



**Towards Hydropolitical Cooperation  
in the Nile Basin**

**Assessment of Joint Integrated Water Resources Projects  
between Sudan and Ethiopia to  
Transform Conflicts**

**Mohamed Mustafa Abbas  
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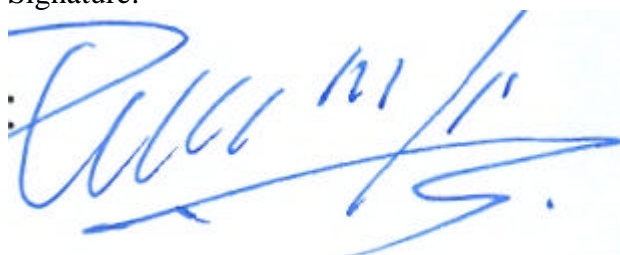
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## **Assessment of Joint Integrated Water Resources Projects between Sudan and Ethiopia to Transform Conflicts**

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### **Abstract**

Water conflict can be viewed as a competition over scarce freshwater resources that can lead to hard political tensions. Conflicts can appear in many different settings on the local level, between sectors of one country, between upstream countries and downstream countries or between upstream and downstream users. It can be due to lack of water, increased demand or mismanagement. Water conflict is an important issue for people's survival and livelihood. In this article we focus on the possibility of cooperation between Sudan and Ethiopia, the benefits and risks of integrated win-win projects on water resources management between the two countries. Interviews were done with researchers, academics, consultants and experts working for their governments on water issues. The 15 Ethiopian and 15 Sudanese experts saw lack of funding as one of the key challenges, and better relations, trade, and transport as main benefits of joint water development projects between the two countries. One of the main conclusions from our research is that Sudan and Ethiopia can enhance cooperation through step-by-step projects shared between the two countries. Ethiopia can be regarded as the main provider for hydropower, and Sudan as the main provider for agriculture and marketing. On the institutional side, the Nile Basin Initiative is still a "very soft" institutional framework, allowing for project-by-project activities. Yet there are signs that it is clarifying framework questions (about 85% have been agreed on) and therefore slowly becoming more capable in coordinating water resource development in the Nile Basin..

**Key words:** Cooperation, Water Conflict, win-win projects, Nile River, Sudan, Ethiopia

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# 1. Introduction

Water is increasingly becoming a source of conflict not only in the Nile region but also in many other parts of the world. Water conflicts are found in many different settings: Locally, some pastoralists and farmers compete over scarce drinking water and water for their livestock. The residents in dam construction sites sometimes clash with the government when they are not adequately compensated or appropriate relocation plans are not made or implemented. Conflicts between and among countries, rich and poor people, pastoralists, nomads and farmers and non-farmers over water resources is a phenomenon in many part of the world (Mason, Spillmann 2003).

Water and conflicts manifest together with increasing frequency. The approximately 260 international watersheds cover more than one half of the land surface of the world, and affect 40% of its population (Carius, Dabelko, Wolf 2004). Water is a resource which ignores political boundaries, fluctuates both in space and time, has different and conflicting demands on its use, and the international law is poorly developed, contradictory, and unenforceable (Abraham 2004). Some scientists even suggest that “competition for limited ... freshwater ... leads to severe political tensions and even to war” (Abraham 2004). Some politicians (Boutros Boutros Ghali) and academics (Starr 1991) have predicted that the next war in the Middle East will not be over oil or other commodities but over water.

Its abundance upstream and its scarcity downstream can lead to conflict. Those living upstream may reduce its flow for one reason or another and those living downstream may then suffer from flow decreases. On the other hand, upstream users may suffer, when downstream users block water development upstream. Competition for quality and quantity of shared water can lead to international water conflicts, often these are economic or diplomatic conflicts (Kirmani, Moigne 1997). Very often these conflicts hinder much needed development (Mason 2004).

Yet the historic reality has been totally different from the water conflicts literature (Starr 1991) of the 1990s. Newer studies show that violent conflicts caused by water scarcity on an international scale are unlikely (Wolf 1997). Despite the fact that countries seem not to go to war over water, the relationship between water scarcity and conflict still needs to be assessed, as water scarcity and mismanagement may go hand in hand with political instability and economic decline (Wolf 1997). Such an investigation should focus on more accurate relations between water and its users. One promising approach is also to examine water as a source of cooperation, i.e. integrated projects between the shared countries. For the problem of water is not just its physical availability but its management (Wolf 1997).

Conflicts between and among the upper (e.g. Ethiopia) and lower (e.g. Sudan) Nile countries are old. The lack of a basin-wide agreement on water development projects poses a problem for both upstream countries (concern of their development being hindered) and downstream countries (concern of water security). Under pressure from rising demand, water resources will become increasingly exploited due to population growth, agriculture expansion, and the ever-rising expectations for improved standard

of living worldwide. This encourages us to enhance and to move to joint projects or multipurpose projects between the two countries.

The rainfall in the Nile basin is estimated at 1680 km<sup>3</sup>/year (Egypt country paper 2000), and the natural river flow measured at Aswan is estimated at 84 km<sup>3</sup>/year (Osman, Atta 2005). A lot of the rainfall is lost due to evaporation, evapotranspiration, seeping, or it is used inefficiently. For the water to remain a source of life and joy, it must be used wisely and fairly. Countries interests and human needs must be paramount, otherwise conflict is created. International agreements must be respected, or adapted if they are inadequate (Wolf 1997). If properly managed, the Nile has enough water to satisfy the needs of the sharing countries (Abraham 2004). However, because of political disagreements and unilateral policies pursued by the riparian countries, the Nile has often become a source of conflict or latent conflict among the countries encompassed by its basin. Therefore there is a great need to involve all the stakeholders so that all concerns and fears are answered and a fair sustainable water distribution system is put in place.

The study revolves discussing some contending issues in the management of transboundary water resources between Sudan and Ethiopia over common water resources. 30 Sudanese and Ethiopian experts were interviewed. The study highlights five advantages and paths of cooperation between the two countries, so as to peacefully transform conflicts before they reach an unmanageable stage:

1. Building of dams in cooler countries (Ethiopia), this increases water and supports a regular flow.
2. Promoting peace and stability between the two countries, also in non-water areas (economic ties, cultural exchange etc.).
3. Encouraging beneficial division of labour between the two countries.
4. Cooperation to obtain funds from multilateral and bilateral funding sources for developing their water resources.
5. Implementing some projects as multi-purposes projects.

The study does not focus on the relationship between Egypt and Sudan, for one because this is fairly peaceful, and secondly because an agreement on water sharing between these countries already exists (1959 agreement).

