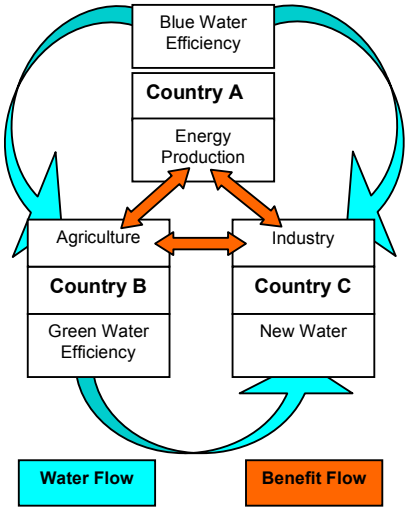
NILE BASIN TRANSBOUNDARY BENEFIT SHARING FRAMEWORK

February 2009



CONTENTS

List of Figures

List of Tables

ABBREVIATIONS AND ACRONYMS

BSF	Benefit Sharing Framework
CFA	Cooperative Framework Agreement
CRA	Comparative Regional Assessment
DSS	Decision Support System
ENTRO	Eastern Nile Technical Regional Office (Addis Ababa)
GEF	Global Environment Facility
ISP	Institutional Strengthening Project
IWRM	Integrated Water Resource Management
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Programme
NILE SEC	Nile Basin Initiative Secretariat
PSP	Professional Service Provider
SAC	Sectoral Advisory Committees
TAC	Technical Advisory Committee
TDA	Transboundary Diagnostic Assessment
TOR	Terms of Reference
TWO	Transboundary Water Opportunity Analysis
VBS	Volumetric Based Scenarios
WUTS	Water Utility and Trade Scenarios

This assignment took place between September 2008 and February 2009 and was managed by Hellen Natu supported by Tamene Tiruneh of NBI. Their extensive practical and technical input and enthusiasm should be properly recognised as it represents a critical contribution to the development and promotion of this benefit sharing approach. Peter Nabende of NBI provided all necessary administrative and logistics support and this was much appreciated. Professor Tesfaye Tafesse of Addis Ababa University undertook the significant task of organising the ToT workshop for 35 participants from the riparian countries. Eng. Mekuria Tafesse and Dr. Ahmend Khalid Eldaw very kindly made available resource materials from the ENTRO documentation centre. The participants at the ToT workshop made many useful and critical comments on the benefit sharing framework and these were used to finalise the document and improve the training materials.

Dr David Phillips of Phlliips Robsinson and Associates Namibia Ltd contributed significant time and effort to this assignment in particular with regard to the Transboundary Water Opportunity [TWO] Analysis. Dr Phillips who was instrumental in developing and applying the TWO Analysis elsewhere, contributed existing and original materials for use in this assignment.

1 INTRODUCTION

This document is the result of a consultancy tasked with developing a Benefit Sharing Framework for the Nile Basin Riparians and training trainers in a methodology to define and develop benefit sharing scenarios which took place between September 2008 and February 2009. The documentary outputs of the consultancy are:

- A Benefit Sharing Framework Document
- A Benefit Sharing Training Manual
- A Case Study (Jordan Basin TWO Analysis)
- Training powerpoint presentations on Methodology and the Case Study

The purpose of a Nile Basin Benefit Sharing Framework is:- to assist the Nile Basin Countries and SAP coordination units *to provide a common understanding upon which riparian states can agree and develop transboundary benefit sharing, identify significant benefit sharing opportunities and determine the magnitude of possible benefits and costs.*

The Framework covers establishing a common understanding amongst riparians of the nature of Benefit Sharing, a methodology for identification of scenarios and suggests how the framework could be harmonised with legal and institutional frameworks emerging in the Basin.

This document –the Benefit Sharing Framework- was developed following discussions with NBI staff – a round of drafting and initial feedback and then revision following the ToT workshop attended by 35 participants in Addis Ababa from 20 to 22 January 2009. The document focuses on the rationale and design for a framework and methodology. The Training Manual addresses the methodology in greater detail and the Case Study illustrates how the generic methodology has been applied in the Jordan River Basin.

