricity generation is driven by rising demand for socioeconomic and domestic use due to the urbanisation of rural areas and industrialisation, or by energy concerns regarding foreign dependence and price volatility; mega-dams are central to the energy strategies of many developing

economies (Shirley & Kammen, 2015). The literature is in line with this research and most participants, and university academic interviewee (15) stated:

*"To some extent, the Merowe Dam has improved energy security by adding a huge sum to what the country produces, but did not resolve demand and security of energy completely".*

According to the literature, mega-projects including the Merowe Dam are viewed as socio-technological systems used to support socioeconomic development in coordination with socio-political institutions. This conception is understandable due to the multi-dimensional nature of energy access needs especially for socioeconomic development. An academic economist stated:

*"The Merowe Dam can help reduce poverty by using energy to develop many aspects of socioeconomic development (e.g. agriculture, education, business, markets). This lead to a reduction in crime, an important social dimension" (university academic economist interviewee 15)*.

This perception implies that Merowe Dam significantly improved the electricity supply in the region and throughout Sudan. However, the critical aspect of Merowe Dam is the scale of constructing such a project within this population density, causing displacement and grievances. However, significant energy needs are often used to justify large-scale energy projects and the projects themselves frequently help to resolve or worsen existing social conflicts (Jia *et al.*, 2011). Mega-dams have been a common approach for socioeconomic development that is still used in many countries across Asia, Latin America and Africa as a swift solution for energy shortages (Shirley, 2015). Critics in the literature suggest the generation capacities and inequitably distribution of energy generated by Merowe Dam is overstated; many critics believe industries and city dwellers are favoured at the expense of locals (McCully, 2001a; Singh, 1997). However, the participants' responses highlighted a different picture of Merowe Dam. A Kruskal-Wallis Likert scale was used to analyse

participants' responses on electricity availability and the cost of access (scored 1, 2, 3, 4 and 5, with 5 as the highest level of agreement). The results in Table 5.13 show significant differences between districts in both indicators of electricity score and the cost of electricity scores high. The test indicates not only the differences between districts, but also shows that participants agreed with the availability of electricity and exposes slight disagreement on the cost of electricity. Viewing criticism of Merowe Dam in relation to electricity contribution from the local participants' perspective, some participants believed it could have been other alternatives, while others perceived it as the only option ($\chi^2$= 67.917*, DF* =2, *P* = <0.001) ($\chi^2$= 33.052, *DF* =2, *P* = <0.001).

**Table 5.13 Ranking of electricity and its cost by districts**

| Location | | Electricity | Electricity cost |
|---|---|---|---|
| **Downstream** | **Mean** | 4.060 | 2.890 |
| | **Std. Deviation** | 1.071 | 0.994 |
| **Upstream-Resident** | **Mean** | 2.320 | 1.990 |
| | **Std. Deviation** | 1.601 | 1.314 |
| **Upstream-Relocated** | **Mean** | 2.690 | 2.260 |
| | **Std. Deviation** | 1.383 | 1.116 |
| **Total** | **Mean** | 3.023 | 2.380 |
| | **Std. Deviation** | 1.557 | 1.206 |
| | **N** | 300 | 300 |
| | **Chi-Square (*df* 2)** | 67.92*** | 33.05*** |

Source: Author questionnaire 2017

As the cross-tabulation in Table 5.14 shows, there is a significant difference between districts. However, overall 54.3% believe there is no alternative to Merowe Dam and 45.7% believe there are alternatives, such as renewable, nuclear, thermal and heightening the Roseires Dam. However, the difference between '*no'* and '*yes'* is not significant. Table 5.14 also shows that '*no'* alternative *actual* count is much higher than *expected* count, at downstream participants see no alternative to Merowe Dam, compared to the upstream '*no' actual* count, which is much lower than the *expected* count. Interestingly, both upstream districts' '*yes' actual* count is much higher than the *expected* count on alternatives to the dam ($\chi^2$= 56.612, *DF* =2, *P* = <0.001).

**Table 5.14 Alternative sources of electricity recommended by participants**

| Location | | Yes | No | Total |
|---|---|---|---|---|
| **Downstream** | **Count** | 16 | 84 | 100 |
| | **Expected Count** | 45.7 | 54.3 | 100 |
| **Upstream-Resident** | **Count** | 67 | 33 | 100 |
| | **Expected Count** | 45.7 | 54.3 | 100 |
| **Upstream-Relocated** | **Count** | 54 | 46 | 100 |
| | **Expected Count** | 45.7 | 54.3 | 100 |
| **Total** | **Count** | 137 | 163 | 300 |
| | **Expected Count** | 137 | 163 | 300 |
| | **Chi-Square (*df* 2)** | 56.61*** | | |

Source: Author questionnaire 2017

This outcome is understandable as upstream-resident have no access to electricity and relocated participants seem to be reacting to displacement, disappointment and dissatisfaction with compensation. However, reading the relocated participants' results, the margin between 'yes' and 'no' is insignificant compared to upstream-residents. The results show not only the degree of awareness among the participants regarding electricity importance but also shows a deep understanding of sources and means of obtaining electricity.

To further understand the participants across districts, a comparison of means Table 5.13 provides remarkable reading. Downstream participants score high on both availability (4.060) and cost (2.890); this indicates the role played by increasing electricity supply and consumption in the economic growth and socioeconomic transformation of the region. However, upstream-relocated participants are positive regarding availability (2.690) and less positive about cost (2.260); but upstream-resident participants are mostly negative in both availability (2.320) and cost (1.990). This is understandable: upstream-resident participants have no access to electricity. Furthermore, the overall means for availability score 3.023, which is positive, however for cost of electricity is negative. University academic and economist interviewee (14) elaborated on the matter of electricity accessibility and cost:

"*The Merowe Dam added extra electricity to the national network, but the question is does it help to reduce the price of electricity for consumers? Of course not, the price has increased".*

Another university academic and economist interviewee (15) went further to acknowledge the contribution of Merowe Dam in driving efficiency, industry, workshops and labs: all these need electricity. Overall, there is stability in electricity supply, but there are demands to be met. He added that the cost of production has changes, but the price has increased for consumers, especially after the separation of South Sudan, where the government lost oil revenue thus it relies heavily on services, especially electricity. Certainly, the entire socioeconomic development framework of Sudan is based on the certainty and availability of energy for manufacturing, civil, commercial and other purposes (Sen, 2001). Interviewee 15 agreed with this notion, however, believed that the government of Sudan passed the cost of socioeconomic development through electricity to its citizens:

*"If a citizen wants to bring electricity into their home, they have to pay the value of the post, the line, and the meter. Despite the low cost of electricity production, service costs are very high. This is not due to Merowe Dam but because of the government's wrong economic development policies. After the separation of South Sudan, the government lost oil revenue and the country faced economic crisis, therefore the government stopped subsidising services and goods, including electricity. This made electricity very expensive, even compared to neighbouring countries".*

As Sen (2001) suggests, absence of access to energy in Africa results in energy poverty, as well as the fact that poor people are unable to afford to access and use energy resources even when it is available. This reality affects Africa's socioeconomic development and citizens' quality of life. The majority of local participants acknowledge Merowe Dam's success in improving supply and access to electricity across the region and Sudan. Other participants and interviewees expressed their appreciation of electricity that Merowe Dam produces by claiming that the day in rural Merowe has extended beyond sunrise to sunset. Furthermore, a

group of students from Khartoum University expressed their opinion regarding Merowe Dam's electricity contribution by claiming that they have a better environment now, especially at night, because of a significant and noticeable reduction in smoke and sound that filled the atmosphere from electricity generator machinery. This statement sums up Merowe Dam's electricity contribution and, to have further understanding, it is important to consider the following section, which provides details on domestic, agricultural and industrial uses of electricity in the region and the country.

### 5.4.3 Electricity for domestic and industrial used in the region

The main purpose of electricity generated from Merowe Dam is to support socioeconomic development through supporting industrial development and domestic use. The electrification of rural areas of Merowe is an important element in socioeconomic development. The extension of transmission lines across Sudan from Merowe Dam allowed most villages in the Northern States to have access to electricity, reaching from Merowe to Al-Multaga, covering hundreds of villages, in addition to electrification of more than 500 villages in Al-Jazira State and applied to most areas across Sudan. The Sudanese are dependent on energy domestically in many ways for household work. The amount of energy used per household varies subject to people's standard of living, the climate, and the age and type of residence. Generally, in Sudan and the northern regions, there has been an increase in domestic use of electricity with improvements in the socioeconomic status of citizens because of increases in electrical appliances, such as TVs, air conditions, fans, refrigerators, computers, phones, etc. According to a Director of Sudanese Electricity Distribution Ltd (2017):

*"Since Merowe Dam's electricity went live into the national network, Sudan has witnessed huge increases in both industrial and domestic use of electricity".*

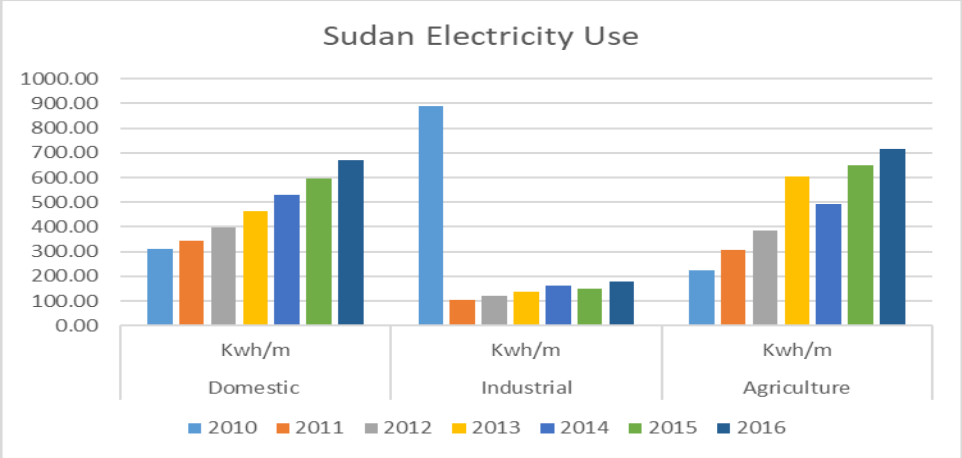



**Figure 5.10 electricity use in Sudan 2010-2016 in Million kWh**

Source: Sudanese Electricity Distribution Ltd 2017

Figure 5.6 and Table 5.15 show the degree of increase in electricity consumption in the country. Domestic use has seen a rapid increase since Merowe Dam went live into the national network, in comparison to industry and agriculture. This indicates the stagnation of the industrial and agricultural sectors in Sudan, although many benefited from surface irrigation through canals (e.g. Al-Jazira Scheme) which reduced dependence on electricity.

**Table 5.15 Electricity use in Million kWh/Sudan Pound (SUG) in Sudan**

| | Domestic | | Industrial | | Agriculture | |
|---|---|---|---|---|---|---|
| Items | Kwh/m | SUG/m | Kwh/m | SUG/m | Kwh/m | SUG/m |
| 2010 | 309377146.23 | 60019707.11 | 88842913.80 | 15473202.3 | 22432153.83 | 3627172.216 |
| 2011 | 343671674.57 | 66464115 | 104894342.30 | 18143882.44 | 30807172.39 | 4963263.536 |
| 2012 | 398627473.67 | 79839596.07 | 121560099.90 | 21015326.77 | 38690095.78 | 6221134.943 |
| 2013 | 465028878.00 | 97314911 | 139295090.00 | 26936720 | 60692107.00 | 9710730 |
| 2014 | 530291977.38 | 105886689.7 | 1628004.45 | 27945323.94 | 49206529.15 | 7874066.034 |
| 2015 | 597312286.72 | 121205858.3 | 151225831.40 | 25787463.26 | 65066371.86 | 10419629.56 |
| 2016 | 669330967.85 | 142268989.9 | 179407143.08 | 30579904.97 | 71892350.01 | 115,093.08 |

Source: Sudanese Electricity Distribution Ltd 2017

Figures 5.8, 5.9 and Tables 5.16, 5.17 show both the River Nile and Northern States have witnessed significant increases in domestic use of electricity. This increase in demand indicates the changes the dam and its accompanying projects brought to these states in terms of the socioeconomic status of displaced and regional citizens. The increase in income, availability, and affordability of food allows residence to use their disposable income to buy electrical appliances, which leads to increased electricity use in the region. In relation to local increases in electricity consumption and use, local committee member interviewee (4) suggested:

*"Electricity have change our lives and now we are using it in cooking more that gas and in the passt we use wood, and now we have TV, laptops, fridges, electric cookers etc".*

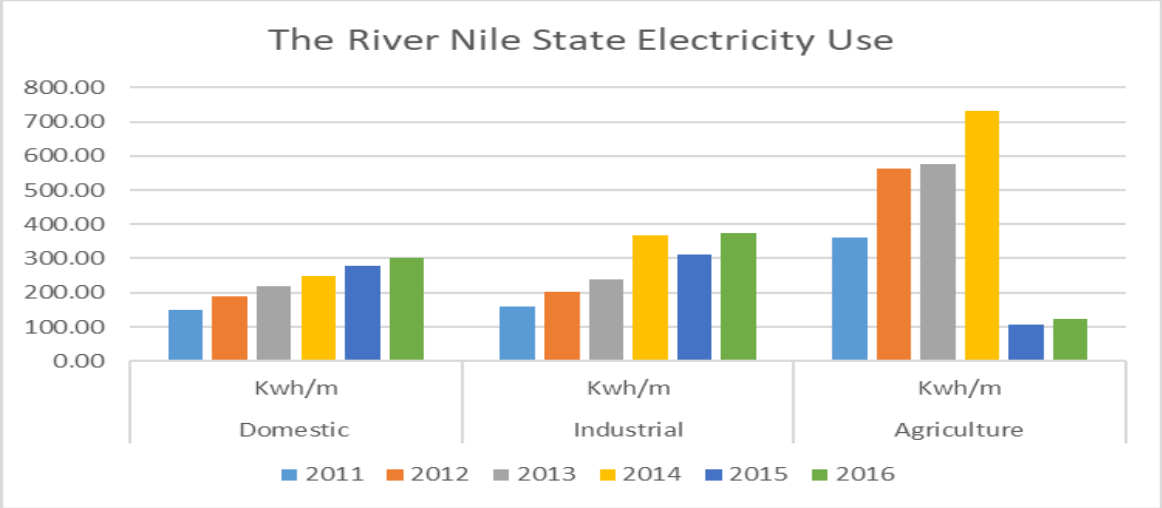



**Figure 5.11 Electricity use in Million Kwh in the River Nile State**
Source: Sudanese Electricity Distribution Ltd 2017

Furthermore, local farmer questionnaire participant (266) elaborated on the changes in electricity brought to the region:

*"It is a quantum leap to high standards of living. The Merowe Dam and its electricity has improved our living conditions and living standards. Now we use all sorts of electrical appliances which we could not afford before the dam and our lives are much easier".*

The majority of participants agreed with Merowe Dam's contribution to electricity availability and accessibility for domestic use at the regional level and the country as whole. Political analyst interviewee (19) suggested:

*"The changes in Sundanese culture to modern residential complex buildings leads to increased use of electricity domestically, due to national and regional socioeconomic developments"*.

However, in relation to industry, university academic interviewee (18) suggested:

*"The Merowe Dam's electricity has little impact on industrial development because electricity prices are high. However, the dam contributes to the stability of the electricity supply, which has positive effects on manufacturing nationally and regionally"*.

**Table 5.16 Electricity use in Million kWh/Sudan Pound (SUG) in River Nile State**

| The River Nile State | | | | | | |
|---|---|---|---|---|---|---|
| | Domestic | | Industrial | | Agriculture | |
| Items | Kwh/m | SUG/m | Kwh/m | SUG/m | Kwh/m | SUG/m |
| 2011 | 1169797 | 254147 | 15825527.5 | 2559018.36 | 3624105.91 | 582736.058 |
| 2012 | 1884477 | 325419 | 2011167.07 | 325330.483 | 563013.33 | 90460.495 |
| 2013 | 2181438 | 381563 | 2381634.84 | 385166.415 | 576849.03 | 92302.282 |
| 2014 | 2487950 | 443309 | 3699799.81 | 596108.764 | 730199.08 | 116906.457 |
| 2015 | 2773113 | 502881 | 3131173.3 | 504676.581 | 1082443.26 | 173185.092 |
| 2016 | 3017860 | 565632 | 3761332.42 | 606624.444 | 1248339.05 | 199732.82 |

Source: Sudanese Electricity Distribution Ltd

According to ministerial official, interviewee (22) Merowe Dam has supported the founding of large-scale investments in cement factories in the River Nile State as well as food processing in Northern State. This effect gave some stimulus to manufacturing; however, most manufacturing firms have remained small or medium in scale, concentrated on food processing in urban centres such Khartoum or Port Sudan.

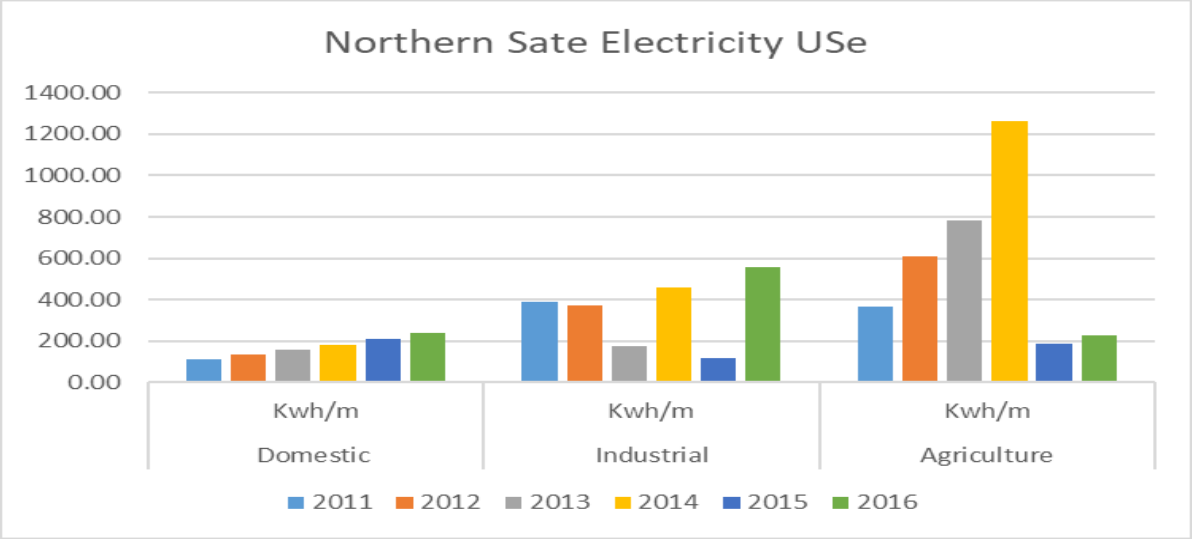



**Figure 5.12 Electricity use in million Kwh Northern State**

Source: Sudanese Electricity Distribution Ltd 2017

Manufacturing was problematic in the past, partly because of issues with irregular electricity supplies; most firms have operated below capacity. However, since Merowe Dam has operated at its full capacity, there are improvements in industrial and new manufacturing: for example, the leather industry, textile, footwear and steel.

**Table 5.17 Electricity use in million Kwh/Sudan Pound (SUG) in Northern State**

| Northern State | | | | | | |
|---|---|---|---|---|---|---|
| | Domestic | | Industrial | | Agriculture | |
| Items | Kwh/m | SUG/m | Kwh/m | SUG/m | Kwh/m | SUG/m |
| 2011 | 109085.10 | 1821802.97 | 39167.10 | 7367.75 | 3639705.43 | 580884.99 |
| 2012 | 1354886.95 | 230256.21 | 3697.92 | 665.62 | 607833.73 | 97243.31 |
| 2013 | 1559851.43 | 268264.08 | 17752.67 | 3017.56 | 783559.90 | 125366.02 |
| 2014 | 1806351.82 | 315822.40 | 46089.30 | 7721.15 | 1265804.37 | 202523.88 |
| 2015 | 2090356.22 | 374177.47 | 118732.83 | 7386.16 | 1857369.04 | 297764.43 |
| 2016 | 2409758.97 | 443334.43 | 5544.10 | 9600.00 | 2272347.40 | 363561.16 |

Source: Sudanese Electricity Distribution Ltd 2017

To understand Merowe Dam's influence, a Kruskal-Wallis Likert scale of industrial development (scored 1, 2, 3, 4 and 5, with 5 as the highest level of agreement) provides further insight into participants' perception across districts (Table 18). The analysis on Table 5.18 shows strong evidence of significant differences between

districts. Furthermore, the means on Table 5.18 show downstream scores higher (2.39) than both upstream-resident and relocated (1.52-1.70).

**Table 5.18 Ranking of industrial development indicator by districts**

| Location | Mean | Std. Deviation | N |
|---|---|---|---|
| **Downstream** | 2.390 | 1.171 | 100 |
| **Upstream-Resident** | 1.520 | 0.915 | 100 |
| **Upstream-Relocated** | 1.700 | 0.959 | 100 |
| **Total** | 1.870 | 1.085 | 300 |
| **Chi-Square (df 2)** | 41.62*** | | |

Source: Aothure questionnaire 2017

This indicates that all three districts perceive the dam not to have had a positive influence on industrial development by scoring less that 2.50 ($\chi^2$= 41.621, *DF* = 2, *P* = <0.001). The result of analysis is in line with many interviewees' perception, attributing industrial failure to many factors including ineffective government policy as well as electricity shortages (university academic and economist interviewees 18 and 19):

*"Merowe areas have benefit from multiplier influence of manufacturing growth after Merowe Dam, especially through reviving the Karimah Factory for Canning Vegetable and Fruits, and founding the Al-Nile Poultry at Amri."*

However, according to a University political analyst and academic interviewee (13):

*"The Merowe Dam has no big influence on creating new factories in the region. In fact more than two thirds of manufacturing firms were located in Khartoum. The one bright spot is growing investment in Karimah food processing factory and Al-Nile Poultry and cements factories, which could boost employment opportunities in rural areas. Overall, I the stagnation of manufacturing in Sudan is related to a lack of good policies that support industrial development, not just a lack of electricity. Therefore, Merowe Dam electricity may have positive impacts in supply stability, but will not change the status quo because there is no investment. Even the current manufacturers are not working to full capacity, and 70% of factories are not functioning".*

In contrast, DIU official interviewee (23) views electricity increases in agriculture, particularly in the Northern States, as a sign of huge international investments inflow as a result of Sudan becoming the breadbasket of Arab countries. Most pervious Sudanese governments adopted the strategy; however, the current government has managed to draw large inflows of capital, primarily from Arab States, for all types of

agro-industry. The idea that Merowe Dam electricity may support industrial and other developments is shared by Varma (2003), suggesting that electricity generated from the Hirakud Dam in India has attracted steel, cement, paper, textile and other supplementary industries. This led to improved socioeconomic development in the area, and new facilities for the advanced study of engineering and medicine, and universities were founded in the Orissa state because of the Hirakud Dam. These arguments can be applied to Merowe Dam as it has all these attributes, which suggests that large dams deliver substantial direct and indirect economic contributions to the localities in which they are constructed.

## 5.5 Conclusions

This chapter has analysed Merowe Dam's economic contributions in the Northern States of Sudan. Wetzel *et al.'s* (2003) three trajectories of socioeconomic development approach provides a framework to understand how technology influences the socioeconomic status of displaced communities and the region as a whole. This chapter has focused on the interlinkage between agro-economic, non-agro-economic, and socioeconomic change. Wetzel *et al.* (2003) has claimed that technology affects society, particularly in rural areas, referring to the positive impacts of technology through innovation and increased productivity, which leads to market expansion, improved socioeconomic status and human development. Agrawala (2003) argued that dams have had a substantial impact on diversifying the economies of developing economies. However, there are also many critics of dams' contribution to economy, especially agriculture, electricity and other areas, who imply that dams have negligible contributions (McCully 2001, Singh 1997 and Flyvbjerg 2009).

This analysis of Merowe Dam has shown that any large dam produces both adverse effects and benefits because they tackle complex socioeconomic, environmental and political issues. The Merowe Dam has generated mostly winners (downstream, relocated and country), but some losers (displaced and upstream-resident). Nevertheless, the economic contribution margin between winners and losers is insignificant and can be reduced further through comprehensive stakeholder participation, consultation, and transparency in project appraisal, design and implementation. However, achieving the economic and socioeconomic development needed through Merowe Dam requires constructive engagement and discussion with all stakeholders to gain the best results for Merowe Dam because both costs and benefits have long-term consequences on the communities. However, the stakeholders' engagement in Merowe Dam discussion has been limited; to some degree, it was negative and ineffective because of the political nature of the state agencies delivering the project (see Chapter 6 and 7).

This chapter has presented an analysis and discussion of the key economic factors, which characterise Merowe Dam's economic benefits in the region. Examining rationales for non-agro and agro-economic contributions have exposed how it has engendered various societal changes in the region. The data demonstrates that people in the three districts understood the beneficial opportunities that Merowe Dam and its accompanying projects as "technology" offered them. The community involvement, which was necessary to gain economic development, supports the work by Varma (1999 and 2003), who argues that dams have brought many countless benefits to hosting communities.

Furthermore, the chapter shows that there have been significant responses to the availability and accessibility of electricity, especially domestically, in the region where electricity previously was limited if it existed at all. However, this effect was affected by factors such as the cost of obtaining electricity services, which involved many different elements. There was also evidence of improvement in communication, such as internet and telephone networks.

The analysis showed significant differences between districts in economic contributions, increases in food production, electricity access, electricity cost and farming-economy. The analysis shows that there was strong evidence of income increase's dependency on land increase. This reflects previous studies by Ahmed, (2013), Castelán, (2002), Chen, (2016), Ersumer, (1999), Schultz, (2002), Varma, (1999), which posit that dams' irrigation schemes increase land size and income which themselves support socioeconomic development. The chapter also discussed how infrastructure and communication provides huge support for socioeconomic development in the region. It became clearer that Merowe Dam has changed some aspects of rural Merowian life. Respondents identified income increases, improved living standard's job opportunities, education, increased food production and health as important spheres for socioeconomic and human development in the region.

The analyses revealed most participants in the districts have a link with farming. This suggests that the lack of formal modern agriculture training and lack of water supply for irrigation at the agriculture schemes has causes some deficiency in productivity. The chapter also analysed respondents' opinions on whether there should be an alternative to Merowe Dam for electricity. From this, it was understood that most of

the northern residents perceived the dam to be the most suitable option for electricity, highlighting their awareness of energy sources.

Finally, respondents were not only aware of the need for economic and socioeconomic development, but were able to promote and discuss it and make suggestions on how it should be delivered within the developing economies. Although most of the participants in this research agreed with Merowe Dam's economic contribution to the region, there were some underlining social grievances (this is discussed further in Chapter 6). These findings, therefore, suggest that:

I. The Merowe Dam is similar to other dams in the world, but there are significant differences in the context and delivery.

II. The economic contribution of Merowe Dam to the region is different in many ways to that reported in literature by McCully (2001), Singh (1997) and Flyvbjerg (2009), because it is constructed as a package with many supplementary projects for socioeconomic development. Some of these projects are unique to the region, which achieve unforeseen result that surprised many stakeholders, participants and observers.

III. The remote rural location of Merowe means that there are certain significant advantages to residents in using the supplementary projects e.g. infrastructures to replace the lack of services such as roads, bridges, hospitals, communication networks and employment opportunities.

This investigation of Merowe Dam's economic contribution to the region has shown that inhabitants are aware of the benefits the dam has brought to them; nonetheless, there is a segment of the population who do not see it as beneficial to them. This inequality raises questions about not solely focusing on economic benefit of Merowe Dam, but combining it with social, political and environment benefit, which will be discussed in Chapter 6 and 7, providing a better understanding of some people's resentments.

# Chapter 6 The social influence of Merowe Dam on communities of the region

## 6.1 Introduction

The preceding Chapters 4 and 5 have revealed the current economic and past socioeconomic situation of the Merowe region. Agriculture, especially the cultivation of date trees, is an important economic and social capital and is viewed as an important symbol of social status in the region. Agriculture provides a clear representation of the socioeconomic conditions of the region. Furthermore, it provides a better understanding of the economic and social contexts of mega-dams in developing economies. The political and environmental contexts will be discussed in Chapter 7. This chapter tackles the second objective of this research, exploring social influences of mega-projects, particularly Merowe Dam, by highlighting social issues related to the dam: the changes it has brought to local communities, such as displacement, resettlement, access to resources, conflicts, community fabrics, relationships; and health issues for both the displaced and resident populations.

The chapter provides insight into conflicts among communities and with the authorities. Furthermore, the chapter explores non-material aspects, such as culture, community health, social relationships and social structure. These indicators were selected due to their high level of influence on the wellbeing of the Amri, Manasir and Hamdab communities as a consequence of the construction of Merowe Dam, which had the aim to stimulate the socioeconomic development of the region. Another reason is the vital role of Merowe Dam in improving socioeconomic and human development of people by providing both displaced and local residents with better living standards and quality of life. The research also explores these indicators because they are integral elements of the initial planned objectives of Merowe Dam

project (DIU, 2007f). Therefore, it is important to analyse these pre-set social development objectives and compare them with present social conditions to establish if Merowe Dam has achieved its objectives of contributing to better living standards and quality of life for local residents and in rebuilding new settlement areas for displaced people. All of the above indicators are fundamental for establishing satisfaction with socioeconomic developments which have shaped healthier societies through housing, healthcare, education, jobs and community relationships at the micro-level to support overall human development in the region.

**Table 6.1 Social indicators used to analyse the data**

| Social indicator case study area | Main methods used |
|---|---|
| • Home space and structure | Questionnaire/interview |
| • Family ties and social relationships | Questionnaire/interview |
| • Community coherence | Questionnaire/interview |
| • Social status | Questionnaire/interview |
| • Farm land as measure of wealth and pride (e.g. date trees) | Questionnaire/interview |
| • Archaeological and historical sites | Questionnaire/interview |
| • Feeling of belonging to the place | Questionnaire/interview |
| • Mental health | Questionnaire/interview |
| • Personal Health | Questionnaire/interview |
| • Self-esteem | Questionnaire/interview |
| • Children schooling | Questionnaire/interview |
| • Quality of life (work, schools water, electricity, etc.) | |
| **Other non-material indicator** | **Questionnaire/interview/observation** |
| • Feeling about Merowe Dam | Questionnaire/interview/observation |
| • Satisfied with new settlement | Questionnaire/interview/observation |
| • Adequate services at new settlement | Questionnaire/interview/observation |
| • Distance between farm and home | Questionnaire/interview/observation |
| • Social conflict | Questionnaire/interview/observation |
| • Community relationship | Questionnaire/interview/observation |

Source: Author questionnaire 2017

The chapter draws upon data from the displaced (upstream) and non-displaced (downstream) communities and experts obtained through administering questionnaires, interviews and observation, archives and recent similar studies of projects in developing economies (see Chapter 3). As De Vaus (2002) recommends, demographic variables such as locality, region, age, gender and education are used

as independent variables to analyse the social influence of Merowe Dam on the region's communities.

The debates on pros and cons of constructing large dams have intensified. Apart from physical and ecological impacts, such debate has moved towards the inclusion of relevant stakeholders, resettlement of displaced inhabitants and the interruption of community society and culture by dam construction (Jackson & Sleigh, 2000) (see Chapter 2). Increased in social costs of mega-dams has led to raise in global concern on how to solicit meaningful participation from those most affected in finding resolution. In this regards, international agencies such as the World Commission on Dams have been founded to assess the social impacts of dams (Hennig *et al.*, 2013). Mega-dams have involuntarily and voluntarily displaced around 40-80 million people in the past decades, according to the World Commission on Dams (Jackson & Sleigh, 2000). Locals and tribal communities have been hit hardest (Hildyard & Goldsmith, 1984). The majority of dam-based refugees are affected economically, socially, culturally and emotionally (Webber, 2012). Those displaced by reservoirs are the only visible victims of large dams. Many more have lost land, access to food sources, natural resources and homes to obstructed areas, canals, irrigation schemes, roads, power lines and development projects accompany dams (Nüsser, 2003). In addition, the water-borne diseases that dams and large irrigation projects create affect many, especially in tropical regions. Downstream residents have been especially affected by hydrological changes to rivers and ecosystems (Kennedy *et al.*, 2011). Furthermore, many of the displaced inhabitants have complained about the conditions of new settlements (Jackson & Sleigh, 2000): water supplies, health services and educational facilities, if available, are substandard. However, as

Ersumer (1999) and Varma (2003) argue, dams in India, China and Turkey provide better social and living conditions to displaced peoples compared to before the dams' construction. Dams are criticised for negative social influences on food security, increased diseases and social disruption, and the communities living close to dams often do not benefit from the electricity generated by these projects (McCully, 2001a). With the pace of development increasing, the rate of dam construction is accelerating, and so too displacement.

The process of economic development through mega-projects always has social consequences for both physical (resources) and anthropogenic factors (socioeconomic, social mobility and political factors). Either part can influence the social factors of a project significantly (Dao, 2010). Regarding dams, electricity demands for urbanisation, improved living standards, health care and education services have influenced how society perceive the effects of dams (Dao 2010 and Verhoeven 2011). Sudanese society's relationship with Merowe Dam is no exception, with economic and socioeconomic development being primarily driven by energy availability (Kleinitz, 2011).

These macro-level social forces of local rural communities and rural households, when translated to the micro-level, provide a clear understanding of the dam's social influence (see Chapter 3). Some key elements can be identified in terms of social changes, such as housing structure, health, feeling settled in the new place, community relationships and culture. These elements are in addition to other factors, such as marketplace, jobs, infrastructure and services, which allow communities to flourish socially. This process leads to a new identity of a healthy and diverse society,

especially at the new settlement. Resettlement caused by dams can be viewed as the social transformation of dysfunctional fragmented social units to a productive local socioeconomic system unit in developing countries (McDonald, Bosshard & Brewer, 2009). For Merowe region of Sudan, the dramatic social and economic transformation of these fragmented social units primarily surrounded the process of building Merowe Dam (changes in identity, housing, healthcare systems, education and culture, creating modern communities and highly-functioning social systems) which many other developing countries experienced (Verhoeven, 2011; Wallach, 1988).

Sudanese society and communities are inter-connected and have rural and urban extensions always reflecting at the community level due to migration specifically Northern Sudan communities (Hashim, 2009). Social lives in Merowe region have greatly expanded and become more diverse, which is driven by a huge influx of migrants because of socioeconomic development activities, especially services (Haberlah, 2012). To reduce the social tension, enhance socioeconomic development and improve the resettlement communities, the Sudanese government has also initiated numerous accompanying economic and social service projects alongside Merowe Dam (see Chapter 4).

There are seven sections in this chapter. Section 6.2 examines how Merowe Dam influenced community displacement and to what degree these communities were affected socially, culturally, emotionally, etc. Section 6.3 explores how the resettlement of the communities to new locations unfolded in terms of services, relationships between communities, and adaptation to new homes. Section 6.4

examines how Merowe Dam affected the health of the population from the spread of diseases, such as waterborne diseases, and the role of the accompanying projects in supporting community health. Sections 6.5 and 6.6 analyse social coherence, relationships and conflicts created by the dam for communities and authorities at the local and regional levels. Section 6.7 concludes this chapter.

### 6.2 Displacement of Amri, Hamdab and Manasir Communities

The social impacts of large dams can be largely divided into two groups: the effect on material possession and property, which can be mitigated by compensation, good preparation and implementation; and the effect on sentimental possessions, which is difficult or impossible to replace or mitigate. The discussion and debates on displacement have benefit tremendously by using contextual approaches to allow dams' influences to be addressed and mitigated accordingly. The debate on the social issues associated with mega-dams is a point of disagreement, dominated by overstated social benefits and the high costs of displacement and resettlement. Critics of mega-dams consider social benefits to be exaggerated to make projects attractive to investors and the public (Scudder, 2005). However, scholars like Agrawala (2003) and Varma (2003) support dams and believe their economic and social benefits are significant to local communities, indicating countries who benefit socially from building dams though economic development (e.g. Turkey, India).