## 1.1 Objectives

The objectives of the study are to:

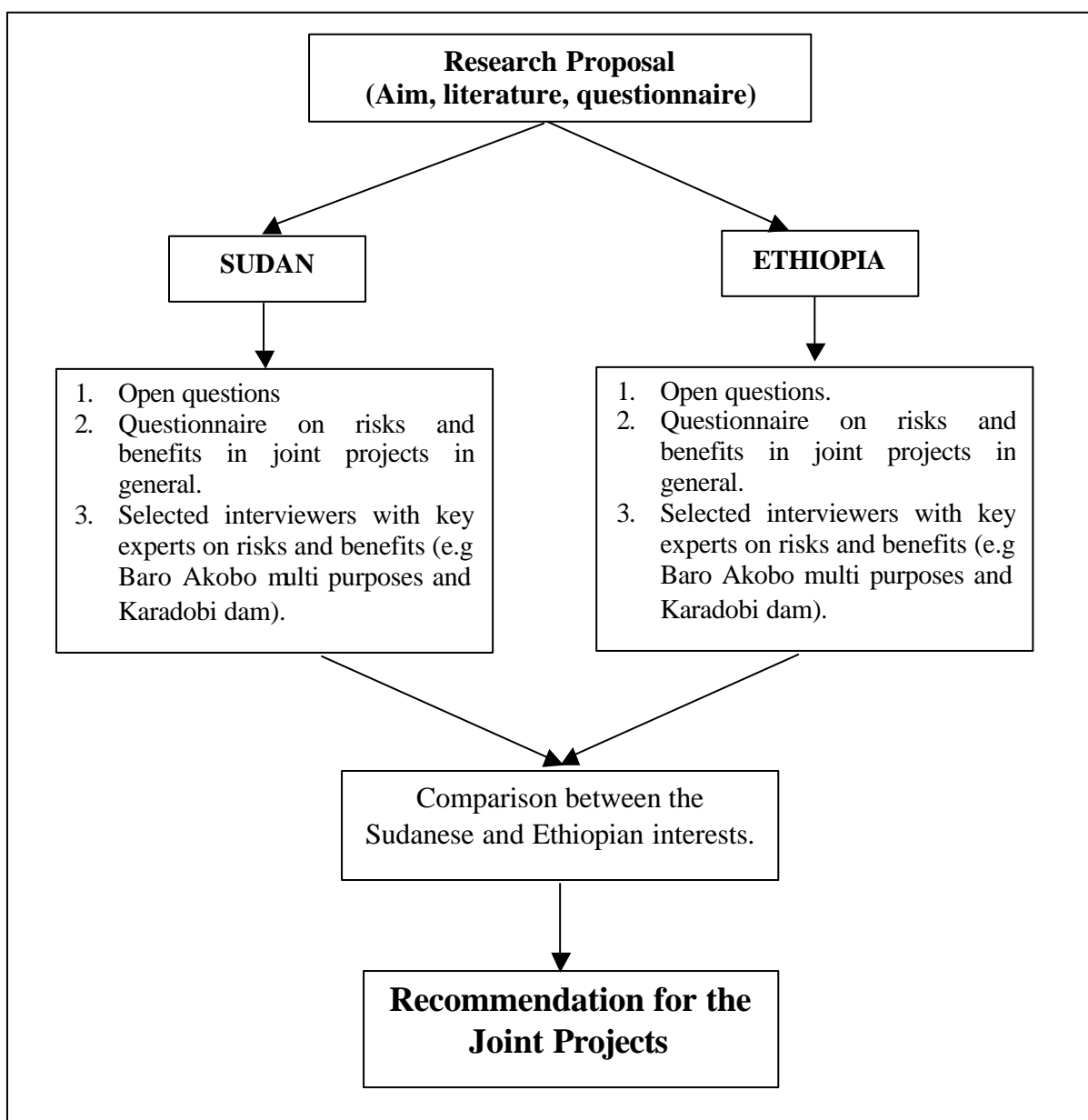
1. Draw the attention of stakeholders of the Eastern Nile Basin to the necessity of joint projects for sustainable utilization and cooperation over shared water resources.
2. See the comparative advantages, challenges and risks and potentials, of the future joint integrated water resources projects.

## 2. Methodology and Approach

The study used an expert-interview methodology, 30 people were interviewed, 15 from Sudan, 15 from Ethiopia, including academics, consultants, experts working for their governments on water issues, and coordinators for the Eastern Nile Technical Regional Office (ENTRO). Furthermore, background analysis of the available documents from workshops, Nile 2002 conference series, and other conferences and workshops were used. The researcher does not present a governmental position in his research.

The research approach (Figure 1) consisted of independently assessing the upstream (Ethiopia) and downstream (Sudan) views, and then comparing them in this report.

Figure 1: The Research Approach



The researcher stayed for two weeks, 6<sup>th</sup> – 21<sup>th</sup> September, 2005, at the Center for Security Studies (CSS), Swiss Federal Institute of Technology, ETH Zurich – Switzerland, where he gained the overall views of his research approach. In October 2005 he discussed and filled the questionnaire with the Sudanese expert's opinions. This was followed by another two weeks, November-December, 2005, at Addis Ababa University, where he discussed his questionnaire with the Ethiopian expert's opinion. This research derives from the experts and literature overview. As background, the researcher participated in two international workshops<sup>1</sup>.

The study takes a conflict prevention and/or resolution transformation approach. There are four types of conflict management types, except for overt actions (such as use of military means), which are:

- Prevention: this is an active planning attempt to identify types of conflicts, and to remove or reduce them.
- Avoidance: is a reaction done in a situation where incompatible goals have emerged without dealing with the root causes of the conflict.
- Settlement: aims primarily to alter the symptoms of the conflict, and is often a non-sustainable agreement that retains the possibility of re-emergence of the conflict-quite.
- Resolution: is a mutually acceptable and sustainable agreement that eliminates the root causes of the conflict (Abraham 2004).

Besides conflict resolution between human users of a resource, conflict prevention over water resources also needs to consider how to use the environment in a sustainable way. Some suggestions concerning a cooperative watershed development plan at a regional level are explored in the study:

- Separating the control of water resources from their use,
- Examining the details of initial positions for options which can induce cooperation, focusing on interests (why do the Nile countries want what they say they want) from their positions (what they want), and
- Designing mutually beneficial projects, starting with small-scale implicit cooperation, and then working toward an every increasing integration, always keeping pace with political relations that warm up.

### **3. Background**

The following section describes the global water situation, and then the relevant water data of the Nile, Sudan and Ethiopia.

#### **3.1 Global Water Availability and Withdrawal**

Water is one of the most essential substances for the sustenance of life. It is needed for agriculture (food) (70% of world water withdrawal), industry (20% of world water

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<sup>1</sup> The Regional Media and Water Resources Managers Workshop 'Water for Peace', 11-12 December 2005, Khartoum-SUDAN, and the International Training Workshop 'Nile Capacity Building Forum on Water Development and Cooperation', Addis Ababa 30 Jan. – 2 Feb. 2006.



withdrawal) and domestic/municipal (10% of world water withdrawal) purposes. Water is also used for re-creation, transport and is essential for all natural environments. Water is part of the hydrological cycle (the constant movement of water through a cyclic process). The oceans contain about 96.5% of the world's water and only 2.5% is estimated to be fresh water (Mohamed 2004). 70% of the fresh water (1.75%) is located in ice sheets and glaciers and nearly 30 percent is groundwater (0.75%). Only about 0.3% of the fresh water (0.00075%) is available for uses by human-kinds (Abraham 2004). Besides agriculture, energy production by hydropower is another important use of fresh water, which also includes the use of water for cooling in the production of electricity. An important use of water in connection with urban and industrial life is for energy, with a great potential for further development of hydroelectric power in almost all international rivers in developing countries. Demand for water, and the services it can provide, is increasing worldwide, particularly in arid and semi-arid lands.

### 3.2 African Transboundary Waters

Africa is a land of transboundary waters, with international river basins covering fully 60% of the continent's landmass (AWL 2005). Africa is also a continent with a long history of transboundary water management and a voluminous body of transboundary water law, which at least partially regulates the use of many of its basins (AWL 2005). While an understanding of the scope and nature of the continent's transboundary water law supplies an important tool to improve future management of the its shared waters, an examination of the factors which have driven the formation, orientation, and realization of these laws can help to understand both why it evolved, in whose interests, and the likelihood for its meaningful implementation.