The Framework is not intended to be a tool for the detailed design, financing or implementation of programmes, but it is a means to enable the riparian states to jointly identify and agree upon opportunities of mutual benefit. As such it is concerned with opportunities which are properly transboundary in nature – that is they affect more than one country. Benefits are also seen in a very broad context including for example, cooperation and integration such as adopting common procedures and standards. As such these benefits have to be valued in both qualitative and quantitative ways.

A critical contribution which the framework aims to make is enhanced cooperation between the Nile Basin Riparians – since this is the basis from which benefit sharing is possible.

The framework therefore concerns establishing a common understanding and methodology upon which benefit sharing scenarios can be considered by the riparians using a process which facilitates cooperation and consent. It therefore begins by establishing a broad conceptual approach for a flexible and adaptable methodology, it proceeds to broadly scope potential scenarios and ends by recommending generally quantified Benefit Sharing Portfolios for further consideration through existing planning and approval mechanisms.

At this point in time A Nile River Basin Cooperative Framework Agreement [CFA] is under negotiation. That legal structure will have significant bearing upon the Benefit Sharing Framework. Whilst it is not possible to provide statements of those linkages until negotiations are completed, analysis has been conducted as far as possible on the basis of the present CFA draft as well as related International Water Law. In the interests of preserving the integrity of ongoing negotiations no explicit reference to the provisions of the CFA are made in the present document.

2 OVERVIEW

> *"The emergence and maintenance of transboundary water management regimes rests on a complex web of inter-related factors that define incentives for cooperation. Fostering cooperative regimes is, essentially, a matter of altering perceptions such that the benefits of cooperation are seen to outweigh those of unilateral action. This is at the heart of the concept of benefit sharing. The difficulty lies not in the conceptualisation, but in the realisation." (Quaddumi 2008)*

International law and the emerging Cooperative Framework Agreement [CFA] is the foundation upon which the substantive and procedural mechanisms for countries sharing the Nile Basin is being developed. Consequently the objectives and procedures for realising benefit sharing ***between*** countries differs significantly from the more familiar approaches adopted ***within*** a single sovereign country. A major difference with this international system is that it does not rely upon a central source of authority – as is the case for a national government. Instead it can only achieve an effect through the mutual consent and cooperation of the countries themselves. Under this international legal system there is no constituent body which can forcibly manage the water resources of the Nile Basin since it lacks the established powers and authorities of a sovereign government managing waters within their own jurisdiction.

Because cooperation and consent lie at the heart of this international mechanism, it is essential that there is a common understanding of both the objectives and mechanisms to achieve transboundary benefit sharing. Consequently a benefit sharing framework should enable trust to be built, consolidate properly shared concerns and alloy political will to act towards mutual goals. There is little doubt that in the absence of such forms of cooperation transboundary benefit sharing is not possible.

The Nile basin benefit sharing framework therefore begins by defining the basis for a common understanding of the many factors necessary to establish benefit sharing. These definitions may be changed and added to over time as the scope for mutual cooperation grows. A guiding principle for the framework as a whole is therefore to establish a working basis for cooperation which can and should be dynamic and changing over time – such that it enables –rather than prevents cooperation. The Nile Basin Initiative – and its successors – are identified as the facilitator for this growing framework. The purpose of developing common understanding is therefore to strengthen trust and cooperation and avoid uncertainty and hesitation to act.

It is through the consistent involvement and approval of the riparian countries themselves that benefit sharing itself will be realised in practice. Therefore a second principle for the framework is that agreement of the riparians is built in at critical decision making and approval stages. The framework is therefore not a "black box" model into which countries submit information – and out of which an "optimal decision" mysteriously emerges. Instead negotiation and agreement by the countries is required at the general level of scoping potential benefits as well as at the more specific level of evaluating the potential magnitude of benefit sharing options.