This research pays great attention to social issues related to dams in rural areas. Different aspects are analysed using questionnaire data and interview quotes. Region, age, gender and education are used as classifying variables to study social matters of Merowe Dam (De Vaus, 2002). Dams and their applications have touched

the lives of displaced people and surrounding communities in all aspects and changed their social lives including health, housing structure, culture and identity. However, some scholars argue that dams provide positive opportunities for social development in rural areas (Srinivasan, 1994; Verhoeven, 2011; Wallach, 1988). The debate raises legitimate questions about the distribution of social benefits in rural areas derived from dams, and about how citizens construct and perceive the social influence of dams, especially in the era of political ecology and socioeconomic development (see Chapter 2). One of the main Merowe Dam purposes is to provide holistic development for societies in Northern Sates. For example, electricity generation, irrigation and other accompanying projects, which significantly improve social and socioeconomic development in the region. According to national ministerial official interviewee (22):

*"The social goal is to minimise the negative effects on the displaced and surrounding communities and transform their lives by improving their living standards through basic services such as health, education and infrastructure for transportation and communication, as well as taking care of environmental issues and supporting fish production. It is also to save and collect the artefacts in the area and create a museum. Additional to electricity and agriculture as the main goals of the dam – important elements for socioeconomic and human development in the Northern States, especially for the displaced – is the transformation of fragmented traditional communities from rural to modern agricultural communities integrating productive socioeconomic units".*

Currently, the debate on large dams, especially in social aspects, is focused on classifying dams as either naturally damaging or inherently beneficial to societies. This research argues that the social benefits of dams cannot be either extreme or separated from economic benefit at all. The idea of having a clear line of difference between social and economic benefit distorts the overall benefit of dams. Instead of focusing on the short-term social-adverse side only, the focus should be on the overall long-term benefits of socioeconomic development, especially in developing economies where the need of development is greater (see Chapter 2). As mentioned

in Chapters 4 and 5, the location and context of Merowe Dam is unique, and the aims are far more important to local people because of a long history of anticipation.

Merowe Dam displacement began when the floodgate closed in July 2008 and the water rose rapidly. Many communities living in villages along the River Nile were caught off-guard. Those who were slightly prepared escaped the rising waters with limited belongings. They managed to gather for makeshift shelter far from the river. Eventually, many of the displaced settled with relatives who had been previously moved to resettlement villages established by the Government of Sudan, kilometres away, remotely into the desert, far from the river (local committee member interviewee 20) (see Figure 4.4 and 6.1). There are three groups of displaced: the Hamdab communities living at the centre of the dam location were relocated to Al-Multaga; the residents of Amri lived immediately after the dam's location and relocated to New Amri; and the inhabitants of the lake are Manasir communities. About 60% of Manasir refused to migrate and demanded to stay near the lake because it has about 15000 tons of fish and 60000 acres of silt, and fertilised land good for agriculture. However, the other 40% have relocated to Al-Makabrab and Kehila, where the compensation land is on the upper terraces, which are less fertile, and the high cost of irrigation makes this very difficult for the displaced. However, the DIU has refused the upstream-residents to stay by the lake, which led to conflicts (local committee member interviewee 20) (see Figure 6.1).

To explore the issue of displacement in respect to participant sentiment about the dam, the question of how people feel about the presence of Merowe Dam cross-tabulation test shows a significant difference between districts on feelings of both displaced and non-displaced people about Merowe Dam (Table 6.2). The *actual*

count of *'like very much'* and *'like'* are higher than *expected count* at downstream and the actual count of *'dislike'* is much lower than the *expected* count. Downstream have positive feeling about the dam, which is predictable because of benefits gained from supplementary projects and no displacement at the district. In contrast, the *actual* count of *'dislike'* is much higher the *expected* count and *'very much like'* and *'like'* *actual* count is much lower than *expected* count at both upstream districts ($\chi^2$ = 38.838, *DF* = 2, *P* < 0.001). This analysis shows stronger evidence of negative feelings about Merowe Dam from upstream-residents, with 64% feeling *'dislike'* towards the dam. While upstream-relocated participants show some lenience toward positive feelings, especially when combining the both *'very much like'* and *'like'* 57%. However, the aggregate result of *'very much like'* and *'like'* indicates that the positive feeling (55.6%) compares to 44.4% dislike on questioning on how the participants feel about the presence of Merowe Dam.

**Table 6.2 How do you feel about the presence of Merowe Dam?**

| Location | | Like very much | Like | Dislike | Total |
|---|---|---|---|---|---|
| **Downstream** | **Count** | 26 | 49 | 25 | 100 |
| | **Expected Count** | 24 | 32 | 44 | 100 |
| **Upstream-Resident** | **Count** | 12 | 24 | 64 | 100 |
| | **Expected Count** | 24 | 32 | 44 | 100 |
| **Upstream-Relocated** | **Count** | 33 | 24 | 43 | 100 |
| | **Expected Count** | 24 | 32 | 44 | 100 |
| **Total** | **Count** | 71 | 97 | 132 | 300 |
| | **Expected Count** | 71 | 97 | 132 | 300 |
| | **Chi-Square (*df 4*)** | 39.867*** | | | |

Source: Author questionnaire 2017

This research believes displacement and a lack of willingness address the underlining issues, adequately driving negative sentiment about Merowe Dam, especially within Manasir communities at upstream-resident where disputes about resettlement and compensation are still in effect. Many participants and interviewees, especially from Manasir communities, have expressed their dismay about the displacement, despite their high anticipation and knowing that displacement is

imminent. To illustrate this sentiment, local farmer questionnaire participant (160) suggested:

*"The Merowe Dam is a failure and the government should review its policies toward displaced people or it will not be able to conduct any future projects".*

However, other participants and interviewees, especially from Amir and Hamdab communities, have a moderate reaction to displacement. Local farmer questionnaire participants (66 and 206) stated:

"*A huge project could have been successful if the displaced have been given the right compensation for their properties"*.

"*The Merowe Dam is a success and provides development sources for the region, but it was bad for the displaced people because we have been treated unfairly and oppressed by DIU".*

These expressions demonstrate the degree to which people in the region view Merowe Dam as a means for socioeconomic development. This suggestion is not degrading the displacement costs of the dam down to how people feel about it, but it is an indication of authorities' mistreatment and unfulfilled promises to displaced people, which have a greater influence on the way these communities perceive Merowe Dam. Moreover, the literature supports this research position, as Varma (1999; 2003) argues, that local politicians, NGOs and intermediaries are confusing and exploiting dam-affected people for their own ends by criticising dams for causing displacement and resettlement while doing little themselves to support displaced people.

By viewing displacement from western and international perspectives, it seems as if the critics are aiming to create utopian dams and settlements, especially when it comes to developing economies. However, dams and displacement from developing economies' perspectives are driven by necessity. For example, the majority of

displaced people in Merowe Dam are grateful to the dam for the current improvements in their lives past (see section 6.3). Furthermore, a Kruskal-Wallis test on the question of 'how you feel about the presence of Merowe Dam' in Table 6.3 supports this statement, using a Likert scale of *'dislike'*, *'like'* and *'like very much'* (scored 1, 2 and 3, with 3 as the highest level). The test show significant differences between the districts.

**Table 6.3 How do you feel about the presence of Merowe Dam?**

| Location | Mean | Std. Deviation | N |
|---|---|---|---|
| Downstream | 1.99 | 0.718 | 100 |
| Upstream-Resident | 2.52 | 0.703 | 100 |
| Upstream-Relocated | 2.10 | 0.870 | 100 |
| Total | 2.20 | 0.798 | 300 |
| Kruskal Wallis Chi-Square (*df* 2) | 26.22*** | | |

Source: Author questionnaire, 2017

The means of both upstream districts scoring high, toward 'like very much' despite been subject to displacement (2-2.50), and downstream scoring (1.99) indicates the understanding from the displaced people of the necessity of the dam in supporting socioeconomic development in the region ($\chi^2$ = 26.224, *DF* = 2, *P* < 0.001). The majority of participants appear to be aligned with the above statement about Merowe Dam, despite having been displaced, as local farmer questionnaire participants (222 and 233) suggest:

*"The goal is acceptable and reasonable, but the way people were relocated is not".*

*"Generally, Sudan has benefited from the dam, but not all the people who have been displaced have benefited"*

However, some participants have different views and they disagreed with the dam goals and displacement by voicing their disappointment. As local farmer questionnaire participants (270 and 277) suggest:

*"The Merowe Dam is very bad, wasting public funds and causing displacement for local communities" (270).*

*"The project did not meet the aspirations of local and regional people" (277).*

To test the social influence of Merowe Dam, especially on displacement, it is important to analyse the participants' responses to the questionnaire and interviews. A Kruskal-Wallis analysis of a 5-point Likert scale of community coherence, social status, farmland as measure of wealth and pride, archaeological and historical sites, feeling of belonging to the place, and self-esteem (scored 1, 2, 3, 4 and 5, with 5 as the highest level of agreement) showed a significant level of agreement for downstream and upstream-relocated participants, with a moderate level within upstream-resident on positive social influences of Merowe Dam.

**Table 6.4 Ranking of social indicators**

| Location | | community coherence | social status | land as wealth/pride | historical site | feeling of belonging | self-esteem |
|---|---|---|---|---|---|---|---|
| Downstream | Mean | 3.98 | 4.02 | 3.53 | 2.88 | 3.24 | 3.56 |
| | Std. Deviation | 1.12 | 0.94 | 1.07 | 1.22 | 1.25 | 0.99 |
| Upstream-Resident | Mean | 2.63 | 2.51 | 2.19 | 1.92 | 2.83 | 2.56 |
| | Std. Deviation | 1.45 | 1.39 | 1.38 | 1.36 | 1.61 | 1.42 |
| Upstream-Relocated | Mean | 3.29 | 3.09 | 2.70 | 2.32 | 2.49 | 3.26 |
| | Std. Deviation | 1.34 | 1.19 | 1.23 | 1.19 | 1.37 | 1.47 |
| Total | Mean | 3.30 | 3.21 | 2.80 | 2.37 | 2.85 | 3.13 |
| | Std. Deviation | 1.42 | 1.34 | 1.35 | 1.32 | 1.45 | 1.37 |
| | N | 300 | 300 | 300 | 300 | 300 | 300 |
| Kruskal Wallis Test | Chi-Square (*df2*) | 42.892*** | 61.834*** | 47.411*** | 33.881*** | 13.876** | 25.249*** |

Source: Author questionnaire, 2017

The test shows there are significant statistical differences between the districts (*P* = <0.001 in all 6 indicators) (Table 5.8). The means test elaborates further, showing downstream participants hold a positive sentiment towards all social indicators (2.88-4.02), which can be explained as a result of not being affected by displacement and gaining more through social development projects. However, upstream-relocated and upstream-residents where displacement took place have scored 1.90-3.29, which indicates some resentment towards positive social influences because of displacement. The aggregate means scores very positively on social matters at the 3 districts (2.37-3.30, with standard deviation across all districts ranges between 1-1.60), meaning the responses are within the mean. Archaeological and historical sites, feelings of belonging, farmland as a source of pride, and self-esteem all scored

slightly low. This finding shows a clear link with Scudder (2012) on sociocultural impacts of Merowe Dam on local farming communities. These indicators are very important in northern Sudanese culture due to a long history of association with the Nile, agriculture and land all viewed as sources of wealth and pride. It not surprising that archaeology and self-esteem scored low because of their interconnection with other indicators. Most participants and interviewees expressed their concerns over these indicators. For example, a fear of change or the unknown and mixing with other tribes led to relocation resistance within Manasir communities ($\chi^2$ = 42.892, *DF* = 2, *P* = <0.001). These sentiments are very strong amongst upstream-residents and upstream-relocated participants as local farmer questionnaire participant (104) states:

*"We are not against the dam, but we want to stay on the land and at the place we belong to. As a Manasir tribe we don't like to mix with other tribes and we feel safer here."*

Other participants have concerns about changes coming with displacement, as local committee member interviewee (2) states:

*"The displacement has affected Amrian culture and way of life a great deal as we are farmers and depending on farming. After displacement, the compensated land was low quality without enough water supply for irrigation. I planted 100 date palm trees but only 60 survived due to a lack of water. This led to a reduction in my income by 50% and now I rely on other arable crops for income".*

However, many participants realise the opportunities displacement provides through relocating and mixing with other communities: enriching their culture and gaining new life experiences. As local farmer interviewee (7) suggested, playing down the fear of safety and mixing with other tribes:

*"I believe we miss our land where we born. However, displacement has some social benefits. Relocating allowed us to mix with other tribes because the dam brought many Nile-based communities together in one place. We managed to marry with other communities such as the 'Robatab tribe'. As you know, mixed marriages produce smart babies and as a result of mixing with others we have learnt new cultures and traditions, which we are not accustomed to".*

Other participants have agreed with criticism of dams suggesting the DIU did not pay attention to the needs of people in their displacement methods and that their focus is mainly on how to evacuate the people and get the place ready for building the dam. Local committee member interviewee (12) elaborates:

*"We are not opposing the displacement, but we requested it be conducted on mutual terms with enough time to prepare, but we realise that DIU only cares about building the dam at any cost. In order to expel us from our homes they closed the dam and submerged 2800 families without informing us".*

However, DIU official interviewee (23) rejects this claim and states:

*"Our main concern is resettlement of the population and fully supporting them to settle into their new location, and then we give permission to start building and subsequently filling the lake".*

In contrast to the official view, most observers and experts believe the government – and its DIU wing of building water management projects – treated the displaced as subjects without negotiation or consultation rights. Even those who were consulted felt their opinions did not carry much weight (see Chapter 7). A university academic interviewee (25) suggests that:

*"At the start, everyone in the region welcomed the dam and there was no resistance or opposition to displacement until further down when the citizens, especially Manasir communities, realised how the DIU treated them with no respect and as subjects to be brought to modernity kicking and screaming".*

Displacement is a highly controversial subject in dam studies. There are many claims and counter claims on dealing with its effects and how it influences displaced and local communities. As the literature suggests, some materialistic social aspects, such as houses, farms and other property, can be replaced. However, sentimental or social aspects, such as feelings and memories, cannot be compensated by any means (Loney, 1995). In respect to Merowe Dam, local committee member interviewee (4) confirmed trends in previous research and stated:

*"Naturally, people do not forget their birth place. I lived near the Nile, I heard the sound of water, and I can drink from the Nile with my bare hands. Every morning I would go and sit by the Nile; I remember the places of mountains and the burial places. I miss it because of the displacement, but now our lives are better in many aspects compared to the past, and the rest is memories.*

Displacement and resettlement processes have caused conflicts between Manasir communities and the DIU, and within communities. There are claims and counter claims of who caused the conflict, but the bottom-line is that the communities are not satisfied with the way DUI dealt with the displacement. Many participants have claimed that they receive no support from the government or NGOs because of government restrictions in place to enforce the evacuation. However, many government officials, locals and experts interviewed have alluded to non-financial types of support, which were provided to displaced people, including emotional support, comfort, and food provisions. In order to have a better understanding of social issues related to Merowe Dam, it is essential to study displacement in association with resettlement in the following section (6.3)

### 6.3 The Resettlement of Amri, Hamdab and Manasir Communities

The growing desire for more energy sources appears to be insatiable, leading governments to continue developing and implementing new projects. Voluntary and involuntary resettlement is one of the massive dilemmas developing economies face (Jaffee, 1998). Governments pursue modernisation and socioeconomic development, but they have to pay a substantial social and environmental price for development. The price of such projects is tremendous, yet they these costs do not always receive the necessary consideration (Scudder, 2012). Involuntary resettlement is by no means a major side effect of development (Couch, 2002). Governments around the world, international organisations like the World Bank and NGOs have acknowledged

the economic and social effects. Dam displacement is an apparently perverse friend of socioeconomic development, but the consequences differ from one country to another because of the scale of the projects, local conditions and specifications (Ritchie, Shipway & Cleeve, 2009). This research suggests that the international settlement debate and matters seeking standardisation of resettlement are more harmful than beneficial to displaced people. With Merowe Dam, the condition of displaced people in the region is much better post-Merowe Dam in many aspects: socially and economically, services and living conditions. However, this conclusion by no means undermines the agony of property lost and the disruption of social life that the displaced communities have experienced, especially emotional distress, which cannot be compensated. The magnitude of mega-dam criticism is partially feeding into residual resettlement difficulties, especially for Manasir communities. Therefore, more focused discussion among researchers and practitioners on localisation and contextualisation of resettlement is needed now more than ever. Without this discussion materialising, the debate, despite the good intentions of both sides, will do little to support the predicament of the millions affected by mega-dams.

The Merowe Dam resettlement villages were built in four locations in two different states, as shown in Figure 6.1. Around 7% of displaced Hamdab communities living where the dam was constructed were resettled in 2003 to the “New Hamdab” or “Al-Multaga” settlement in the Northern State, about 45 km from the dam. Only a few people in these communities refused the resettlement and preferred to stay by the reservoir or moved in with relatives in the region. Around 2,800 Amri families (accounting for 28%) were displaced following the unexpected flooding in 2006 when the floodgates were closed temporarily. The majority of these people ultimately resettled in the five villages of “New Amri Villages”, (No. 1-5) many kilometres away

in the Bayouda desert within the Northern State; about 15% rejected the resettlement (local committee interviewee 12). The Manasir communities who lived further upstream from the dam were displaced when the floodgates were closed following the dam's completion in late 2008. Around 5,000 families from Manasir villages have been flooded or partly flooded. Manasir communities account for 65% of the total displaced population.

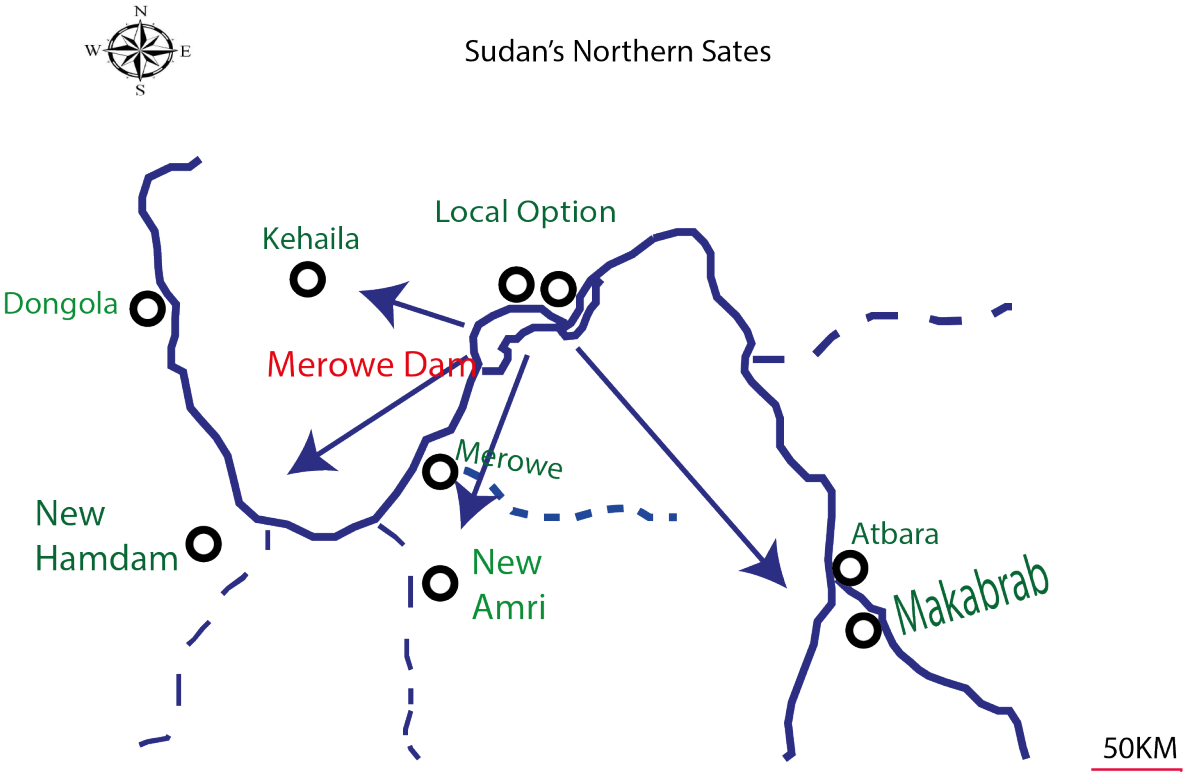



**Figure 6.1 the locations of resettlement villages**

Source: Author adapted from Google, 2018

The Manasir displaced people were offered accommodations in up to six new villages in the River Nile State (DIU, 2007f; Askouri, 2014), but two-thirds of Manasir community rejected the resettlement. Some of the displaced have migrated to Khartoum, but the majority still live in new villages established by the displaced alongside the reservoir coast, or in a higher ground of semi-submerged area near their original settlements known as "Alkhiar Al Mahali" (which means local choice)

defined by this research as ‘upstream-resident’). These communities have managed to live on fishing and agriculture from the fertile land of flood bed and fishing. The ‘upstream-resident’ communities are eligible for full compensation for property lost. Only a few have received monetary compensation for date trees, with no broader compensation package such as new homes, services, etc. However, some sections of the community (nicknamed “Karazies”, a degrading term meaning traitor) have accepted the compensation package and resettled in Makabrab and Kehila (see Figure 6.1). In effect, this arrangement has caused strained social relationships with their compatriots among upstream-residents. The government’s perspective of settlement is clearly optimistic in its portrayal as the most adequate settlement ever created. As DIU official interviewees (23) stated:

*“The selection of the locations and house design was decided in consultation with displaced people according to the design of existing housing and materials in the region. The components, interior design, furniture and space are expanded and updated to modern national standards. We have also built excellent public services, such as schools, hospitals, social and public services like mosques, young people’s culture centres, women’s centres and nurseries”.*

Despite the government’s claims of social, economic, environmental and political success through Merowe Dam, it also claimed that lessons were learned from the AHD by resettling the displaced people with the same environment, culture, and region (see Chapter 4). However, government disputes with the Manasir concerning compensation packages and resettlement location have cast doubt on the government’s claims of success. The majority of Manasir’s displaced people accepted parts of the compensation package, except the resettlement location, which lies at the centre of their dispute with the government. The displaced suggested resettlement by the reservoir where they live currently, but the government disagrees because of technical reasons considered dubious by the settlers (see Chapter 7). As

the government continues to refuse the demands of Manasir communities to resettle by the reservoir, the chance of finding a solution gets slimmer. Furthermore, the DIU not only refuses to negotiate with upstream-residents, it has tried to disrupt all attempts made by many mediation committees to resolve the issue. This practice not only contradicts the government's claim of participation and bottom-up development approach, it also suggests that development in non-democratic states is mainly dictated by the state and citizens have little input or none at all (see Chapter 2).


**Figure 6.2 Images of new settlement and old settlement**
Source: Author and DIU, 2017

This trend supports the literature, as Scudder (2005) suggests resettlement stresses are a form of deprivation by removing economic, social and cultural resources as well as political power and, most profoundly, the determination to make a decision about where and how to live. In fact, as many local participants, experts' interviewees and observers agree, some success has been achieved in respect to settlement. Those

who disagree with this perspective refer to the Manasir issue. A local farmer and a local committee member interviewee (1 and 4) stated:

*"It is human nature not to forget one's birthplace and I am emotionally affected by the displacement. I do miss my old place but, when I compare our conditions in the past to now, the new settlement is better economically, socially and services are available. My feeling is that everyone who migrates from a village to a city will not forget where they came from, but life is very easy at the new settlement".*

*"In the past, we lived traditional and basic lives. We were closed societies resisting change. Now our attitude has changed: we are open to modernity, education, and technology, and 99% of communities own fridges, electric cookers, TV receivers and washing machines. All these are available to us and life is easier. The communication companies have created mobile networks, which we did not have at the old settlement" (local interviewee 1).*

These opinions about new settlement are supported by many participants and interviewees, and challenge the critics of dam resettlement, such as Scudder (2005). Singh (1997) acknowledged that resettlement living standards have improved slightly and livelihoods have been restored to some degree by studying 50 large dams resettlement in five continents. In relation to Merowe Dam, it is important to recognise the issues of misrepresentation by the government, which reverberated among Sudanese through the headlines and media portrayal of substantial facilities of new houses, land, services, and financial compensation. With the government controlled and directed by the media, the public dialogue among unaware Sudanese citizens about the matter is easy to be misled: to be critical of the Manasir and others affected who protest or show dissatisfaction with resettlement.

An analysis of participants' responses provides a clear picture of settlers' perceptions of the Merowe Dam resettlement using a Kruskal-Wallis analysis of a 5-point Likert scale of home size, schools and quality of life (scored 1, 2, 3, 4 and 5 with 5 as the highest level of positive). The indicators show a significant level of agreement among downstream respondents that Merowe Dam had a positive influence on these social indicators. However, upstream-relocated and upstream-residents show a moderate

level of agreement on the positive social influence of Merowe Dam. The test shows a significant differences between the districts with $P$ = < 0.001 in all 3 indicators (Table 6.5). In addition to a Kruskal-Wallis test, Table 6.5 shows a means comparison test in which home size, schools and quality of life provide important insights into participants' opinions. As expected, downstream means are higher (3.64-3.89) in all three indictors, especially quality of life and schooling. This outcome is due to improvements in health, education infrastructure and income, helping people to have access to modern building materials in the downstream-district.

**Table 6.5 Ranking of resettlement suitability indicators**

| Location | | home sizes | schools | Quality of life |
|---|---|---|---|---|
| Downstream | Mean | 3.640 | 3.840 | 3.890 |
| | Std. Deviation | 1.235 | 0.950 | 0.994 |
| Upstream-Resident | Mean | 2.230 | 2.460 | 2.040 |
| | Std. Deviation | 1.420 | 1.459 | 1.286 |
| Upstream-Relocated | Mean | 2.550 | 3.180 | 2.440 |
| | Std. Deviation | 1.095 | 1.388 | 1.402 |
| Total | Mean | 2.807 | 3.160 | 2.790 |
| | Std. Deviation | 1.391 | 1.400 | 1.470 |
| | N | 300 | 300 | 300 |
| Kruskal Wallis Test | Chi-Square (*df*2) | 55.81*** | 43.40*** | 86.50*** |

Source: Author questionnaire, 2017

Upstream-residents score low (2.00-2.46) in these indicators (home size, schools and quality of life), suggesting the status quo is the same as pre-dam if not worse. However, upstream-relocated participants show a positive perception of the indicators (2.44-3.18) ($\chi^2$ = 55.811, $DF$ = 2, $P$ = <0.001), driven by availability of essential services (schools, health facilities, running water, electricity, marketplace, etc.) at the new settlement, which allow the settlers to flourish in their new social lives. A local official interviewee (1) stated:

*"The social aspect before the dam was challenging. We used to live traditional lives in the villages, scattered across a wide area with no services and a community depending on the clan. There were 99 islands and no proper schools, no electricity or roads and the distance between villages was very far and we lacked transports. Our life at the new settlement is 100 times better in all aspects".*

Majority of local farmers responding to the questionnaire agreed with this position, and local farmer questionnaire participants (164 and 176) suggested:

*"The presence of the dam has helped to provide public services in the area and it is in the public interest of the country".*

*"The Merowe Dam provides many benefits to the country, especially to sons of the displaced. The benefits of education and health services and the future will be bright for them".*

Majority upstream-relocated and upstream-resident participants expressed their agreement that the new settlement is better than the old villages, because of services and facilities for health, etc.


**Figure 6.3 health facilities before and after Merowe Dam**
Souce: DIU, 2017

However, some have expressed an emotional attachment to their old life while still having a positive perception of the new place, as local farmer questionnaire participants 297, 269, 256 and 254 respectively state:

*"The new settlement is better for services and facilities, however for living and agriculture the old one was better".*

*"The new settlement is better because of health facilities and schools, but the old one was better economically to some degree".*

*"The new settlement is better because of health facilities and schools, but the old one was better in terms of living, water and fertilise land".*

*"The new place is suitable for living because it has services and health facilities. The new settlement is better because of health facilities and schools but the old one is better in term of living".*

It is clear from the responses above that the settlement is suitable for living. The purpose of resettlement is to restore or improve the living standards of dam-affected people to better than pre-project levels. In this regard, Merowe Dam resettlement has managed to restore many aspects of the displaced lives, especially when considered in addition to the agriculture scheme attached to each settlement, despite deficiencies in production (see Chapter 5). Furthermore, Figure 6.5 shows there are adequate services in the settlement, which allowed the displaced to resettle and restore their lives.

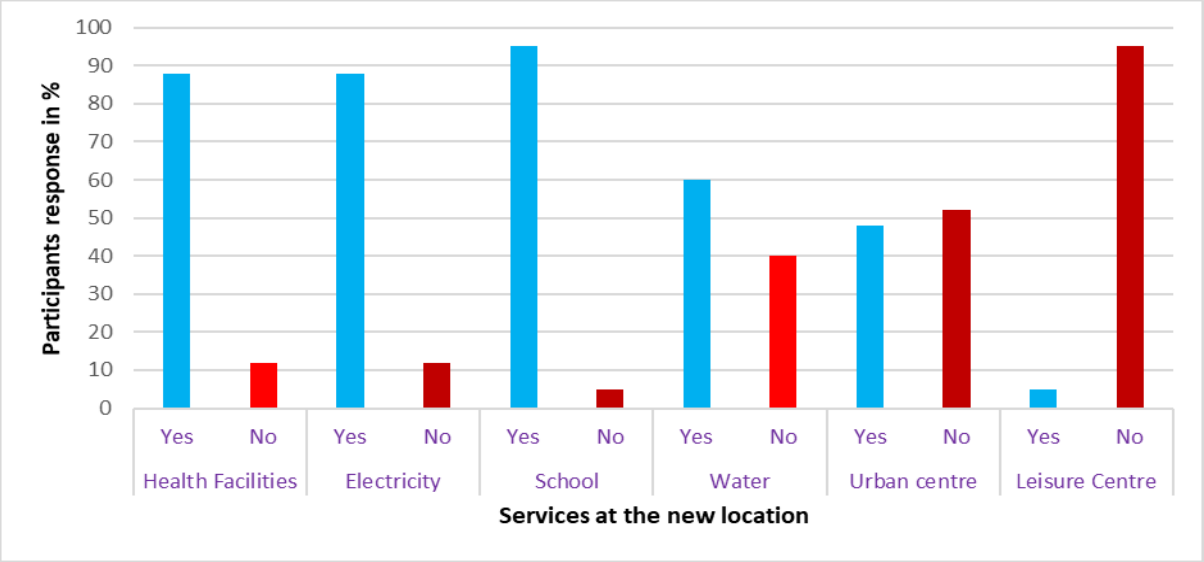



**Figure 6.4 Adequate services at the new location**

Source: Author questionnaire, 2017

As Figure 6.5 shows, 60% to 98% of upstream-relocated communities believe there are adequate electricity, health facilities, water and schools. While 56% see no adequate urban centre and 95% see no adequate leisure centres, the water service is also not fully appreciated by the settlers. There are many complaints about an

irregular supply of irrigation water and many settlers have been ill because of drinking from underground wells. A local official interviewee (4) suggested:

*"The houses are generally very good compared to the old ones. They are suitable for us, but there is a drinking water problem. We used to drink from the Nile and now we drink from underground wells. We could not adapt to drinking the underground water. However, now there are efforts to build a drinking water station at the Nile".*

Despite the high level of appreciation showed by interviewee and local questionnaire participants regarding the houses and services at the resettlement, it important to consider governmental bias in overstating the condition of services and houses. However, many observers, interviewees and this research have observed huge improvements between the resettlements and pre-dam settlements.


**Figure 6.5 Other services and activities facilities before and after Merowe Dam**
Sources DIU, 2017

Furthermore, many interviewees, participants, observers and experts have noticed the opportunities that the dam has brought for women, especially among upstream-relocated communities. Some participants suggested the resettlements have had a positive social influence on women, as many are freed from family farming duties

because farms have been moved away from houses. However, this trend may have some negative consequences on farming economics and family income. This trend affect families due reduction in labour as women are the main driver of vegetable cultivation and keeping livestock. This change to some extend allows women to engage in many social and other activities, such as development programmes for women, and increases girls' attendance to school because of accessibility: all schools are within walking distance. A local female interviewee (30) elaborated on the influence of resettlement on the female socioeconomic position within the new social order at the resettlement:

*"The relocation has positive and negative impacts for women, economically and socially. On one hand their contribution has been limited in farming due to farms' distance away, which may add psychological and economic pressure on families. On the other hand, it provides a new opportunity for women in other economic areas, such as handcrafting, cookery, and working at a local farming poultry factory. Socially, the resettlement has benefited women more in term of education and learning new skills like sewing, cooking, crafting, etc. Also, it enables women to engage in public life and to be up-to-date with local, national and international affairs through the availability of media (e.g. TV). Furthermore, there are significant improvements in housework by using modern electronic equipment".*


**Figure 6.6 Education facilities before and after Merowe Dam**
Sources: DIU, 2017

Services are key factors in restoring the displaced people's lives to pre-dam levels or better. Education has been a champion for many settlers, as local businessperson (7) suggested:

> *"As a Northerner, migration is embedded in our blood. Seeking better life opportunities, especially when it comes to education. We do everything to educate our children. Before the dam many children did not attend school, especially girls, due to the distances between villages and schools. Yet, Merowe Dam and its accompanying projects have given us the means to settle into the region with good services, especially education. Now we have very good schools and six colleges and universities, for example, Merowe University of Technology Abdulatif Alhamad. The availability of education at all levels across the region, including the new settlement, reduced the cost of education. Also, it allows families to stay in the region and get the best education without moving to Khartoum or sending their sons away".*

Furthermore, some local farmers and settlers perceive the resettlements as a gateway to connection with the rest of Sudan and the world.

> "*Our settlement is close to main roads and provides our sons with a better environment for education and they excel in it. We are leading the region in the national results for primary school and high school exams. Our sons now use computers, internet and smartphones, allowing them to connect with the world. Now they are exposed to all kinds of sport and we have football teams. I believe we will have a new generation who will be highly skilled in many fields. We have access to electricity, which allows us to have air conditioning, television, nice houses, mobile phones and everything else available to us" (local female interviewee 30).*

Certainly, there is some improvement in the urban centre of Sudan in term of services. The Merowe Dam has contributed immensely to that, especially in providing electricity. However, the scope of this research is regional, particularly the rural communities of the Merowe region, in comparison to other rural areas in northern, eastern and Blue Nile states of Sudan (except Darfur and Nubba Mountain because of conflict). The Merowe Dam and its accompanying projects have made a huge difference in the Merowe region. The difference is noticeable compared to other regions in services, electrical access and overall socioeconomic development. To understand whether settlers are satisfied, and if settlement has helped them to

restore their life, Table 6.6 shows a high degree of satisfaction for 77% of participants across two Merowe Dam settlements (Amri 2 and Amri 3).

**Table 6.6 Opinion of Upstream-Relocated residents about the new resettlement**

| | | Frequency | Percent |
|---|---|---|---|
| **Valid** | **Dissatisfied** | 23 | 23% |
| | **Satisfied** | 77 | 77% |
| | **Total** | 100 | 100% |

Source: Author questionnaire 2017

This figure is not only strong evidence of the improvement for settlements caused by the dam, but challenges the critics of dams who seek a global standardisation of dam resettlement. To further understand the extent to which the resettlements help to restore displaced people's lives, it is important to examine how Merowe Dam and its settlements influenced people's access to resources.