### 3.3 The Nile River

The Nile River Basin covers 3,352.710 km<sup>2</sup>, about one-tenth of the area of the African continent. The Nile Basin River is regarded as the most important river for the large number of countries that share its water: Burundi – Democratic Republic of Congo – Egypt – Eritrea – Ethiopia – Kenya – Rwanda – Sudan – Tanzania – and Uganda. The Nile River is the longest river in the world with numerous tributaries and headwater lakes. It traverses ten states, from equatorial Africa in the south to the Mediterranean Sea in the north of the continent: some 6,800 kilometers'. 10% of the continent landmass is inhabited by 40% of Africa's population (Hultin 1995). The total population of these ten countries is estimated at over 250 million (Table 1).

*Table 1. Hydrology characteristics of the two case study basins in Ethiopia:*

Basin	Drainage basin area in km <sup>2</sup>	Distribution in billion m <sup>3</sup> /year	Sediment load in million m <sup>3</sup> /year	Total discharge of Nile in percent
Baro-Akobo	74,102	13.6	10	13.2
Atbara/Tekeze	90,001	10	120	9.7

Source: Arsano, Tamarat (2005), and Hamad, El-Battahani (2005).

### 3.4 Sudan

Sudan has the largest reserve of cultivable land in Sub-Saharan Africa, with an estimated 47 million hectares available for agriculture (MOIWR 2003). The potential for developing irrigation is substantial, due to the high quality, alluvial soils between the Blue Nile and White Nile rivers in the eastern part of the country. In the past irrigation development has been limited in Sudan due to the long civil war and a lack of funds for new investments and for operation and maintenance of existing irrigation systems. Now after the Comprehensive Peace Agreement established in the year 2004, efforts have been done from the government to increase the irrigated areas. The expansion of irrigated area and improvements in agricultural production are needed to support economic growth and to accelerate the development process in Sudan.

Sediment originating from the Ethiopia Plateau, the Blue Nile and its tributaries serve almost 70% of the irrigated area in Sudan, and represent the main source of sediment in the canalization systems (Seifeldin 2003).

*Table 2. Population growth versus irrigated area*

Total population	Rate of increase (%)	Total area (Million km <sup>2</sup> )	Irrigated area (Million hectares)
38,114,160	2.71	2.506	1.62

Source: Abbas (2004)

Map 1 shows the Sudan location with its nine neighboring countries (Egypt, Libya, Chad, Central Africa Republic, Democratic Republic of Congo, Uganda, Kenya, Ethiopia, and Eritrea).

Map 1. Location of Sudan



Source: Yahoo Factbook (<http://education.yahoo.com/reference/factbook/su/>)

### 3.5 Ethiopia

Ethiopia is the main source of the Nile waters. More than 86% (Arsano 2004) of the water of the Nile arriving at Aswan (in Egypt) originates from Ethiopia. The geographical location of Ethiopia and its endowment with favorable climate provides a relatively high amount of rainfall in the region. Much of the water, however, flows across the borders being carried away by the transboundary rivers to the neighboring countries. The main water resources problem in Ethiopia is the uneven spatial and temporal occurrence and distribution. Between 80-90% of Ethiopia's water resources are found in the four river basins namely Abbay (Blue Nile), Tekeze, Baro Akobo, and Omo Gibe in the west and south-western part of Ethiopia.

Ethiopia has an elevated central plateau varying in height between 2,000 and 3,000 meters. In the north and centre of the country there are some 25 mountains whose peaks rise over 4,000 meters. The most famous Ethiopian river is the Abbay (or Blue Nile), which runs a distance of 1,450 kilometers from the source in Lake Tana, to join the White Nile at Khartoum.

The proposed irrigation schemes in Ethiopia in general focus on three locations Around Lake Tana, on the Sudanese-Ethiopia border, and on the Angar and Finchaa tributaries. The location of Ethiopia is shown in Map 2.

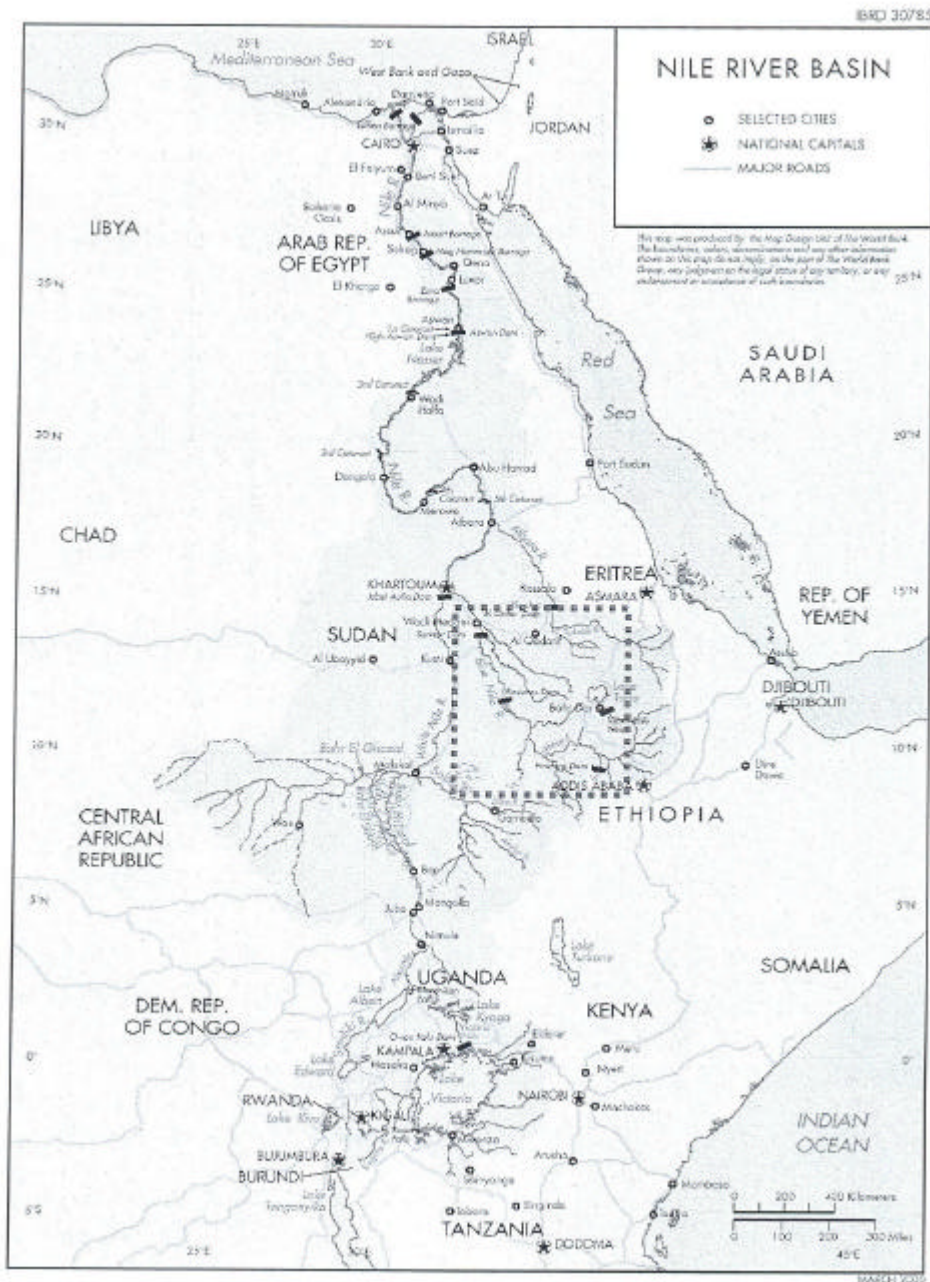
Map 2 shows the country of Ethiopia with its five neighboring (Eritrea, Sudan, Kenya, Somalia, and Djibouti).