The end point of the framework comes after countries agree to determine the general magnitude of benefits of a broad scope of potential opportunities and recommended that some scenarios are formally considered in full detail. This agreement from the countries at

the framework end point will then trigger detailed planning at the level of the countries concerned. The framework does not imply formal approval of projects or interventions – what it signifies is that countries agree and recommend that ideas are examined in increasing detail. The framework itself is therefore a means to enable cooperation and the identification of benefit sharing programmes which are both of mutual priority and potential qualitative or quantitative benefit to two or more of the Nile Basin Countries. The framework is not the mechanism to provide the formal approval, detailed design, finance and implementation planning for such opportunities. That is to be undertaken by the relevant countries themselves – and so follows the legal principles of Subsidiarity and the Right of States to use waters within their territories. Therefore whilst all countries are part of the overall approval procedure, only those countries affected or benefiting from the potential benefit sharing would undertake the detailed planning work.

Of particular concern to establishing cooperation is the need to provide a mechanism that results in multi national consensus of the benefits which can be shared by many instead of a mechanism which results in competition and benefits to few. Such a mechanism is presently seen to be based upon two key concepts. The first is the idea of Positive Sum (or win-win) outcomes in which the sum of benefits gained from cooperating are greater than the sum of benefits available to the same countries acting individually. The second idea is that of negotiating on the basis of "Baskets of Benefits" (Phillips et al 2006). The basket of benefits approach avoids unproductive and difficult negotiations over single objectives by negotiating on the basis of a range of possible benefit sharing opportunities – this provides a basis for a positive sum outcome. Negotiating on the basis of a single objective is likely to have a zero sum or even negative sum outcome, in which we "rob Peter to pay Paul." This basket of benefits approach was also developed to enable the whole hydrology – and not just the "blue" river water in a basin to be considered, as well as enabling complex synergies and opportunities to be properly grasped.

Consequently in the benefit sharing framework, identification and negotiation of benefit sharing goes hand in hand. A basket of benefits is intentionally kept open both at the time of general scoping of potential scenarios as well as during the determination of the potential magnitude of benefits to be shared. Agreement is not therefore pursued on the basis of single projects and hard numbers – but for scenarios in which more than one country will benefit in a variety of ways. Therefore an upstream development can be negotiated jointly with a downstream development – since together those developments can represent a positive sum outcome and gain mutual approval, whereas negotiating the upstream development by itself may not succeed.

Adopting an approach that keeps the basket of benefits open suggests preliminary agreement on a range of potential opportunities which yield benefits to several countries – rather than agreement based upon specific benefits to individual countries. This essentially calls for initial agreement that a range of scenarios represents benefits which are **significant** to several countries, before analysing what the **magnitude** of those benefits may be to any of the countries in particular. Consequently the framework has three stages as summarised in fig 1 below.

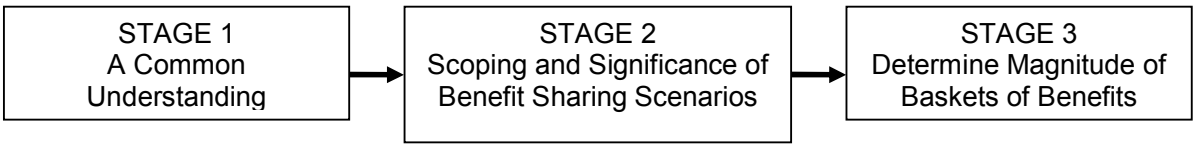


Fig. 1 - Benefit Sharing Framework: Simplified Flow Chart

Stage 2 is conceptual and qualitative – it scopes potential benefit sharing scenarios and "maps" them pictorially in the form of a matrix. This approach follows methodologies proposed by Sadoff and Grey 2005, the work of the GEF, and futher refined and applied by Phillips et al 2006. It results in a qualitative picture of significant benefits which could be

shared. This approach is now increasingly used in practice and has been applied to the Jordan River and elsewhere. Initial feedback suggests that an approach of scoping benefits at a broad general level can pave a way to productive discussion on how shared water can be managed in new ways to achieve those benefits. (David Phillips, pers comm. 2008)

The framework then calls for the agreement of the riparians to proceed to stage 3 in which the magnitude and costs of the potential benefits are determined with respect to the various countries concerned. It is intended that these determinations are fully integrated with the Nile Basin Decision Support System, such that the effects of a variety of common criteria can be explored. These might include, climate change, cropping patterns and the importance of blue /green water balance or conjunctive water source use.