### 6.3.1 Access to farms and other natural resources

Displacement and resettlement are complex processes, connected to compensation, livelihood restoration, and changes to natural resource access. This process, in relation to the dam construction, becomes very complex due to social structures in the region. As the affected households are tribal groups, this composition means that disputes are likely to be intensive. This section considers how the Merowe Dam has influenced ' access to, and the availability, of farms, natural resources and other resources by displaced and resettled communities. This section goes beyond economic factors to analyse the support in restoring the livelihood of resettled and displaced people, and discuss the influence of Merowe Dam on their access to resources for livelihood. Most research focuses on displacement and resettlement schemes, such as infrastructure, compensation, housing and livelihood support, ignoring the quality and quantity of natural resources and the time people spend accessing them, as well as their right to them. The quantity and quality of natural

resources may decrease after resettlement, meaning there is no alternative form of livelihood in place and people have to change their livelihoods and adapt to new realities, while some may have low level of skill and education. This effect may lead to decreased income and food security, and increased unemployment and social problems. Therefore, obtaining stability and improving the living standards of resettled people means ensuring access to resources of a quantity and quality equal or better than before resettlement.

In the case of Merowe Dam, according to DIU official interviewees 11 and 23, long-term livelihood support for resettled people was provided through agriculture schemes, but no alternative source of livelihood was provided as agriculture is the main source of income and livelihood. Voluntary and involuntary resettlement and compensation packages significantly affected the livelihoods and prosperity of the communities displaced by Merowe Dam. Although some have thrived, others continue to live in hardship despite the benefits that they have been promised by the Sudanese government. The Merowe region agricultural land, Nile and other natural resources are the main source for food and income for both upstream-resident and upstream-relocated people. For the current displaced people or upstream-residents, access to farming lands and other natural resources is not restricted completely; it is limited based on reservoir flood recession, as local committee member interviewee (20) stated:

*"The area is different in the way it is submerged by the water. There are areas that appear and disappear, and there is some relative change in it but it is very good for agriculture. There are lands, which have not been submerged and have fertile agriculture lands. There are massive fertile lands, about 60,000 acres and huge fishing wealth at the reservoir, but is not exploited by the upstream-resident people".*

The official view on access to resources for both displaced and upstream-relocated people is clear according to DIU official interviewee 11:

*"The situation is different from area to area. Legally, what remained from the land at the dam site was left for the citizens to benefit from and I see no problem in the farmers using land in the old settlements if it is available, as well as at the new settlement".*

Access to resources for upstream-resident communities – whether agricultural, or livelihoods like fishing or jobs – is limited because they chose to continue living independently of the state in refusing resettlement packages. However, they adapted their livelihoods by engaging in fishing and flood recession agriculture when the reservoir is drawn-down. Moreover, many among upstream-resident and resettlement communities work in Khartoum or abroad, or pursue small-scale artisanal gold mining ventures far from home (local committee member interviewee 12). The situation is different between resettlements and upstream-residents in terms of access to livelihood and natural resources. Resettlement communities have the agriculture schemes attached to each of the four settlement. As DIU official interviewee 11 states:

*"Before the relocation, we studied the resettlement area from all aspects as we know agriculture is important to those communities. Their livelihoods, economic and social capital are based on it. We created agriculture schemes at each settlement and provided necessary services, including marketplaces and nearby factories which may help the settlers to gain jobs and access resources. We also supported them during the relocation process by providing logistics and transportation for them and their possessions to ensure they have all the necessary resources to restore their lives. Furthermore, we supported them with two years' worth of free agronomic extension services, water, electricity, seeds, and fertilisers".*

However, the scheme has come under enormous criticism from many participants and interviewees. Some blame the inability of farmers to adapt, and others blame the authorities, lack of water supply for irrigation and training for farmers to enable them

to move from traditional small-scale farms to more modern, commercial farms on larger lands. In support of the criticism, local committee interviewee (20) suggested:

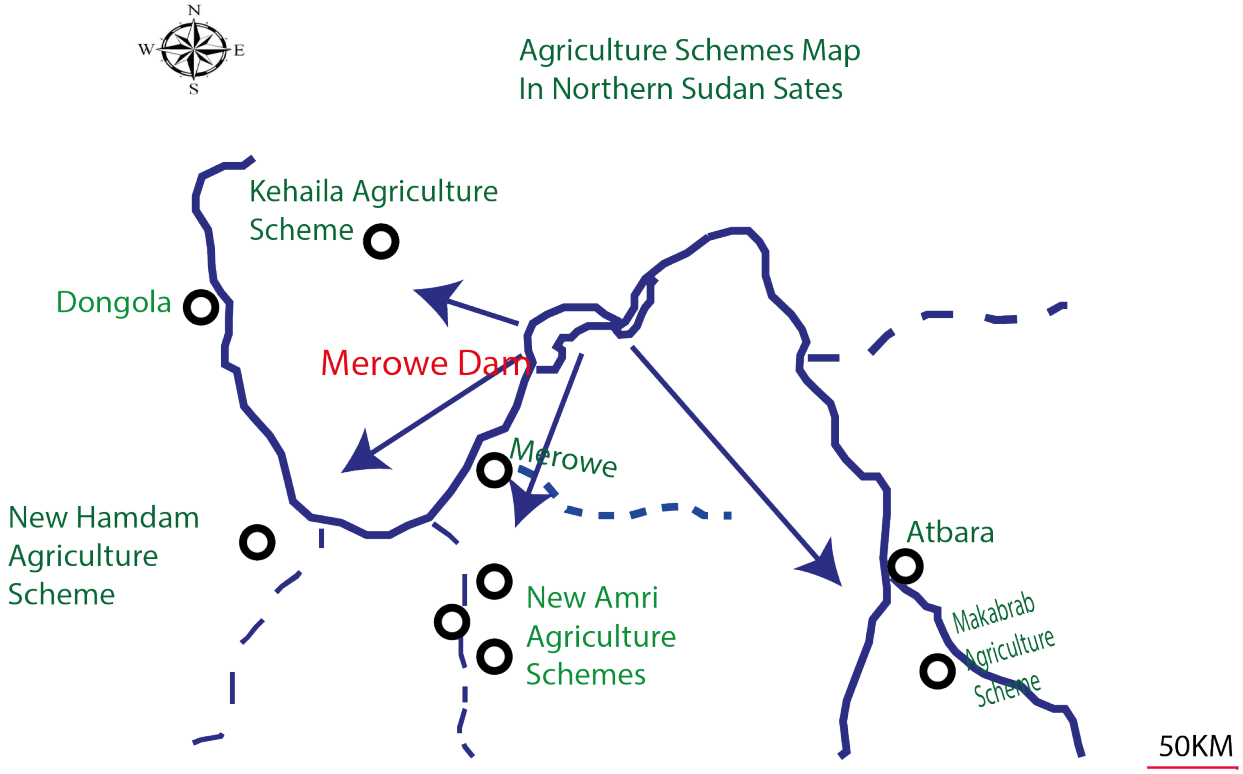



**Figure 6.7 The locations of new settlement's agriculture schemes**

*Sources: Aothur edited fromGoogle*

*"In term of resources, livelihoods and elements of living are available at the new settlement. However, the settlers did not succeed as they were in the old areas. This is due to a lack of water supply, high irrigation costs, less fertile soil, distances between farm and homes, the huge scale of farms and the settlers' unfamiliarity with working in land of such size. There was a deficiency in training the farmers in new systems of agriculture and this is a strategic mistake by the government".*

Other participants and observers went further, agreeing with the literature in criticising the agriculture schemes. For example, local farmer interviewee 2 claimed that, to cultivate 100 date trees, only 60 succeeded due to lack of water for irrigation and he lost 50% of his income. Participants also claimed that households have been seeking alternative sources of income elsewhere and many have even migrated from the region. For instance, local committee interviewee (12) stated:

*"As a resettled man my life is shattered and I no longer have what I used to own. My life has deteriorated. I had to sell or abandon the compensation for the displacement it because it did not help me in my livelihood, which is the main purpose of life. Now I have to look for other sources of income outside the compensation package".*

However, many participants and local observers have challenged this migration claim and suggest people in this region are migrating for many reasons, not just because of Merowe Dam (local committee interviewee 20). Furthermore, many interviewees, local participants and observers suggest livelihoods, sources of income and access to resources are not limited only to settlement schemes, but that there are more opportunities created by Merowe Dam and its accompanying projects to support access to resources, jobs, and sources of income in the region. For example, there are two big farming factories, artisanal gold mining and farm labour on commercial potato farms owned by the DIU (economist interviewee 18, 19 and 20). However, some interviewees have warned of the DIU's use of television advertising to overstate the success and productivity of Merowe Agricultural Schemes and mislead the Sudanese public about what displaced and upstream-relocated people experienced (university academic and economist interviewee 19). Access to resources is not only limited to livelihood, farming and natural resources, it also includes health facilities and healthy environments. To deepen understanding of these resources, the following section elaborates on the influence of settlements and displacement on local people's health.

### 6.4 The influence of Merowe Dam on displaced and local communities health

Agriculture schemes and irrigation systems have many benefits, such as food security and economic development, providing rural households with healthy incomes to obtain essential commodities, including better quality healthcare services and education (Altinbilek, 2002; Chen *et al.*, 2016). However, the negative side of

irrigation projects and their operation is increased transmission of waterborne diseases (Scudder, 2005). The underlying factors are the formation of new breeding sites and the density of human transition because of environmental and demographic changes (Singh, 1997). In Merowe Dam resettlement and its agriculture schemes, surface irrigation is the main method for irrigating wheat, sorghum, fennel, onion, tomatoes, broad beans and date fields. Irrigation schemes create temporary surface water, in addition to irrigation canals, producing the right breeding conditions for malaria and other vectors. However, some observers, experts, locals and official interviewees argue that northern Sudan is a place known to have the least waterborne diseases (malaria) in Sudan due to extreme heat, low humidity and extreme desert climate, unfavourable conditions for mosquitoes to breed. They cite the World Health Organization's 2009 report, which suggests that northern Sudan has a very low risk at the desert fringe with mixed malaria ecology that supports low transmission (Noor *et al.*, 2012).

The effects of dams and settlement is not limited to physical heath only as many scholars argue it causes psychological and emotional stresses suffered by displaced and resettled people that may outweigh socioeconomic contributions of mega-dams (McCully, 2004; Scudder, 2005; Singh, 1997). However, Ersumer (1999) sees dams and irrigation development as an opportunity to provide overall infrastructural improvements: better roads, better health services, rural electrification and housing improvements. This research believes the economic contribution of Merowe Dam cannot be separated from social aspects because of its interconnectivity. Therefore, socioeconomic improvement has a broad influence on the lives of settlement people, including heath aspects. This research argues the point made by Ersumer (1999)

that improving these factors plays a key role in improving people's health and creating healthier environments in the region.

**Figure 6.8 Merowe New Hospital (Chinese Hospital)**

Source: Author questionnaire, 2017

The influence of dams on health is debated, and Merowe Dam is no exception. Many view it as the cause of disease or as a means of providing better health services and socioeconomic development. Neither side presents strong evidence to establish their claim. Merowe Dam supporters cite improvements in health facilities and socioeconomic development, especially government officials. Critics mainly rely on international NGOs' environmental reports and activists' claims, but there is no scientific evidences present to indicate that Merowe Dam influences the health of locals. To explore how Merowe Dam and its settlement and agriculture schemes influence people's health, a cross-tabulation test shows no significant difference between districts ($\chi^2$ = 1.872, *DF* = 2, *P* = 0.392) on the question of if any member of the family infected by any waterborne disease caused directly or indirectly by Merowe Dam (Table 6.7). As Table 6.7 shows, 'yes' *actual* count in both downstream and upstream-relocated districts is much higher than *expected* count and upstream-resident *actual* count is lower than *expected* count. However, the 'no' *actual* count in

both downstream and upstream-relocated is lower than *expected* count in contrast upstream-resident 'no' *actual* count is higher than *expected* count.

**Table 6.7 Did Merowe Dam caused any waterborne diseases?**

| Location | | Yes | No | Total |
|---|---|---|---|---|
| **Downstream** | **Count** | 70 | 30 | 100 |
| | **Expected Count** | 66 | 34 | 100 |
| **Upstream-Resident** | **Count** | 61 | 39 | 100 |
| | **Expected Count** | 66 | 34 | 100 |
| **Upstream-Relocated** | **Count** | 67 | 33 | 100 |
| | **Expected Count** | 66 | 34 | 100 |
| **Total** | **Count** | 198 | 102 | 300 |
| | **Expected Count** | 198 | 102 | 300 |
| | **Chi-Square (*df* 2)** | 1.87* | | |

Source: Author questionnaire, 2017

This indicates a high probability of Merowe Dam and its accompanying projects causing an increase in waterborne diseases at district level. In Figure 6.8, over 60% of participants were infected by malaria. However, 63-85% of participants across districts were not infected by cholera, bilharzia, typhoid and other types of diseases. This indicates the role played by increased surface irrigation in creating the right environment for mosquitoes to breed, which could causes increase in malaria infection in the region.

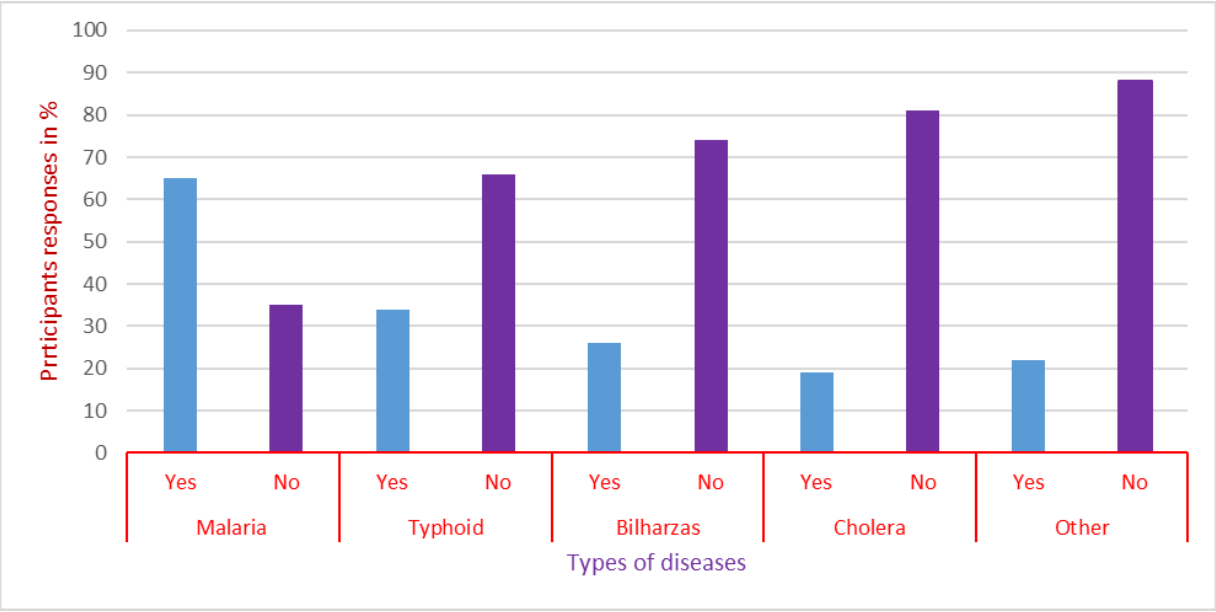



**Figure 6.9 Frequency distribution of waterbourne diseases in the study area.**
Source: Author questionnaire, 2017

This argument is challenged by government officials, local committees and even some environmentalists who argue that no scientific evidence supports these claims, and some have referred to the climate of the region, as malaria is known to be limited. As DIU official interviewee (11) suggests:

*"I am not denying people have contracted malaria, but the matter is overstated as a form of political protest by a small segment of people".*

There are significant differences among participants and local interviewees on the causes and levels of infection by waterborne disease and health provision in the region, especially at the settlement. Some believe the dam played an active role in increasing the level of infection, especially malaria, as local committee member interviewee (2) suggests:

*"Yes there are some diseases which we did not encounter before the displacement like diarrhoea and hepatitis. Malaria was present, but it was very limited; now it is prevalent".*

The influence of dams on health has been criticised in the literature by many, including Scudder (2005), McCully (2004) and Singh (1997), both physically and psychologically. However, in the case of Merowe Dam, the focus is more on the physical aspects of health than psychological. This emphasis is due to Sudanese culture and perceptions of mental health, and perceptions that emotional issues are at the lower end of health needs. Sudanese society is spiritual in nature, relying less on materialism; which hastens emotional recovery, as people believe everything is replaceable except the dead. A Sudanese saying supports this claim: *the calamity that afflicts you, in your possessions, is forgiven for you*. Furthermore, faith is a means of comfort from any distressing event, by praying to 'God' and hoping things will be better. However, this attitude is not an attempt to diminish the psychological trauma of Merowe Dam on resettled people, such as stress relating to anxiety about

the future, and the loss of home, the sense of 'community', familiar landscapes, history, religious symbolism, and cultural identity (Scudder, 2005). Most participants, interviewees and experts have acknowledged the probability that Merowe Dam directly or indirectly affected people's physical health, but there is less emphasis on mental health. Remarkably, even the most vocal critics of Merowe Dam (the local displaced people committees) have minimised the dam's influence on people's health, especially malaria. As local committee member interviewee (12) states:

*"The health problems began gradually after some of the underground wells stopped providing drinking water. The administration started drawing water from the irrigation canals, which led to cases of diarrhoea and a liver disease epidemic. These diseases did not exist in the area before Merowe Dam. There might be no direct link between these diseases and Merowe Dam, but they only emerged after displacement. As a result of lacking sanitation, a large quantity of flies appeared but, those infected with malaria are fewer than those infected with other waterborne diseases".*

Despite the magnitude of dam criticism in health aspects, many challenge these critics – including Ersumer (1999), Chen (2016), Focacci (2003) and Varma (1999) – suggesting socioeconomic improvement can be indicative of improving people's health and creating healthy environments. Likewise, many local observers, interviewees and government officials agreed with this view. As local committee member interviewee (4) stated:

*"Yes, there are some psychological and physical health effects on people, I cannot negate that. We miss living by the Nile, but now we feel like someone who moved from a village to a city: we cannot forget our history. However, in relation to physical health, yes, there were some issues with drinking water and some people could not adapt to underground well water. This is normal for people brought up to drink water from the Nile, but there is no malaria as many people have claimed. The settlement is suitable for living and the future is bright for our sons due to services, especially health facilities and education, and the availability of agricultural land and population density with all-round socioeconomic improvement foreseeable in the future".*

The Merowe Dam has caused fierce debate around its health influence within the region and at the settlement. The majority of observers agreed with its positive health

contribution but some observers perceive it as a direct or indirect cause of most physical illnesses, at least at the settlements. To explore whether Merowe Dam has caused illness in the region, a cross-tabulation analysis elaborates on participants' perspectives. Table 6.8 shows no significant difference between districts on whether Merowe Dam caused malaria, cholera, bilharzia, typhoid or other types of disease in the region.

**Table 6.8 What you think the reasons behind the illnesses in the region**

| Location | | Not related to Merowe Dam | Insects | Environment | Total |
|---|---|---|---|---|---|
| **Downstream** | **Count** | 30 | 51 | 19 | 100 |
| | **Expected Count** | 37 | 47 | 17 | 100 |
| **Upstream-Resident** | **Count** | 45 | 42 | 13 | 100 |
| | **Expected Count** | 37 | 47 | 17 | 100 |
| **Upstream-Relocated** | **Count** | 35 | 47 | 18 | 100 |
| | **Expected Count** | 37 | 47 | 17 | 100 |
| **Total** | **Count** | 110 | 140 | 50 | 300 |
| | **Expected Count** | 110 | 140 | 50 | 300 |
| | **Chi-Square (*df* 4)** | 5.293* | | | |

Source: Author questionnaire, 2017

The *actual* count of participants at downstream and upstream-relocated perceiving the dam to be the main cause of waterborne disease through insects (mosquitos and flies) or unhealthy environments is higher than the *expected* count. In contrast, the actual count of upstream-resident participants' deeming the dam to not be the cause is higher than the expected count ($\chi^2$ = 5.293, *DF* = 4, *P* = 0.259). The Merowe Dam has played a role in creating both negative and positive health effects. However, population increases at downstream and in resettlements because of migration from across Sudan led to increased water use, poor sanitation, commercial waste, etc. These factors can create unhealthy environments, which increase waterborne diseases.

Furthermore, World Health's Organisation 2009 report suggests the people who tested positive for malaria reported travelling to other parts of Sudan before the

survey and nobody in Northern desert state groups reported a case of malarial infection (Noor *et al.*, 2012). There is the possibility for a role for migration in increasing infection in the region. This point is not an attempt to exclude Merowe Dam's role in increasing waterborne diseases, but it is an attempt to consider all factors. Many participants from downstream and upstream-relocated view Merowe Dam as sole contributor to the waterborne disease increase. Local farmer questionnaire participant (176) stated:

"*Increased mosquitos, flies, pollution, waste and no form of environmental concern from the administration, such as spraying pesticides, caused increased infection".*

However, many observers, interviewees and participants, especially upstream-resident, see no connection between Merowe Dam and increased waterborne diseases. This lack of recognition suggests the level of disease is the same or less than the rest of Sudan, as local farmer questionnaire participant (241) stated:

*"I think there is no relationship between the dam and increased waterborne diseases; I believe the increase is nationwide"*

Almost all participants, interviewees, observers and experts have agreed with the positive contribution of Merowe Dam to health facilities. These health facilities and services are of a high standard, compared to the average in Sudan, although some critics suggests they are below standard. Contrary to the majority of negative perceptions on how dams influence health, a local female interviewee (30) elaborated further:

*"As a woman I can say that, in the past, pregnant women struggled to reach health centres. Some women have died on route because of the distances and we have few midwives. At the new Amri resettlement, we have seven midwives and specialist doctors, which has a positive impact on women and babies' health. There is a well-equipped hospital, four medical centres, and critical cases are referred to the main hospital in Merowe."*

This point shows the disparity between dams' impact on health in tropical regions compared to desert climates, where the impact is less than the literature claims. Health matters, access to natural resources and resettlement are areas not only witnessing intense debate, but also can cause widespread social conflict, especially within mega-dam project developments. The subsequent Section (6.5) explores social conflict and community relationships in Merowe Dam context.

### 6.5 Social conflict amongst communities, societies and the authorities

In the past few years, the struggle of native and other minority communities with mega-dams building has deepened and become better coordinated. In many countries (e.g. Brazil, India, Turkey, China), local resistance has included effective and organised use of local and international media, internet and social media (Jia *et al.*, 2011). Some resistances have gained international recognition through transnational ties via information resource contributions, which led to extra political weight added to the struggle (Jia *et al.*, 2011). Subsequent to the famous social conflicts of the Nubians, who were displaced by Egypt's Aswan High Dam in the 1970s, lessons were learned for and from Merowe social conflicts, which were interrelated with other Nubian communities in the Dal and Kajbar villages who anticipated consequences of two proposed dams (Askouri, 2014; Hashim, 2009). Both local and international sets have contributed to broadening the acknowledgement of indigenous rights. The construction of mega-dams continues to create intense social conflicts between dam authorities, supporters and opponents. With Merowe Dam, there is social conflict around different perceptions of the economic, social, and environmental benefits and impacts. These conflicts are hostile, and many displaced people see Merowe Dam authorities and its supporters as their

enemies. The authorities argue that Merowe Dam is an efficient means of storing critically needed water, to produce electricity, irrigation and to govern the flow of rivers (DIU, 2007f). However, critics and local communities cite the dam's negative environmental and social impacts, predominantly the mass relocation of Hamdab, Amri and Manasir communities, who become socially, economically and politically marginalised. Politicians further complicate the conflict over Merowe Dam because they view it as a strong symbol of autonomy, pride and political achievement, as evidence of progress toward modernity.

The Merowe Dam has caused conflict at three levels. First, between communities and project authorities, which is linked to power relations and interactions between government and communities. An uneven distribution of authority and power divides society into two opposing groups: the ruler and the ruled (Dahrendorf, 1958). This division leads to conflict between the two groups, as happened with Merowe Dam. Secondly, conflict among communities, which involve power relations, resource access, intermediation and affiliation. Beyond the confrontation, social conflict plays a constructive role in ensuring the continuity of society by decreasing the likelihood of greater conflicts. The case of Merowe Dam social conflicts played a flexible role in supporting a social system that allowed both parties to address and resolve the conflict (Coser, 1957). Finally, conflict among authorities, supporters of local and international NGOs, and civil societies in Sudan, viewed by the government as a form of opposition related to political affiliation (see Chapter 7).

To gain insight into the issue of social conflict and its consequences on the communities and authorities, it is vital to examine the participants, interviewees' and

experts' opinions. Most interviewees, participants, observers and officials confirmed that communities initially accepted the dam, and that animosity has developed over time because of years of failures in drinking and irrigation water supply, resettlement and for many broken promises towards Manasir communities. However, officials have played social conflicts and acknowledge some social issues that have not reached the level of conflict. Furthermore, many officials suggested that some community members used the situation for personal gain (DIU official interviewee 23). He added:

*"There are no conflicts about land, displacement or compensations. All these have been done through research and legal routes with consultation of committees. What has happened is a strong reaction and pressure from people who refused the resettlement toward the people who accepted resettlement to force them to decline relocation which causes ill feeling among all parties".*

The official standpoint of denial shows the disparity between official and common peoples' perspectives, which is a demonstration of power relation theory in social conflict where the dam authorities see affected communities as subjects without the right to demonstrate or show objection to their decision. To understand the participants' take on the social conflict, a cross-tabulation analysis illustrates whether the official claim of no conflict is correct.

**Table 6.9 Were there any social conflicts amongst all parties?**

| Location | | Yes | No | Total |
|---|---|---|---|---|
| **Downstream** | **Count** | 34 | 66 | 100 |
| | **Expected Count** | 48 | 52 | 100 |
| **Upstream-Resident** | **Count** | 57 | 43 | 100 |
| | **Expected Count** | 48 | 52 | 100 |
| **Upstream-Relocated** | **Count** | 53 | 47 | 100 |
| | **Expected Count** | 48 | 52 | 100 |
| **Total** | **Count** | 144 | 156 | 300 |
| | **Expected Count** | 144 | 156 | 300 |
| | **Chi-Square (*df* 2)** | 12.10*** | | |

Source: Author questionnaire, 2017

Table 6.9 shows significant statistical differences between districts on perceiving the dam to cause social conflicts. Downstream participants believe it did not cause any form of social conflicts as the *actual* count of 'no' is much higher than *expected* count

and the *actual* count of 'yes' is much lower than the *expected* count. These are expected responses from downstream participants, as they suffered less from displacement, loss of property or land and compensation disputes. In contrast, upstream-resident and upstream-relocated participants believe the dam has caused social conflicts. The *actual* count of 'yes' in both districts is much higher than *expected* count. However, the difference between total actual count of 'yes' and 'no' for social conflict is small ($\chi^2$ = 12.099, *DF* = 2, *P* = 0.002).

This data indicates the disparity in opinion on the social conflicts and its causes. For example, most interviewees, participants and observers regard only the serious incidents as social conflict, unlike the western approach to social conflict where even disputes over land claims count as social conflict. The social issues of Hamdab and Amri communities that related to Merowe Dam were resolved in a less confrontational style. This is one reason for the close result between 'yes' and 'no' camps, as university academic interviewee (25) stated:

> *"Power relations are the main cause of conflict, how the government officials looked down upon Hamdab, Amri and Manasir communities by not paying attention to their concerns. These communities started to question who are the beneficiaries of the dam, especially Manasir, and some of them suggested that officials and the elite support Shawiqa communities (Amri and Hamdab) because they control the government".*

This quote illustrates the uneven power distribution even within the ruled groups, where the elite prefer one group based on affiliation or ethnicity. It demonstrates Dahrendorf's power relation theory in society in how it reflects Merowe Dam's social conflicts, which led to further uneven division between communities and even within ruled groups. It further indicates that the social conflicts associated with Merowe Dam varied in levels of intensity within the affected communities. As university academic interviewee (25) stated:

*"The conflict was not that intensive at the beginning, especially from Hamdab and Amri communities. It started with simple protest they arranged in March of 2009 about the failure of the government provides support for resettlement agricultural scheme, the protest were faced with strong police force".*

Despite the early warning of Hamdab protests and the appeal for resolution to resettlement and agriculture problems, the government continues to ignore Manasir and Amri communities. This point shows that there is a place for Coser's (1957) social conflict theory in Merowe Dam context. Communities attempted to negotiate with the government, despite their low level of power, to maintain the continuity of their relationship and preserve their environment. As Coser (1957) suggests, most Hamdab and Amri communities have reached an understanding that allowed both parties to resolve the conflict and accept the status quo. However, according to local committee members and university academic interviewees (12, 20 and 25), communities, especially the Manasir, were unwilling to approve the DIU's compensation package, and subsequently formed committees to protect their interests and rights. During the negotiations, the committee suggested six alternative resettlement sites alongside the reservoir to government officials. Local committee member interviewee (20) elaborated further on the social conflicts:

*"The Merowe Dam brought serious social conflict among local communities, caused by conflicts of interest: the people who were responsible for building the dam are the same people responsible for resettlement and this is a big mistake. They concentrated their energy on building the dam and ignored the displaced people, which caused more social conflict and animosity as the people who were supposed to help us to relocate, their main objective was how to evacuate us to build the dam. DIU aimed not only to evacuate us, but also to relocate us away from 60,000 hectares of fertile agricultural land alongside the reservoir and huge fish wealth in order to lease it to Arab investors".*

To understand how serious the conflicts was between all parties, a Kruskal-Wallis test of 3 Likert scale: not serious, serious and very serious (scored 1, 2 and 3 with 1, as lower and 3 as the highest level) provides insight on the conflict level. Table 6.10

shows significant difference between districts on the level of social conflict. Downstream means (1.49) suggest no social conflict; in contrast, both upstream-resident and upstream-relocated means (1.92- 2.01) indicate the level of conflict is between serious and very serious ($\chi^2$ = 27.885, *DF* = 2, *P* = < 0.001).

**Table 6.10 Ranking of the level of conflicts by districts**

| Location | Mean | Std. Deviation | N |
|---|---|---|---|
| Downstream | 1.49 | 0.628 | 100 |
| Upstream-Resident | 1.92 | 0.774 | 100 |
| Upstream-Relocated | 2.01 | 0.732 | 100 |
| Total | 1.81 | 0.747 | 300 |
| Chi-Square (*df* 2) | 27.89*** | | |

Source: Author questionnaire, 2017

According to most participants and interviewees, the officials caused conflict by sabotaging committees' efforts to resolve the disputed issue before it turned serious through "*broken promises and devious tactics to create division within the committees and communities*". "*In fact, the DIU managed to create divisions within the committees, communities and families, and this led to further conflict and breakdown in relationships. As a result of government tactics, some Manasir members accepted the resettlement packages and resettled at the new location"* (local committee members' interviewees 12 and 20) see (Chapter 7). Many participants agreed with the seriousness of conflicts between governments, communities and even within one family, as local farmer questionnaire participants (1 and 233) stated:

> *"Yes, it was serious, to the extent that brothers disagreed with each other on land control and settlement which sometimes led to fighting and harming each other".*

> *"The conflict is very dangerous and led to the killing of three people in the area"*

Form participants and interviewees' responses, social conflict theory is applicable to Merowe Dam in the two approaches used in this research: power relation and conflicts as means of continuity and preventing further conflicts. Clearly, the conflicts between Merowe Dam authorities and local communities, especially Manasir, has

damaged their relationships beyond repair. This finding is consistent with Jia's (2011) suggestion that dams are the cause of social conflicts (see Chapter 2) and also reinforces the economic and political power that governments and funders have over social and environmental aspects in the future of Merowe Dam. However, Merowe Dam has helped to resolve conflicts between family members on inheritance land rights by giving each family members a piece of land registered in each name, which supports Jia's (2011) views on dams as both the cause and resolution of conflicts by resolving land claims and allowing Amri and Hamdab communities to move on.

The sentiment of good relations and the sense of reconciliation between communities is clear throughout discussions with a group of over 10 people representing different stakeholders: government, farmers, students, local committee members and businesspersons at Kehila resettlement (26/07/2017). There was unanimous agreement at the meeting that politics and politicians have played a role in fuelling the conflict; they also agreed that Merowe Dam was the cause of it. As one member said, all communities have been living side-by-side for decades without a single conflict on land, grazing areas or anything else, and now they are as they were before the dam: strong, coherent communities.

This discussion indicates the weaker position of these communities and their environment in the balance of power within Merowe Dam dynamics by accepting the status quo (see Chapter 2). In order to understand the level of seriousness of the conflicts, Figure 6.9 provides further information. Figure 6.9 confirms the disparities between regions and is supported by the means results in Table 6.10. Also, as the Figure 6.10 shows, 60% of downstream participants see 'no conflicts', but about 40% think there are serious conflicts. However, for upstream-resident and upstream-

relocated, 35%- 50% perceive the conflict to be serious and 25%-30% very serious, which suggests serious conflicts outweigh non-serious conflicts. Many participants and interviewees believe the seriousness of the conflicts in Merowe Dam context was galvanised by DIU stubbornness, manipulation and unwillingness to compromise. As local committee member interviewee (2) states:

*"This situation ultimately led to an attempt from some local communities to consider withdrawing their consent to build Merowe Dam. This boiled over into a series of vicious exchanges between government, committees and the activists, leading to a succession of activists' arrests and protests against the DIU".*

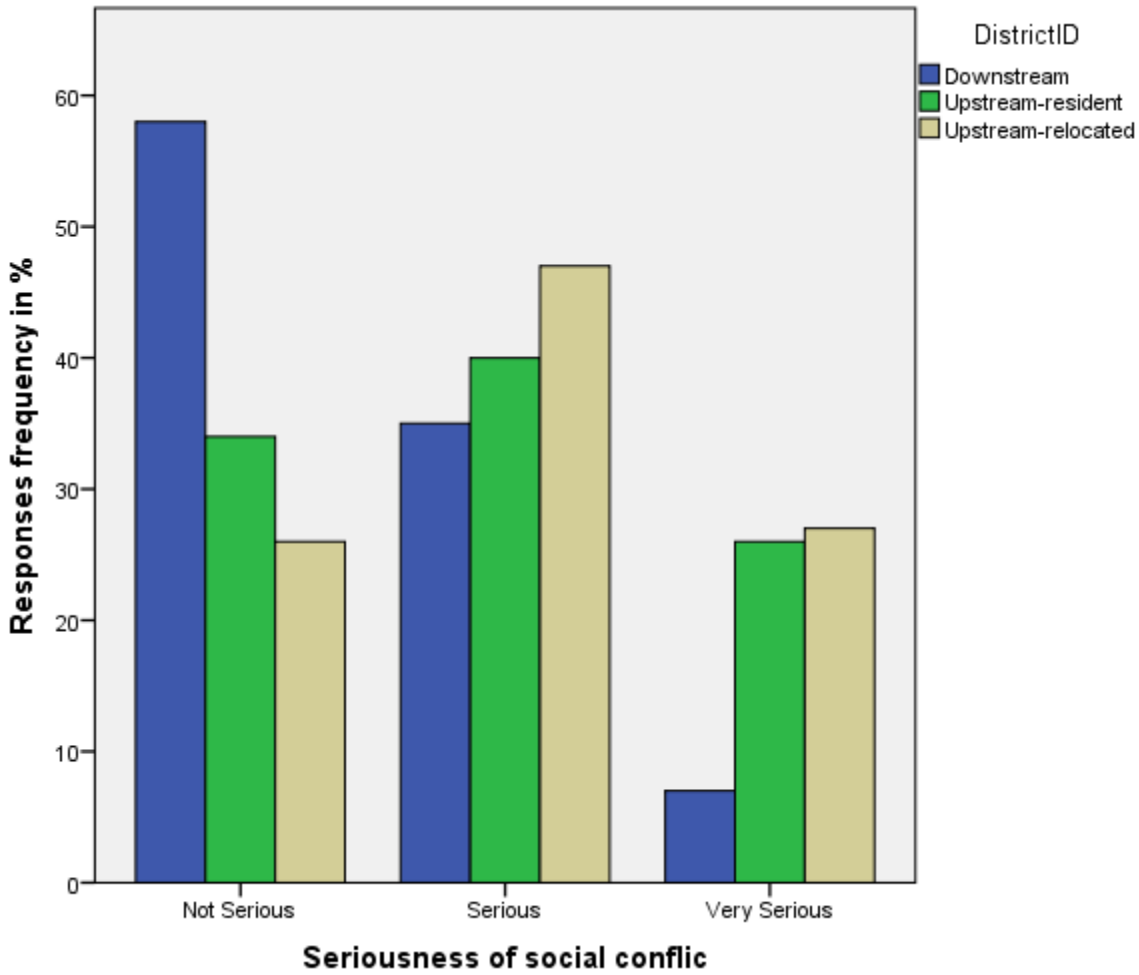



**Figure 6.10 The level of social conflicts at study area**

Source: Author questionnaire, 2017

Furthermore, university academic interviewee (25) stated:

*"The situation started to get out of control, leading to the sabotage and burning of DIU offices by both Amri and Manasir communities. Eventually the government*

*deployed three army battalions to Al Qab, Sherri, and Sani. The conflicts intensified when DIU paramilitaries opened fire on peaceful and unarmed demonstrations, killing three and wounding 50. This event led hand Amri and Manasir struggles being internationalised through local and international media coverage, such as the Qatar-based Al Jazeera television and local newspapers".*

However, university academic and political analyst interviewee (3) believed:

*"The state's media reported the incident in an attempt to reduce its impact and not just to minimise the public support for the demonstrators. It also attempted to change public perception in order to demonize the protesters. Despite the government's efforts to conceal the event from the local media, the struggle gained local and international public support".*

This public support led to the organisation of many protests in support of the Merowian struggle by activists and students in Khartoum and especially across universities campuses (Sudan Tribune, 2011). Furthermore, many international NGOs voiced their concern, including the UN Special Rapporteur – who demanded adequate housing for the displaced based on UNHRC's Basic Principles and Guidelines in Development Based Evictions and Displacement (UN-OHCHR, 2002) – and US-based International Rivers, which claims to be "at the heart of the global struggle to protect rivers and the rights of communities that depend on them" (IRN, 2008). In addition to many in Northern Sudan, diaspora communities and Sudanese activists based in the UK, the USA and European countries have joined the struggle (Askouri, 2014). A legal action was submitted against Merowe Dam consultant company Lahmeyer International in 2010 to the European Centre for Constitutional and Human Rights (ECCHR) on behalf of Ali Askouri, as a representative of the Leadership Office of the Hamdab Affected People (ECCHR, 2010.). Furthermore, the Corner House was very active in criticising multinational construction companies and financial institutions and, in 2008, they published a critical report suggesting Merowe Dam violated many of the World Commission on Dams' Framework, and the World Bank's Involuntary Resettlement guidelines (Hildyard, 2008, p. 8).