Source: Yahoo Factbook (<http://education.yahoo.com/reference/factbook/et/>)

The current projects affected areas are seen in the Map No. 3, surrounded by dotted lines:

Map No. 3, current projects in the Eastern Nile



Source: Nile river documents (NBI 2005)

The major hydroelectric projects, lie on the Blue Nile between Lake Tana and Sudanese border. Four dams proposed for the Blue Nile downstream of Lake Tana; Karadobi, Mabil, Mendaia, and the Border projects. Together these four dams would have an initial active storage capacity of about 51 billion m<sup>3</sup> and an estimated annual electricity generation of over 25 billion KWA, about three times the actual production of the Aswan High Dam (in Egypt). The annual mean flow of the Blue Nile at the

Sudanese-Ethiopian border about 54 billion m<sup>3</sup>/year; thus the combined active storage would be approximately equal to the mean annual flow (Osman, Atta 2005).

*Table 3. Population growth versus irrigated area*

Total population	Rate of increase (%)	Total area (Million km <sup>2</sup> )	Irrigated area (Million hectare)
69,130,000	2.0	2.506	0.46

Source: Abraham (2004)

## 4. The Nile Basin

Tensions over the control of Nile waters are longstanding obstacles to growth and development in the area. Conflict prevention and cooperative water resources management in the Nile Basin are therefore central development challenges for the ten countries that share the Nile Rivers.

### 4.1 Nile Basin Initiative (NBI)

The key forum for this is the Nile Basin Initiative (NBI), initiated formally in 1999, it provides a basin-wide framework to fight poverty and promote socio-economic development amongst the ten Nile countries. The NBI is led by the Council of Ministers in charge of Water Affairs from the member state (Nile-COM), with the support of a Technical Advisory Committee (Nile-TAC), and a Secretariat (Nile-SEC).

The Nile Basin Initiative's Strategic Action Program is guided by a shared vision "to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources" (NBI 2000).

Since 1996, thus before the NBI, the Africa Water Resources Management Initiative sought to improve national water resources management through institutional and legal review and reform efforts, with an emphasis on ownership sustainability, demand management and cost-efficiency. The initiative is now led by the Council of Ministers of Water Affairs of the Nile Basin States (Nile-COM), supported by a small secretariat in Entebbe/Uganda.

### 4.2 Legal Agreements in the Nile Basin

An overview of the historical agreements is made, to show the various attempts that were made to set up a number of Nile-based agreements and organizations:

- **Anglo-Italian Protocol of April 15/1891** affirms that the Italian Government does not engage construct any work on the Atbara River in view of irrigation, which might sensibly modify its flow into the Nile (Abraham 2004).
- **Ethio-British Agreement of May 15/1902** says that His Majesty the Emperor Menelik II, King of Kings of Ethiopia, engages himself towards the

Government of His Britannic Majesty not to construct any works across the Blue Nile, Lake Tana or the Sobat river which would arrest the flow of their waters except in agreement with His Britannic Majesty's Government and the Government of Sudan (Abraham 2004).

- **Agreement of December 13/ 1906 between Britain, France and Italy** asserts that the interest of Great Britain and Egypt in the Nile Basin, more specifically as regards the regulation of the waters of that river and its tributaries, shall be respected (Abraham 2004).
- **Agreement between Britain and Italy, December 14-20, 1906.** This agreement contends that the Government of Italy engages not to construct on the head-waters of the Blue Nile or White Nile or tributaries or effluents any works which might sensibly modify their flow into the river (Abraham 2004).
- **The May 7, 1929 Agreement between Britain (on behalf of the Sudan) and Egypt** states that Egypt as an independent state and Britain on behalf of the Sudan, signed the first agreement after World War-I. Egypt complained, for the first time, that Sudan may undertake irrigation development in its territory. Under this agreement, the concept of 'Egypt's natural and historical rights' came into being (Abraham 2004).
- **Agreement for the Full Utilization of the Nile Waters between Egypt and the Sudan was signed in 1959.** The proportion of waters of the Nile was 55.5 billion m<sup>3</sup> for Egypt, 18.5 billion m<sup>3</sup> for the Sudan and 10 billion m<sup>3</sup> was estimated to evaporate under condition the flow stays the same (84 billion m<sup>3</sup>) (Abraham 2004).
- **Agreement of July 1/ 1993 between Presidents Meles Zenawi and Husni Mubarak** states that one party shall not carry out any act that affects the interest and benefits of the other in relation to the use of the River Nile (Abraham 2004).

Due to Ethiopia's disagreement with Britain, the latter excluded the former when other agreements (Anglo-Italian, Anglo-Egyptian and Egypt-Sudan) were signed in 1925, 1929 and 1959 respectively (Abraham 2004). On July 1, 1993, a new agreement on the use of water on the river Nile was signed by Presidents Meles Zenawi and Husni Mubarak. The two leaders agreed 'not to do anything with the Nile waters that might harm the interests of either party' (Abraham 2004).

In summary, although there are many benefits of basin-wide agreement (see the following sections), the Nile agreements do yet sufficiently provide a framework for these to be fully used. In part this is because many of the agreements were undertaken in a colonial and cold war context. Since the end of the Cold War, there is space for more cooperation and greater joint efforts to shape a common water use strategy.

### 4.3 Policies and Goals Regarding Transboundary Waters

Studies of Ethiopia watersheds have revealed that the country has 144,710 GWh/yr potential of hydroelectric power, where the combined potential of the Abbay, Tekeze and Baro-Akobo equals 102,710 GWh/yr (Arsano, Tamarat 2005).

The Ethiopian/Sudanese water policies regarding transboundary water have the following goals (points mainly taken from the Ethiopian Water Resources Management Policy 1999):

- Study on a sustainable basis Ethiopia's stake and national development interests in the allocation and utilization of transboundary waters (Ethiopia).
- Promote the establishment of an integrated framework for joint utilization and equitable cooperation and agreements on transboundary waters (both countries).
- Ascertain and promote Ethiopia's entitlement and use of transboundary waters based on those accepted international norms and conventions endorsed by Ethiopia (Ethiopia).
- Foster meaningful and mutually fair regional cooperation and agreements on the joint and efficient use of transboundary waters with riparian countries based on 'equitable and reasonable' use principles (both countries).
- Comply with those international covenants adopted by Ethiopia, and manage transboundary waters accordingly.
- Increase fish utilization (from 27% of their potential) (Sudan).
- Develop a number of instruments over the years to regulate navigation on its domestic and international waters (Sudan).
- Promote appropriate linkage mechanisms for the cooperation with the two governments (both countries).
- Establish water resources management institutions for sustainable development and management of the water sector (both countries).
- Minimize institutional instability in order to maintain sufficiently skilled manpower and womanpower as appropriate (Ethiopia).
- Establish phase-by-phase Basin Authorities, for efficient, successful and sustainable joint management of the water resources of the basins through concerted efforts of the relevant stakeholders (both countries).
- Put in place conducive situations for the establishment and sustainability of appropriate Federal level agencies for study, design, and engineering and construction supervision (Ethiopia).

This means the policies of Sudan and Ethiopia are the same, and joint integrated projects can go smoothly, at least from policy goal point of view.