The outcome of Stage 3 is a quantitative valuation of the general magnitude of the benefits. Agreement is again called for from the riparians in the form of a recommendation to proceed beyond the benefit sharing framework and into more detailed joint design and planning procedures at the beneficiary country levels. The framework contains no mechanism to formally approve a project, instead it aims to enable cooperation to achieve agreement for a broad conceptual range of benefit sharing scenarios on the basis of their significance and move forward to agreement for a basket of benefits on the basis of their general magnitude. Having thus arrived at a common understanding of the significance and magnitude of benefit sharing ideas – the riparians concerned have a more robust basis upon which to begin detailed planning and possible approval for joint transboundary programmes.

Table 1. Nile Basin BSF– Stages and Outputs

STAGE	PURPOSE	OUTPUTS
Stage 1 Common Understanding	Overview of opportunities to utilise "whole hydrology" to meet development objectives	To agree on sub benefit categories
		To agree on definitions and methodology for analysis
		To produce a whole basin matrix
		To agree on whole basin / sub basin unit approach and timelines
Stage 2 Scoping Benefits	To identify potential benefit sharing scenarios using country level data.	Develop benefit sub category matrices reflecting country level data and hydrology
		Analysis of matrices across countries and benefit categories
		To identify/outline baskets of benefits
		To develop preliminary Benefit Sharing Portfolios
Stage 3 Magnitude of Benefits	To use quantitative data to establish general magnitude of benefits and costs.	To balance baskets of benefits
		To identify potential Positive Sum Outcomes
		To complete Benefit Sharing portfolios

A Nile Basin Benefit Training Manual was produced as part of the present consultancy and presents a detailed methodology.

3 STAGE 1- A COMMON UNDERSTANDING

> *"In fact, most of what is termed 'benefit-sharing' falls into one of two traps: either it resembles the previously utilized concept of Integrated Water Resource Management; or it consists of idealistic appeals for what should be done, without entering into a discussion on the real-world viability of such visions."* *Phillips et al 2006*

Purpose

The purpose of Stage 1 of the framework is to provide working definitions of the concepts and principles behind benefit sharing such that a basis for trust and cooperation is established. Because it is essential that this understanding is commonly shared by all riparians it will be necessary to continuously update these definitions in the light of new knowledge and agreements. It is important that a common understanding begins by presenting a foundation for basic concepts of benefit sharing – before defining more practical and applied aspects.

It is mainly in recent times – following the rapid growth of International agreements to share transboundary waters- that the idea of a planned approach to benefit sharing has become possible. Consequently theoretical ideas currently outweigh practical experience and much of what is being undertaken in terms of organization and planning in the Nile Basin is new ground. A significant amount of this Benefit Sharing Framework must therefore be modified as new experience is gained– as it cannot rely solely upon present day theoretical knowledge. However current theories regarding developing benefit sharing appear to have more in common with each other than any significant differences. So whilst terminology may differ between authors – the fundamental approach appears to be basically the same. Therefore it is possible to draw a consistent picture from the literature cited, in the certain knowledge that the practical experience of applying these approaches in the Nile Basin will generate extensive new understanding. The common understanding presented for the Framework is therefore drawn from across the current literature.

Many of the questions which have to be met with appear at first glance to be fairly simple, but on deeper analysis turn out to be surprisingly complicated. Terminology and jargon often makes matter worse. The examples of “Transboundary,” “Benefit Sharing” and “Water” are reviewed below as illustrations.

What is Transboundary?

IWRM has emerged as a valuable planning tool for managing the complex issues and multiple stakeholder concerns associated with water resources management. IWRM is fundamentally concerned with defining a hydrological unit as the basis for planning and has seen considerable success at the country level. Adopting the hydrological unit of the river basin has thrown up new challenges when it is applied to rivers crossing several countries because the “river” watershed boundary struggles to incorporate all of the factors driving water resource management in such a large geographical, political and economic geography. For example a mid stream country might develop agriculture, but the market for its produce is likely to be international. Consequently that country’s management of water will be driven by economic forces outside the basin itself. Also as knowledge of the extent of major regional aquifers improves it is clear that the boundaries of groundwater are distinctly different from those of the countries and the river basin – consequently the management of groundwater will also be influenced by non basin countries.