However, the government sees these campaigns as attempts from political opposition and activists to make political gains and strategies to negotiate better compensation and resettlement outcomes (DIU official interviewee 23). University academic and political analyst interviewee (13) challenged this claim:

*"Those people have a right to express their rejection to DIU oppression and unfair compensation through sit-ins, demonstrations and raising complaints to Khartoum and international organisations. This does not mean political opposition to the government nor rejection of the dam, but demanding justice and fair compensation".*

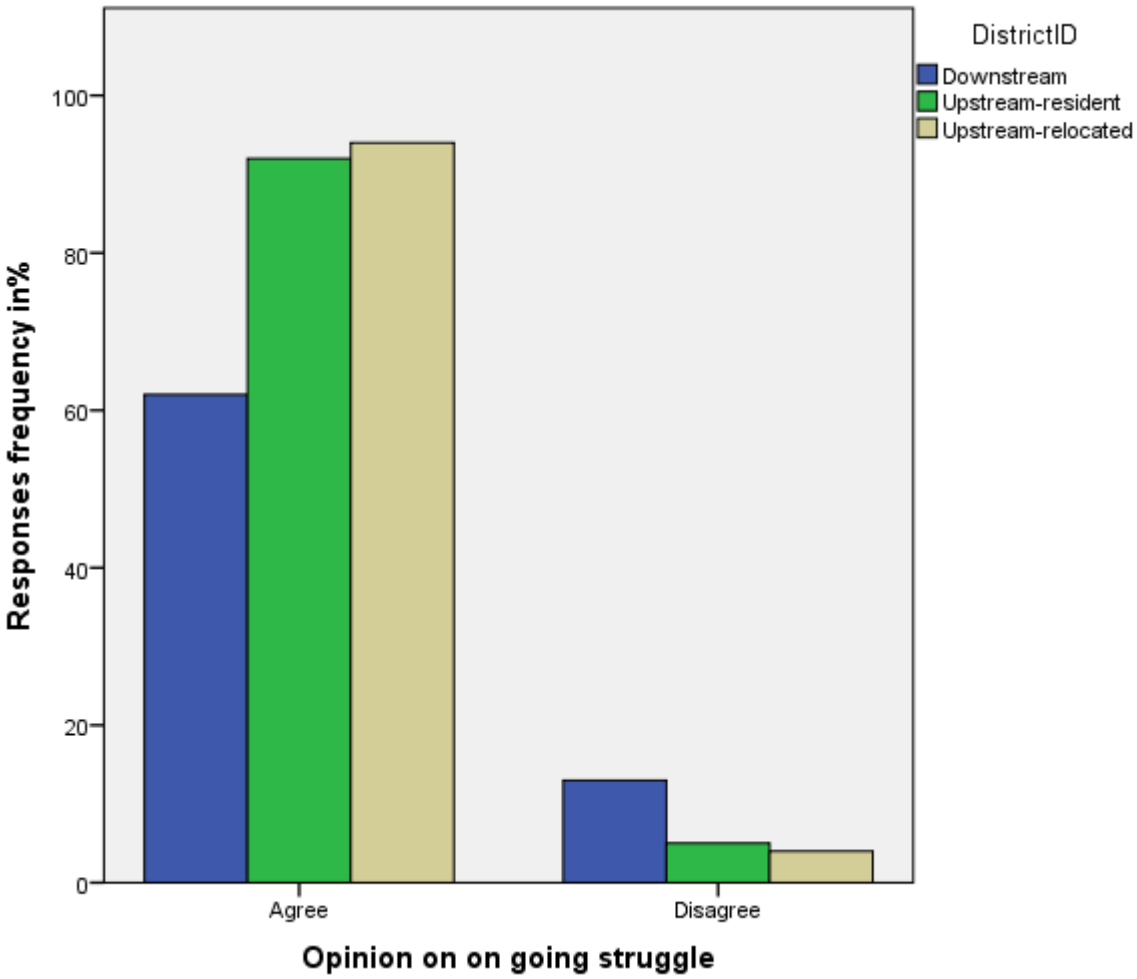



**Figure 6.11 Participant's opinion on the ongoing struggle of locals**
Source: Author questionnaire, 2017

Most participants, observers and interviewees believe Merowe Dam conflict could have been resolves if DIU accepted the upstream-resident demands, as university academic and political analyst interviewee (13) stated:

*"The needs of displaced people should have been met. Over 60% of Manasir displaced preferred to resettle by the reservoir, so why not? Those people have sacrificed their birthplace and their history for the dam. This is one of the biggest mistakes made by the DIU and they should have listened to people's demands instead of using force and without proper consultation with local people".*

Some participants and interviewees suggested that the social conflicts of the Merowe Dam are not only between displaced and DIU, but reach state level. Many River Nile State citizens suggest the Northern State has the lion's share of development projects because most of the elite are there. The Merowe Dam has dominated economic, social and political debates in Sudan for a considerable period (see Chapter 5 and 7), which shows how intensive the debate was. Amri and Manasir conflicts have played a big part in this debate, raising awareness about the conflict and gaining widespread support across Sudan. As Figure 6.10 shows, 65% of downstream participants and 95% of upstream-relocated and upstream-resident participants have agreed with on-going protest and demonstration against DIU. However, many people across Sudan perceive the struggle to be in-house, between northern Sudan elites for economic and natural resources control. To better understand the extent of the social conflicts of the Merowe Dam is vital to examine how Merowe Dam affects community relationship in the region, which is covered in the next section.

### 6.6 Merowe Dam effects on community's fabric and relationships

The discourse on displacement, resettlement and social conflicts caused by mega-dams had less emphasis on the fabric of family and communities and the nature of their relationships (Jia *et al.*, 2011). The issue was perhaps only mentioned as a footnote until the late 1990s, when scholars started to pay attention due to increased social conflicts generated by dams (Jia *et al.*, 2011). This section makes an effort to

explore the nature of communities and family relationships in the context of displacement and resistance, and analyses the influence of Merowe Dam. This section drew upon the experience of displacement on Manasir and Amri communities' relationships, especially at the upstream-resident. It also addresses issues of communities' participation in anti-Merowe Dam movements from the perspective that such resistance represents a moment of transformation for their communities.

Certainly, Merowe Dam has caused serious social conflicts between government, communities and NGOs. However, the extent of damage caused by the conflicts in communities' relationship is unknown. Most participants and interviewees have expressed their support for the displaced struggle for justice, which resonates throughout the country. Despite the nature of Sudanese societies of quick reconciliation and forgiveness, it seems the relationship between the government and communities, and between the resettled and non-resettled, have been deeply fractured. Many interviewees blamed DIU of using divide-and-conquer strategies by manipulation and deception, but DIU official interviewee (23) challenges this assertion and stated:

*"There is no ill-feeling between the DIU and local communities nor within the communities and, to the best of my knowledge, everyone working at DIU has strong relationships with local people. They know us and we know them and we participate in their social events".*

However, many participants and interviewees disagree with DIU official claims denying a break in relationships, as local committee member interviewee (20) stated:

*"There were conflicts between people who resettled as a result of pressure from DIU and those who refused resettlement. As a result, families and communities have cut ties between each other. This led to vandalism and damage to properties even to those who accepted compensation but without resettlement. The relationship*

*between the two groups was broken up, but time is a healer and now the kinship and social relationships are back to normal".*

The element of tribal politics and clan affiliation started to play out in the regional relationship between common people and politicians, as Manasir communities questioned the action of the ex-head of the DIU by suggesting whether he would flood his own family and the Shagiah or Ja'alin communities. The situation strained social relationships across communities and their compatriots, especially between those who relocated after accepting the compensation package and those who remained upstream-resident. The tensions are apparent through various stories and meetings or interviews with locals, but mostly in the expression "Karzai". The term is used to label community members who accepted, encourage others to accept, or vocally supported government resettlement and compensation packages. This is like the US-supported Afghani president, who is perceived to represent the interests of the US-government more than Afghani people's interests.

To further understand the circumstances of communities' relationships a cross-tabulation analysis is conducted. The test shows that significant variances between the districts on how they perceive the state of their relationships within these 3 indicators: not good, good and very good (scored 1, 2 and 3 with 3 as the highest level). The result indicates that most participants perceive community relationships to be good in all three districts, especially when combining 'good' and 'very good' counts. However, the *actual* count of very good is lower than the *expected* count at downstream and upstream-resident, but the *actual* count of participants perceive the relationship as not good is higher the *expected* count.

**Table 6.11 The relationship between the state and communities by districts**

| Location | | Not Good | Good | Very Good | Total |
|---|---|---|---|---|---|
| **Downstream** | **Count** | 20 | 38 | 42 | 100 |
| | **Expected Count** | 19 | 33 | 49 | 100 |
| **Upstream-Resident** | **Count** | 28 | 30 | 42 | 100 |
| | **Expected Count** | 19 | 33 | 49 | 100 |
| **Upstream-Relocated** | **Count** | 8 | 30 | 62 | 100 |
| | **Expected Count** | 19 | 33 | 49 | 100 |
| **Total** | **Count** | 56 | 98 | 146 | 300 |
| | **Expected Count** | 56 | 98 | 146 | 300 |
| | **Chi-Square (*df* 4)** | 17.643*** | | | |

Source: Author questionnaire, 2017

Upstream-relocated's *actual* count on very good relationships is much higher than the *expected* count, but the not good relationship *actual* count is much lower than the *expected* count. This is despite the ill-feeling between the relocated and non-relocated and indicates that commuities have moved on ($\chi^2$ = 17.643, *DF* = 4, *P* = 0.001).

Perhaps the emotional attachment to family and rooted kinship allowed people to forget the violence and betrayal, which had created the longest social divisions within the communities. This sentiment within participants is very positive for relationships, the following expression was used to describe communities' relationships: *"intimate relationships full of love, kindness and like one family"* (local farmer questionnaire participants 4, 11, 100 and 220). This relationship runs parallel to Coser's (1957) and Jia's (2011) ideas that communities can move on after conflicts to preserve their social relationship. However, for Manasir's relationship with the government is not preserve based on Coser's idea despite the recent emerging news of agreement being reached to allow them to resettle by the reservoir. The dispute on the resettlement is still ongoing as neither side is willing to change their position. The government believes they have built the new settlement away from the reservoir, which is still empty as the Manasir communities refuse to move in, because they

would prefer to resettle by the reservoir. Many observers and interviewees have questioned the wisdom behind building the new settlement against the wishes of Manasir communities and why they could not be built based on the community's preference (university academic and political analyst interviewee 13). It is clear there were tensions between the government and DIU, and the local communities, which is the cornerstone of community conflicts and contaminated their relationships. The conflicts have been the drive for the breakup of old relationship and formation of new relationships. On top of this conflict comes the nature of societies and their ability to heal grievances and reconcile. This foundation keeps communities together and manages to reform relationship as many participants, interviewees and observers have expressed.

### 6.7 Conclusions

The chapter has analysed the social influences of Merowe Dam and its contribution in the northern region of Sudan, focusing on the social aspects of local communities: the differences, changes and interlinkages between the old and new settlements. Technology has brought changes to society and particularly rural areas, bringing positive influences through innovations like electricity, used in all aspects of life. This introduction of new technology increases the opportunities for education, health and improved living standards and conditions, which lead to improvement socioeconomic and human development. Altinbilek (2002), Chen (2016), Ersumer (1999) and Varma (2003) argue that dams have positive influences on improving hosting communities' social statuses by providing better living conditions, services, housing, etc. However, there are many critics of the social influence of dams, especially on health,

displacement, relocation and other areas, implying that dams have insignificant social benefits (McCully 2001, Singh 1997 and Scudder, 2005).

This analysis of Merowe Dam has revealed that mega-dams produce both negative and positive influences for societies through dealing with complex social, economic and political issues. The Merowe Dam has generated more fortunate beneficiaries socially (downstream, upstream-relocated and country) and some less fortunate (displaced and upstream-resident). Yet, the social benefits margin between the two sides is negligible when counting the numbers of vital social projects created in the area. Furthermore, the margin can be minimised through inclusive stakeholders' participation, consultation, and transparency in project appraisal, design and implementation. However, attaining the much-needed social improvement and economic development through Merowe Dam requires positive engagement and dialogue between stakeholders to gain the best outcomes, because the social costs and benefits of Merowe Dam has long-term consequences on the communities. However, the situation is different in Merowe Dam compared to other dams due to the destructive nature of the engagement and discussion in the Merowe region and state agencies in Sudan that delivered the dam.

This chapter has presented analysis and discussion of the main social aspects, which symbolise Merowe Dam's social benefits in the region. Examining rationales for displacement, resettlement, resources access, health issues and social conflicts has uncovered how it has created various positive and negative social changes in the region. The data demonstrates that people at the three districts acknowledge the valuable social opportunities that Merowe Dam and its accompanying projects as "technology" offered the communities, which required further social development.

This view is supported by Varma (2003), who argues that dams have brought many social and economic benefits to hosting communities.

Furthermore, the chapter shows diverse feelings about Merowe Dam among locals, the region and the country. Local participants' responses show different perceptions within districts, however, the majority of participants like the dam despite the grievances of displacement. This reinforces the argument suggesting local communities are not opposed to Merowe Dam as much as the way in which the government dealt with the displacement and compensation issues. The displacement and its effects on many people economically, socially and politically, combined with an unwillingness to address its underlining issues, drove negative sentiment, especially within Manasir communities.

There was also evidence of strong associations between displacement resentments and social conflicts, especially between the government and Manasir communities and within Manasir communities. The analysis showed significant differences between districts in level of conflict and its impact on the relationships between members of families and communities. Upstream-resident (Manasir) and some upstream-relocated (Amri) communities are widely affected by the levels of conflict unlike downstream, where communities are unaffected. However, they still support their counterparts at other districts. Furthermore, the analysis suggested that Merowe Dam has both positive and negative influence on resource access across the districts. However, upstream-relocated and downstream have been positively affected and benefited from multiple access points to resources. Unlike the upstream-resident communities, who have been negatively affected, they gained free irrigation and

high-quality soil at the expense of land size and support from the agriculture development authority. The analysis indicates there is no direct connection between Merowe Dam and waterborne diseases in the region. However, indirectly, the dam has some negative influence on the communities' health as the result of displacement and increased waste and water levels, especially at resettlements and downstream.

The chapter also discussed how providing the new settlement and the region with electricity, education, health facilities, infrastructure and communication supported social improvement. The analysis shows strong evident of satisfaction with the new settlements. As respondents acknowledged, the Merowe Dam has changed many aspects of the resettled communities' social lives through availability of electricity, modern technology, access to services and greater socioeconomic units.

The analysis revealed most participants in the districts have a link with farming. This connection suggests that having agriculture schemes attached to each settlement has played an important role in restoring some aspects of communities' social lives despite a lack of water supply for irrigation, which caused some deficiency in productivity. This finding reflects previous studies, such as Scudder (2012), which posit that dams' resettlement schemes have been improving significantly.

To conclude, respondents were not only conscious about social improvement needs, but were able to endorse the debate and provide suggestions on how social improvement can be conducted in future projects. Although most participants agreed with Merowe Dam's positive social and economic influence in the region, there is some underlying political and environmental issues to be explored (see Chapter 7)

These findings, therefore, suggest that:

- Displacement and resettlement caused by dams as a social impact is a common phenomenon across the world, regardless of displacement and its nature and so too at Merowe Dam. However, socially, there are differences in resettlement contexts and the degree of satisfaction with resettlement in providing better living standards and conditions allowing displaced communities to restore many aspects of their lives.

- The social influence of Merowe Dam in the region is positive in comparison to literature reporting on dams' social issues. The Merowe Dam has exceeded the expectations of locals in delivering social projects (education, health facilities, sources of income, etc) that support social improvement in the region, even though it has caused conflicts between authorities and local communities, which led to death of three people.

- The condition of the region before Merowe Dam is equal or worse than post-dam. In addition, the environment and circumstance are different from most dams in the world. The Merowe Dam has been long-anticipated with high expectations, making it different; it has been welcomed by most communities despite some social conflicts.

This study of Merowe Dam's social influence in the northern states of Sudan has revealed that citizens are conscious about the economic and social benefits the dam brought to them. Nevertheless, there is a segment of communities still questioning and debating the political and environmental aspects. This discussion leads to Chapter 7, which provides a better understanding of communities' resentments of how Merowe Dam's political and environmental issues influence socioeconomic development in the region.

# Chapter 7 The political and environmental issues of Merowe Dam

## 7.1 Introduction

Chapters 4, 5 and 6 established the economic and social outcomes of Merowe Dam, providing a detailed understanding of the socioeconomic contributions of large-scale infrastructure development projects in developing economies. This chapter addresses the third and fourth elements of the research objectives, namely to explore the political and environmental issues related to Merowe Dam. The chapter highlights the links between political influences of Merowe Dam authorities in the delivery process. It assesses the state's role in determining the amount of compensation, consultation and the decision-making process and considers how the dam was funded. The chapter also examines the state-sponsored environmental impact assessment of Merowe Dam to analyse the ecological change brought by Merowe Dam both down- and upstream. This research argues that there is a strong link between politics and environmental aspects, especially in the area of water resource management, and the role they play in regional, national and international settings in determining the fate of the dam (ICID, 2001a). This chapter is based on Merowe Dam case study and considers politics and the environment, and their influences on planning, construction and post-construction environmental impacts, which the dam has exerted on the displaced population, resettlement areas and the region as whole. This chapter uses Bryant and Bailey's (1997) political ecology theory, especially 'resource wars', as the term of reference to understand the conflicting relationship between political and environmental aspects in accessing natural resources for socioeconomic development. This conflict is at the heart of the regional and international debate on water resources control, which many experts and observers

see as causes of regional conflicts (Gleick & Ajami, 2014) or an effective means of combatting climate change (Agrawala *et al.*, 2003).

The vital role that mega-dams play in economic development makes them politically attractive to many developing economies. The Sudanese leadership views the Merowe Dam as an icon of nation-building, a national vanity, protection and an agent of nationalism (Flyvbjerg, Bruzelius & Rothengatter, 2003). Consequently, Merowe Dam became part of the political progression because of its visibility, presence, prestige and long lifecycle. However, local communities seem to view Merowe Dam as a form of political oppression and a means of depriving them of their natural resources within their preferred environment, where they lived and flourished socially and economically for centuries. This perspective led to an association between dams and the politicians who justified and funded them, especially in developing economies. Dams were a physical legacy for a politician to be remembered (Pearce, 1992).

Environmental aspects are often considered less important than economic ones, especially in developing economies. Egypt's Aswan Dam and China's Three Gorges Dam are very good examples of environmental impacts. These impacts support the view of many critics of mega-dams, such as Ansar *et al.* (2014) and Flyvbjerg (2009), who suggest that dams only serve the ambitions of the politicians who build them. Egypt's Aswan Dam and Ghana's Akosombo Dam are linked with Nasser and Nkrumah respectively as ambitious projects for modernisation and socioeconomic development, which establish the politicians as heroes in the history books of their countries (McCully, 2001a; Pearce, 1992). However, many scholars, such as

Altinbilek (2002) Ersumer (1999), Shirley (2015), Varma (2003) and Wu (2013), view dams as a means of providing economic and social development through good environmental policy and sound political processes. Furthermore, other scholars, such as Agrawala (2003), believe that dams can play an important role in tackling climate change through water management. Given the gravity of politics and environmental decision-making that surround dam projects, the importance of mega-dams is driven by political motivations as well as development goals. It is important to understand the politics of these projects and the manner in which the schemes emerge, as well as the institutional and natural environment in which they take place (Schultz, 2002). The process of development through mega-dams constitutes both physical elements of environment (e.g. water resources) and anthropogenic factors (e.g. local, regional and international political factors) (Pearce, 1992).

**Table 7.1 political and environmental indicators used to analyse the data**

| Social indicators of case study area | Main methods used |
|---|---|
| • Who do you think are the key decision makers what role do you think political influences play in building the dam | Questionnaire/interview/secondary |
| • Was there a period of consultation | Questionnaire/interview/secondary |
| • what was the nature of the consultation | Questionnaire/interview/secondary |
| • what you think about the duration of consultation | Questionnaire/interview/secondary |
| • Was the consultation process open to all | Questionnaire/interview/secondary |
| • was Merowe Dam project a result of consensus of all stakeholders | Questionnaire/interview/secondary<br>Questionnaire/interview/secondary |
| Environmental indicators | Questionnaire/interview/secondary |
| • Spread of Waterborne diseases(e.g. bilharzias) | Questionnaire/interview/secondary |
| • Habitats communities along the river bank | Questionnaire/interview/secondary |
| • Wildlife, | Questionnaire/interview/secondary |
| • Forests | Questionnaire/interview/secondary |
| • Water Logging | Questionnaire/interview/secondary |
| • Salinization | Questionnaire/interview/secondary |
| • Erosion (wearing of soil by water force) | Questionnaire/interview/secondary |
| • Sedimentation | Questionnaire/interview/secondary |
| • Water supply | Questionnaire/interview/secondary |
| • Water flow | Questionnaire/interview/secondary |
| • Distance to the river bank | Questionnaire/interview/secondary |
| • Flooding | Questionnaire/interview/secondary |

Source: Author questionnaire, 2017

Either part can influence the outcome of a project significantly (McCully, 2001). Converting these macro-level environment and political forces into the micro-level of rural communities and rural households may provide a clear understanding of their role in the development of dams. Key characteristics have been identified in this chapter to analyse Merowe Dam, discussing the way in which politics helped shape the project's plan and implementation, in relation to Sudanese governmental development policies in relation to funding, compensation and the consultation process. The chapter examines the environmental influences on the Merowe Dam project decision-making within the unstable political context of global economic and finance relationships, especially in the wake of increasing concerns about environmental degradation.

Studying the politics of huge economic infrastructure projects is the central theme of development strategies for developing economies (Alexander, 2015). The past few years have witnessed intense debate over the politicisation of mega-dam construction. Away from the economic and social debates of Merowe Dam, ecological and natural resource impact on both downstream and upstream is debated. This consideration also moves toward the international and national distribution of power and environmental resources (water resources) management process (Jalon *et al.*, 1994). With growing global concern about the political ecology of large dam projects, a resolution to allege political bias from those who initiate these types of projects is sought (Akyürek, 2005). This research focuses on a variety of political and environmental aspects that impact upon mega-dam projects, such as the state's environmental and political involvement, funding for the project, ecological impact for both down and upstream, compensation and the consultation process.

In this chapter, a number of environmental questions are answered, comprising ecological aspects, such as the spread of waterborne diseases, wildlife, effects on river systems changes, flooding, salinization, erosion, etc. The chapter tackles the debate and perceptions of the alleged role of Merowe Dam in environmental degradation, based on the analysis of the questionnaire and the existing literature. The often-negative perceptions of political and environmental aspects are taken into account, but this research focuses not only on negative political and environment perception of literature on dams. This research argues that, as Bryant (2015) suggests, minimal consideration has been given to potential benefits to Sudan and riparian communities of the north in the process of building Merowe Dam. The interconnectivity between political and environment arguments for and against Merowe Dam are analysed in the Sudanese context and debated using evidence gathered from questionnaire, interviews, observation and similar case studies around the world. Indepth analysis is considered in order to assess Merowe Dam's influence on natural resources (fishing, habitats, water, flooding and sediment).

There are seven sections in this chapter divided into two parts. The first investigates political aspects and the second explores environmental issues. Section 7.2 investigates the political involvement of the state by studying its influence of decision-making on the construction of the Merowe Dam in the unstable political context of global economies and finance. This focus provides an understanding of Merowe Dam's development in the wake of local, national and global resource wars and opposition to dams. Sections 7.3 studies the compensation process, focusing mainly on the loss of natural resources (land, farm product, farmlands) and other properties. Section 7.4 investigates the consultation process, providing a clear understanding of

the government's and local communities' involvement in Merowe Dam decision-making and whether their opinions counted or not. Section 7.5 examines positive and negative environmental issues related to Merowe Dam, and the state's role in managing and adhering to international environmental guides and environmental policy on dams, especially in the changing landscape of global politics and economic and environmental policies about dams. Section 7.6 examines the influences of Merowe Dam's ecological system in both downstream and upstream, specifically aspects of water supply and other natural resources. Finally, Section 7.7 concludes this chapter by showing Merowe Dam's environmental and political influences in the region, through an examination of the involvement of local communities in decision-making, environmental effects on the displaced, resettlement communities and the region.

## 7.2 The state's political involvement in mega-dam construction`

### 7.2.1 Introduction

The politicisation of mega-dam development is a result of the involvement of state-run institutions in delivering and administrating dam projects in an attempt to obtain economic and political goals (Kennedy *et al.*, 2011). The changes brought by capitalism and technology have accelerated the process of economic development, which forced states at all levels to engage in an energy quest to compete effectively in the global economy. In developing economies, giving politicians control over state institutions tasked with achieving development goals, often leads to a race to the bottom and environmental degradation in order to attract global investments. This research acknowledges the huge risk of political misuse of this type of mega-project (Flyvbjerg, 2004), although state involvement is unavoidable in projects with such

huge investment, especially in developing economies where states are the main providers for such projects. This involvement led to the politicisation of funding, especially with growing social and environmental concerns and the involvement of international organisations, such as the World Bank (McCully, 2004). Such wider involvement introduces restrictions on dam project funding, especially from western organisations who judged the developmental performance of dams as economically and environmentally unsound investments or projects of political interest (Flyvbjerg, Garbuio & Lovallo, 2009). This perspective suggests that international NGOs have vested political-economic interests in supporting environmental agendas by emphasising environmental problems and diminishing the benefits of mega-dam in developing economies (Winpenny, 2003). Because of international institutions' economic, political and environmental operations, it is not surprising that these influences have made some developing countries believe such institutions were attempting to take away control of their national resources (Winpenny, 2003).

### 7.2.2 The political influence in constructing Merowe Dam

The Sudanese government perceives the motive behind building Merowe Dam to be purely economic, with no political influence in its development. This view is widely expected. However, almost 70% of interviewees and participants disagreed with it and believed there are some economic elements, but not as the government perceives it (see Table 7.2). Yet, most officials involved in this research agreed with total government control over Merowe Dam project's activities. As ministerial national official interviewee (21) stated:

*"The construction of Merowe Dam is a result of economic feasibility and no political influence in any form or shape locally or nationally and even internationally. The downstream and upstream countries, such as Ethiopia and Egypt, have no objection. As you know, water flow is governed by political and international treaties. I can*

*confirm that Merowe Dam is built because of the need for electricity in Sudan for socioeconomic development and all this talk of political motivation is unfounded".*

Nevertheless, the majority of participants, interviewees, experts and observers disagreed with this official view. As much as 70% believed that there is huge political influence at all levels and that the state-controlled media have played a vital role in diffusing the positive message and the high expectation of dam outcomes, as well as reducing its social and environmental affects (see Table 7.2). Such perceptions and opinions suggest the presence of political ecology, especially resource wars, mainly driven by water resource management or control at local, national and international levels (Bryant & Bailey, 2015). Locally, the resource war is mainly about farmland and water for irrigation. Nationally, it is about political power and resource control between the government and the opposition – especially at the time of election in 2010 – by using the dam to send powerful messages about the government's ability to provide the socioeconomic development the country needs. Internationally in Nile basin countries, the resource war is based on water flow for irrigation and electricity generation between Sudan, Ethiopia and Egypt, especially in the wake of climate change rhetoric. Nonetheless, the basin countries had no dispute about building Merowe Dam. However, since Ethiopia announced its plan to build the Grand Renaissance Dam, a resource war with downstream countries has been initiated, especially with Egypt, which have involved threats to sabotage the dam (Economist, 2017). Currently, the political negotiation is ongoing between Sudan, Egypt and Ethiopia about the distribution of water resources, especially around amending the 1959 Treaty, which allowed Egypt full control of the Nile water flow (Aljazeera, 2018). To understand the political influences on Merowe Dam, a cross-tabulation in Table 7.2 provides a clear reading on participants' perception by districts. Table 7.2 analyses a question of 'yes' or 'no' on whether there were political influences on

building Merowe Dam shows significant differences between districts in responses. The analysis shows that participants at all three districts believe there is political influence, with 'yes' *actual* count is much higher than *expected* count. In contrast, the participants who believes there is no political influence with 'no' *actual* count is much lower than *expected* count. However, at downstream the *actual* count of 'no' is much higher than *expected* count ($\chi^2$ = 32.906, *DF* = 2, *P* = <0.001). This result is a product of government controlling all aspects in the projects, by excluding local communities and many other stakeholders, such as academics, experts, technicians in the field of environment and water management, economists and sociologists from the process.

**Table 7.2 Was there political influence on Merowe Dam construction?**

| Location | | No | Yes | Total |
|---|---|---|---|---|
| **Downstream** | **Count** | 26 | 74 | 100 |
| | **Expected Count** | 11 | 89 | 100 |
| **Upstream-Resident** | **Count** | 2 | 98 | 100 |
| | **Expected Count** | 11 | 89 | 100 |
| **Upstream-relocated** | **Count** | 6 | 94 | 100 |
| | **Expected Count** | 11 | 89 | 100 |
| **Total** | **Count** | 34 | 266 | 300 |
| | **Expected Count** | 34 | 266 | 300 |
| | **Chi-Square (df 2)** | 32.906*** | | |

Source: Author questionnaire, 2017

The results in Table 7.2 support the views of dams' critics in literature (Flyvbjerg, Garbuio & Lovallo, 2009; McCully, 2004; Singh, 1997). Furthermore, many interviewees see Merowe Dam as a result of political motivation, and university academic interviewee (25) went further to suggest:

*"The Merowe Dam has been used as a means of election campaigning by politicians supporting the current government to win the election in 2010. Yes, Merowe Dam construction and operation generated some jobs and new skills, and provided electricity for schools and hospitals, which enhanced the living conditions for some communities in Sudan. However, there is no openness or full engagement with local communities and experts, except those who are loyal to the government. Furthermore, the dam was politicised and used as an election campaign tool to enable the Islamist Government of Ingaz to continue in power. This is misleading because politicians are not telling the whole truth about the dam to the public, especially local communities".*

Furthermore, many Sudanese political analysts, participants and interviewees see government domination and control through DIU as a main factor that drives the politicisation sentiment because of their approach in dealing with opposition to the dam, which is viewed as opposition to the government or treason against the country. As local committee member interviewee (12) stated:

> *"The Merowe Dam is delivered by DIU, which was created by presidential instruction precisely in order to implement water management and dam projects across the country, consequently removing the power of the Ministry of Irrigation and Water Resources and legitimatising DIU through Presidential decree using Article 13".*

The outcome of Table 7.2 is supported by Hashim (2009), suggesting the presidential decree gave DIU executive power and exemption from civil service laws, including retirement law, national social insurance fund law, civil servants' accountability law, and fiscal and accounting law. Most participants, interviewees and observers agreed with Hashim's view, by suggesting a lack of accountability for DIU generated much bitterness and dissatisfaction within other overlapping ministries responsible for tasks interrelated to water, agriculture, electricity, and public works (Local committee member interviewee 12). In particular, many observers acknowledged the unpleasant statement of the DIU's ex-director and its proxy's violent wing, which used intimidation and violence against opposition to the dam (University academic interviewee 25). Likewise, the operational actions of the DIU go against the parliamentary or administrative standard and processes. Its activities are not even up for debate in the parliament (university academic interviewee 13). All these matters discussed above help to illustrate the nature of DIU as above the laws of the state. To further politicise Merowe Dam affairs, many presidential decrees followed, which allowed DIU to expand its activities as local committee member interviewee (20) stated:

*"In 2007, DIU was recognised as a fully-fledged presidential department with presidential decree No. 217, tasked with building water management projects across the country. Another decree, No. 206, handed a large piece of land in River Nile State and the Northern State in North Sudan to UID. This was confiscated from the state authorities and handed over to the DIU, and was eventually leased to Arab investors for irrigated agriculture projects".*

In effect, the special status of the DIU surely indicates the political urgency of dams' construction in Sudan and the relationship with the political economic development ambitions of the "competence agenda" and strategy of the government. It also compromises the technicality and professionalism of dam building with grave social and environmental consequences.

There are high levels of agreement in the literature (Lee, 2009; Nüsser, 2003; Webber, 2012 and Winpenny, 2003) and among participants on the politicisation of dams' outcomes, both positive and negative, especially in social and environmental aspects (McCully, 2004; Singh, 1997). However, the diffusion of decision-making in the construction of dams is less inclusive of all stakeholders, especially at later stages after consultations for displacement and resettlement is more likely to be controlled by institutions that delivered the dam. The Merowe Dam is no exception. Most participants, interviewees and experts suggest that DIU has total control over dam activities and decision-making, even at the consultation stages. As university political analyst and academic interviewees (3 and 13) suggested:

*"The authoritarian approach of DIU on the procedure of dam construction has led to artificial consultation, neglect of suitable feasibility and impact studies, and a high degree of secrecy and poor transparency. These issues were translated into clear social, cultural and environmental damages. This was worsened by the subjective and special recruitment of technocratic and loyal engineers, disregarding other experts' input and opinions, such as ecologists and anthropologists".*

However, the officials have disagreed with these claims, believing they conducted comprehensive consultation in the form of workshop and public meeting with all

affected communities and listened to all natives' and experts' opinions and that these were taken into account when deciding any matter related to Merowe Dam, as DIU official interviewee (23) stated:

*"With regards to decision-making, all views and consultations were taken into account and decisions were not based on political references, but rather on scientific, professional, economic, and social references. All these have been taken into consideration in implementing Merowe Dam decisions".*

The government views appear to suggest Merowe Dam was delivered through a participatory development approach based on communities' involvement and participation on plans and implementation. Most participants and interviewees challenge this suggestion, although some agree there was minimal participation, as university academic interviewee (25) stated:

*"All developmental projects in Sudan are conducted top-down and not through a participatory approach. As a DIU engineer told me – 'you know all these ideas about western participation you ask me about. In western countries farmers buy their seeds from the internet, indicating that they are educated enough to be consulted. How can you ask me to consult the Merowian people? What do they know about feasibility studies for me to bring this to them?' This goes back to how the government perceives its people: as subjects, not citizens with a right to be consulted".*

To better understand the decision-making for the Merowe Dam, a cross tabulation of participants' views provides a picture of micro-level perceptions of communities on who had the upper hand in decision-making.