## 5. Joint Projects between Sudan and Ethiopia

Joint win-win projects are ones that can enhance the cooperation between the two countries in the political border area between the two countries. In Ethiopia there are five border states (Southern Nations Nationalities and People's State (SNNPS), Gambella Regional States, Oromiya Regional State, Amara Regional State, and Tigray Regional State), on the other side in Sudan there are six border states (Al-Gadarif, Sinnar, Al-Nil Al-Azraq, A'Ali Alnil, Jungoley, and Sharq Al-Estiwaiyya States). Some suggested areas for joint projects are small and large dams<sup>2</sup> and

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<sup>2</sup> A large dam is 15 metres or more high, from foundation, if dams are between 5-15 metres and have a reservoir volume of more than 3 million cubic metres they are also classified as large dams (The World Commission on Dams, 2000).



irrigation systems on a village or household level along the various Lake Tana and Blue Nile tributaries. Small-scale hydro-electric power stations can also be built in most of the tributaries on community and village levels.

Some areas located around Lake Tana have been suggested as a natural storage, suitable for the regulators of large volumes of water. One of the numerous advantages of the construction of the Blue Nile reservoirs in Ethiopia can be the saving of a huge amount of waters that presently evaporates (through evaporation and evapotranspiration) from the downstream countries (e.g. Sudan). These reservoirs could provide over-year storage (Mohamed 2004). They could also control the unexpected floods that also affect the Sudan, and they could help to reduce the large sediment loads. Through the construction of water reservoirs in and around Lake Tana, the alluvial plains of Fogera and Dembya in the north, Takusa in the west and Achefer in the south of Lake Tana can be irrigated and crops could be cultivated 2-3 times a year, which could help the Blue Nile river basin to be self-sufficient in food (Ethiopia 2000).

The implementation of the above mentioned areas could lead to the co-operation and regional-based conservation of the natural resources, and alleviate human misery and environmental conflicts between the two countries. Despite the positive signs about possible benefits, it is difficult to evaluate how benefits and costs are related and thus how responsibilities should be shared. Increasing transports, for instance, imply environmental consequences. Trade and trade restrictions are both a hindrance and a stimulus to regional development and resource utilization. With a broader perspective on water policy and management, a focus on the benefits that can be derived from water use in a wide perspective, therefore seems to make sense. The discussion on how water can be allocated and shared can be replaced by a more useful discussion on how these benefits can be shared in society. The notion of 'shared benefits' rather than 'sharing water' is increasingly being accepted (for a discussion of points of agreement as well as open questions, see: Amer, Arsano, Atta, Osman, Hefiny, Tamarat 2005). Whatever is to be shared, for example water flow, jobs, food, timber, income, risks, environmental costs, investments, etc., it is crucial it fosters mutual trust and transparency. Thus we need to identify the mechanisms for the processes which will lead to mutual trust and confidence across political and cultural entities.

The vision for Sudan and Ethiopia for 2025 must be designed to avoid the disastrous consequences of the threats that face the region and lead to a future where the full potential in the Blue Nile River water resources can be readily unleashed to stimulate and sustain growth in the region's economic development and social well-being. This follows the shared vision agreed by the Nile Basin Initiative (see quote above). Within this agreed overall vision between the two countries, the Blue Nile river may serve as a key catalyst, with its yield increased and utilized in a rational, fair, efficient and environmentally sustainable manner, with effective flood and drought management, watershed management, reversed desertification, and pollution control (Kamal 2000).

Given the ecological characteristics of the Eastern Nile Basin, one can plausibly suggest that construction of dams in upstream Ethiopia, where the climate is temperate, can provide a more sustainable alternative to constructing a dam in the desert climate of the downstream locations. Further benefits to be derived from having a water reservoir in the upstream area include possibilities such as irrigation,

generation of hydroelectric power, eliminating the hazards of seasonal floods and silt accumulation in the Sudan. We found out that most people interviewed in Sudan felt that Sudan can gain by Ethiopia having dams on the Blue Nile, i.e., a series of dams like Rosaries and Sennar. Constructing reservoirs in Ethiopia would greatly help to avoid excessive evaporation rate, contrary to what is happening the case of Lake Nassir in Downstream Egypt (Arsano 2004).

## 5.1 Risks and Benefits

The following points are a summary of the different options suggested from the interviewed Sudanese and Ethiopia experts. Where the word ‘they’ is used it refers to experts from the two countries.

Both Sudanese and Ethiopian experts agree that the benefits of joint projects for the two countries are power trade, food security, watershed management, less soil degradation, reduce reservoir siltation and inlet canals, river regulation, flood regulation potential, trade, additional capacity for water storage which will be used in irrigation and hydropower generation, and peace and development. Improvement of people’s livelihood (increase in income, food security), more crops can be grown, less climate vulnerability, greater regulating flow, flood control, less soil erosion, less sediment in downstream reservoirs (hydraulic work), increase in power generation (opportunity to electricity), navigation (in Baro/Akobo Sobat river). Both Sudanese and Ethiopians agree that there are benefits from the silts that came from Ethiopia highland in agriculture to Sudan, at the same time there is a great risks of the silt in the Sudanese reservoirs, 27 million cubic meters (MCM) of the sediment is deposited upstream Rosaries dam every year, which decreases the availability of about 120 Feddans and 20 Megawatts every year (MOIWR 2003). At the same time agricultural land in Ethiopia is suffering from the movement of the silt and erosion. The two countries complement each other (one for hydropower and the other for irrigation). Ethiopia is regarded as the main provider for hydropower, whereas Sudan is regarded as the main provider for agriculture. Sudan can also pass products from Ethiopia to the rest of the world. Cooperation beyond water can include trade, transportation, development of tourism, to strengthen cooperation peace and security.

On the risks side, the following points were mentioned: Risks are often viewed in the problem of mis-understanding one another, and lack of security in the area, if a country goes ahead unilaterally or because of security reasons that have nothing to do with water. Some people think cooperation is not going to produce good results, because until now there is no fixed agreement regarding the future projects for each country, no one knows what the other is going to do, this can produce mis-trust between the involved people, as the more actors involved the more complicated the planning and implementation process. Joint decision-making and consultation on all levels to reduce the history of mis-trust is therefore necessary. Projects are often delayed, making people question if they will ever occur, thus projects must go very fast to give early results (fast track), but still the necessary caution (that takes time) in the planning and implementation is important.

Finally the interviewed people pointed out the great risk in the instability and frequent changes of government institutions, and in the decision-making process that do not

involve the main stakeholders, or if the international donor agencies do not support the process. Some Sudanese mentioned risks to Sudan such as operational problems, failure of structures, and reduction of flood irrigation areas. Both Sudanese and Ethiopians agreed that if there is no cooperation tension between the two countries will increase, resulting in less development, less trade, and unmitigated natural disasters.

Some of the experts see that hydropower projects are not going to create conflicts, where the irrigation projects could create conflicts between the countries. In summary, however, the benefits were generally seen as outweighing the risks.

## 5.2 Impact of Dams

Impacts of the large dams on the positive side are water regulation, flood mitigation, hydropower, irrigation and in this way the potential to improve the livelihood of people. The impacts depend on the dam's location, and the respective topography. On the negative side there are also impacts: If upstream dams in Ethiopia are built, Sudan may lose some of their agricultural land due to less silt that is now an important source of fertilization. At the same time there will be less storage capacity in the downstream reservoirs.

The impacts of large dams on ecosystems, biodiversity and downstream livelihoods can lead to various negative impacts:

- Loss of forests and wildlife habitat, loss of species populations and the degradation of upstream catchment areas due to inundation of the reservoir area.
- Loss of aquatic biodiversity, of upstream and downstream fishers, and of the services of downstream floodplains, and wetlands.
- Cumulative impacts on water quality, natural flooding and species composition where a number of dams are sited on the same river.
- Negative impacts on the people living in the area that is flooded by a dam.