There is however a present trend in which countries and country boundaries as recognized in international water sharing agreements form the basis **across** which benefits are to be shared - and this is not the same thing as sharing benefits within the boundaries of the river watershed. The key factor defining this difference is that the countries which make the water sharing agreement also interact regionally as well as globally in political and economic

activities. Currently we are also seeing a trend in the growth of major regional economic and cooperation blocks such as SADC and the EU which are addressing water resource management from the perspective of all rivers and countries within their boundaries. Therefore whilst we may presently be concerned with managing water resources on the basis of countries which lie within a particular basin – the trend is to move towards an even broader boundary based upon a regional economic community in which the potential to share benefits and enjoy stable economic growth is significantly enhanced. These blocks have been called “hydro-political complexes” (Turton 2005) and seek to overcome some of the limitations of defining benefit sharing boundaries on the basis of countries within a river basin. The political implication of this trend is clear – that the benefits of acting as a block of countries outweigh the benefits of pursuing individual national interests.

This trend has considerable impact upon the potential to develop major benefit sharing, because as yet International Law is a far from perfect mechanism for ensuring equitable water sharing between countries. International law can favour the powerful and prosperous nations, and enabling a balanced use of power in its various manifestations is increasingly seen to be important if treaties and water sharing generally is to be reasonable and equitable. Moving towards regional economic blocks appears to balance out power within the region and offer stability. The influence of power therefore shifts from an internal contest between countries and moves towards protecting the interests of the block as a whole.

Therefore at the present time the idea of ”transboundary” as applied to the Nile Basin concerns interactions between two or more riparian countries within the Nile watershed, but this notion is likely to include interactions with countries outside the basin watershed in future. Activities which do not benefit or affect more than one country are not transboundary concerns. That is not to say that purely national level projects have no significance to benefit sharing. Such projects can influence the agreement on baskets of benefits and they can also be the basis for sharing new knowledge and ideas between riparians. Therefore whilst the legal rights to develop national projects may fall outside an international agreement, the benefits those projects generate can be international in nature.

This may help to clarify the earlier idea of a benefit sharing framework adopting a three tier policy framework at the macro – median and micro levels. For the present it is suggested that:

Micro Level Policy: This is not a direct concern for a transboundary benefit sharing as it is a sovereign issue as benefits and impact primarily affect only one country. But it is recognized that national level projects can contribute ideas, skills and knowledge to other countries and investing in them can contribute to productive transboundary negotiations. But whilst the benefits of a project may only be enjoyed by that country alone – it is possible for the projects to have harmful effects on a neighbouring country – and so have a significant transboundary effect. Annex I provides a checklist to identify non transboundary projects and corresponds to the legal ***obligation not to cause significant harm.*** This is important because it shows that benefit sharing and the legal obligations of shared water agreements are in fact addressing the same issues- albeit from different angles. So the dis-benefits of a purely national project can be shared by another country and become important when the harm is significant.

Macro Level Policy: This is a central concern because all riparians benefit or are affected in some way by an activity. Consequently riparians have a mutual interest in the decision making process.

Median Level Policy: In certain cases it could be argued that a project affects two or three countries, but not all countries in the basin and so the development of such projects may not require the full involvement of all riparians. For example agreement on navigation on Lake Victoria might not benefit or affect Ethiopia. In essence then a median level policy is likely to be concerned with bilateral programmes – or programmes between some but not all of the riparians. Because the BSF is concerned with identifying and examining possible benefit sharing scenarios and not with planning or approval, the principle safeguard that has to be in place is that the institutional framework ensures parties give **prior notification** of their activities. This reveals yet another link between benefit sharing and international legal principles. Other international legal obligations however do not require compliance at such

an early stage. A key output from establishing a common understanding concerns whether the riparians intend to apply the BSF methodology to the basin as a whole or to basin sub units.

What is Benefit Sharing?

It appears that the problem of defining what we mean by benefit sharing has to be answered through practical experience rather than first exhausting its theoretical meaning. However significant work has been done to identify how such a practical approach can be undertaken and it is useful to consider some earlier concepts in order to grasp the current situation.