**Table 7.3 Who are the key decision-makers in building Merowe Dam**

| Location | | Government | DIU | Local | Total |
|---|---|---|---|---|---|
| **Downstream** | **Count** | 61 | 27 | 12 | 100 |
| | **Expected Count** | 56.3 | 32.7 | 11 | 100 |
| **Upstream-Resident** | **Count** | 74 | 15 | 11 | 100 |
| | **Expected Count** | 56.3 | 32.7 | 11 | 100 |
| **Upstream-Relocated** | **Count** | 34 | 56 | 10 | 100 |
| | **Expected Count** | 56.3 | 32.7 | 11 | 100 |
| **Total** | **Count** | 169 | 98 | 33 | 300 |
| | **Expected Count** | 169 | 98 | 33 | 300 |
| | **Chi-Square (*df 4*)** | 42.17*** | | | |

Source: Author questiionnnaire, 2017

The test shows that the *actual* count of government as main decision-maker is much higher than the *expected* count at downstream and upstream-resident. However,

upstream-relocated believe the DIU is the main decision-maker with the *actual* count much higher than *expected*.

The local communities have no power in decision-making, as the test shows lower *actual* count that *expected* count with very low figure at all districts ($\chi^2$ = 42.176, *DF* = 4, *P* = <0.001). Based on the above analysis of interviewees and participants, there is no supervision of the government and the DIU has the power in decision-making compared to local communities. This finding is further supported by Figure 7.1, where the government as main decision-makers gained between 36-75% while DIU achieved 20-60% and local communities managed less than 15%.

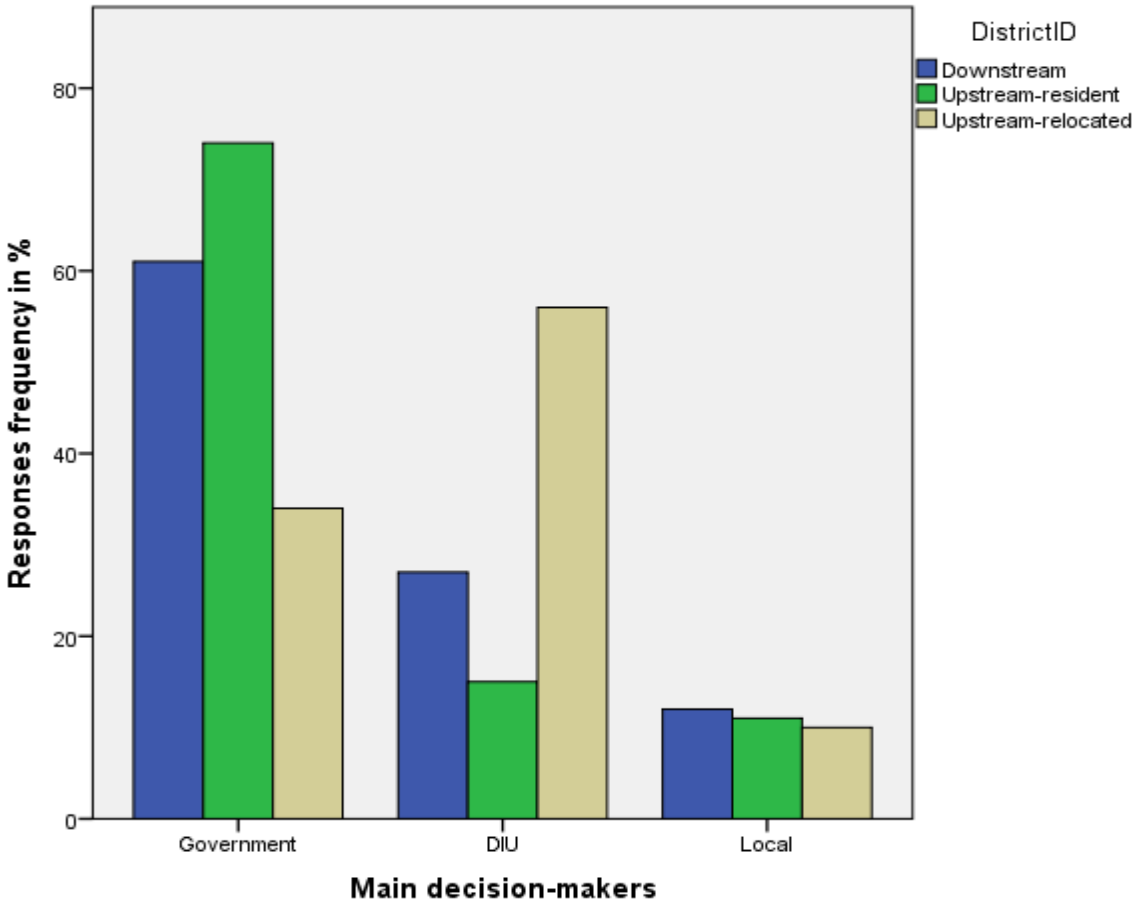



**Figure 7.1 Precentage of main decision-makers in Merowe Dam**
Source: Author questionnaire, 2017

Therefore, when combining the percentages scored by both governments and its agent of delivery, DIU, it shows how the government has control over all activities related to the Merowe Dam, which supports the claim of Ansar *et al* (2014) and Flyvbjerg (2009). Also throughout this research, participants and interviewees referred to the Manasir relocation dispute, false consultation and politicalised selection of committee members as a clear evidence of governmental control of decision-making (see Section 7.2.4 and 7.2.5). As argued by Stiglitz (1998), and many local participants and interviewees believed that government don not taken into account community's opinions when deciding dam matter they only reliance only on expert opinion. One local farmer questionnaire participant (200) stated:

*"If our opinion carried any weight we wouldn't be living in the desert away from the Nile. Would you believe we chose to live here? This not our decision. The government and its "Karazies" [loyal local government committee members] forced the displaced communities to accept the current location".*

This view is typical of many participants' opinions on decision-making across the districts. However, other participants disagreed with this view and believed that the communities and the government were partners in decision-making on matters related to communities' affairs. One local committee member interviewee (4) stated:

*"In my opinion most stakeholders in the region, especially the affected, were involved in compensations and resettlement decision-making, even with unequal power leverage between the parties".*

There is significant power which economic and political aspects have over social and envirnmental in the balance of power in decision-making on Merowe Dam development. As Stiglitz (1998) suggests, participation can also be limited to experts without undermining communities' power in decision-making.

As the country is polarised by civil wars, ethnic tension in Darfur and elsewhere, and international economic sanctions, the Merowe Dam has been a political and

economic achievement for the government. Therefore, the last issue that the government needs is another tension at the heart of political establishment and elite household “northern Sudan”. However, political tension about the Merowe Dam and Merowian communities has led to questions about the distribution of development projects in Sudan. Many interviewees suggest that there is a huge disparity between regions and communities in economic development. Northern Sudan development schemes are widely covered by state-controlled media because of the political power and social structure privileges within Sudan. In contrast, Upper Atbara and Setit Dams and the Heightening of Al Rousers Dam have caused displacement and dispute on compensation and resettlement but, because of the locations and status of those displaced people, there is no political support or media coverage for these projects. In addition, the government is concerned about political stability in order to access international fund for future projects. To understand the extent to which Sudan government struggled to access funds for the Merowe Dam project development, the following Section 7.2.3 elaborates.

### 7.2.3 Funding of Merowe Dam

Funding sources and types of funding are essential parts of mega-dam construction in developing economies. A few decades ago, the World Bank was the major investor in mega-dams, but the conditions of this source has changed significantly since the adoption of non-involvement policies in the funding of contentious water management projects (Bank, 2004). In the 1970s, the World Bank financed 3.5% of dams constructed, but by the 1990s, it financed less than 1%. In 2000s the World Bank finances less than 0.5% of all new dams in developing economies, with its investments in hydropower projects reduced by 90% in the past decades (Winpenny,

2003). Winpenny (2003) suggests that large dams are funded by the public sector in the form of governmental bodies with little aid from international donors and only 5% from the domestic private sector (Bank, 2004). However, in the wake of growing global concern over the social and environmental influence of dams, many international financial institutions and donors, especially in the west, have reduced investments in large dams, especially the World Bank. This policy change has contributed massively to the decline in mega-dam construction, especially in developing economies.

However, developing economies, especially African, including Sudan, have benefited from the resurgence of Chinese funding power, which comes with less politics and scrutiny related to the social and environmental issues of dams (Verhoeven, 2011). However, the increasing influence of China causes western institutions to worry about its growing funding power and control of natural resources in developing economies. Nevertheless, this support has benefited the Sudanese government by overcoming US sanctions and allowed the DIU to actively search for funds from across the world. The DIU has approached many countries, including Malaysia, China, Canada, Arab countries and some Europeans countries, despite US economic sanctions on Sudan and the high risk of investing in Africa because of economic and political instability risks associated with the continent (Bank, 2004; Winpenny, 2003). However, according to DIU official interviewee (27):

*"In 2000, the government managed to attract a delegation of Arab funders to assess the project. The outcome was an agreement to provide 70% of the funds, used for civil works. The Sudanese government was tasked with the 30% of the cost".*

**Table 7.4 The composition of funding for the Merowe Dam by investors**

| No | Investors | Fund (in millions of $US) |
|---|---|---|
| 1 | Government of Sudan | 1.1 |
| 2 | Government of China | 0.6 |
| 3 | Arab Fund for Economic and Social Development | 477 |
| 4 | Saudi Fund for Development | 215 |
| 5 | Abu Dhabi Fund for Development | 210 |
| 6 | Kuwaiti Fund For Development | 200 |
| 7 | Sultanate of Oman | 106 |
| 8 | State of Qatar | 15 |
| | Total | 2,946 |

Source: DIU, 2017

According to the majority of officials, experts and interviewees, funding restrictions and newer requirements for environmental and social impact assessments have not affected the ability of the Sudanese government to fund Merowe Dam. As ministerial national official interviewee (22) stated:

*"The sanction had a negative impact on the project but, despite that, the project was implemented and achieved its goal. We faced some problems in transferring money from the Arabs to contracted companies, but the generation plants technology was up-to-date from a French company. The downside was that, after the construction of the dam, we faces the problem of buying spare parts for the plant from America and Europe, which proved to be very difficult".*

**Table 7.5 The percentage of funders' contribution and project cost ratios**

| Total cost of the construction and relocation | | | |
|---|---|---|---|
| | 2,946 | | |
| *Sudan* | 33% | Project Cost Ratios | |
| *China* | 21% | *Civil Work* | 37% |
| *Arab Fund* | 13% | *Generation Station* | 17% |
| *Saudi Fund* | 13% | *Transmission Lines* | 16% |
| *Abu Dhabi Fund* | 5% | *Relocation* | 30% |
| *Kuwait Fund* | 8% | | |
| *Sultanate of Oman* | 6% | | |
| *Qatar* | 1% | | |

Source: DIU, 2017

Yet many participants and experts in Sudan believe the government made many concessions in order to secure the funds. As local committee member interviewee (12) suggests:

*"The government not only accepted high interest rates against its Islamic principles, it also gave up land sovereignty by leasing massive lands to Arab investors for 90 years. In addition to corruption, they wasted money on expensive media campaigning promoting the dam instead of using this money to better the condition of resettlements and displaced communities".*

Many interviewees have acknowledged some of the tough terms of debt attached to dam funding, especially from western financial organisations such as the World Bank. Most countries affected by these tough terms of debt are developing countries (Linaweaver, 2002). However, with the Merowe Dam, a ministerial national official interviewee (22) suggested:

*"Yes, we are aware of tough debt terms some countries proposed, but for us Merowe Dam is funded by Arab funds. Our Arabs friends felt this was an opportunity for them to show their solidarity with Sudan. The funds were originally established for development in the Arab region. This is part of their work and they have a desire to help Sudan without us making concessions and with very low interest rates".*

The government is in favour of dam fund and view on Arabs funds seems to support the critics' view of international funding bodies, suggesting that tough terms and restrictions and the requirement of social and environmental impact assessments may hinder development in poor countries (UNEP, 200). The critics believe it may deprive local communities of many socioeconomic benefits to local people and nations because dams provide security against climate variability, which affects the livelihood of poor people the most (Bank, 2004; Linaweaver, 2002; UNEP, 2000). It is important to reflect on the economic, social, political and environmental justifications given for such a huge public investment, as well as the government's funding decision-making process. From a governance standpoint, the entire process, including funding, was perhaps reasonably surrounded by secrecy in many aspects,

such as compensation and the consultation process. This secrecy often led officials to made contradictory statements, therefore, the following two sections provide further information on the compensation and consultation processes.

### 7.2.4 Consultation process in building Merowe Dam

Previous mega-project consultations showed that public hearings were often not as transparent as many observers believed them to be, especially in developing economies. In some countries, some form of consultations was used to legitimise mega-dams in which public funds had been used in their construction (Flyvbjerg, Garbuio & Lovallo, 2009). Furthermore, in many undemocratic countries, the consultation process had been poorly prepared or even bypassed completely in order to build a dam (Webber, 2012).

According to Johnston (2012), stakeholder participation and prior-consultation process are regarded as essential, especially with those whose lives may be impacted negatively. This approach should be consistent with approaches taken in the Merowe region for social and environmental impact assessments, resettlement and displacement assessments. Based on good development practice, participatory development is an important method in achieving sustainable development (Johnston & Kummu, 2012; Lee & Scurrah, 2009; Smith, 1968) (see Chapter 2). This practice is especially needed in the development of dams because of their huge impact on many aspects of community life. Therefore, public participation in the development of dams enabled information to be disseminated widely in communities to capture attitudes, concerns and expectations of relevant stakeholders to be presented to decision-makers (Johnston & Kummu, 2012). As Lee (2009) suggests, based on the consultation conducted by the Mekong River Commission (MRC), which takes into

consideration local, national and international contexts in information access and availability, the ability of stakeholders to discuss the subject matter and provide feedback and to review the procedures of mitigating social and environmental negative impacts is an important aspect of consultation.

As detailed above, stakeholder participation is intended to include those possibly affected, stakeholders and the wider public to increase awareness of the Merowe Dam project by publishing and sharing information and obtaining stakeholder feedback on key issues such as relocation, compensation, plus environmental, social and economic impact. However, as Askouri (2014) states, the project was surrounded by high secrecy in all aspects, to the extent that no one had the opportunity to examine the dam's initial plans, even the main stakeholders, except the DIU and the government. Many experts, especially political analysts, environmentalists and academics, believe that consultation for the Merowe Dam and its prior-construction study was conducted only superficially to allow the process to go ahead immediately after securing funding and the government deciding to construct the dam (Askouri, 2014). However, the official perspective on the consultation process appear to follow MRC standards, as DIU official interviewees (11 and 23) stated:

*"The consultation process started before the construction of the dam. The social consultation began with the participation of citizen. It was open to all affected citizens. At first, there were tours to introduce the project in all areas of impact, where large gatherings attended and long debates were held. Then negotiating committees were selected from Hamdab, Amri and Manasir communities by citizens and everyone had their say on the location of resettlements and were informed about the dam and its accompanying projects".*

The official viewpoint on consultation is expected to be biased and to present the process as perfect. Nevertheless, many local participants and interviewees have agreed with the government view, but suggest it was not a consultation per se: it was

mainly about informing citizens of the dam and its benefits and whether to go ahead or otherwise. The majority of local people agreed that the dam be constructed. A local committee member interviewee (12) stated:

*"Before the construction of the dam there was a consultation with citizens across communities, however Merowe Dam idea was already established in people's minds in the region. They welcomed it and knew they could be displaced. The consultation on approving the dam's construction resulted in 80% of attendees supporting. The consultation was opened but only about building the dam, and there was no clarity on other aspects. They left everything ambiguous and overstated so that citizens would not change their opinion.*

Furthermore, some interviewee and observers have agreed with critics of dams, such as Flyvbjerg (2009), McCully (2004) and Singh (1997), and described the consultation as a stage show. As a university, environmentalist and academic interviewee (9) suggested: there was no consultation in the true sense of the word - it should have happened through local leaders. Even when the consultation was conducted, it was limited to a few local leaders - some of whom were loyal to the government and many of whom were not consulted. The committees and communities had objections on many aspects, such as the location of resettlement and compensations. Many participants questioned the way in which the committees were formed and reformed again. Many viewed this process as an opportunity for the government to infiltrate the committees.

**Table 7.6 Was the consultation period long enough**

| Location | | Yes | No | Total |
|---|---|---|---|---|
| **Downstream** | **Count** | 56 | 44 | 100 |
| | **Expected Count** | 54 | 46 | 100 |
| **Upstream-Resident** | **Count** | 36 | 64 | 100 |
| | **Expected Count** | 54 | 46 | 100 |
| **Upstream-Relocated** | **Count** | 70 | 30 | 100 |
| | **Expected Count** | 54 | 46 | 100 |
| **Total** | **Count** | 162 | 138 | 300 |
| | **Expected Count** | 162 | 138 | 300 |
| | **Chi-Square (*df* 2)** | 23.5*** | | |

Source: Aothur questionnaire, 2017

A cross-tabulation test provides a clear understanding on whether there was a period of consultation or not. The results in Table 7.6 show that downstream and upstream-relocated believe there was consultation where the *actual* count of 'yes' is higher than *expected* count but upstream-resident the *actual* count of 'no' is much higher than *expected* count. The test shows strong evidence of significant statistical difference across the districts in the question on whether there was consultation or not ($\chi^2$ = 23.510, *DF* = 2, *P* = <0.001). Interestingly, 70% of upstream-relocated communities believe that there was consultation with communities over the project, which might be because of successful negotiation, which led to resettlement and an acceptance of the compensation package. In contrast, 64% of upstream-resident communities believe that there was no consultation because of unresolved issues and long-standing disputes over resettlement. The downstream appears to be split in their opinion: 54% 'yes' and 46% 'no'. This outcome might be a consequence of being outside the consultation scope, but it seems that people took sides based on family ties and political affiliation.

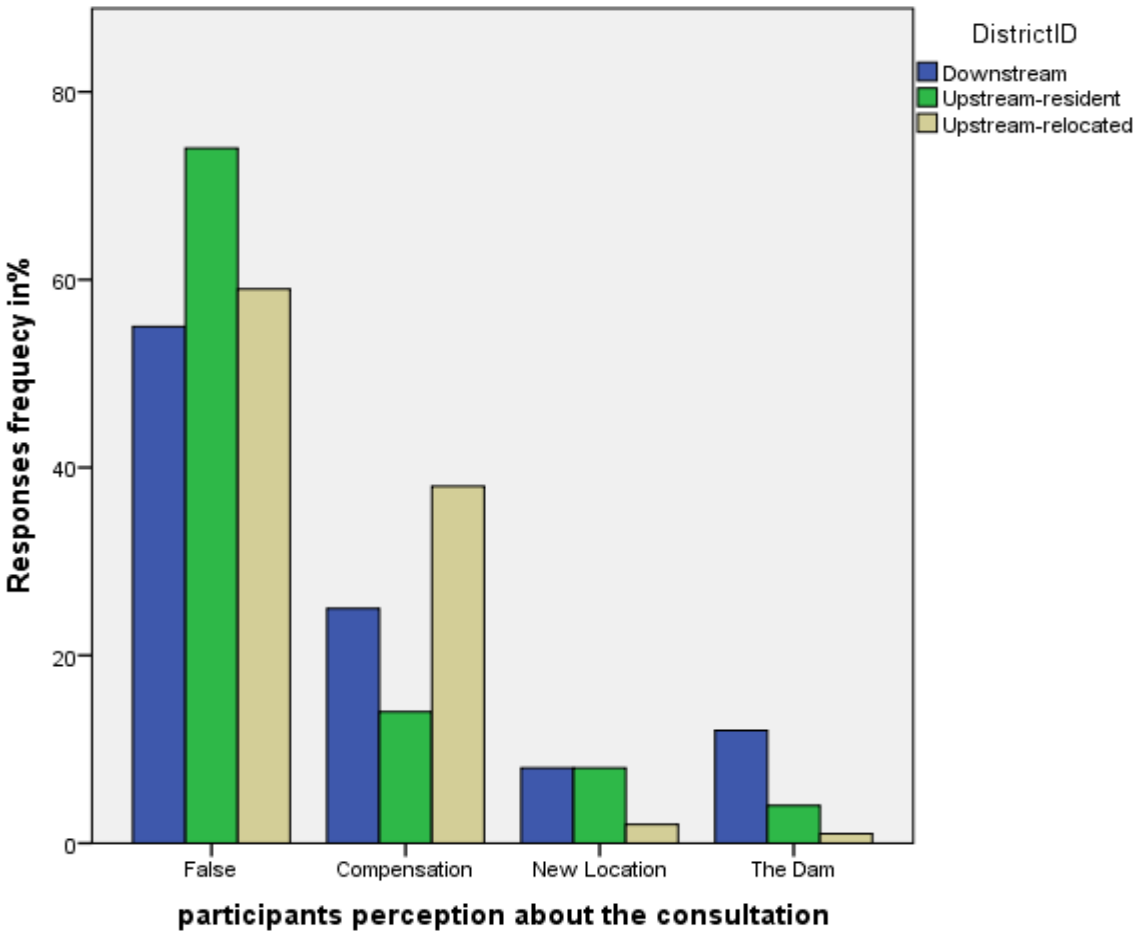



**Figure 7.2 The perception of participants about the consultation**

Source: Author questionnaire, 2017

Figure 7.1 provides a clear picture through questioning the nature of the consultation and what it concerned. The Figure 7.2 shows that 58-78% of participants across districts believe that the consultation was ineffective and that the government was not seriously considering their opinion. In contrast, less than 40% of participants across districts believed that they were consulted on compensation and less than 20% confirmed being consulted on the new location of the resettlement and the dam. The nature and effectiveness of the consultation appears to be highly variable depending on a wide range of factors. Such variability is likely to have added another dimension of inequality within the affected communities. However, while some form of consultation process was conducted, it may not have been in the fashion that complies with MRC standards. Such a finding confirms the previous research and

scholarship on the topic. As Stiglitz (1998) suggests, experts can deliver mega-dams alone. University academic interviewee (25) suggested that there was no proper consultation and small numbers of the elite delivered the project:

*"When Sudan's government thought to implement something big and quick, it had to be like a pharaoh because if it spent time consulting people and taking their interests into account the dam may never being constructed".*

The consultation process is an important part of a participatory development approach, applied in many countries, especially in the development of the dam (Johnston & Kummu, 2012). In respect to the Merowe Dam, the government was not keen to apply the full process of consultation as university academic interviewee (25) suggested:

*"The government does not believe in following the process and adhering to the western ideas of democracy and consultation. Many officials said 'let be like China developed our economy, then democracy and consultations come later'".*

Most participants were in agreement with this statement. For example, the following quotes from local farmers participants (1, 2,169 and 279 respectively) suggested:

*"During the construction phase we were consulted on resettlement location and the value of date trees, but they didn't take our opinions into account".*

*"The consultation was false. Our opinion as displaced people was not taken into account. Evidently the choice of resettlement location was imposed upon the displaced".*

*"It focused on those who are loyal to the government and the governing party. Committees distributed forms to all displaced providing the necessary information about building the dam".*

*"It just informed people about the dam's benefits for the displaced by building them houses and given them farming lands".*

It is clear from these quotes that the scope of the consultation was very narrow and controlled by the government. Following on from the consultation process, as mentioned by Johnston (2012) and Lee (2009), openness, information sharing and

receiving feedback from all stakeholders in the Merowe Dam project are critical elements of proper consultation, but were not followed. The majority of interviewees, participants and experts believe that the Merowe Dam consultation was not an open or inclusive process. To understand how the process unfolded, a cross-tabulation analysis provides insight into the participants' thoughts on the process. The test is conducted on whether the consultation was open to all stakeholders and being given enough time to be competed or not. The test shows that there is significant evidence of statistical differences between districts.

**Table 7.7 The openness of consultation process**

| Location | | Not Open | To Displaced | To Committees | To Public | Total |
|---|---|---|---|---|---|---|
| **Downstream** | **Count** | 63 | 15 | 6 | 16 | 100 |
| | **Expected Count** | 75 | 6 | 3 | 16 | 100 |
| **Upstream-Resident** | **Count** | 83 | 0 | 2 | 15 | 100 |
| | **Expected Count** | 75 | 6 | 3 | 16 | 100 |
| **Upstream-Relocated** | **Count** | 80 | 2 | 1 | 17 | 100 |
| | **Expected Count** | 75 | 6 | 3 | 16 | 100 |
| **Total** | **Count** | 226 | 17 | 9 | 48 | 300 |
| | **Expected Count** | 226 | 17 | 9 | 48 | 300 |
| | **Chi-Square (*df 6*)** | 31.29*** | | | | |

Source: Author questionnaire, 2017

The *actual* count of participant at upstream-resident and upstream-relocated believes the process was not open to all stakeholders is higher than *expected* count. However, at the downstream, the *actual* count of not open is lower than *expected* count. Nevertheless, the *actual* count of participants believe it was open to displaced communities, committees and the public is higher than *expected* count with very low count. At upstream-resident and upstream-relocated districts, the *actual* count on open to displaced communities, committees and the public is much lower than expected count ($\chi^2$ = 31.292, *DF* = 6, *P* = <0.001). This result shows that communities across districts do not trust the government, especially upstream-resident and upstream-relocated, because of false promises and poor consultation. Even downstream, the least affected, have shown no trust in the government. To

elaborate further on the openness and inclusivity of the consultation, Table 7.7 shows that 63-83% at the three districts believe the consultation was not open to all, despite officials suggesting otherwise. As a ministerial national official interviewee (21) stated:

*"The consultation time was more than enough. We started the process in May 1999 and finished in 2002. We sat down with all citizens to discuss how to preserve their rights and many displaced and technical committees were formed from communities. Ministers of justice, finance and agriculture looked into compensation and relocation".*

Nevertheless, many participants and interviewees disagreed with officials. As a local committee member interviewee (12) stated:

*"At the beginning, the consultation was open but, after the first group moved to a new settlement, we started to see deficiencies in compensation and failure in many areas started to come to light. This led to mistrust between the government and the communities".*

Moreover, most participants, observers and interviewees believed the lack of explanation on the dam issue caused huge distrust and scepticism, especially where only the positive impact was promoted at the expense of the negative impact it may have on communities. These factors have played a vital role in shaping the participants' thoughts on the consultation. Also, as mentioned in Section 7.2.2, the politicisation of the dam had a huge impact on participants' thoughts on the consultation process. For upstream-residents, the struggle is ongoing for unresolved resettlement issues, while upstream-relocated still seek the electrification of irrigation systems, with a lack of commitment from the government. All these factors make it difficult for the participants to perceive the consultation as an open and inclusive process. Furthermore, most participants suggested that the government used the committees as an agent to implement its own agenda by infiltrating their ranks and adding loyal people to it. This situation caused more doubt about the reliability and

openness of the consultation, especially in upstream-resident and upstream-relocated districts. In addition, downstream were not consulted as they were considered unaffected. However, many participants have shown their disapproval of the process because they have been overlooked. In relation to the duration of the consultation, Figure 7.2 contradicts the official claims. Up to 80% of participants across the districts believe the duration of the consultation was not enough. This perception is understandable given the political and economic urgency from the government to build the dam, which led to hasty consultation to build the dam, which led to many downsides on both side of the debate. This result has further deepened distrustful sentiments between the government and the displaced communities, especially the Manasir, where negotiations are still ongoing to resolve the resettlement dispute.

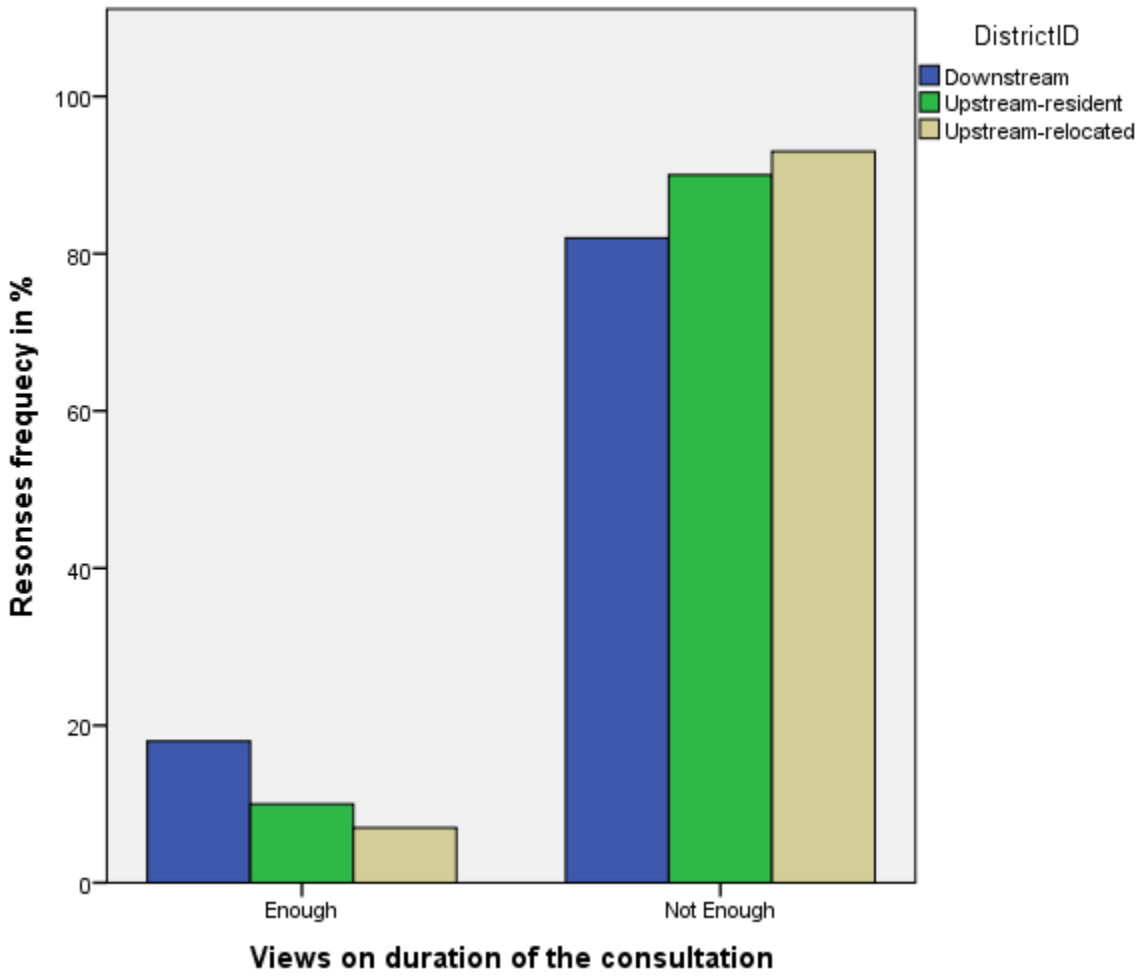



**Figure 7.3 Views on the duration of the consultation**

Source: Author questionnaire, 2017

Distrust in the government's motive for building the dam is one of the causes of the dispute and led communities to feel that they are left out of the process. Many participants believed that their interests were not considered when building the dam, which suggests that there is no consensus among stakeholders in the region in building Merowe Dam. As local farmers questionnaire participants (11, 130 and 270 respectively) state:

*"The dam was built based on the interests of and benefits to the government and those in the governing party".*

*"Yes, some stakeholders agreed, but the majority disagreed and did no relocate".*

*"Some of the stakeholders consented, but others opposed the entire process until today because we did not receive suitable compensation".*

The distrust between the government and communities caused by political influence has not only affected the consultation and decision-making process. Consequently, the distrust has great impact on the compensation process, which is discussed in the following section.

### 7.2.5 Compensation process for displaced people

In some recent dam projects, in many developing economies, compensation or resettlement plans have been set up and implemented without displaced communities' consent. Nevertheless, it is mistaken to assume that it is easy to resettle people and compensate the many tangible and intangible things that they have lost (Nüsser, 2003; Webber, 2012). Compensation is a complex process, not merely a one-off payment or providing a contemporary housing. It is a long process of reparation and providing communities with the means to manage their new life. Adapting to change is absolutely vital, as shown by the experiences of communities affected by the Aswan Dam, Three Gorges Dam and Lesotho Highlands dams (Scudder, 2012). Compensation has mixed outcomes, sometimes succeeding and other times failing. With the Merowe Dam, resettled communities were promised many benefits, including free water and electricity. However, the government provided few 'public goods' that it had promised the communities (Askouri, 2014; Hashim, 2009). The main aim of compensation is to restore some of the communities' livelihoods, which was not as easy as many thought, particularly when the affected communities are not seriously involved in the development process. Successful development processes must include all members of the society, and decisions should be made after consultation with all affected communities and with their consent (McCully, 2001a).