Any planning of large dam has to include an Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA), so any environmental or social impact can be mitigated already in the planning process. It is, however, clear that nothing can be had for free, each project must be assessed to see if the benefits are actually worth-while in comparison to the negative impacts. The careful analysis of all alternatives before building a dam is one of the key recommendations of the World Commission on Dams (Dams, 2005).

Impacts of hydropower projects on the Blue Nile could be mitigated by proper planning, consultation and proper operating schedules agreed upon by the two countries. Some of our interviewers (Ethiopian) said that hydropower projects have no affect for downstream countries, where the dam operation is carried out well, keeping the water and releasing it when needed is a potential benefits for the downstream country. In Sudan, where the river flows on the flat surface area, many people have to be displaced when building a dam, in Ethiopia the river flows in gorges, so there are not, or much less, displacement of people.

### **5.3 Legal Institutional Framework and/or Project-by-Project Approach**

A key legal issue is the harmonization of national water laws. The transboundary water legislation in Sudan is mainly concentrated on water quality, water control, flood control, and enhancing cooperation between the two countries. There is still separated legislation for each country. This makes planning and implementation difficult. There are formal agreements on the ministerial level, however, which can be regarded as the beginning of harmonized legislation. The legal discussion in the ENTRO is another step in the right direction.

Ethiopia and Sudan need more water for their future projects. If Ethiopia and Sudan take water unilaterally, then tension will rise which may lead to conflict between the two countries (as well as with Egypt, the most downstream country). To avoid this tension three ways forward can be identified:

1. A “hard” comprehensive legal and institutional framework, where outstanding issues (such as the significance of “acquired right”, or “equitable use”) are agreed on.
2. A “soft” institutional framework, clarifying the framework in very general terms, but leaving the present open issues for later clarification (15%). Thus the legal agreement can be discussed through the institution itself, where the confidence building through these bilateral projects will facilitate the thinking about the legal instrument.
3. A “very soft” institutional framework (e.g. such as the NBI at the moment), only clarifying how decisions are made on a project-by-project basis. If there is no legal and institutional framework established, some of our interviewers see that projects will go forward nevertheless. Even without an established legal framework, a lot can be done.

At the moment the last version seems to be what is happening, over time the “very soft” institution may develop into a “soft” or even “hard” institution. Yet now what is going is a piece-by-piece, step-by-step, project-by-project approach. Thus agreements will have to be made for each specific project, in the “soft” NBI framework.

To enhance cooperation many Sudanese suggest to focus on implementation projects to put action on the ground rather than on a legal framework. The Ethiopian experts were more ambivalent about this, some thought a legal and institutional framework is the sine quo non for cooperation, so that Ethiopia has clarity and access to funds, others thought the project-by-project is the way forward, as it seems very difficult to negotiate a legal framework at the moment.

### **5.4 Cooperation between Sudan and Ethiopia**

Sudan and Ethiopia can enhance cooperation by win-win projects shared between the two countries. There are great needs for joint cooperation between the two countries to reduce the sediment transportation and to increase the recharge to groundwater going to the Nile. But all these joint projects have to be negotiated, integrated projects

are projects that integrate hydropower's generation, irrigation, watershed management, navigation, fishing and flood control. Such projects are mainly situated on the Blue Nile and Baro/Akobo-Sobat River, this can be done through ENTRO or others joint committees. The two countries agreed to shared water resources management (as described in the shared vision), to achieve sustainable socio-economic development through the equitable utilization of the benefit from, the common Nile Basin resources, where they prefer to used common instead of shared. However, there are many obstacles to cooperation that need to be surmounted: uncertainty about the impacts, about what the other actors interests and strategies are, etc. People or countries normally only cooperate if they can gain something from cooperation, thus it is important to clarify what each party to a cooperative set-up can benefit. Some suggested options to enhance cooperation between the two countries are seen in: Negotiating a Nile agreement acceptable to all, Development of irrigation and hydropower, Watershed management to hinder soil degradation and erosion, Cooperation of national water policies and development master plans (EWRMP 1999).

To start cooperation Sudan and Ethiopia has to therefore first respect the interest of each party (also the downstream Egyptians), and then look to and promote all those win-win projects that promise early results, build confidence and then the Nile riparians can build on that to enhance cooperation in a more long-term, institutionalized manner. In the following sections, some areas of cooperation are described.

### **Data and Information Exchange**

Data and information exchange are vital for construction and operation of the Nile models. This has already been approved by the three Eastern Nile countries (Ethiopia, Sudan, and Egypt) and it is also important for designing the operation of water projects in the Nile (existing and in the future).

There are three types of data which are published yearly, monthly, and daily data. To exchange information one first needs to know the type of data needed for specific projects. For data banking, one needs to have an agreement to establish central office linked to the existing ministries in each country, this can be done through ENTRO.

### **Investment Funds**

There is a big potential for obtaining investment funding for development and shared win-win projects between the two countries. Where this process is supported by the international community and World Bank, and other such agencies, cooperation is often set as a pre-requisite for getting financial assistance. Now the motivation of international donors to help projects of transboundary nations is because these projects help stability, peace and prosperity in a region that is very poor. Another reason is the hoped for economic return from such projects. Joint project between countries have better chances for gaining investment funds, as donors to not want to fund a project that can cause a conflict.

## **Better Outcomes**

Better outcomes can be achieved by sincere cooperation and good political will, and also by working together (trust, transparency, and joint work), and by going early through projects implementation. In this way the riparians can save some lives, as for example early warning, flood control, food security, more power stations can support development and mitigate floods and other natural disasters.

Better and more sustainable outcomes could be gained through legal and institutional frameworks, as this clarifies what each actor can expect, how actors cooperate, what are their rights and duties. Yet such an institutionalization of cooperation may take time. Win-win projects can come up with quicker results, building trust that can then be consolidated in a legal, institutional framework. In any case the Nile countries must avoid cooperation on the international level that leads to conflicts on the local level (Mason 2004). To avoid local conflicts, stakeholders have to be involved from the beginning, and possible environmental and social impacts need to be carefully considered.

To improve development outcomes in the future we need to look at proposed water and energy development projects in a much wider setting, a setting that reflects full knowledge and understanding of the benefits and impacts of large dam projects and alternative options for all parties. One of the most important parameters of the “equitable use” approach is not to cause significant harm, so by insuring reasonable use through prior consultation between the involved countries in planning, design and operation of the projects. The chance of avoiding significant harm can be improved through communication and consultation – that takes the needs and interests of all actors into account. Water shortage is a big challenge. Any project should be started by discussion and then followed by planning. By protecting the watershed some water can be saved (e.g. upstream storage can save some water). This cooperative approach needs a mind shift, thinking that focuses on mutual benefits rather than sharing “drops of water”, because benefits are easier to share and thus can be made more sustainable, especially significant harm can be guaranteed. Sudan and Ethiopia share greater cultural activities and historically they had common cultural behavior. A revival of this could improve political relations between the two countries (Arsano, Tamarat 2005).

Ethiopian and Sudanese people generally like each other, where Ethiopia peoples regard the Sudanese as gentle people and helpful. The problem is the political relation between the two governments, that go up and down.