It has been assumed that if countries sharing waters could agree upon rules to allocate volumes of water between themselves, then benefits would be forth coming. However there are two problems with a purely "volumetric allocation" approach. Firstly the rules for allocating volume are constantly challenged by population growth and environmental change, and secondly because those allocations are made to a country – rather than to a use which is of benefit to several countries. Even so - many treaties have entered into force because it has been possible to achieve political consensus of the basis of allocating flows.

Much progress has been made in applying economic indicators to the value of water under certain uses as a means to relate allocation to use and benefit. Without doubt this is a useful approach as it can optimize the economic use of water, but it is also seen to have limitations concerning the broader concept of benefit sharing and water resource management itself. Some benefits recognized by countries prove difficult to quantify with respect to water volumes and money – for example stability and security. Also if we consider the example of the mid stream country exporting irrigated produce - If the export price drops, they would consider increasing irrigation to meet the expected benefits, on the other hand if the export price increases they would consider increasing irrigation to increase benefits. Those responses would not provide a robust mechanism for managing a shared water – since the only response is to increase demand. Obviously this calls for the "managers" being able to manage these tools rather than the other way around. Benefit sharing can therefore be seen a dynamic response to the fixed allocation approach.

Current practice in International Water Law has shifted away from purely volumetric allocation towards the principle of reasonable and equitable utilization. This approach weighs a number of factors against an obligation not to cause harm. It is not intended that the factors are applied to reach "set in stone" allocations of water – the factors are more a set of considerations to be used as the need for negotiation arises. Consequently they represent a very similar approach to that of establishing benefit sharing. As benefit sharing opportunities are suggested, the factors to determine reasonable and equitable utilization become a tool to enable the negotiation of water sharing to meet potential new objectives or challenges. At the present time there is very limited practical experience of applying these legal factors. In particular in order to apply the factors decision makers will need to be supported by an already established array of basic tools and skilled human resources. The BSF is designed to enable progress to be achieved in applying the factors of reasonable and equitable utilization – but begins by focusing on enabling the human resources and tools to emerge to support that future approach.

The current literature provides a range of factors which help identify what the concept of benefit sharing appears to mean:

	Table 2: Emerging Principles of Transboundary Benefit Sharing in River Basins
A	*Where the river basin is not yet being used optimally, improving use and management can release new benefits for the riparians. This condition can also apply in a "closed" basin where all of the available waters are already allocated to the riparians, because their use of water could still be optimized. (Phillips - Sida)*
B	*Transboundary cooperation can release benefits which are greater than those benefits realized through unilateral country actions (Phillips - Sida)*
C	*Transboundary benefit sharing means that the effects and impacts of an activity are felt in more than one country.*
D	*Water Resources Management is directly linked to stability, integration and economic growth. (Phillips - Sida) (Sadoff & Grey 2002)*
E	*Analysing and identifying transboundary water benefit sharing potential requires both a process to build cooperation as well as a mechanism to examine benefits.*
F	*The nature of benefits which might be shared is an open debate and includes inter alia environmental, economic, and political benefits. The process of cooperation to determine benefits is in itself also a benefit. Not all benefits can be assigned a financial value.*
G	*The most successful transboundary benefit sharing outcome depends upon identifying Positive Sum Outcomes (or win – win scenarios) in which all countries recognize a net benefit, rather than a Zero Sum Outcome (win – lose scenario) in which the benefit for one country can represent a loss to another, or Negative Sum Outcome (lose-lose scenarios), where all parties lose.*
H	*Successful transboundary benefit sharing depends upon the consideration of the hydrological cycle as a whole and not only "blue" water present in a river system.*
I	*Cooperation lies at the heart of realizing Positive Sum Outcomes (win –win scenarios) whereas competition over benefits results in (win- lose) Zero Sum Outcomes*
J	*A cooperative approach to benefit sharing scenarios is likely to be successful when based on negotiating "a basket of benefits" rather than negotiating a single benefit. The "basket of benefits" approach puts more opportunities for trade off's and developments on the negotiating table. (Phillips- Sida)*
K	*Benefit sharing should not create future conditions for conflict or competition*
L	*Benefit sharing should be environmentally, politically and economically sustainable.*
M	*Benefit sharing should not aggravate equity and result in those who have more getting more – or those who have less getting less.*

It can be seen that benefit sharing is not an "either or" alternative to water allocation, Phillips describes it as "two sides of the same coin" (Phillips pers. com. 2008). If a number of countries see the means to create additional benefits from their transboundary waters, this may be an inducement to negotiate the management of shared waters in new ways. So in fact whilst some benefit sharing could be possible on the basis of an existing water allocation regime, it may be that new and greater benefits can only arise out of a new water allocation regime. Benefit sharing suggests that where the benefits are sufficiently attractive to the parties this can act as the incentive to explore new ways of sharing the water.