In relation to Merowe Dam, the affected communities believe that many promises and agreements made by the government were never fulfilled. The communities claim that there was no transparency on how the process was conducted and they have lost trust in the government and its DIU agent. However, the reparations for compensation and resettlement plans and their implementation were executed by DIU, the authority responsible for constructing the dam. The official claims of the project authorities, according to DIU official interviewee (23), were:

*"The compensation process was conducted in accordance with the law, rules and regulation. Firstly, the compensation was chosen based on census, according to who the real owner of the land or the palm tree is, and regardless of gender or age. Whether resident or migrant, in principle he is entitled to compensation. Accordingly, the technical committees and specialised committees for implementing the statistics for houses, plantations and land was formed. The committee was established to determine crops' and lands' value based on amounts that were determined to be very satisfactory and appropriate by all stakeholders. Each person who owned a house and agricultural land was awarded 6 acres as gift, not a compensation. However, lands have been compensated by land or money and date tree plantation, mango and other types of crops were compensated with money". (see Chapter 6).*

However, many participants and interviewees have disputed these official claims and believe that there were mistakes in implementing the compensation process in many areas, such as establishing the committees, valuation of properties, inventory of properties, census, etc. As local committee member interviewees (12 and 20) stated:

*"The first thing which was unfair was the inventory of population and their properties which were already submerged in the water before the start. The inventory was supposed to be carried out shortly before the displacement, however citizens were surprised to know that the government was keen to forcibly evict us. Therefore the authorities based their compensation on an inventory conducted in 1999 for assets' economic estimation in the region. Therefore, the citizens refused to be counted and a new committee was formed by the Minister of Justice. Its work was formal with no effects and the basic issue was not solved. As a result many citizens were denied their rights".*

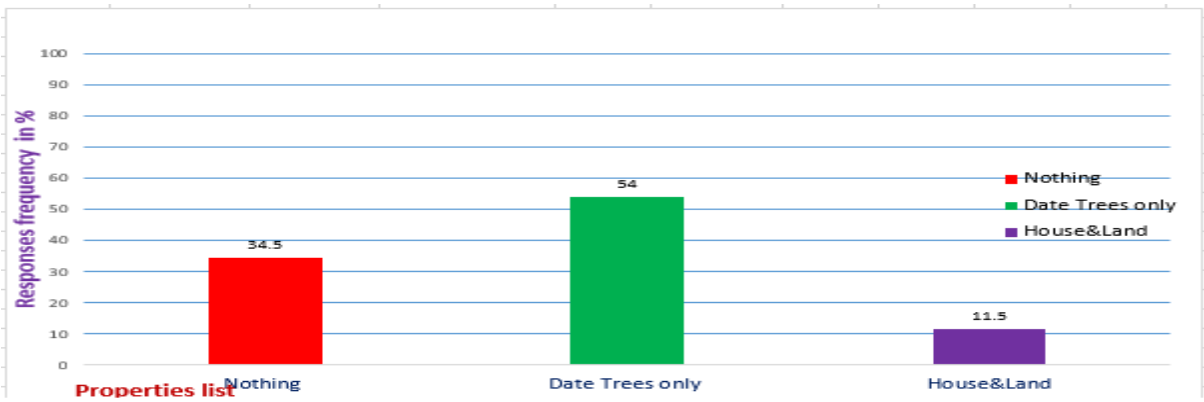
Many interviewees and observers have agreed with critics in literature on dam compensation processes, such as Scudder (2012). They consider compensation and

resettlement practice to lack transparency, poor consultation with affected communities and with deplorable tactics used by DIU to undermining the negotiations between the committees and state officials (Hashim, 2009). Likewise, according to local committee member interviewee (12), there was conflicting bureaucracy and contradictory statements by different local, state and national ministries and departments going back-and-forth to enable the implementation of upstream-resident. He added:

*"Debate on the compensation issue was intense. After going back-and-forth, the authorities designed their own resolution for compensation, belonging to the government only, without consulting the displaced people's opinions. They decided to compensate one palm tree with 310 Sudanese Pound and one acre with an acre and half and started to implement it. However, the citizens refused the resolution and, after a long debate, we reached a new resolution after cancelling the government resolution".*

Many participants believed that pressure from committees and displaced people's protests led to the establishment of a new resolution, improving the unfair compensation for lost assets. The package offered to the displaced by the authority was based on the 1999 census conducted by the DIU. A productive palm tree was compensated with 50,000 Sudanese Dinars, to be paid in cash over a period of 6 years, (equalling $10,000), based on an exchange rate at the time of compensation which ($1=5SD). Non-productive palm trees were compensated with 6,500 SD ($1300), and palm seedlings were compensated with 400 SD ($80). Compensation rates for other trees was pre-determined as following: mango 50,371 SD ($10,000), citrus 55, 325 SD ($10,000) and guava 50,000 SD ($10,000) (DIU, 2006 #465; DIU official interviewee 23). Most people interviewed believe the Census of 1999 was driven by mistrust between the government and its citizens, which led people to underestimate their assets, assuming it was conducted for taxation purposes. To

explore further the question on what compensation individuals received, the results in Figure 7.3 shows that 54% have received compensation, 11% received housing and land compensation and about 35% received no compensation. The majority of participants, even the ones living in the area, inherited some date trees and may be a piece of land. Furthermore, many young people, married or single, who still live with their family are yet to establish their own life and did not receive a house or land in compensation, as they do not own one yet. This is common practice in Northern Sudan: the extended family live on the same land, with house and farm together passed through generations.




| | | Frequency | Percent | Valid Percent |
|---|---|---|---|---|
| Valid | Nothing | 69 | 34.3 | 34.3 |
| | Date Tree only | 108 | 54.2 | 54.2 |
| | House & Land | 23 | 11.4 | 11.4 |
| | Total | 200 | 100.0 | 100.00 |

**Figure 7.4 Compensation of properties upstream affected communities**

Source: Author questionnaire, 2017

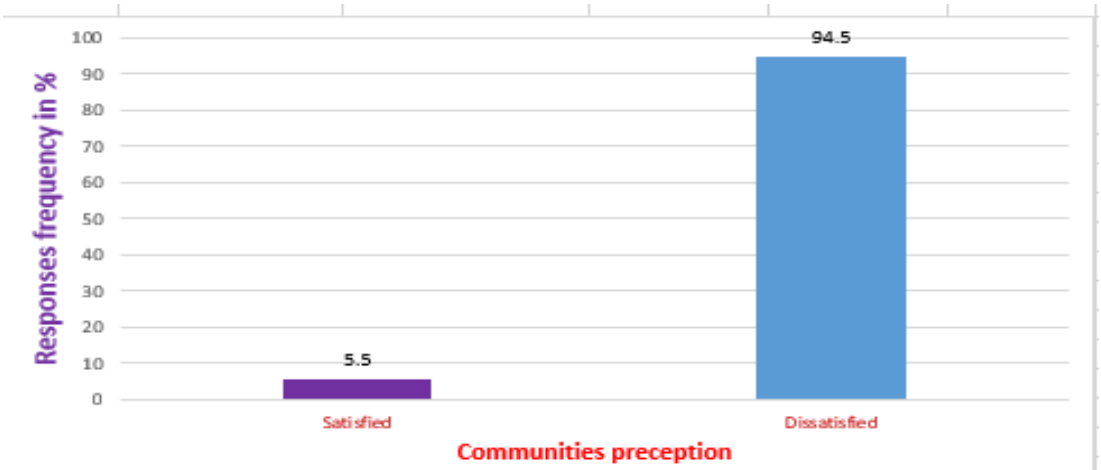
A special technical committee formed by the government to determine the rates of monetary compensations for lost assets. It was responsible for the compensation of various assets like land, fruit trees and other property. In addition, the DIU compensation package included a new house for each homeowner, ownership of six acres of land to each family and three acres of land for every acre lost (DIU, 2006). The monetary compensation is only applied to assets listed by the technical committees. Furthermore, the government promised each resident family 50,000 SD

($10,000) to be paid in instalments annually over six years with the first payment made in first day at resettlement. In addition, farmers at the resettlement were granted two years of free agricultural extension services of water, electricity, seeds and fertilisers as a goodwill gesture (DIU 2006 and DIU official interviewee 23):

"*Further monetary compensation was provided to all homeowners, including those who refused to relocate and stayed at upstream-resident. However, any houses built after the 1999 census were not qualified for compensation".*

However, despite the official claim of generous compensation, many participants and interviewees believed the compensation to be insufficient and felt cheated in their properties' evaluation, and that the land is less fertile than their land at the old settlement. To further explore whether participants are satisfied with the compensation and its process, Figure 7.4 shows over 90% of the participants are dissatisfied.

There is clearly a distance between government claims and the experience of the communities affected. Dissatisfaction was clear throughout the group discussion with over 10 stakeholders representing government, farmers, student, local committee members and businesspersons at Kehila resettlement on 26/07/2017. The majority of participants in the meeting agreed that the dissatisfaction was mainly caused by the politicisation of the compensation process by DIU and the unresolved settlement location matter. Others related the sentiment to being side-lined in decision-making on the new location, determining the value of properties and corruption within the DIU, local and national government. However, there was also a sense of agreement on improvement of the communities' lives socially and economically despite the conflicts, which the majority attributed to political involvement.




| | | Frequency | Percent | Valid Percent |
|---|---|---|---|---|
| Valid | Satisfied | 11 | 5.5 | 5.5 |
| | Dissatisfied | 189 | 94.5 | 94.5 |
| | Total | 200 | 66.2 | 100.0 |

**Figure 7.5 Upstream communities' perception about the compensation**
Source: Author questionnaire, 2017

The resettlement villages were built in four locations in two different states (see Chapter 6, Section 6.3 for details). The majority of participants considered the process of selecting new settlement locations and compensation negotiations to be dominated by DIU representatives, despite the involvement of committees representing each of the Hamdab, Amri, and Manasir communities (Hashim, 2009). Furthermore, the Environmental Impact Assessment and Resettlement Assessment conducted by Lahmeyer which suggested following the international standards in accordance with World Bank guidelines on involuntary resettlement, which includes the participation of all stakeholders (Hashim, 2009). However, many participants, interviewee and observers have disputed Lahmeyer's claim because of health problems, poor soil quality, etc. Moreover, the people's opinions were widely disregarded and the experience of committees and common people revealed that no such standards of consultation and participation were adhered to. To examine Lahmeyer's environmental assessment, the following section provides insight into environment issues related to Merowe Dam.

### 7.3 State role in managing Merowe Dam environmental issues

It is beyond the scope of this study to conduct an environmental evaluation, but data from interviews, perceptions of respondents and secondary sources were used to study Merowe Dam environmental issues. There is a growing interest in mega-dams as a means to manage water and produce electricity and decrease energy shortages, especially in developing economies, and to moderately reduce global climate change effects (Rivers, 2013). This environmental concern led to reviving interest in dams' social and environmental implications and the method used to manage the impacts of dams (Skinner & Haas, 2014). Despite these environmental concerns new dam projects have been implemented and other planned globally, but predominantly in developing countries. For example, South East Asia has become the world's highest investment region for large dams (Rivers, 2013). Yet large hydropower dams have been contentious in terms of social (see Chapter 6) and environmental influences. In terms of the biophysical aspects, the main impact of dams are the fragmentation of river systems, fragmentation of vegetation, impacts on soil and water quality, impacts on species composition and changes to geomorphology. Furthermore, the critics of dams, such as International Rivers (2013), Siciliano (2015) and Skinner (2014), believe such infrastructure can change the pattern of river flow, both decreasing its total volume and changing its seasonal variations. However, some scholars are in favour of dam, such as Agrawala *et al,* (2003), Ersumer (1999), Pearce (1992), Schultz (2002) and Varma (1999), who believe it can be environmentally feasible in an era of climate change and the nature of the impacts can be managed, depending on the design, purpose and operation of the dam. This research argues that, environmentally, the location of a dam may pose huge risk or opportunity. For example, the impact in a tropical region may differ from dry or desert climates, where

water management is needed for irrigation, due to less rainfall, high temperatures and less surface water which mean less health risks. In relation to Merowe Dam, many interviewees and participants viewed the Sudanese government's environmental impact assessment, conducted by Lahmeyer International as inadequate. The assessment emphasises that all negative impacts of the dam can be mitigated, and the project has beneficial impacts on wildlife, the welfare of the affected people, and health.

The summary of Lahmeyer International's Environmental Assessment Report (2002) identified the negative impacts and mitigation measures and the environmental benefits of Merowe Dam. The environmental impact assessment (EIA) concluded a clear impact on community displacement, mitigated by resettlement to restore communities' livelihoods and providing further development opportunities for resettled and host communities. According to Lahmeyer-International (2002, p 1-15):

*"The Nile River downstream of Merowe Dam has experienced some form of degradation of the riverbed and erosion of its bank. These issues are addressed by monitoring to identify sensitive sites and eventually determine the necessity for revetments to protect endangered buildings. The water level fluctuations of the River Nile affects operation of ferry landing sites and many small-scale irrigation pumps. The first can be mitigated fairly easily with pumps: a study determined their sensitivity to specific water level changes. If necessary, possible mitigation measures consist of sliding devices and electrification of pumps. For biomass, due to its very small amount in the reservoir area, the retention time of water is very short at the reservoir and for specific drawn-down characteristics of the Merowe Dam reservoir, no degradation of water quality occurred and the production of greenhouse gases is extremely low".*

However, the government not only identified negative impacts and provided mitigation measures, it further identified some beneficial environmental impacts of Merowe Dam. The areas of benefit suggested by the government was a point of debate amongst participants and interviewees, yet the government believed that:

*"The Merowe Dam provided many beneficial impacts including a more favourable microclimate, improved vegetation areas in the water fluctuation zone around the*

*reservoir, unhindered access to water and better grazing areas for wildlife and the livestock of nomadic groups. Although the number of typical river fish decreased, especially downstream, but will mean the typical lake fish will increase and total fish production will be greater than before. The areas surrounding the reservoir, along the river and downstream of the dam benefited from improved conditions regarding vector waterborne related diseases. There are improved living conditions for the resettled population because of electricity supply, better dwellings, water supply, sanitation and health services" (Lahmeyer-International, 2002) p 1-15).*

However, many participants, interviewees and experts disagreed with the government and Lahmeyer assessment, and believed that, although there are some positive impacts – such as opportunity to cultivate the seasonal silty fertile land created by the dam at the reservoir during flood recession at upstream, improved infrastructure and health facilities – there is no comprehensive environmental mitigation plan for post-resettlement and no long-term monitoring plan. As university environmental academic interviewee (28) stated:

*"The government environmental assessment report is very poor and vital environmental aspects such as reservoir sedimentation, irrigation, water quality, and downstream ecological impacts resulting from hydropeaking were not addressed adequately. Furthermore, the quickly prepared environmental assessment of the Merowe Dam conducted by Lahmeyer International, in 2002 was in violation of Sudan's Environmental Protection Act of 2000. Therefore, the Ministry of Environment's technical body never approved the report, but DIU didn't permit them to evaluate or certify the environmental assessment".*

In addition, Verhoeven (2011) suggests UNEP (2006) assessed Merowe Dam as part of a post-conflict environmental impact assessment of Sudan and EAWAG, (2006), the Swiss Federal Institute of Aquatic Science and Technology. Both organisations concluded that the Lahmeyer report did not meet European or international standards and point out many areas that were not addressed in the EIA, such as silt loss for flood recession agriculture, dam sedimentation, riverbank erosion, reduced river valley groundwater recharge and blocking of fish migrations. However, other participants and experts have argued that Merowe Dam has many environmental

benefits, especially in dry desert climates where the need for water management is greater. As a university environmental academic (26) believed:

*"The Merowe Dam had positive impacts, by creating a reservoir in this very dry area the water can be utilised with a strategic plan. It could be an opportunity for Sudan to transform the desert into an oasis. You know around 60% of Sudan and 90% of northern Sudan is desert, so to expand our sources, livelihood and take care of our nature and environment by fighting climate change, the dam is an opportunity to transform this vast desert into a green environment can be an added value to Sudan".*

On the other hand, many participants and interviewees agreed to some degree with the dam's negative environmental impacts. However, they viewed the Merowe Dam as beneficial to a region with very low population density because of its harsh environment, believing that the dam makes the region more habitable. Furthermore, many participants, especially interviewees, view environmental issue as a matter of management problems more than dam environmental degradation per se. This perspective is in line with literature by scholars such as Agrawala (2003) and Varma (2003), which views dams as a means for water management for better use. Furthermore, an university environmental academic (26) argued:

*"Environmental problems are about managing natural resources. In a place like Sudan, Merowe Dam can change Sudan from a country of scarcity to a country of abundance, because nature has no value in itself except when related to human needs. We cannot protect the nature for sake of nature. When looking at Merowe Dam from a broader environmental perspective, if used wisely, it can transform the desert and dry region to a green area by using the water to expand agriculture and a green zone, which is very good for reducing climate change and the desertification of northern Sudan".*

In addition, most environmental experts in Sudan suggested that the negative impact of Merowe Dam is minimal compared to many dams in tropical regions. As the university environmental academic interviewee (26 and 28) elaborated:

*"It is not necessary that dams are negative, especially in desert areas such as northern Sudan where they can soften the atmosphere and reduce the temperature, provide better micro-climate. The percentage of groundwater reserves can be increased and the water can be used for planting forests and agricultural crops. The Merowe Dam reservoir is a useful and suitable place for fishery production, so you*

*are creating a source of wealth for the people and for the country at large. The dam provides electricity, which is more environmentally friendly than other energy sources because you are not utilising any fuel or petrol and has very low greenhouse gas emissions".*

Many environmental experts view governments to be the main contributor in environment degradation by building mega-projects for economic and socioeconomic development (Verhoeven, 2011). However, private organisations, such as multinational corporations, are no better than sates institutions in negotiating environmental impacts assessment and mitigation, which is complex and time-consuming, especially for dams' construction. Many scholars have joined NGOs in criticising the environmental impact of dams and argued that politicians are not doing enough to protect the environment, that they only focus on the economy and use dams for political gains (McCormick, 2007). Eventually, under pressure from NGOs, this criticism caused many international western institutions to change their environmental policies regarding funding dam development, which limits developing economies from accessing global funds for dam construction (Akyürek, 2005). However, some concerns have been raised by many western organisations that Chinese lenders have lower environmental standards as a strategy to win more international large infrastructure tenders including dams. The introduction of China into the debate on dams and development has changed the dynamics of political and environmental aspects, providing a source of funding without environmental concerns or political pressure. At the time, the sponsors of the Merowe Dam sought funding, Sudan was in arrears with its debt service to international funding bodies and the official export credit agency of France rejected support for its construction because of the project's environmental and social impacts (Verhoeven, 2011). Despite all the political and environmental challenges, the project went ahead; achieving many positive and some socially negative impacts (see Chapter 6). This set of

circumstances emphasise two points: whether there is greater economic and political need for Merowe Dam to be built, or an embodiment of weakness and deficiency in environmental awareness and policies within the government institutions and in public domain. The weakness of environmental policies in Sudan has been highlighted by Lahmeyer International Environmental Assessment Report (2002), suggesting there are more than 150 pieces of legislation addressing many aspects of environmental protection. However, many of the laws are incoherent, fragmented, uncoordinated and lacking a unifying legislative framework, which governs environmental policies. Furthermore, most legislation is concern with the protection of natural resources with less emphasis on environmental problems caused by cultural and social practices. At the community level, many participants and interviewees have highlighted the lack of awareness and understanding of environmental issues in Sudan, let alone the environmental impact of dams. As a university academic interviewee (9) suggested:

*"Environmental awareness in Sudan is very weak. We need water and we need to manage the water we have, especially in the northern Sudan region where water is greatly needed for agriculture and combating desertification in the light of global climate change. However, the environmental global outcry over dams for us in Sudan is less-concerned because we do need to manage our water. As you know, the River Nile is the most fluctuating river in the world".*

However, another university academic interviewee (26) disagreed with this interpretation and suggested that dams should not be built at the downstream, but at the upstream where water can be stored and managed effectively to benefit all downstream inhabitants. He added in respect to Merowe Dam that, because of the rocky nature and desert in the region and high level of water evaporation, it provides many benefits such as reduced waterlogging, less biomass greenhouse gas because of low vegetation and the use of water for irrigated agriculture. However, two university environment academic interviewee (26 and 28) believed that:

*"Sudan can manage to produce electricity without having to build this type of large dam by using other means like solar energy and wind power which are available in abundance, cheap and clean or even build smaller dams to reduce the social and environmental impacts".*

Despite the useful debate on the environmental aspects of Merowe Dam, many participants and interviewees view the government's role in the debate as "judge and jury". This dual role of the government intensified the environmental debate, which led to questioning the government's integrity and Lahmeyer International's credentials for conducting an environmental impact assessment of Merowe Dam. Many experts and interviewees claimed an independent body should have carried out the assessment. However, others appear to argue that the lack of credentialed Sudanese environmentalists on the panel added more doubt over the process especially from the perspective of regional local knowledge. This doubt led to an ecological section of the environmental issues of Merowe Dam, which this chapter has examined.

### 7.3.1 Merowe Dam's ecological influences upstream and downstream

Usually dams to transform the ecological structures both down and upstream, with accompanying hydrological and environmental implications (McCully, 2001). The very complex nature of ecological transformation may have long-term influences on the physical, chemical, biological and hydrological systems because of variations and fluctuations in water (inflows and outflows), which influence the water equilibrium of the basin where the dam is built (McCully, 2001b). The artificial lakes created by mega-dams accelerate ecological transformation, which happens because of changes in riverine ecosystems, affecting the entire biological productivity of the ecosystem (McCully, 2001; Scudder, 2005).

The critics of impact of dams on ecosystems, such as Scudder (2012), McCully (2004) and Singh (1997), believe that mega-dams are influential in endangering, reducing or even eradicating rare wildlife. Consequently, the implications of the ecological impact of manufactured lakes and water fluctuations down- and upstream on aquatic and terrestrial ecosystems make mega-dams unsustainable (Scudder, 2012). However, scholars such as Ersumer (1999), Agrawala (2003) and Varma (2003) challenge the alleged ecological problems associated with mega-dams, suggesting it is overstated and that there is evidence that wildlife is thriving in the area of reservoirs. For example, the Idukki dam in Kerala, India offered a new sanctuary for existing wildlife in nearby forest areas and attracted new species of birds and animals because of water availability at the reservoir area. In the case of Merowe Dam, the position of the government and some participants and interviewees is supported by the standpoint of Ersumer (1999), Agrawala (2003) and Varma (1999) on the ecological issue. However, many participants, experts and interviewees appear to agree with the critics' position (such as Scudder, 2012).

The above discussion is part of an ongoing wider debate on dams, including Merowe Dam, and their negative ecological impacts. However, there has been a shift in opinion on dams' ecological impacts, such as reforestation. For example, Sardar Sarovar Dam authorities provided support to plant 11 million compensatory trees and created sanctuaries for wildlife and marine life (Gupta, 2001; Varma, 2003). The above views suggest that mega-dams can sustain and improve the ecological diversity and environment of some rivers. Furthermore, according to DIU, the Merowe Dam complies with the improvement in the design of dams as part of the environmental social impact assessment (ESIA), which required mitigation measures

to be in place before funding is approved and dam construction begins, significantly reducing their ecological impact (ICID, 2001b). Moreover, the incorporation of biodiversity matters in modern mega-dam design enhances fish migration, water flow regime to downstream, environmental flow releases and productivity of mega-dams, which might improve their sustainability (Varma, 2003).

Authorities believe Merowe Dam has had minimal negative ecological impact and has mainly benefit the ecosystem in the region. According to Lahmeyer International's (2002) environmental report, most ecological aspects of the dam have been addressed, such as habitats in the region, which have been divided into three groups: aquatic, water-related terrestrial, and desert. In relation to biotic environments, the report covers studies on the impact on birds, fish and dorcas gazelle on the regional level (Lahmeyer-International, 2002). The report argues that the dam's impact is minimal and may increase fauna due to the presence of water. However, in relation to flora, natural vegetation is very sparse and only found where water is present. Many fish species were found with potential commercial interest despite fisheries in northern Sudan being negligible as it is not in their culture (Lahmeyer-International, 2002). Furthermore, the report claims that Merowe Dam area has a relatively low density of wildlife because of its nature, which comprises desert with some vegetation in the wadis only after rare rain showers. The cultivated areas on the islands, riverbanks and lower terraces leave only sparse natural vegetation as refuge for birds and minor animals. Consequently, biodiversity in the area is very low (Lahmeyer-International, 2002). In relation to water flow downstream, the report indicates that Merowe Dam Lake reduced total flows, silt from flood and water levels and increased the daily variation of release flow, as well as

affecting the erosion-sedimentation regime downstream from the dam (Lahmeyer-International, 2002). However, the rocky and desert nature and the climate of the region may contribute to a reduced ecological impact of the dam.

A Kruskal-Wallis analysis of questionnaire responses provides a clear idea of how communities perceive Merowe Dam's ecological impact. A lack of awareness and knowledge of environmental issues among the research population may have impacted on how the participants answered the questions. The Kruskal-Wallis test covered a 5-point Likert scale: question of dam impact on spread of disease, habitats communities, wildlife, forests, water logging and salinization (scored 1, 2, 3, 4 and 5, with 5 as the highest level of agreement toward positive impact).

**Table 7.8 Ranking of ecological indicators by districts**

| Location | | Waterborne diseases | Habitats communities | Wildlife | Forests | Water Logging | Salinization |
|---|---|---|---|---|---|---|---|
| **Downstream** | **Mean** | 2.110 | 3.230 | 2.750 | 2.520 | 2.620 | 2.630 |
| | **Std. Deviation** | 1.127 | 1.286 | 1.095 | 1.123 | 1.270 | 1.178 |
| **Upstream-Resident** | **Mean** | 1.980 | 1.740 | 1.790 | 1.900 | 1.980 | 1.960 |
| | **Std. Deviation** | 1.333 | 1.041 | 1.038 | 1.115 | 1.295 | 1.247 |
| **Upstream-Relocated** | **Mean** | 1.970 | 2.050 | 2.060 | 1.750 | 1.780 | 1.800 |
| | **Std. Deviation** | 1.201 | 1.234 | 1.162 | 0.925 | 1.040 | 1.005 |
| **Total** | **Mean** | 2.020 | 2.340 | 2.200 | 2.057 | 2.127 | 2.130 |
| | **Std. Deviation** | 1.221 | 1.350 | 1.168 | 1.106 | 1.255 | 1.199 |
| | **N** | 300 | 300 | 300 | 300 | 300 | 300 |
| **Kruskal-Wallis Test** | **Chi-Square (*df 2*)** | 2.133* | 66.08*** | 38.99*** | 28.17*** | 27.66*** | 30.74*** |

Sources: Author questionnaire, 2017

The combination of Kruskal-Wallis test and means comparison in Table 7.8 show significant evidence of statistical differences between districts in all indicators. Only the spread of waterborne disease shows no difference statistically. An examination of the means comparison between districts shows that downstream scores higher in most indicators (2.52-3.23), which indicates that there is some agreement toward

positive impacts on the ecological aspect, except the spread of waterborne disease (2.11), which leans towards negative impact ($\chi^2$ = 2.133, *DF* = 2, *P* = <0.344). Nevertheless, upstream-relocated and upstream-resident communities both score very low means (1.70-2.00) in all indicators, which indicates that there is a huge tendency toward agreement with Merowe Dam's negative environmental impacts on the ecological indicators mentioned in Table 7.8 ($\chi^2$ = 66.080, *DF* = 2, *P* = <0.001). Despite insufficient environmental knowledge in Sudan at the micro-level, the results contradict experts' claims of partial environmental impact of Merowe Dam, especially in upstream districts. However, despite the uncertainty of water flow, less silty soil and expected erosion of the riverbanks downstream, the results show that downstream ecological systems appear to benefit from the dam. It is very difficult to determine the reason behind this result, but it may be due to a harsh mountainous and desert environment with little forestation, wildlife and habitats. However, waterlogging produced groundwater close to the surface and has been viewed by locals as useful in reducing the cost of digging wells. The argument that Merowe Dam causes waterlogging and salinization is further challenged by Varma, (2003) and ICID (2001), who suggest it can easily be managed through effective implementation and management of large irrigation schemes. This issue should not affect the development of mega-dams. The above argument and views are supported by one of the university environmental academic interviewee (26), who stated:

*"As you know, the area is desert and stony. I believe the dam provides an opportunity to enrich the fragile ecosystem, both flora and fauna, especially at the upper part of the lake, not just to enrich it but also to maximise the ecosystem, not only the fishery but as whole"*

Yet critics of dams perceive negative ecological impacts on downstream environs, such as McCully (2001), who claims a reduction in water flow may change the landscape that the river flows through, leading to an effect on ecosystems' flora and

fauna. However, the evidence on whether mega-dams lead to gains or losses in ecosystems such as fishing, wildlife, habitats and forests is mixed. The Merowe Dam has provided the region with much-needed management of water throughout the year and controls floods. Therefore, the results in Table 7.8 challenge these alleged issues, as downstream of Merowe Dam is marginally affected. Farmers' pumps at the riverbanks are not affected by the changes in water supply. In regard to ecological issues, the citizens see the increase of fishermen in the lake as a new phenomenon. However, in the general view, there little interest in other ecological elements apart from the spread of waterborne diseases. In contrast, upstream the ecological negative sentiment on the indicators mentioned above is a result of losing silty fertile land, date trees and the spread of waterborne diseases, especially at the resettlement. This result is expected upstream, because of environmental impacts the reservoir caused the communities through the displacement and resettlement process. Moreover, many participants and interviewees argue that the lack of post-resettlement environmental assessment has contributed to the increase in waterborne diseases in the areas (see Chapter 6). As a local official interviewee (1) stated:

*"Environmental studies should have been conducted pre-resettlement and post-resettlement to monitor any environmental changes and take action to mitigate them. However, we rely only on the pre-resettlement assessment and this is huge misjudgement".*

To better understand Merowe Dam's ecological impact on the region, Table 7.9 provides a Kruskal-Wallis test assessing 5 Likert scales: questioning of the dam's impact on erosion, sedimentation, water supply and flow, riverbank distance and flood control (scored 1, 2, 3, 4 and 5, where 1 is very negative and 5 is the highest level of agreement toward positive impact). The test on Table 7.9 shows that there is a significant evidence of variation in participants' responses across districts. The

comparison of means test provides strong evidence of agreement towards the positive impacts the dam has had on ecosystems downstream and upstream-resident, where downstream scored (2.67-3.79) and upstream-resident (2.14-2.93) in all indicators ($\chi^2$ = 34.806, *DF* = 2, *P* = <0.001) (see Table 7.9).

**Table 7.9 Ranking of ecological indicators by districts**

| Location | | Erosion | Sedimentation | Water supply | Water Flow | Riverbank distance | Flooding |
|---|---|---|---|---|---|---|---|
| Downstream | Mean | 2.670 | 2.670 | 2.690 | 2.980 | 3.040 | 3.790 |
| | Std. Deviation | 1.129 | 0.943 | 1.061 | 1.035 | 1.082 | 1.225 |
| Upstream-Resident | Mean | 2.140 | 2.540 | 2.600 | 2.580 | 2.650 | 2.930 |
| | Std. Deviation | 1.263 | 1.560 | 1.497 | 1.458 | 1.417 | 1.665 |
| Upstream-Relocated | Mean | 1.730 | 1.770 | 1.830 | 1.730 | 1.740 | 1.840 |
| | Std. Deviation | 0.897 | 0.897 | 1.045 | 1.004 | 1.031 | 1.220 |
| Total | Mean | 2.180 | 2.327 | 2.373 | 2.430 | 2.477 | 2.853 |
| | Std. Deviation | 1.169 | 1.235 | 1.275 | 1.290 | 1.305 | 1.596 |
| | N | 300.000 | 300.000 | 300.000 | 300.000 | 300.000 | 300.000 |
| Kruskal-Wallis Test | Chi-Square (*df 2*) | 34.81*** | 32.32*** | 28.157*** | 50.719*** | 54.784*** | 73.698*** |

Sources: Author questionnaire, 2017

The Kruskal-Wallis test results show significant differences in all indicators. This result defies the literature on dams' environmental influences downstream, where many scholars, such as McCully (2001), Singh (1997) and Scudder (2005) view dams to have negative impacts. Clearly, downstream experienced less erosion due the flat and rocky nature of the riverbank in the area. Interestingly, distance of the riverbank from water and flood control have scored higher than other indicators, which proves that Merowe Dam has little impacted the river flow and water supply for downstream, yet the design of the Merowe Dam allowed flood control still permitted some sediments and fish to pass through. In addition, many environmental experts, interviewees and participants challenged the overstated environmental impacts, as an university environmental academic interviewee (28 and 29) suggested:

*"For me the context is important. I cannot say every dam is bad. In some places, there is a need for dams, especially in arid and desert place, such as Merowe Dam's*

*location. It is needed because it brings many benefits environmentally such as water management, forestation, fishing anti-desertification etc.*

This perspective is in agreement with Varma's (1999; 2003) argument against the critics of dams, suggesting that new dam engineering and special channel designs, such as fish passes and sediment cleaning flushing points specially designed to allow the passing and reduction of sediment retention at the reservoirs. This design reduces erosion by maintaining the natural vegetation through minimisation of deforestation in both down- and upstream areas. Furthermore, Varma (2003) argues that fish bypass channels support smooth movement through the dam for fish and other migratory species, although its success was not that great. Also, nutrients created by submerged rotten vegetation and soils in lakes increase micro-organisms in reservoirs which lead to a massive growth of fish populations in reservoirs which compensates for the loss of fisheries downstream. University environmental academic interviewees (9, 26 and 28) support the above argument and views. They stated:

*"In terms of Merowe Dam's impact on fisheries, definitely the downstream experienced a reduction and, at the same time, is now the main supplier for Khartoum and urban centres as far as Al-Ubaid with fish from the lake. 90% of Khartoum fish come from the Merowe Lake. The lake created an opportunity for many people, providing new jobs even for farmers and shepherds who became fishermen".*

Evidently, as Varma (2003), Latif (1973) and Lowe-McConnell (1973) argue, lakes created by dams increase the production of fish. For example, Volta Lake production increased about tenfold from 6,000 million tonnes to more than 60,000 million tonne between 1969 and 1970. Also, other lakes such as Lake Nasser of Aswan High Dam and Nam Pong Reservoir on the Mekong River witnessed significant increases from 764 million tonnes in 1966 to 4545 million tonne in 1969. Evidently, upstream-resident have benefited from retention of sediments at the reservoir floodplain during

water recession season and free water supply to cultivate 60,000 acres of fertile land provided by Merowe Dam (local committee member interviewee 20).

Furthermore, after the above discussion, it is important to ensure the government's claims about the ecological impacts of Merowe Dam have been addressed. To verify this claim, Table 7.10 has a cross-tabulation test on the question of whether the environmental issue have been addressed that shows clear evidence of differences between districts in relation to addressing environmental impacts. Table 7.10 shows the *actual* count of responses perceiving the environmental problems as not addressed is much higher than the *expected* count at upstream-relocated and upstream-resident. In contrast to downstream, the *actual* count of not addressed is much lower than the *expected* count. However, the *actual* count of responses on yes and partially addressed is much higher than the expected count, although the margin between participant who perceive yes (9%) and partially (30%) addressed, and not addressed (61%) is very high ($\chi^2$ = 51.232, *DF* = 4, *P* = <0.001).

**Table 7.10 Participants answers on DIU addreesing environmental problem**

| Location | | Yes | Partially | No | Total |
|---|---|---|---|---|---|
| Downstream | Count | 9 | 30 | 61 | 100 |
| | Expected Count | 6.3 | 12 | 81.7 | 100 |
| Upstream-Resident | Count | 6 | 5 | 89 | 100 |
| | Expected Count | 6.3 | 12 | 81.7 | 100 |
| Upstream-Relocated | Count | 4 | 1 | 95 | 100 |
| | Expected Count | 6.3 | 12 | 81.7 | 100 |
| Total | Count | 19 | 36 | 245 | 300 |
| | Expected Count | 19 | 36 | 245 | 300 |
| | Chi-Square (*df* 4) | 51.232*** | | | |

Sources: Author questionnaire, 2017

Most participants have simplified the environment impacts of Merowe Dam solely on health aspects. The majority of local participants and interviewees reiterated this idea, which suggests that the authorities did not address the issue of waterborne diseases such as malaria and typhoid caused by increased surface water for irrigation and unclean underground wells (see Chapter 6). Therefore, the focus of many participants is mainly on one aspect of environmental issues related to Merowe Dam.

This focus led to a neglect of other aspects. Although not deliberate, it was the result of limited knowledge and interest in the environment and ecosystem within Sudanese culture. Even within academia, the environment is yet to establish a strong presence. Otherwise, it means that participants agree that Merowe Dam has had a negligible environmental impact. As two university environmental academic interviewees (26 and 28) suggested:

*"The problem of Merowe Dam within the northern Sudan is mainly political, related to displacement, resettlement and compensation. However, those people affected by the dam were not eager to protect their environment. They only discuss it when it comes to diseases, which I believe the dam has little to do with".*

The sentiment of health and waterborne diseases is well present throughout the local farmers and local communities' responses in the environmental questions in both down- and upstream. However, other participants see the opportunity the dam provides in fishing. This idea is supported by the following quotes from local farmers' questionnaire participants (4, 110, 150 and 200 respectively) who stated:

*"Some environmental and ecological problems, such as flood control and water management, have been addressed. However, life at the riverbank is attractive because of working in fishing".*

*"Up to 60% of environmental issues have been addressed, such as flood control, which has a reduced effect in rainy season".*

*"Some of it has been addressed, like flood control. However some have not yet, like the spread of diseases and decreased water supply in dry season".*

*"Somewhat, but a lack of water supply and spread of waterborne diseases are not addressed yet".*

Health issues became a sensitive environmental matter to local people in Merowe areas because of its direct impact on their lives, especially the diseases they encountered after Merowe Dam's displacement and resettlement, which are unknown to the area before the dam. However, other ecological elements with no direct impact on individuals' lives gain minimum attention from common local citizens.

This situation does not mean it is less important to ecosystems, which include societies as the main beneficiaries of its sustainability. However, the results show the degree of variation in views and understanding of ecosystem, environmental elements and environmental influence of the Merowe Dam on debates in many contexts (experts, academics, communities, NGOs, governments).