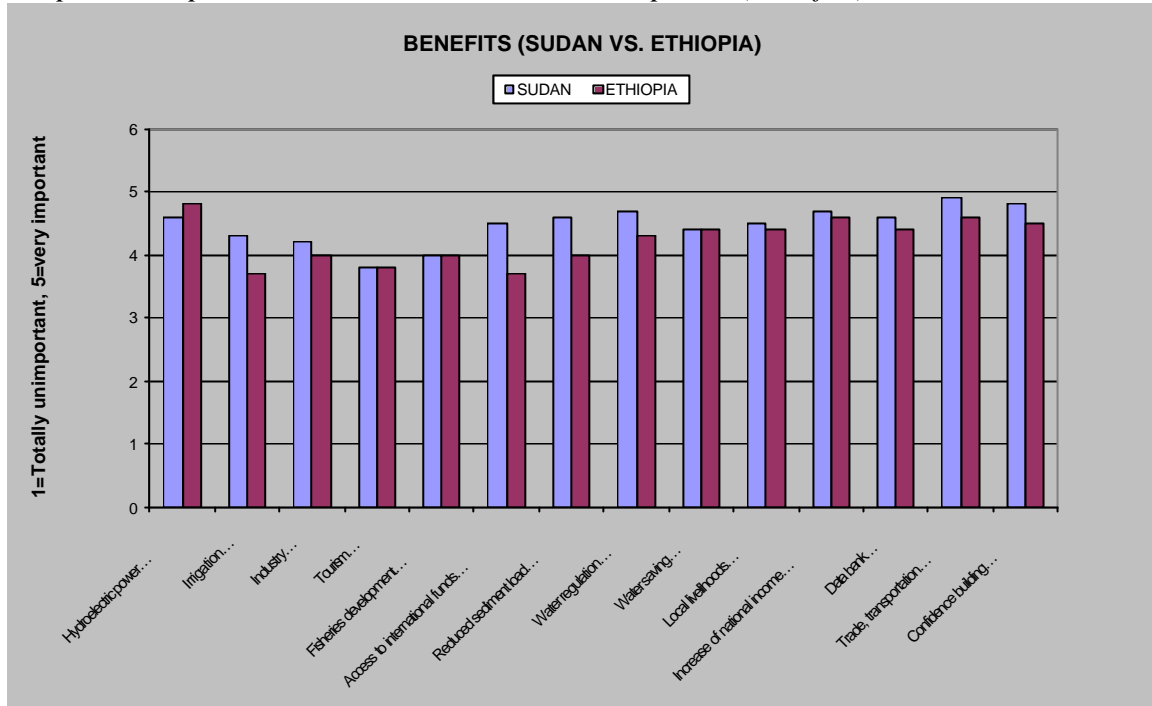
## 6. Comparison of Sudan and Ethiopia Perceptions

By analysis of the questionnaires No. 2 and No. 3, we found that most of our experts from Sudan and Ethiopia approximately had the same opinions; see graphs No. 1 and 2. The expert's opinions have almost the same vision for cooperation especially in security, development, irrigation, hydropower generation, and flood and drought mitigation.

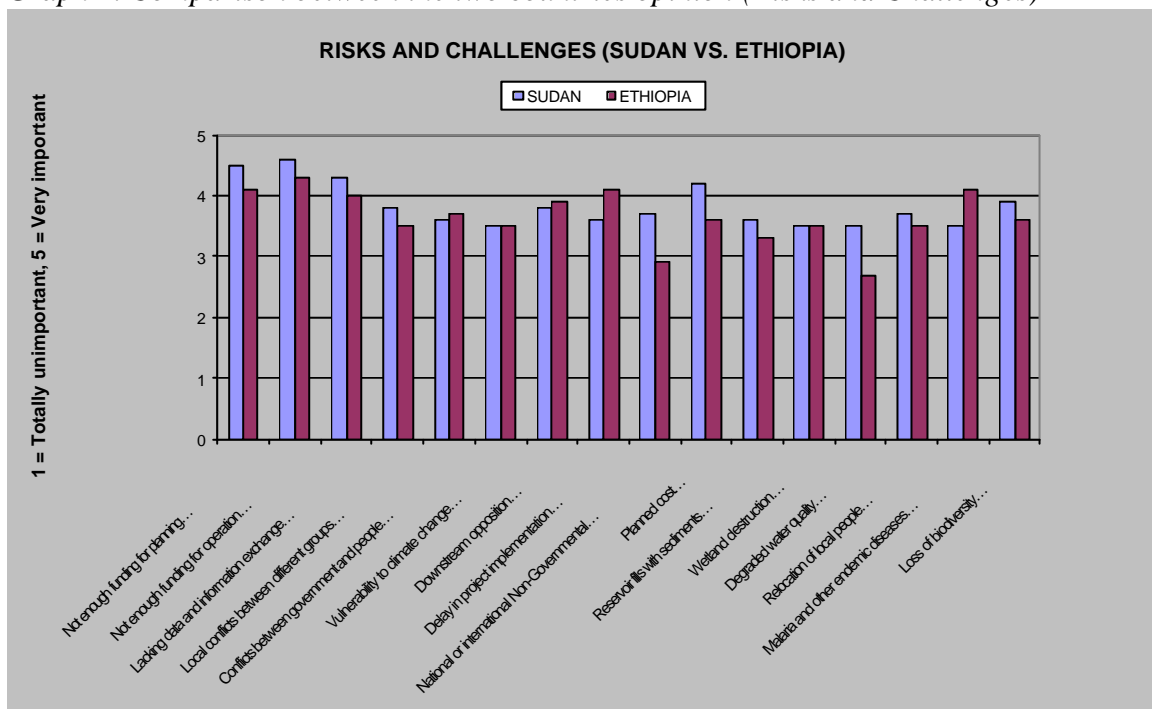
Both Sudanese and Ethiopians see greatest benefits in trade and transportation, confidence building, water regulation and hydroelectric power generation. Tourism was viewed by fewer as a benefit (Graph 1).

Regarding risks, both Sudanese and Ethiopians agree that not enough funding is one of the greatest risks. Although the number of people asked does not make for any significant findings, it is interesting to see that more Ethiopians (highlanders) were worried about diseases such as Malaria in relation to water projects, than their Sudanese counterparts (that already live with such diseases). For the Sudanese experts (downstream) the question of data exchange was graded as a more important challenge than by their Ethiopian counterparts (Graph 2).

Graph 1. Comparison between the two countries opinion (Benefits)



Graph 2. Comparison between the two countries opinion (Risks and Challenges)





## 7. Conclusion and Recommendations

By enhancing joint projects between Ethiopia and Sudan to build dams and construct irrigation projects, the Nile countries can enhance peace and stability in the region. Without this principle it is not possible to satisfy human needs for the present and coming generations.

The benefits of joint projects can be summarized in:

- Maximizing water resources,
- Linking the issue of water to other resources,
- Establishing a supra-national organization,
- Better use of technology,
- Basin-wide conservation,
- Positive spill-over for political relations,
- Environmental protection, and
- Combating drought.

Conflicts between upper and lower Nile countries are more than 100 years old, the lack of a basin-wide agreement on water development projects poses a problem for both upstream and downstream countries. Conflict prevention and cooperative water resources management in the Nile Basin are therefore central development challenges for the ten countries. Experts from Sudan and Ethiopia highlighted advantages (benefits) of cooperation between the two countries such as power trade, improvement of people's livelihood, watershed management, less soil degradation, river regulation, reduced reservoir siltation and inlet canals, flood regulation potential, trade, additional capacity for water storage, hydropower generation, peace and security, and development. All these can be done through legal and institutional frameworks, and quicker outcomes can be provided through win-win projects.

Without communication there is no negotiation. Negotiation is a process of communication back and forth for the purpose of reaching a joint decision. Sudan and Ethiopia need to increase and develop their water resources to meet the increasing demand from agriculture, hydropower, industry, tourism and transportation. There are different priorities to enhance cooperation between the two countries, e.g., focus on project-by-project, develop a legal and institutional framework, build strong political cooperation over the Blue Nile water between the two countries, and understand the different stakeholder perspectives (also local actors). All these are key steps towards cooperation.