### 7.4 Conclusion

This chapter analysed the political and environmental influences on the delivery of Merowe Dam and its environmental consequences downstream and upstream. The chapter focused on political conflicts of interest, which dictated the funding, consultation, decision-making and compensation processes, at national and local levels. In addition, the chapter analysed the alleged environmental and ecological positive and negative changes brought by the dam to both up- and downstream. As many scholars suggested, technology such as Merowe Dam could bring changes to the political and environmental landscape and particularly rural areas, where the government is gaining popularity. This change happens through providing economic development, referring to two important elements: producing electricity and managing water, both used in many aspects of people's lives economically and socially. Clearly, there was debate on Merowe Dam's political and environmental influence, compensation, and consultation processes, which can be endless. The majority of participants, interviewees, and experts have agreed that there is some political and environmental disappointment. However, there is also a huge positive contribution for communities, both environmentally and politically. In fact, there are legitimate arguments and concerns from both sides of the debate on the environmental impacts of the dam. However, the analysis of Merowe Dam has revealed its ecological impact

seems to be more likely balanced in both downstream and upstream. Nonetheless, the topography and climate of Merowe Dam's location played an important role in reducing its environmental impacts in the region. Furthermore, the result of analysis of some aspects contradicted the literature, either agreeing or disagreeing with critics of dams.

The analysis of Merowe Dam suggested that there are many political problems associated with the dam's delivery, such as undermining local communities' participation in decision-making around compensation, selection of resettlement locations and even an attempt to sabotage and influence the committees' selection. Yet the government has enormously benefited politically. The dam is a symbol of power, a political success at a time when the government is in need of a shining moment after long economic and financial sanction and difficulties.

The analysis of Merowe Dam suggests deficiencies and limitations in stakeholder participation, consultation, and transparency in project planning and implementation. However, attaining such openness in consultation and decision-making requires positive engagement and dialogue between the main stakeholders to gain the best-possible political and environmental outcomes, due to the high costs of Merowe Dam's long-term political and environmental consequences. Yet obtaining full participation and openness seems to be difficult, if not impossible. The engagement and discussion was destructive because of authoritarian and unrestricted power held by DIU. This point suggests how inferior the environmental element is in comparison to politics in the balance of power to determining Merowe Dam's delivery. This chapter has presented analysis and discussion of the main political and

environmental aspects, examining the rationality for consultation, compensation, funding decision-making process and uncovered how Merowe Dam's environmental influence has created various positive and negative ecological changes at down and upstream.

The data demonstrates that downstream and upstream have benefited from Merowe Dam through valuable environmental opportunities, in terms of fishing, water for agriculture, diversification of the ecosystem, increased flora and fauna inhabitants and improving the region micro-climate.

Furthermore, this chapter shows how diverse opinions are about Merowe Dam regarding political and environmental influence among the locals, the region and the country as a whole. The local participants' response shows different perceptions within districts on political issues. However, the majority of participants agreed that building Merowe Dam was politically motivated. Evidently, Merowe Dam has created extreme political and social tensions between authorities and communities regarding compensation, consultation and the resettlement processes. Even though the communities show no objection to building Merowe Dam, they only objected to the way in which DIU deal with the displacement, compensation and consultation processes. The dam's environmental impacts on many aspects of the ecosystem is minimal due to the arid terrain and desert climate of the region, yet it exposed the political lack of will to address the underlining issues adequately, which caused the spread of waterborne diseases, especially downstream.

The analysis shows a significant level of difference between districts on how participants understand and perceive the ecological impacts of Merowe Dam on their environment. Furthermore, the analysis suggests that Merowe Dam has both positive and negative ecological influences, both down- and upstream. Both sides have been

positively affected and benefited from huge fishing wealth, less erosion, and improvement in the whole ecosystem through water availability.

The analyses throughout this research identified that the majority of local participants have a connection to farming. This finding suggests that having a stable environment and diverse ecological system (including a supply of water for fish farming) with stable political system and will could improve the agricultural economy in the region. To conclude, these respondents were not only mindful of the political tension that dams can cause, but were able to distinguish between political issues and real economic developmental needs in the region. Therefore, they managed to negotiate some environmental and political advantages despite the low balance of power they have, while suggesting how improvements can be made on future projects. Although most of the participants agreed with Merowe Dam's positive, economic, social, and environmental benefits in the region, they still believed politically, if the process is managed well, the outcome could have been better appreciated.

These findings, therefore, suggest that:

- The Merowe Dam is politically and environmentally different from other dams in the World. However, politically, there is some similarity with other dams in the compensation and consultation processes, yet funding, economic, and political urgency to construct Merowe Dam for political gain is unique.

- The Merowe Dam has some positive environmental influences because of the natural composition of the soil, terrain and climate in the region in comparison to literature reporting on dams' environmental issue, especially in tropical regions. This may be the reason for minimal environmental impact downstream and enhancement of the ecosystem upstream.

- The region's environmental condition before Merowe Dam is no better than post-dam. In addition, the environment and circumstance are different from most dams in the world. The Merowe Dam has long been anticipated with high expectation. This makes it different, as the majority of communities despite knowing it may cause political tension and environmental impacts has welcomed it.

This study of Merowe Dam's political and environmental influence in the northern states of Sudan has revealed that citizens are well aware of some of the environmental benefits the dam has brought to them. Nevertheless, there is a segment of communities still dissatisfied with political aspects, especially the compensation and consultation processes and the way in which the government dealt with them. The analysis of previous Chapters 5,6 and 7 leads to the formation of Chapter 8 which provides a synthesis of the results, summary of findings, conclusions and policy implications.

# Chapter 8 Discussion and Conclusions: summary of findings and policy implications

## 8.1 Introduction

This chapter summarises the key findings of this thesis. The main aim of this research was to assess economic, social, political and environmental issues related to mega-projects in developing economies through a case study of Merowe Dam in Sudan.

Various methodologies were used in data collection and analysis to address the aim and specific objectives of this research. These include elements of quantitative and qualitative methods and various research tools, such as survey questionnaires, semi-structured interviews, participant observations and secondary sources. A combination of analytical methods was used to obtain reliable and credible results. Statistical software SPSS V-24 was used to analyse descriptive and inferential statistics and to test associations among various socioeconomic attributes and responses. A contextual analysis of the materials obtained from interviews, observations and secondary resource documents was conducted. To better understand the 'why' questions, an examination of the qualitative aspects of the research provided depth and breadth of information on intangible issues such as feelings, expressions and underlying contexts.

Section 8.2 summarises key findings of the research organised under three key research objectives: the economic contribution of Merowe Dam, its social influence on the communities and the region, and the political and environmental issues surrounding the construction and operation of the dam. Section 8.3 presents broader

implications of the results for socioeconomic and human development stemming from the detailed case study of Merowe Dam. Building on this discussion, Sections 8.4 and 8.5 propose policy suggestions for decision makers and other relevant stakeholders and highlight key contributions made by this thesis to existing literature and wider debates surrounding large-scale infrastructure, such as mega-dams and development. Section 8.6 recommends areas for further research.

## 8.2 Synthesis of results

Based on four hypotheses developed in this research, it is unrealistic to portray mega-projects, particularly dams, as economically unviable, socially and environmentally destructive and mainly driven by political motives (Varma, 2003). However, by acknowledging the heterogeneity of mega-dams, a consensus-based argument would suggest that dams can be both beneficial and detrimental beyond the four hypotheses outlined in Chapter 1. The following discussion is based on Merowe Dam case study findings in order to build an understanding of the influence of mega-dams on socioeconomic and human development in developing economies. There are differences in positive and negative impacts that dams exert in developing countries, including economic, social, political and environmental aspects. This discussion presents the distinctive nature of Merowe Dam, as well as its similarities with other mega-dams in developing countries. The following sub-sections synthesise key results of the economic, social, political and environmental issues examined in details in Chapters 5, 6 and 7, respectively.

### 8.2.1 The Merowe Dam's economic contributions to local communities

By focusing on Merowe Dam's economic contributions in rural Merowe in northern Sudan, this thesis explains the extent to which the dam has improved local

communities and the regional economy. The economic contribution of Merowe Dam in the region is embedded in the overarching socioeconomic transformation of the region (see Chapter 5).

The analysis highlighted the influence that the Merowe Dam has reached into everyday life in the region and has changed the economic landscape of many Merowian citizens. This study revealed how Merowian respondents identified potential opportunities and noticed wide-ranging changes with regard to how Merowe Dam has improved both farming-economic and non-farming economic factors associated with infrastructure development and service provision. Some of the main findings emerged from the analysis, reported in detail in Chapter 5, are:

- Electricity produced by Merowe Dam is both the main outcome and a main driver for economic and socioeconomic development in the region and the country as a whole. Electricity has had a profound impact in improving the local economy and has positively contributed in many areas of the lives of communities, including those displaced by the dam. There are strong beliefs among participants that electricity has played an important role in supporting some industrial and agricultural development locally and nationally, although many suggest the cost of producing and obtaining electricity has a very high social cost in the form of displacement of people.
- The dam made electricity accessible for domestic use, where it was either limited or non-existent in the region previously. This effect suggests that the electricity supply has positively impacted economic, social and commercial structures in the region despite the high cost of obtaining electrical services. Electricity adoption was influenced by availability as well as socioeconomic status, and almost every household in the region now has access to electricity. Electricity is used frequently in many aspects of daily life, especially in the downstream and relocated communities. This technology is a new phenomenon for these communities.
- Electricity and infrastructure have provided an essential and much-needed instrument for economic development in the region and revealed the positive impacts that large-scale infrastructure has had on remote Merowe areas, which are deemed less important commercially in the past. The infrastructures and services that DIU implemented, such as roads, bridges, airports, communication networks, educational and health facilities, provide important means of achieving economic success and unlock access to national and international markets. They have attracted skills, trade, and people from all over Sudan.

- The Merowe Dam and its complementary projects have provided great potential for socioeconomic change and economic improvement for both down- and upstream communities. The findings suggest that people who live in downstream areas have benefited equal to or more than upstream people. Infrastructure improvements have positively influenced tourism development in the region by connecting the rest of the country with its historic sites.
- The findings suggests that both electricity and infrastructure have had a significant influence on farming and non-farming economies supporting the improvement of economic and socioeconomic development in the region. By supporting the movement of goods in and out of the region, the use of technology and electricity in agriculture, and increased market access locally and across of Sudan (e.g. providing produce and fish to Khartoum).
- With improved communication networks, businesses such as services, transportation and trades are thriving. Electricity and infrastructure have positively influenced food production, trade, small business and skill-based workshops for tradesmen. These benefits supported employment and increased incomes for local and resettled communities. Electricity and infrastructure were identified as main factors for positive socioeconomic changes in the region.
- Infrastructure and electricity have reduced emigration and increased immigration to the region, which has increased economic output. Perhaps due to the delay in electrifying the irrigation system, which led to a lack of water for irrigation at resettlement areas, the positive impact of electricity generation on some farming communities and commercial agriculture schemes have been weaker than expected. However, there is strong evidence of a link between infrastructure, electricity and increased land size with greater agricultural output, food production and income in the region.

### 8.2.2 The social influence of Merowe Dam at community level

The social influence of Merowe Dam in rural Merowe is embedded in frequently perceived global concerns over the negative impacts of dams on host communities (Ersumer, 1999a). However, this thesis has explained the extent to which Merowe Dam has improved or damaged social aspects of the local communities. It found that social influence is embedded within the economic input of Merowe Dam in the region, which interlinked with the overall socioeconomic changes that occurred in the region (see Chapter 6). This research indicates that, without links to advanced infrastructure and services, accomplishment of social improvements may not have been possible in rural Merowe communities. The study revealed that locals viewed Merowe Dam as a

powerful new opportunity to overcome the disadvantages and stagnation in social progress caused by isolation of the region. This finding shows the implications of the relationship between development and remote location on everyday life in the Merowe region. This research reveals that Merowe Dam's positive social influence outweighs negative ones in the region. The key findings emerging from the analysis presented in Chapter 6 are:

- Opinions about Merowe Dam are diverse, but the majority of communities have positive perceptions despite displacement. The negativity is mainly caused by the government's unwillingness to adequately address the underlining displacement issues. The politicisation and authoritarian management of Merowe Dam have influenced consultation and compensation processes, which has led to the limited participation of local communities in decision-making and increased negative sentiments about building the dam. However, these sentiments did not affect the fact that the communities have welcomed and favoured the dam due to anticipation of its positive economic contributions in the region.
- Displacement and resettlement processes have caused serious social conflicts between stakeholders. The severity and impact of these on stakeholders' relationships are different between location and period. These conflicts have cast doubt on the success of Merowe Dam because of high political tension between local communities and the government. This tension led to strained relationships and distrust between the government and local communities at all three districts. With the Manasir resettlement dispute ongoing, it might be interpreted that the social benefits of the dam appear to be limited. The findings reveal that most Merowian communities have managed to reconcile.
- The findings reveal that resettlement areas and the wider Merowe region benefit from electricity, education, access to technology, health facilities, services, infrastructure and communication. This finding supports social improvements in the region through strengthened communities and increased immigration, diversifying region's social fabric. The level of satisfaction with the new settlements provides further evidence of success with respect to social context. Despite the unresolved resettlement dispute of the Manasir communities, the project has changed the region from being a group of traditional, disparate villages to united, vibrant towns with huge socioeconomic potential.

### 8.2.3 Political and environmental issues surrounding Merowe Dam

Following the new discourse on political and environmental issues related to mega-dams (Akyürek (2005), Bakken (2013), Varma (2003) and Agrawala *et al*. (2003), this thesis has explained the involvement of politics in Merowe Dam processes and its

influence on the environment. It focused on how the dam influenced the environment and how politics influenced the process. The study indicates that the Sudanese political landscape influenced the decision to construct Merowe Dam. Consequently, the environment of up- and downstream areas were less impacted by the dam's construction (see Chapter 7). The political engagement of local and regional stakeholders in assessment, consultation and compensation has only been superficial, to hasten the construction of Merowe Dam. The key findings that emerged from the analysis in Chapter 7 are:

- A clear explanation of the role of global, national and local political interests in mega-dam construction, especially politicisation by both citizens and politicians as part of political campaigning was observed. Politics is mainly about development in Sudan, where its citizen expect implementation of noticeable development projects in their communities and the country. Politicians pursued legitimacy to govern any developing country by outlining their visions and intentions, including building mega-dams as election strategies. The criticism by Western countries and environmental NGOs of Chinese investment in developing economies' infrastructure dominates international geopolitical debates on mega-dams. Chinese and Arabic investment led to the establishment of the Dams Implementation Unit as part of a political involvement in development project in post-2000 Sudan. The relationship with China and financial input from Asia is a vital part of highly visible projects, particularly in northern Sudan, to influence the 2010 election. China's involvement was the Sudanese government's economic development idea after the separation of South Sudan: building a new economic power within northern Sudan. This connection indicates that the Sudanese government is dependent on Chinese financial and political backing for its continuation, especially at this time of international sanctions and isolation.
- Accessing information during consultation, especially the negative impact of Merowe Dam on the environmental, social processes and interaction with decision-makers, was challenging. Only a selected few experts had the privilege of accessing the plans and the entire process of the mega-dam project was surrounded by secrecy. This process revealed the extent of deficiency and limitation in stakeholders' participation, which indicates the conditions of mega-dams delivery in developing economies, especially in countries with authoritarian regimes and delivery agencies controlled by the elite.
- Analysing debates surrounding Merowe Dam has revealed that each involved group was motivated by specific objectives including the NGOs thereby challenging the notion that environmental NGOs are impartial parties who protect the interests of disregarded and powerless communities. This research has shown that tensions exist between international western environmental NGOs and developing countries due to variation in the significance and understanding of

development needs, environmental problems, resources, access and sovereignty issues. Consequently, some NGOs cannot claim to represent economic, environmental, social worries and interests of weak local communities because their conservation and protection activities are rhetorical.

- The topography and climate of the Merowe region have played an important role in reducing Merowe Dam's environmental impact and the possibility of improving the environment if the water made available is used wisely. In some aspects of ecosystems, the findings have contradicted the literature, especially ecologically with regard to both flora and fauna. There is a paradox of attitudes among participants about the importance of the environment and ecosystem in the region. Physical health issue are the main concern of local communities, which indicates a different perspective of the environment and environmental knowledge in Merowe region and the country as whole. There is a weak association between the Merowe Dam and waterborne diseases, especially in the driest region, but Merowe Dam has indirectly negatively influenced the physical and mental health of communities because of displacement. Further adverse health impacts have been reduced by the improvement and availability of health facilities in the region.

### 8.4 The broader implication of the Merowe Dam case study

Previous research has revealed that mega-projects have become increasingly important, especially in developing economies. This growth in significance is due to rapid changes in initiatives in local, national and international contexts, which may affect developing economies (Agrawala *et al.*, 2003; Ersumer, 1999a; Flyvbjerg, 2009; Kim, 2006; McCully, 2001b; Pearce, 1992; Scudder, 2012; Singh, 1997; Varma, 2003). Studies analysing mega-dams have predominantly focused on economic parameters of mega-projects and used quantitative methods, substituting human agency with less emphasis on the wider context and stakeholder interactions (Ansar *et al.*, 2014; Flyvbjerg, Bruzelius & Rothengatter, 2003; Flyvbjerg, Garbuio & Lovallo, 2009; Scudder, 2012). Few attempts have been made by academics, such as Ersumer (1999), Varma (1999, 2003) and Agrawala *et al.* (2003), to study the wider impact of dams using qualitative methods based on contextual studies. To assess Merowe Dam's contribution to economic development, it was necessary to consider fundamental economic, social, political and environmental elements that underpin

socioeconomic and human development in Sudan. As noted throughout this thesis, Merowe Dam represents a typical dam's relationship with economic growth in developing economies (Flyvbjerg, Garbuio & Lovallo, 2009; Varma, 2003). Under Sudan's centralised political system and dominant top-down rural development approach (Verhoeven, 2011; Wallach, 1988), the Merowe region is a window of rural regions in developing economies. Based on Merowe Dam case study, the findings can be generalised for other developing economies sharing similar characteristics. This comparability is because the Merowe Dam and its development issues are positioned within the broader context of development debates surrounding mega-dams in developing economies. This research argues that governments in developing economies seek to improve and modernise their societies and economies by providing electricity for socioeconomic and human development. It is impossible to understand Merowe Dam's contribution to socioeconomic and human development without considering the historical context of the region, its economy, political, social, environmental contexts and long-term contributions that the dam can make. These are some of the questions this research aimed to answer. This research has argued that many previous studies have overlooked some aspects in their research, which were covered in this thesis as mentioned above.

The Merowe Dam is unique in many aspects, but also similar to other dams in developing countries. To understand how unique Merowe Dam is, a comparison of the economic and social condition of the region during its post-dam period must be assessed for a clear understanding of the impacts. The region was isolated and without infrastructure or services. According to Haberlah (2012), this hostile desert region included over 100 fragmented villages in the riverbank and isolated islands

without modern transportation or communication or even much vegetation except some by the riverbanks (see Chapter 4). The communities were mainly self-sufficient, farming vegetables and crops on strips of fertile land by the riverbank (Barbour, 1966). The socioeconomic transformation in the region is impressive. Currently, as the findings indicate, the region has benefited from the Merowe Dam and its accompanying projects, especially through provision of essential services such as healthcare, education, marketplaces, transportation and electricity (see Chapters 5 and 6). Based on this case study of Merowe Dam, it might be concluded that dams arguably provide huge benefits to regions and countries if accompanied with social and economic supplementary projects. However, this finding is only applicable to mega-dams in dry regions and may not be relevant to other types of mega-projects in developing economies.

There were already shifts in development in Sudan, especially in services like education and health (McDonald, Bosshard & Brewer, 2009; Verhoeven, 2011). However, these were concentrated in the urban centres, such as Khartoum and Wadmadani. This urban bias is common in developing economies. However, when compared with other rural regions similar to Merowe, such as the Blue Nile region of Sudan, there is a marked difference in all aspects of life: services, electricity, education, health and socioeconomic improvements for citizens. This situation could also be a result of the political situation, which played an important role in distributing development projects across Sudan. Arguably, without Merowe Dam and its accompanying projects, such economic and social improvement would not have been possible given the economic stagnation and shortage of development funds in Sudan (see Chapters 5 and 6). This regional economic improvement is the case in

Turkey, India and other developing economies. Ersumer (1999), Varma (1999; 2003) suggested that dams contribute to socioeconomic development regionally and nationally. The Merowe Dam has provided a unique perspective on the contribution of regional development strategies in developing economies, especially in dry desert regions.

Some argue that the social and environmental costs of obtaining such socioeconomic developments outweigh the benefits (Flyvbjerg 2009, Ansar *et al.* 2014 and Scudder 2012; McCully 2001). However, the methods used to study Merowe Dam and the findings are similar to other research conducted in India Turkey, Brazil, and China, which refute the above argument (Ersumer 1999; Pearce 1992; Schultz 2002 Shirley 2015; Varma 2003; Agrawala *et al.* 2003; Alexander 2015).

Comparing the findings of this research with the wider debates in the critical literature on mega-dams in developing countries challenges the rhetoric that dams have insignificant social and economic contributions. This research suggests that Merowe Dam has equipped the region with the necessary means for economic growth and social improvement, such as services, electricity and infrastructure, which support both agricultural and non-agricultural economic development. These factors have collectively improved socioeconomic development and living conditions in the region (see Chapter 5 and 6). However, Merowe Dam process was flawed in dealing with social elements such as displacement, consultation and compensation. In addition, the process lacked appropriate environmental assessments. These factors are driven by political influence, which led to lack of transparency, participation, openness and accountability in the process. This process is in contrast to the western approach of

conducting such projects, where the process offers transparency, participation and accountability throughout. This lack of consultation does not override Merowe Dam's economic and social contributions though. This research and other studies provide a platform for developing economies to reflect on mega-dams as a means of electricity generation and water management for irrigation. These are necessary factors for economic and socioeconomic development, especially in arid areas such as the Merowe region, where water management is crucial in the wake of climate change.

It is important to elaborate on the future of Merowe Dam. The dam meant to provide infrastructure and a platform for commercial agriculture with a plan for cutting two canals into the west and east side of the reservoir. With the loss of oil revenue to South Sudan, Sudan's strategic plan for economic development is centred on agriculture. Arab investors are ready to enter and some are already leasing lands and producing different crops. Many participants and interviewees, including officials, in this research have described future plans beyond commercial agriculture schemes. There are also the resettlement agriculture schemes to support the export of farm produce nationally and internationally, especially with the development of Merowe International Airport. To conclude, mega-projects always produce some adverse effects, and Merowe Dam is no exception, but their benefits for developing economies are irreplaceable.

### 8.5 The position of Merowe Dam in current development debates

The position of Merowe Dam in contemporary development debates are many, but two are of particular importance. One is linked to the traditional development approaches in the pursuit of economic growth (see Chapter 2). The second covers alternative development approaches, which are based on the viability, inclusiveness,

participation in decision-making and political dimension, such as bottom-up processes aimed at enhancing participation of local communities in the development process (see Chapter 2).

The findings of this research are commensurate with traditional approaches to development that govern and drive economic growth. The economic and social conditions that Merowe Dam and its accompanying projects created – such as providing water for irrigation, electricity to support industry, services, infrastructure and food to resolve hunger, disease and poverty in the region – suggest a clear alignment with traditional investment led growth theories (Varma, 2003). This investment-led approach can be applied to many developing economies where most of the poorest peoples live and offers provisions for present and future generations by creating a strong socioeconomic foundation of reduced dependence on natural resources due to modernisation of production processes (Toman, 2006; Varma, 2003). The practices surrounding Merowe Dam are consistent with aspects of growth theories such as modernisation, industrialisation, neoliberalism and promotion of the free market, which are mainly intended to increase economic output (Munt, 2009; Todaro, 2015.) (see Chapter 2).

The aims of alternative development approaches (i.e. bottom-up processes and community participation) are not clearly observed in Merowe Dam development (see Chapter 2). However, the high level of acceptance and anticipation of Merowe Dam in the region, including affected communities, indicates some alignment with alternative development approaches. This alternative alignment is despite a lack of local full participation of the local communities and conflicts regarding compensation

and relocation between the authorities and some communities. Therefore, from the human development perspective, which underpinned this research, Merowe Dam is consistent with alternative development approaches applied to achieve some aspects of rural community development (i.e. improvement in services, education, health facilities and living conditions, food production and economic development). In relation to environmental aspects, water management may fulfil this role if used wisely in irrigation and electricity production and may also improve the upstream ecosystem. Consequently, many aspects of the region's environment may improve, but with some negative effects downstream, such as reduced water supply. By ensuring future generations' capacity to meet their own needs, Merowe Dam and its accompanying projects have produced many education and health facilities, better living conditions and infrastructure to sustain future development (Bhalla, 2002; Bryant & Bailey, 1997; Rogers, Jalal & Boyd, 2006). As Rogers *et al.* (2006: 26) suggest, in developed industrialised countries, each generation is better off than the previous generation. This progression suggests that the current development is unlikely to deprive future generations of any opportunities.

The emergence of China as a global player in the development of mega-projects further complicates development approaches and practices, especially related to investments in dams in developing economies. For example, the 'Belt and Road' initiative – which connects China to 70 countries across Asia, Africa, Europe and Oceania through infrastructure, transportation, and energy mega-projects – suggests a shift towards a new development paradigm (Liu & Dunford, 2016; Swaine, 2015). A new approach is required to position mega-dams within development theories, especially with the current shift in environmental and funding politics. Conditions for

dam development have changed because of changes in geopolitical and environmental policies even within western countries' funding organisations (e.g. the World Bank). This changing geopolitical context suggests the likelihood of both traditional and alternative development approaches to witness a new theoretical shift in order to accommodate mega-projects in the broader context of development.

### 8.6 Policy implications

This research highlights three policy suggestions to address the adverse consequences discussed in relation to Sudan's economic development policy:

- Long-term monitoring of resettlement impacts and improvements needs to be established. This action could influence the planning and implementation of resettlement programmes effectively and mitigate negative impacts. As Scudder (2005) highlighted, with resettlements in developing economies, dams failed due to a lack of long-term support and treated as a one-off activity instead of continuous process. Long-term monitoring of resettlements would be a significant policy shift in supporting displaced people, their socioeconomic development and wellbeing.

- Environmental impact assessments in the region, particularly at the resettlement, are very weak. The issues of unclean drinking water and the concentration of flies around the new settlement have caused the spread of waterborne diseases due to a lack of comprehensive post-resettlement environmental assessment. This research recommends a policy of environmental assessment to be conducted in stages at the resettlement pre- and post-dam construction phases. Linking this to the long-term monitoring of resettlements would safeguard the environment, especially with setting up a specific environment agency for this purpose.

- There was a lack of participation and open consultation at every stage of the construction process. This weakness in the process was due to politicisation and DIU's process of consultation, compensation, resettlement and construction. This research proposes having an independent body to oversee these processes to avoid any political or particular civil society group influence. This measure will positively affect satisfaction, save time and money, reduce social conflicts and bring communities together through inclusivity of all stakeholders. The process of deciding the compensation was overseen by a semi-independent committee, but the implementation was conducted by the DIU, where problems began. It is in the best interest of all parties that both phases be conducted by a fully independent body, including the selection of settlement locations and compensation packages to ensure relocation is completed satisfactorily.

### 8.7 Contribution of this study to the wider development literature

This section proposes some of the key findings emerging from Merowe Dam case study. These may help shape future research agendas surrounding mega-dams. Chapters 5, 6 and 7 highlighted how Merowe Dam and the supplementary projects implemented by DIU have been credited with socioeconomic improvements in remote rural areas, thereby overcoming the negative effects of distance and isolation from core markets, cities and agencies in Sudan. The findings from this study broadly support arguments made in previous studies, which have acknowledged the 'positive' role mega-dams play in rural areas, especially in improving rural services and infrastructure and diminishing distances from markets and services (Agrawala *et al.*, 2003; Bank, 2004; Ersumer, 1999a; Pearce, 1992; Schultz, 2002; Varma, 1999; Varma, 2003).

This study has shown that mega-dams are undoubtedly important tools to harness socioeconomic and human development, especially in rural areas, by providing electricity and water for irrigation and better housing conditions for displaced communities. This research recommends a more focused debate among academics and practitioners on the localisation and contextualisation of resettlements, moving away from the standardisation and internationalisation of settlements. Slow progress on this debate does nothing to support the problem of millions affected by mega-dams. This recommendation is supported by residents of Merowe Dam's resettled communities related to the level of satisfaction with the use of local materials, which is a design that reflects their culture and a living environment they are familiar with.

While many studies suggests mega-dams have huge negative environmental impacts, this study showed that Merowe Dam had minimal environmental impacts and might even have improved biodiversity upstream due to water availability. As

Agrawala *et al.* (2003) and Varma (2003) suggest, dams may have some positive environmental impacts. This research went further to suggest that dams, especially in arid and desert areas, may have many positive benefits on the environment through critical water management, which led to enriched biomass, biodiversity and forestation at reservoir areas. This case study of Merowe Dam suggests that treating each dam as a case in its own right, examining the wider context using many indicators, and taking into account political, social, economic, and cultural contexts will provides better outcomes for studies made on mega-dam impacts.

### 8.8 Further research directions

As highlighted by this thesis, electricity and irrigation are not the only economic developments that mega-dams support. They also support complete social and economic systems, specifically improved socioeconomic human developments in the northern Sudan region. This broad impact leaves many topics for future in-depth research agendas. For instance, an in-depth political ecology to study the roles of the state, environment and society in Merowe Dam. There are more concrete processes that the state and its agencies of political power influenced during the construction phase, which are still unknown. Therefore, a future research agenda in this field might be four-fold:

- In-depth political ecology studies may provide sufficient details on political, economic, cultural and environmental influences at the level of communities.
- A study of Merowe Dam as the cause of environmental degradation or a new phenomenon that can enrich biodiversity in an arid region.
- Investigating the relationship between environment and livelihood diversification due to environmental changes that Merowe Dam exerted in the region.
- Investigation of Merowe Dam's ecological impacts downstream and upstream.

# 9. Appendices

## 9.1 Appendix A: Households Questionnaire Survey

Assessing mega-dam economic contribution and social, political and environmental issues in development context.

**Introduction**

The purpose of this questionnaire is to solicit your opinion and perception about large dams and their role in the development of a nation, particularly Sudan. This will be looked at within the context of the Merowe Dam project. This interview into large dams is part of research towards a Doctor of Philosophy Degree at the University of Plymouth UK. I therefore thank you for sparing some of your time to discuss this topic with me.

**Basic background information**

Participant ID: ----------

**Q1-** Name of Village / Community / Settlements: ----------

| | | | |
|---|---|---|---|
| **Q2-** Age of participant | | | |
| **Q3-** Gender | Male | | |
| | Female | | |
| **Q4-** Level of education | | | |
| **Q5-** Number of household members (including children) | | Male | |
| | | Female | |

| | | |
|---|---|---|
| **Q6-** What type of farming do you do? (please order in terms of importance) | Date palm trees | |
| | Vegetables | |
| | Arable crops | |
| | Livestock | |
| | Others (If others, please specify) ---------- | |

**Merowe Dam**

**Q8-** How do you feel about the presence of the dam? ----------
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| | | | |
|---|---|---|---|
| **Q7-** What proportion of your total income is derived from these sources (please provide percentage values) | Farming | | **%** |
| | Fishing | | **%** |
| | Trading/ Selling | | **%** |
| | Others (If others, please specify) ---------- | | **%** |

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**Q9-** What do you think are the main purposes of Merowe Dam? ----------
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---

| Rate the following indicators (1-5) based on observed influence to you since the construction of Merowe Dam (1 is Strongly disagree, 2 Disagree 3 Neutral, 4 Agree and 5 Strongly agree) | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
|---|---|---|---|---|---|
| **Q10- Economic** | | | | | |
| a. Irrigation of agriculture | 1 | 2 | 3 | 4 | 5 |
| b. Industrial development in the region | 1 | 2 | 3 | 4 | 5 |
| c. Employment generation | 1 | 2 | 3 | 4 | 5 |
| d. Infrastructure (e.g. bridges, roads, hospital, schools) | 1 | 2 | 3 | 4 | 5 |
| e. Access to electricity | 1 | 2 | 3 | 4 | 5 |
| f. Communication network (e.g. telephone, internet) | 1 | 2 | 3 | 4 | 5 |
| g. Transportation across the region (e.g. travel) | 1 | 2 | 3 | 4 | 5 |
| h. Sources of income (e.g. market and working places) | 1 | 2 | 3 | 4 | 5 |
| i. Cost of electricity | 1 | 2 | 3 | 4 | 5 |
| j. Price of assets (e.g. business, land, stocks) | 1 | 2 | 3 | 4 | 5 |
| **Q11- Economic (farming)** | | | | | |
| a. Types of farm production | 1 | 2 | 3 | 4 | 5 |
| b. Volume of farm production | 1 | 2 | 3 | 4 | 5 |
| c. Grazing area for animals | 1 | 2 | 3 | 4 | 5 |
| d. Land size | 1 | 2 | 3 | 4 | 5 |
| e. Quality of the soil | 1 | 2 | 3 | 4 | 5 |
| f. Cost of irrigation | 1 | 2 | 3 | 4 | 5 |
| g. Price of farm products (e. g. date, vegetables) | 1 | 2 | 3 | 4 | 5 |
| **Q12- Social** | | | | | |
| a. Home space and structure | 1 | 2 | 3 | 4 | 5 |
| b. Family ties and social relations | 1 | 2 | 3 | 4 | 5 |
| c. Community coherence | 1 | 2 | 3 | 4 | 5 |
| d. Social status | 1 | 2 | 3 | 4 | 5 |
| e. Farm land as measure of wealth and pride (e.g. date trees) | 1 | 2 | 3 | 4 | 5 |
| f. Archaeological and historical sites | 1 | 2 | 3 | 4 | 5 |
| g. Feeling of belonging to the place | 1 | 2 | 3 | 4 | 5 |
| h. Mental health | 1 | 2 | 3 | 4 | 5 |
| i. Personal Health | 1 | 2 | 3 | 4 | 5 |
| j. Self-esteem | 1 | 2 | 3 | 4 | 5 |
| k. Children schooling | 1 | 2 | 3 | 4 | 5 |
| l. Quality of life (work, schools water, electricity, etc.) | 1 | 2 | 3 | 4 | 5 |
| **Q13- Environment** | | | | | |
| a. Spread of Waterborne diseases(e.g. bilharzias) | 1 | 2 | 3 | 4 | 5 |
| b. Habitats communities along the river bank | 1 | 2 | 3 | 4 | 5 |
| c. Wildlife, | 1 | 2 | 3 | 4 | 5 |
| d. Forests | 1 | 2 | 3 | 4 | 5 |
| e. Water Logging | 1 | 2 | 3 | 4 | 5 |
| f. Salinisation | 1 | 2 | 3 | 4 | 5 |
| g. Erosion (wearing of soil, dirt, rock by water force) | 1 | 2 | 3 | 4 | 5 |
| h. Sedimentation | 1 | 2 | 3 | 4 | 5 |
| i. Water supply | 1 | 2 | 3 | 4 | 5 |
| j. Water flow | 1 | 2 | 3 | 4 | 5 |
| k. Distance to the river bank | 1 | 2 | 3 | 4 | 5 |
| l. Flooding | 1 | 2 | 3 | 4 | 5 |

**Q14-** Please can you rank up to three the most important benefits of Merowe Dam to you? ----------
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**Q15-** Please can you rank up to three the most important three benefits of Merowe Dam to your community?
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**Q16-** What contributions do you think Merowe Dam has made to the development of the region since its construction? ----------
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**Q17-** Have economic matters, identified above in question 10 and 11 have been addressed? ----------
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**Q18-** Do you think the perceived social issues identified in question 12 above have been addressed. ---------
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**Q19-** Has environmental issues identified in question 13 above been addressed? ----------
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---
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**Downstream**

**Q20-** Since building of the dam has your land area changed in size.

☐ Yes ☐ No

| **Q21-** How much land do you have (feddan)---------- | | **(a)**Irrigated | Rain-fed | **(b)** What was your land size before the dam? | **(c)**How much extra land do you irrigate after building Merowe Dam? | |
|---|---|---|---|---|---|---|
| | | | | | Before | After |
| Own | | | | | | |
| Rent | | | | | | |

**Q22-** How the change in water regime affect you farm production? ----------
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---

**Q23-** Is there an increased in the cost of irrigation because of the dam?----------
---

**Q24-** Has the change in land size affected your income? ☐ Yes ☐ No

**Q25-** To what extent if yes has, the dam (elaborate in percentages) affected the level of your income?----------
---

**Upper-Stream**

**Q26-** Please explain why you are still living here by the reservoir?----------
---

---

**Q27-** Have you received compensation for properties lost ((e.g. properties, houses, land, agriculture and agricultural products (palm and fruits and livestock)? ----------
---
---

**Q28-** How much did you receive? ----------

**Q29-** Were you satisfied with the compensation you received? ----------
---
---

**Q30-** Were you been given any other form of support in addition to financial (e.g. counselling, mental therapy)? ☐ Yes ☐ No

**Q31-** Can you specify the nature of the support you received? ----------
---
---

**Q32-** Which organisation(s) or institution(s) where involved in supporting you? ----------
---
---

**Q33-** In your opinion was there a lack of support? ----------
---

**Q34-** If yes could please explain why there was a lack of support? ----------
---
---

**Q35-** To what extent are you satisfied with new settlement compared to your old place? ----------
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---

**Q36-** Does the new location have adequate services such as (select all relevant option)?

☐ Health facilities ☐ Electricity ☐ Schools

☐ Leisure centre ☐ Water ☐ Urban Centre (market and work place)

**Q37-** What is your assessment of the resettlement location as compared to your old place in terms of facilities (e.g. health, schools water, electricity)? ----------

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**Q38-** To what degree has the distance changed between the new farm and your home compared to how it was before the dam, (please explain in kilometres)? ----------
---
---

**Q39-** How has the change in distance affected your life? ----------
---
---

**Q40-** Has building the dam caused any conflict of land right in the old settlement alongside claims in the new settlement? ☐ Yes ☐ No

**Q41-** If yes, how serious is the conflict? ----------
---
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**Q42-** In your opinion has building the dam caused any social conflict amongst communities (please explain)?
---
---
---

**Q43-** How about your relation with friends and relatives at old community? ----------
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---
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**Q44-** Do you know any household in your village/community have left the area completely because of the dam? ----------
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**Q45-** Have you or a member of your family been ill because of waterborne disease caused by building of the dam? ☐ Yes ☐ No

| **Q46-**If yes, what kind of common diseases do you or your household suffer from | | | **(a)** the frequencies | **(b)** What do you think are the main reasons? |
|---|---|---|---|---|
| | Before 2004 | After 2004 | | |
| Malaria | | | | |
| Cholera | | | | |
| Bilharzias | | | | |
| Typhoid | | | | |
| Chest problems | | | | |
| Other | | | | |

**Q47-** In your opinion have you received a fair share of the economic benefits of the dam (please explain)?-
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**Q48-** How about your community have they received a fair share of the economic benefits of the dam (please explain)?---
---
---

**Q49-** Was there a period of consultation with you before the construction of Merowe Dam?

☐ Yes ☐ No

**Q50-** If your answer is yes, what was the nature of the consultation? ---
---
---

**Q51-** What do you think about the duration of consultation? ---
---
---

**Q52-** Was the consultation process (if any) open (please explain)? ---
---
---
---

**Q53-** Was the consultation process (if any) involve everyone in your community (please explain)? ---
---
---
---

**Q54-**In your opinion was Merowe Dam project a result of consensus of local/regional stakeholders? ---
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**Q55-** What do you think of the on-going opposition from many of (Hamadab, Amri and Manasir communities) against Merowe Dam? ---
---
---

**Q56-** Who do you think are the key decision makers in Merowe Dam development? ---
---
---

**Q57-** What role do you think political influences play in the decision to build Merowe Dam? ---
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**Q58-** Do you think there could have been alternatives to building Merowe Dam?

☐ Yes ☐ No

**Q59-** If yes, can you give examples? ----------
---
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**Q60-** Finally, what is your opinion on the overall building of Merowe Dam? ----------
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Thank you for taking some of your time to answer the questions. Please feel free to add any comments that you may have.

## 9.2 Appendix B: Ethical Approval Letter


27 February 2017

**CONFIDENTIAL**

Al-Noor Abdullah

School of Geography, Earth and Environmental Sciences

Dear Al-Noor

***Ethical Approval Application***

Thank you for submitting your ethical approval form and details concerning your project:

***Assessing Economic, Social, Political and Environmental Issues related to Mega-projects in Developing Economies: Case Study of Merowe Dam: Sudan***

I am pleased to inform you that this has been approved subject to the following conditions:

 Section 4.3

"…subjects will be identified randomly…"
This may not be truly random, but an alternative method (possibly more likely to be recruiting on a transverse or a network path).
If it is truly random, explain how randomisation will be achieved. Otherwise, remove this and explain how it will be done. If done through third parties, institutions, school teachers, leaders, authorities or officers, explain this.

 *5.4, 5.5 On Consent form and on Information Sheet*

*"….*The details of the person being interviewed will be kept confidential and only institutions referred to where necessary…."
Presumably, this includes some of the personal data (i.e. details about family health, payments, etc.)… this is not necessarily about the interviewee, but also require confidentiality. Explanations on section 5.7 are acceptable; please reflect this on the information document. Faculty of Science and Engineering

**T +**44 (0) 1752 584 584 Mrs Jayne Brenen Plymouth University **F +**44 (0) 1752 584 540 Head of Faculty Operations Drake Circus **W** www.plymouth.ac.uk PL4 8AA

Use similar lines of information on the information sheet and on top of the survey, for example on the information sheet, it is not clear that you are a student working towards a doctorate.
There is no contact information in case anyone wants to find out about this or wanted to raise concerns. An e-mail address should be included, and contact details could be offered on a card if required. Ideally, an information sheet would be available to complement verbal communication.
Suggestions:

A script for the interviewer with checkpoints once each relevant part has been relayed will be required. This could be done for explicit verbal consent.

I would be grateful if you could send me your amended application for my records.

Kind regards
Paula Simson
Secretary to Faculty Research Ethics Committee

Cc. Dr Sanzidur Rahman

Prof Geoff Wilson

## 9.3 Appendix C: Semi-structured interview

Assessing mega-dam economic, political contribution and social and environmental problems in development context.

**Introduction**
Explain who I am, my department, and my research.
Explain why I am doing the research – take no sides, merely investigating.
What I hope to achieve, how and why.
Give copy of information for participants' sheet.

**Ethics**
Explain why recording & making notes, request permission to record, explain option to stop recording/say no, etc at any time. Reassure re privacy and confidentiality. Request signature on consent form. Leave copy of info for interviewees sheet with participant. Sheet includes contact details should they wish to contact me.

**Section 1**
1. Name of Interviewee: ----------
2. Title: ----------
3. Gender: ----------
4. Position: ----------.
5. Name of Organisation ----------

| Main Questions | Additional Steering Questions | Clarification Questions |
|---|---|---|

**Section 2 Development**
**1-What comes to your mind when the word development is mentioned?**
**2-What is your view on mega-project as mean of achieving development of a country?**
**3-What do you make of dams' role as development strategy tool?**
**4-How important is the Merowe Dam to the development of Sudan?**
**5-Do you think the construction of Merowe Dam was necessary?**
**6-In your opinion what is the purpose of build Merowe Dam?**

**Section 3 Economic**
**1-In your opinion did Merowe Dam made a significant economic contribution locally and nationally?**

- In your opinion what are the main economic contribution of the dam for the communities?
- How do you think the communities are benefiting from it?
- In your opinion what change has the dam brought to socioeconomic status of communities?
- Do you see any unforeseen economic cost for the dam?

**2-How do you view its impact on irrigation agriculture in supporting economic growth?**

- In your opinion, does building of Merowe Dam increase food production in the region?
- Can you explain irrigation scheme set by the authority?
- Is it working for the benefit of the communities?
- Is there any change in products prices?
- How about the income of the communities?

**3-Does the building of the dam help in any way in creating employment opportunities in the region?**

- Can you explain in numbers and sectors?
- What type of jobs it brings to the communities?
- Are these jobs relate to the dam or other sectors?

**4-From my understanding of industrial development is one of the key objectives of Merowe Dam. In your opinion has this objective been achieved?**

- What type of industry was developed?
- Where these industries built?
- Has the dam helped communities to have access to jobs within these industries?

**5- Do you think Merowe dam has provided long-term energy security?**

- How do you see communities accessing electricity?
- Is the electricity affordable to people in the region?
- Do you think local communities have benefited from electricity generated by the dam?
- What impact electricity has on the people life?
- Are there any changes in the price of electricity?

**Section 4 Social**

**1-How do you think displacement and resettlement affected the communities?**

- What are the most important social aspect that affected by the displacement?
- To what extent you think displaced people been supported by the government?
- Was there any conflict between communities as result of displacement and settlement?
- What is your view on the new settlements?
- Was it adequate in term of facilities and services?
- In comparison to the old settlement and new settlement, which one is better?
- Could displacement have been avoided?
- Do you see any social benefit of the dam for the communities?

**2- Does Merowe Dam cause restriction to resource access or any land disputes?**

- What about the land right in new and old settlement?
- Was there any plan for people to access their old land?
- Are there any tribal disputes on land or territories?

**3- Has there been at any time health concern during the dam life cycle?**

- In your opinion what are the main area of health concerns?
- Is here any illness detected?
- What is the cause of the illness?

**4- Do you think the dam has impact on the rural community fabric?**

- In which way do you think it has impacted communities the most?
- Has the dam divided families because of displacement and relocation?
- How this impact communities' relation?

**5-In your opinion has Merowe Dam generated any kind of social conflict amongst communities, societies, NGOs and the authorities?**

- What are the reasons behind the conflict?
- How these conflicts affected the relationship between these groups?
- Do you think the issues caused conflicts have been addressed?
- In which way they have been addressed?
- What is your opinion on the demonstration against the dam by many communities?

**Section 5 Political**

**1-In your opinion was building Merowe dam is a result of state political influence?**

- Do you think there is a link between mega-projects and politics?
- Who do you think have high stake in decision making in building the dam?
- Do you think the selection of Merowe area is right?

- Was there any bias in selecting Merowe area

**2- What is your though about funding of Merowe Dam?**

- What is the source the fund?
- How this impact on the control over the dam?
- How do you think the financial sanction against the country impacted the delivery of the project?
- Was there any concession from the government in order to secure the money for project?

**3- For the project to go ahead do you think the government has changed its development politics to suite building dam?**

- For example, is there any change in regional development scheme in the country?
- Was there any movement toward relaxing environmental policies because of the dam?

**4- Was the process of compensation for displaced people fair?**

- How was the process?
- Based on what method the loss properties compensated?
- Do you think displace people were satisfied with compensation?
- What you think should be done differently?
- Do you think the ongoing opposition to the dam mean dissatisfaction?

**5- Was there a consultation process in building Merowe Dam?**

- When the consultation started?
- How long the duration of the consultation?
- In your opinion did the consultation included all affected stakeholders?
- To what extent you think the outcome of the consultation made a different in decision-making.
- Was the consultation open and transparent?

**Section 6 Environmental**

**1-Dams have been controversial when it comes to environment what is your opinion?**

- Do you this dams are only damaging environment?
- How can this assumption change?
- Do you think there is a deliberate intention to demonised dam?
- In the age of growing energy demand do you see dam as solution?
- Can water management project (Adams) play a role in combating climate change?

**2- How Merowe Dam impacts ecosystem both upstream and downstream?**

- What impact the dam has on fisheries
- In your opinion, which side of the dam affected the most?
- Is there difference in type and degree of impacts?
- Is any ecological benefit can be drive from building the dam?

**3- To what extent in your opinion sedimentation issue has become a problem?**

- How do you see the sediment concentration in the reservoirs?
- What impact it may have on irrigation canals?
- How this issue can be resolve?

**4- What are the effects of Merowe Dam on the river system and water supply?**

- Has the dam affect water supply?
- Is there any change in water flow?
- Has the change effects irrigation system downstream?
- Do you see any benefit from the new water regime?
- How the change effect ecosystem downstream?

**5- Dams are associated with waterlogging, what is your view on this perspective?**

- As observer in this field, how you see dam in relation to these issues?

- How salinisation and waterlogging impact the quality of soil?
- Does this problem impacts the level of productivity of the land?
- Is there any way of reducing the impact of salinisation and waterlogging?

**Finally, what do you think of the dam overall?**

## 9.4 Appendix D: Interview Transcript

### Interview 1

Introduction

My Name is Al-Noor Abdullah I am a PhD student, study at Plymouth University this interview is part of my PhD, which is on assessing the economy, social, political and environmental issues relating to a mega project in developing economies. The case study is the Merowe Dam.

The interview will be based on the studies being conducted about environmental impact of the Merowe Dam, before and after construction with an expert in the field and the person who conduct the studies of the area, I am not an expert in the field on environment but trying to get an insight of the environmental impact of the dam.

You are free to withdraw from the interview or abstain from answering any questions, which you feel are irrelevant. Also, you agreed to be interviewed and I passed you the consent forms which you signed, and I have given you an information sheet if you need to contact me for further information.

(Response)

I am an associate professor at the institute of the environmental studies of the University of Khartoum. I used to be part of the directorate of environment and social affairs unit as part of the Dams Implementation Unit which was formerly known as Merowe Dam project Implementation Unit. I joined the dam's implementation unit in the year 2007 but I did not participate in the study of assessing the environmental impact of Merowe Dam. My role with the dam's implementation unit was to go with a group of staff members to go and assess certain environmental, security and safety issues, so I want to stress from the beginning that I did not do the environmental impact assessment study.

Q/ So from what you are saying you are not part of environmental assessment team of Merowe Dam. So, who conducted the environmental assessment of Merowe Dam?

A/ There is an environmental study completed by Lahmeyer International a German Company in 2002.

Q/ What is your overview and what was your role at that time, from your perspective?

A/ My role was an environmental consultant, and therefore if there any issues pertaining to the environment the director of the environmental affairs would consult with me on these issues. Things like for example, the management of the waste, if there were any oil spills in the area, how to manage these oil spills. If there are any for example, if there was any discharge water in the area which might be a suitable environmental or loss of aquatic plants, these are some of the issues we used to go and check. As I said, the German company Lahmeyer were supervising all the work, the contractors were the Chinese, the German company, they are responsible for all environment issues.

Q/ If I may ask regarding dams, it is highly controversial when it comes to the environment, what is your opinion?

A/ Building dams, like any other developmental project they are meant for the benefit of society, they have economic and social benefits, but no doubt, any project will cause adverse impacts on the environment, and dams are no exception. The adverse impacts of dams on the environment you can start with the nature of dams where you build a dam in order to conserve water, and to reserve water for further usage either for electricity or for irrigation, and by that action you are obstructing the natural flow of the river. So, the first impact is the change in the river regime from a running environment into a lake like

environment this will also changes the physical properties of the water the chemical properties and consequently this will be reflected in the biomass. Having built a dam and reservoir is created then definitely you are impounding a large area, you are drowning lands, you are drowning farms, and settlements and these are social and economic adverse impacts on the area. To solve these problems you have to make reasonable plans, the resettling is also an issue because perhaps you are compensating the people there with more land or money, but socially and psychologically these people will suffer because they will be transferred to areas which are alien to them and they perhaps need time to resettle. So, these are some of the environment and social impacts of dams.

Q/ From your perspective as an expert of environment do you think dams are only damaging the environment or otherwise?

A/ Dams may damage the environment but also they can have positive impact. For example, when you create a reservoir this is a very useful and suitable place for fisheries production, so you are creating a source of wealth for the people and for the country at large. Another thing by creating the dam you are providing electricity, this electricity if you compare this with other types of electricity is environmentally friendly because you are not utilising any fuel, petrol and the emittance of the greenhouse gas which is not the case in the building of dam if it is hydro power. So, there are positive impacts for dams, again you can utilise the waters if the dams are built in arid areas or semi dessert areas you can utilise it forestation and shelter, you can improve the environment by using the water stored in the dams.

Q/ Can I ask you about the assumption that dams are always damaging the environment, is there any way this assumption can be changed?

A/ It is difficult, but I think the idea is valid. People can start to rethink, if there is no way for example of avoiding building dams, can we decrease the impact

or adverse environmental impact. If there is a good way and a good challenge, where people come together to try to solve this problem. I think one of the approaches for this, if you talk about dams and the damage they do to the environment, that damage is proportional to the size of the dam, the larger the dam the larger the damage to the environment. So, if we can reduce the size of the dam, and build smaller dams, then this would decrease the damage caused by dams. Also, if you are building a dam in a river, now take the case of Sudan, is part of the River Nile there are many dams built in Sudan. If we go to the sources of the river, at the Ethiopian and Ugandan Equestrian highlands and build large dam there it will service the entire people down stream. In a way you can decrease the number of dams likewise decrease the damage. This is now happening by the building of Renaissance Dam in Ethiopia. This big dam if properly managed, there is no need for more dams in Sudan even the dams, which are already built they would no longer be needed for storing water, because the water would be flowing all the year round because the dam is built for hydropower production. Hydro power production is not consumptive use of the water, if you use and release the water, so this could be a late thinking now, because the dams are already built, but at least now we can reduce the impacts, reduce the area and the lakes, this might make more water and more land available for reuse for agriculture.

Q/ Do you think the idea of building two more dams in North Sudan is feasible or no need for building them?

A/ For me as a scientist there is no need, but for the political decision may be there is a need.

Q/ As a consultant what would be your advice for the politician?

A/ My advice would be is to rely on the Ethiopian dam but this need to be done through some kind of co-ordination between the two countries. If we can guarantee that the flow of water is flowing as needed even the power generated would be shared or sold at reasonable prices to Sudan. I don't

think there is any need for any more dams, Sudan has other huge resources, other resources for power, wind power, solar power and this could fill the gap.

Q/ Are these other resources feasible to be considered as an option?

A/ Yes, these sources are feasible, and studies have been done on them and proven to feasible and achievable.

Q/ From this perspective, do you think the dam is becoming a political tool rather than an economic development tool?

A/ I cannot answer that question, as an expert I would say there was no need, but if the government has any other political reason behind building them, then that is something else.

Q/ Do you think that this assumption or the idea of dams damaging the environment is deliberately spread by environmentalists to stop building dams?

A/ I think this has been done in a limited level through academia and the press, but there is not through the public in general just to stop building dams.

Q/ Not necessarily to the public, but may be to whom involve in dam from expert to academic has been repeatedly portray dams as bad for environment to stop the government from building dams?

A/ I think this has been done on a limited scale with the academia and the press.

Q/ Do you think there is a wide consultation on Merowe Dam negative environmental impact with people and experts?

A/ The people there who might be against building the dam and that is the opinion of the local people and might not be based on scientific background but on political or presumptions. However, if the question is thrown to academia from a scientific point of view they will point to the negative and

positive impact and they will go for decreasing the negative impact rather than avoiding building the dam.

Q/ In your opinion, can dam be used to combat the climate change through water management?

A/ I think as I said earlier the benefit of hydropower production because here you are not using greenhouse gas reducing technology. So, in a way dams are friendly and have no impact on climate change but this should not be taken for granted because during building the dam eventually you are going to  a large area. If that large area is covered with heavy vegetation if you leave it as it is the once the area is impounded and the vegetation is ed then it will decay, and the decay will produce methane, carbon monoxide – greenhouse gases. In one way, you are trying to avoid the production of the gas and now you are producing it.  It is very important that you need to remove all vegetation, so if you remove all the vegetation, then there is no greenhouse production, but if you take bio mass outside and people burn this then you have to balance this, it is delicate situation.

Q/ With the growing energy demand, will the dam be a solution?

A/ Yes, the dam is solution because they contribute to the production and source of power and it is environmentally friendly one way or another.

Q/ How do you think Merowe Dam impacted the ecosystem down and upstream?

A/ Upstream there has been loss of fertile land, as you know it's very limited which tie to the Nile but anyway it has been lost, loss of farm, settlements, livelihoods, these are all negative impacts upstream. However, now this large area that has been impounded might be suitable, where the ground can be recharged, rechargeable ground water might be a positive impact.  If you go down stream, the reduction in flow is an environmental impact. The other thing

is that once the water is kept upstream, it isn't only the water but also the sediment. The sediment is very useful element for people of Sudan, every year it is a natural fertilisation process, so if they are losing this any they may need to use chemicals, a negative impact. The other thing, released to downstream is clean water this can help to erode the banks, the problem of bank erosion an existing problem this would be more serious, this has started. The other thing, the water level would not be enough, because depending on the electricity needed, and that will affect the people who are using the pumps, so if people are alerted and there a coordination way between the people and the dam authority.

Q/ Do you think there any ecological benefits from building Merowe Dam?

A/ Ecologically benefit as I said could be the recharge of the ground water also on a limited scale changes on the microclimate because of huge lack. If the water or the lack is used in the desert area you can increase the green cover around lake, or further down could be positive impact. So, by using a system of irrigation, there are two outlets, canals the eastern and western this hasn't been implemented yet.

Q/ Do you think there is a problem of sedimentation?

A/ I have no idea, but according to the operation of the dam they are taking care of that by opening the lower gates of the dam allowing and sediment, to be flush and flash to pass through. At the same time, we have also to look what is going on upstream, because already other dams upstream have captured some for the sediment such as Sinnar Dam. Furthermore, now the Ethiopian dam will capture most of sediment and this would benefit the Sudanese dams. There would be less sediment and more water storing capacity.

Q/ Do you think the issue of reduction in sediment will impact the agriculture in Sudan all the way from Sinnar to Merowe in term of fertilising the land?

A/ Yes for sure first the flood of one of the most important elements of fertilising the land will no longer be there. Not only the sediment but the water that will cover large areas and the water will be devoid of the high silt, this will have to be supplemented by chemicals.

Q/ You touch a little bit on the water flow. Can you elaborate more on how the new system will affect downstream.

A/ First of all, people downstream will be deprived of the annual flood, or it will be reduced for that many areas will no longer be cultivated like in the past. Also, the water will won't be carrying any silt, and this might reduce the productivity or use chemical fertilise to compensate and this add more cost which will reflect on the prices of crops. Also, the areas near the dam might be eroded by river bank eruption and land could be lost. Also might be a reduction on the ground water because the river has decreased and therefore people might need to dig deeper for the water.

Q/ In relation to water recharge I have been there in Nouri area where the people are telling me that there was too much water in the ground which has impacted on some type of the date palm trees. Do you think water logging or recharge might have negative impact?

A/ You see Merowe dam has not had sufficient environmental study per-construction in my opinion and it should be done by a independent consultant and not by Lahmeyer International because it was the consultant for the Dams Implementation Unit. Even after building the dam there aren't any studies to follow the impact. What you see is an observation by the people and it takes scientific evidence and people should go and do post operation studies in relation to level of water in the ground, moisture around the lack and the impact on the productivity.

Q/ Following my visit to the area people told me the level humidity has increased and they can't sleep. Has this had any relation to the dam changing the microclimate?

A/ It could be if people haven't experienced it before the dam. If so the only change has taken place in the area is building of Merowe Dam so logically can be but it needs to be justified by scientific research.

Q/ It is well known there is no rain in northern Sudan region and now it's raining do you think this change is related to Merowe Dam in term of change in the climate?

A/ I don't think this is so. It reminds me about an incident in Halfa sending letters to the President saying they are witnessing rain which damaging their homes and crops and they said its mainly due to Merowe dam. The later was brought to me through DIU and as environmentalist we wrote a paper indicating that this not the case. Merowe Dam hasn't any impact on the rain in northern Sudan. However, an observation of the wind that carries moisture which comes from south start to go further into northern Sudan and this all related to overall climate change but does not related to Merowe Dam but might have impact the microclimate.

Q/ Do you think having the reservoir might affect the quality of the soil down and upstream in any way?

A/ The dam impact on the soil will be positive and beneficial because of the size of the reservoir will not be constant. It will depends in follow of the water from upstream and the release of water will reduce the reservoir level to allow people to use much fertilised floorplan land for agriculture. There is plan for utilising huge land around the reservoir for irrigation. In downstream the capturing of the silt upstream will reduce the quality of land downstream in the long run this will reduce the productivity of the land and this may lead to further use of chemical fertiliser.

Q/ Is the impact on land quality downstream going to impact livelihood, income, and economy of the people?

A/ Not necessarily negative impact because of the amount of the land that will be irrigated in both sides of the dam. It will be a very big agriculture projects from Dongola to Selaim and this will offsite the side effects of agriculture and fertile land.

Q/ Please can you draw a conclusion on overall environmental outcome of Merowe Dam?

A/ It is a mixed feeling because I think if the government looked at the water management projects in a proper way they not have to build Merowe Dam. Because if you build the dam upstream and is not in the area with huge vibrations a desert where 2 billion cubic meter of water lost annually and this could be avoided if the dam was built upstream. The other things the water store and vibrated is govern by the treaty between Sudan and Egypt and the lost water will be deducted from our share. If we need to a build dam do not we go for smaller dam rather than building huge dam, which mean small damage and this, could different story if they looked into environmental, social and economic impacts. Any as I said however this a political decision we do not have any say in it.

Thank very much for sharing your thoughts with me about Merowe Dam environmental issue and it very useful for this research and I will keep in touch if I need further information.

**Interview 2**

Introduction

My Name is Al-Noor Abdullah I am a PhD student, study at Plymouth University this interview is part of my PhD which is on assessing the economy, social, political and environmental issues relating to mega project in developing economies the case study is the Merowe Dam.

The interview today is about social impact of Merowe Dam, and its implication around compensation, resettlement, social conflict, socioeconomic and political of constricting the dam. As expert in the field of sociology and the person who conduct the social studies in the area, I am not an expert in the field of sociology in Sudan trying to get inside of the social impact of the dam. You are free to withdraw from the interview or abstain from answering any questions, which you feel are irrelevant. Also, you agreed to be interviewed and I passed you the consent forms which you sign and information sheet if you need to contact me for further information.

(Response)

I am researcher on anthropology and sociology of development studies I studied Kajbar dam and particular focus on power relation. My area of interest is the state role in development with local people in Sudan. This the area of my studies where I completed my MCs and PhD on Kajbar dam. At the moment I am teaching at Department of Sociology & Social Anthropology of Khartoum University.

Q/ What are your thoughts about the area of Merowe in relation to Kajbar dam?

A/ What I know about Merowe Dam is different from ordinary people because it's an area of academic interest to me. We can start from the establishment of the Dams Implementation Unit and political development investment strategy post 2000 Sudan relation with China and financial open up toward Asia which is at the political level. Merowe Dam idea is an old one however, the current government wanted to build a huge eye-catching project in particular part of Sudan to win the election of 2010. It was part of Hamdi's (ex-Sudanese finance and economic minister) idea after the separation of South Sudan, which he thinks of building a new economic power within northern Sudan. He thinks the survival of the government is relaying on building more

big economic development projects. Therefore, they have the financial and political backing from China so they can build this kind of project at any cost. This the grand vision which led to the creation of DIU and given wide authorities and exempted from all kind of state control and monitoring mechanism. Merowe Dam was built by authoritarian group of elites with no proper consultation process in place. As the DIU think if we have to consult people we cannot build this type of projects so let us be like China and build our economy and then consult people. The DIU perceive local people to be subjects without any rights to be consulted as one engineer told me you know people in the west brought their seeds from the internet indicating that they are educated enough to be consulted. How can you ask me to bring the feasibility study to Manasir people what do they know about it. At the beginning local people were not opposing to the dam even the resistance is very limited but it grew with time. The Kajbar dam is different from Merowe dam because the Nubian culture is saturated with anti-dam sentiment from their experiences of Aswan High Dam displacement. This is not the case with Manasir in Merowe Dam where people welcomed the dam and the resistance was not that high or intensive from the beginning. When they see their concerns are not taken seriously and not consider being a beneficiary they started to resist. Because of the DIU manipulation, the distrust started to build up between the communities and the government. Therefore, the communities started to elect committees to represent them and things started to get out of control gradually.

Q/ Do you think building the dam is driven by politics and not economic development needs?

A/ Of course there is some economic argument we can't deny that, and dams can bring good benefits Merowe Dam produce electricity that is one fact that we can't deny. The thing is any production has the cost side and who is benefiting from the production and who is paying the cost, there is the mismatch of development and conflict around it. The economic side of it yes but if the whole system has corrupted those who are at the top are more likely to get the benefits and the costs are more likely passed down to the poor people and affected communities. So, if we put all the money spent on Merowe Dam into rain feed agriculture we can offset the affect and resolve the disparities of development in Sudan. Therefore, there is other economic argument, which favour other projects such cutting canals from Rousers Dam it would be economically beneficial more than Merowe Dam.

Q/ How do you think about the displacement and resettlement of the local communities?

A/ The Manasir's communities' have given up any hope of getting on and negotiate any sort of suitable deal with DIU as there is a huge gap between the authoritarian DIU which looking at these people as subjects. The problem with these authoritarian regime development projects is always implemented from top to bottom. From this point, the communities particular Manasir started to be organised and decided not to relocate to the new settlement. They decide not to move and demanded to be resettled by the Nile in the bank of the reservoir (Local Option). Therefore, less than 40% of the Manasir have resettled into the new settlement. For Amri and Hamdab they didn't have this kind of dispute with DIU as they were resettled at the early stage of building the dam. This also needed to be analysis in such hierarchical society where one group is better than the other. It can be seen clearly that the Northern State has benefited from the dam more than the River Nile state. All the complementary projects were built in Northern state due to power control of the people in the state. It is clear you can see their power relation at all level even the naming the dam was an issue because it's far from Merowe. From there the conflict start and the DIU argued that they studied the area of settlement well and would build everything but because of distrust sentiment Manasir even disputed the scientific result about the quality and the composition of soil and demanded to bring in their own expert because they do not trust the DIU experts. The fact is there is nothing negative about the dam in all DIU researcher is the cause people to have doubt on their finding even in the studies that conducted by reputable scholars.

Q/ What is the most important social aspects which impacted by Merowe Dam.

A/ I think the impoverishment of the displaced communities where people were not getting the right compensation or getting it in the manner, they cannot make a good use of it. The problem is bigger because people do not trust the post-colonial authoritarian state by implementing the project in such an unilateral way.

Q/ Are there any conflicts between the stakeholders (e.g. communities, government and NGOs)?

A/ What you hear from the government is there is no conflict apart from a few political parties who tried to capitalise on the issues and mislead the majority of the people. However, we cannot rule-out some political parties who operate in this kind defamed way by capitalising and politicalising the matter more than really working to help the people, but I would give them part in the conflict. The most important part of the conflict is touching the lives and livelihoods of people, they are affected, and they have agencies. You cannot victimise them and take a way that agency and portrayed them as a group of people who are just manipulated and misled they know how their lives were and is now. Also, the insecurity they are going through that definitely instigate a need to act and elect committees to represent them at all level and they question the intention of the government and the people who represent the government. The main factor that aggravate the conflict is the DIU superiority and I can say the power relation is the main factor of the conflict ae well. Of course, global factors may play role in the conflict such the Darfur conflict, but the question is why the government did not sit down with the Manasir people and resolve the matter without exposing itself to global criticism.

Q/ Do you think the displacement could be avoided?

A/ Of course, you can't avoid displacement but by building smaller dam you could avoid huge part of it. The bigger the dam the bigger the displacement will be because you create big lake.

Q/ What is your thought about the new resettlement?

A/ I really don't think much about the settlement but from the recent protest it shows that people are not satisfied.

Q/ What you think about impact of the dam on the fabric of the society in the area?

A/ Of course that kind of change definitely will have huge impact on the fabric of the society for example the huge tension between those who agree to resettled into Makabrab where portrayed as a government agency and traitors by their counterparts who refused to resettle. This division has happened even between brothers and family members. This has also impacted the structure of families because of migration, which led to separation of many families.

Q/ What is your thoughts on the consultation and compensation process?

A/ We have to start from the statistics of properties and valuation is something we need to deal with it theoretically. To prove that the dam is economically feasible we have to proof the revenue and more than the cost, but this is not an objective way because it depends on what you include or exclude. To make the cost appear smaller there is a particular approach used by excluding all the intangible cost. For example, to compensate a palm tree by 500 Sudan Pound however without taking into account the history and emotional attachment to the tree even economically is unfair because this tree can produce this 500 in one or two years. Also, the DUI try to cut as much as possible cost in terms of compensation and depends on the community bargaining power. This could be worse if this dam was implemented for example in Nubba Mountain or Blue Nile because of balance of power, as there are less than Manasir that how power relation played in Sudan.

Q/ What is your opinion on the claim by some communities about distrust and miscommunication between the committees, local government and DIU?

A/ Yes it true because this the role-played by those brokers in the bargaining power where corruption come to play important role within the compensation process. It would better if that DIU deal with the affected communities directly. Unfortunately, this the Sudanese political culture and nothing to do with the regime. However, it's a result of deinstitutionalised the process. This led to some people gaining more than they deserve and other loss more than they should therefore this created the distrust.

Q/ So in this case who do we blame the committee or the government?

A/ Always when forming committees, you find government sympathisers or supporters making the process open but the radical committees especially in Manasir areas always refuse to romanticise this kind open process and refuse to allow government supporters to infiltrate their ranks.

Q/ What role do northern people in diasporas play in the conflict between local people and the government especially in consultation and compensation process?

A/ Let look at the conflict from global perspective. The diaspora people were influential of course but the government has tendency to demonise any resistance

whether there are here in Sudan or abroad. Also, we can't rule-out the idea that some people may be interested in their own benefits and we can deny self-serving interest. The biggest problem of Sudan and Sudanese people we are out-sourcing our legitimacy. We are looking for approval from out-side both the government and communities for their resistance. Internally we can't agree in anything and the government looking for funds from China and Arab states in order to get away from the conditions attached with this kind of investment therefore they can go ahead without any consideration to local communities. The voice of the people from Europe or America is more likely to harm the reputation of the government and give legitimacy to local communities because China and the Arabs are not concerned about the social conflict the dam has caused. Furthermore, the local communities went to the UN and many other global NGOs to have support when they failed to be heard by the Sudan government because the government tend to listen to international body only.

Q/ What you think about the compensation process was it opened and transparent to all stakeholders or not?

A/ From my experience there were so many manipulations, people are not satisfied with valuations and it was surrounded with distrust. DIU wasn't allowed to conduct the evaluations and consultations in many villages because they felt the committees formed by DIU are not representing local communities' interest. Therefore, the government used 1990 statistics to compensate the properties. However, most communities have decreased their assets value in fear of taxation at the time. This indicated both sides were not honest because this type of behaviour is normalised in the political discourse in Sudan like any other African countries.

Q/ What you think about the consultation. Did it include all the affected stakeholders or not?

A/ With the mind set of Islamists which seem not to believe on the democratic system and relaying on (Al-Shora) which is an Islamic way consultation. The question is the consultation binding of just superficial process. Also, there a debate about Al-Shora in term of whom to be consulted the wider community or those who called the so-call wise-men. This meant the government don't have to consult everyone in the

community only consult the elite groups or the so-call leaders. This opened up many opportunities for corruption and the door for manipulation because the government already knew the mind set of those leaders who they are consulting with. With the government system of loyalty, it was easy for the government to have what it wanted because all those local leaders were part chain of command of the Islamist party. With the consultation process started the system of loyalty face difficulties because communities were not agreeing with the government agency, which become a barrier of communication between the government and local communities and further increase the distrust and conflicts. In this sense the stakeholders are divided based on age education political affiliation. Some went with the government and other with their community members. Also, this situation produces a new form of local leaders. All this led to a pull and push situation of the consultation process and people were outcast and demonised. Despite all these conflicts the DIU did not change their approach and continued to seek loyalty from their agency and those agencies are facing rejection from their own communities.

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