If the upper and lower Nile riparian countries continue arguing on legal issues over the so called 'national and regional rights' to water, planning uncertainty is greater and more environmental deterioration is imminent. It is therefore advisable to follow a basin approach and use water on a sustainable basis, because nature has its own laws and limitations to serve its users. Joint management implies agreement on a set of principles or structures on the collective use of common water resources of the two countries. The Integrated Water Resources Management approach will only work if practitioners and policy-makers recognize and accept that sustainability is as much about the social and economic as about water and the environment.

The key lesson learned from this study is that there are great benefits from joint win-win projects that can be achieved through the Nile Basin Initiative. Both Sudanese and Ethiopians we interviewed agreed on the main benefits: trade, transportation and communication between Sudan and Ethiopia, hydropower development, and general confidence building and improved relations between the two countries. On the challenge side, they agree on some of the main risks and challenges: not enough funding.

## 8. Annexes

### 8.1 Annex No.1 "Questionnaire-1"

#### Main Open Questions:

1. What are the benefits and risks of the integrated projects between Sudan and Ethiopia on water resources development in the eastern Nile basin?
2. What has been achieved within ENSAP and what is still needed to make equity, efficiency, participatory decision-making, sustainability, and accountability common practice?
3. What will happen if a legal and institutional framework cannot be established? What are Sudan and Ethiopia's alternatives?

#### Side Questions:

1. What are the impacts of the large dams on eco-system, biodiversity and downstream livelihoods in upstream and downstream countries?
2. How can we make cooperation between Sudan and Ethiopia in the field of shared water resources?
3. How will data and information exchange occur when the two countries official announces plans for water use in case of cooperation?
4. What is the potential for obtaining investment funding for development and shared projects?
5. How can we achieve better outcomes?
6. How can equitable use be insured without causing significant harm?
7. How can we mitigate the impacts of the hydropower on the Blue Nile River?
8. What are the suitable integrated projects between the two countries?
9. How can cooperation between Sudan and Ethiopia over shared water resources be put into practice?
  - What options can come up with Tekezi-Atbara River and Baro/Akobo-Sobat Rivers as integrated projects between Sudan and Ethiopia?
  - What is the adopted water legislation in the two countries concerning transboundary Rivers?
  - How far do 'soft' cultural ties influence political relations between Sudan and Ethiopia?

## 8.2 Annex No.2 "Questionnaire-2 (Sudanese Experts)"

How important are the benefits of the integrated win-win projects on water resources between Sudan and Ethiopia?

<b>Benefits list</b>		Totally unimportant	Not important	Partially important	Important	Very important
1	Hydroelectric power development				6	9
2	Irrigation			3	4	8
3	Industry (industry development in project area; Hydropower/raw material for industries in other parts of the country).			2	7	6
4	Tourism			7	4	4
5	Fisheries development			4	5	4
6	Access to the international funds (e.g. World Bank)		2		2	11
7	Reduced sediment load			2	2	11
8	Water regulation, flood control			1	3	11
9	Water saving, less evaporation, increase in total amount of water in the Nile Basin			4	1	10
10	Local Livelihoods: benefits for the people living in the project area		1	1	3	10
11	Increase of national income (through marketing of agricultural products/hydropower by state controlled organization)			1	3	11
12	Data bank, better information exchange system			1	4	10
13	Trade, transportation, and communication between Sudan and Ethiopia				2	13
14	Confidence building, improved political relations between Sudan and Ethiopia				3	12

How important are the risks (= likelihood of significant damage to the project and or affected economic, social and environmental systems) of the integrated projects on water resources between Sudan and Ethiopia?

<b>risks and challenges</b>		Totally unimportant	Not important	Partially important	Important	Very important
<b><i>Risks that the win-win projects will not work, not work well:</i></b>						
1	Not enough funding for planning and construction		1		4	10
2	Not enough funding for operation maintenance			1	4	10
3	Lacking data and information exchange		2	1	2	10
4	Local conflicts between different groups		2	2	8	3
5	Conflicts between government and people in the project area		2	4	7	2
6	Vulnerability to climate change (e.g. lower average annual river flow)		3	4	6	2
7	Downstream opposition due to harm caused by reduced flow.		2	3	6	4
8	Delay in project implementation because of disagreement between Sudan and Ethiopia	4	1		2	8
9	National or international Non-Governmental Organizations oppose project		4	2	3	6
10	Planned cost / benefit estimates are wrong, project is more expensive than planned		3	1	6	5
11	Reservoir fills with sediment faster than planned		3	2	8	2
<b><i>Risks and problems created by the project:</i></b>						
12	Wetland destruction		3	4	6	2
13	Degraded water quality and pollution (e.g. salinity, fertilizers, increase in aquatic weeds)		4	1	8	2
14	Relocation of local people	1	3	2	3	6
15	Malaria and other endemic diseases		4		11	
16	Loss of biodiversity, loss of forests, desertification		3	1	6	5

## Annex No.3 "Questionnaire-2 (Ethiopian Experts)"

How important are the benefits of the integrated win-win projects on water resources between Sudan and Ethiopia?

<b>Benefits list</b>		Totally unimportant	Not important	Partially important	Important	Very important
1	Hydroelectric power development				3	<b>12</b>
2	Irrigation		3	4	2	<b>6</b>
3	Industry (industry development in project area; Hydropower/raw material for industries in other parts of the country).			3	9	<b>3</b>
4	Tourism		3	1	7	4
5	Fisheries development			4	5	4
6	Access to the international funds (e.g. World Bank)		2	4	5	<b>4</b>
7	Reduced sediment load			4	7	<b>4</b>
8	Water regulation, flood control			3	4	<b>8</b>
9	Water saving, less evaporation, increase in total amount of water in the Nile Basin			4	1	<b>10</b>
10	Local Livelihoods: benefits for the people living in the project area			3	3	<b>9</b>
11	Increase of national income (through marketing of agricultural products/hydropower by state controlled organization)			1	4	<b>10</b>
12	Data bank, better information exchange system			1	7	<b>7</b>
13	Trade, transportation, and communication between Sudan and Ethiopia			2	2	<b>11</b>
14	Confidence building, improved political relations between Sudan and Ethiopia			3	1	<b>11</b>

How important are the risks (= likelihood of significant damage to the project and or affected economic, social and environmental systems) of the integrated projects on water resources between Sudan and Ethiopia?

<b>risks and challenges</b>		Totally unimportant	Not important	Partially important	Important	Very important
<b><i>Risks that the win-win projects will not work, not work well:</i></b>						
1	Not enough funding for planning and construction		3	2	3	8
2	Not enough funding for operation maintenance		2	1	3	9
3	Lacking data and information exchange			5	5	5
4	Local conflicts between different groups		2	5	7	1
5	Conflicts between government and people in the project area		2	3	8	2
6	Vulnerability to climate change (e.g. lower average annual river flow)		1	8	4	2
7	Downstream opposition due to harm caused by reduced flow.		2	3	4	6
8	Delay in project implementation because of disagreement between Sudan and Ethiopia			6	1	8
9	National or international Non-Governmental Organizations oppose project		8	4		3
10	Planned cost / benefit estimates are wrong, project is more expensive than planned		3	4	4	4
11	Reservoir fills with sediment faster than planned		4	4	5	2
<b><i>Risks and problems created by the project:</i></b>						
12	Wetland destruction		5	3	1	6
13	Degraded water quality and pollution (e.g. salinity, fertilizers, increase in aquatic weeds)		7	5	3	
14	Relocation of local people		3	5	4	3
15	Malaria and other endemic diseases			4	6	5
16	Loss of biodiversity, loss of forests, desertification		2	5	5	3

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