Current literature is concerned with getting nearer to a clear definition of what benefits are by suggesting major categories of benefits. The categories can readily be used as a management tool for scoping benefit sharing scenarios. Examples of proposed categories are presented below:

Table 3: Benefit Categories				
Author	Benefit Categories			
Sadoff & Grey 2002	Political	Environmental,	Direct Economic	Indirect Economic
Phillips et al 2006. Inter-SEDE approach	Security	Environmental	Economic Development	
GEF Transboundary Diagnostic Analysis	Threats	Uncertainties	Stakeholders	Actions
	TDA utilizes strategic joint fact finding to arrive at a consensus of actions to address transboundary threats to water sources. The findings are set in a matrix to prioritize actions to be implemented through a Strategic Action Programme. Although this tool doesn't identify benefits it is does adopt a matrix as a means to visualize complex transboundary water scenarios.			

It can be seen that whilst terminologies differ, the overall concepts are very similar, suggesting that we move from broad concepts to the definition of benefit categories and begin a process of qualitative scoping of opportunities. These qualitative opportunities are generally visualised in the form of a matrix. Benefit Categories (or development options) form one dimension of this matrix and water sources form the other.

The literature generally agrees that after benefit sharing scenarios are scoped, identified and "agreed" detailed quantitative analysis can then begin.

Over time it will be essential that the analytical tools move closer to the criteria recognised in international law concerning "reasonable and equitable utilization" – but that may only be possible as practical experience of real situations grows. Hence for the present we are concerned with how to operationalise basic tools for scoping significance and determining the general magnitude of benefit sharing scenarios.

Benefit categories suggested at the ToT workshop are presented in Annex II.

Which Water?

It is useful to ask two basic questions *"Which waters are to be managed to achieve benefit sharing"* and *"Should we be concerned with benefits which do not arise directly from sharing water"*

IWRM readily provides an answer to the first question since managing "blue" river water alone is not an integrated approach. Phillips et al (2006) develop a robust argument for a whole hydrology approach in benefit sharing to include existing and new water sources, improvements in use efficiency and re-use and the particularly essential dimension of the blue / green water balance. It may also be important to include the effects of virtual water transfers. Their argument demonstrates how optimising the use of one particular water source can have profound effects on the availability of other sources and so enable new type of benefits to be developed. Present NBI work on "brown water utilization" can also be considered as a source of water – provided it is clear that we mean "silt loaded blue water" rather than the different issue of sediment transport.

For example – green water- which is located in the soil and plant material cannot readily be pumped, priced or taxed but without it you cannot grow food. If green water management is inefficient- then applying blue water to food production will simply inherit those same inefficiencies. Efficient green water management however can mean blue water savings and you may be able to produce food and electricity from the finite water resources. In general the volume of green water in a basin is almost double the volume of blue water.

Phillips et al (2006) adapted their whole hydrology approach into a practical methodology which they called the Transboundary Water Opportunity [TWO] Analysis and this is suggested here as the basis for a Nile Basin approach which can be adapted and refined as necessary. Again this is a matrix based approach, which compares water sources - in the TWO case not only blue water – against water uses which derive benefits. They use the terms "Volumetric Based Scenarios" [VBS] and "Water Utility and Trade Scenarios" [WUTS] to define the dimensions of the matrix.

NBI Staff discussed in depth the categories of water use from which benefits can be derived and agreed with the literature that in broad terms economic, environmental and political benefit categories should be considered. They also suggested adding a category for Social Capital to capture benefits arising from health, knowledge, skills and education.

The basic matrices used to identify benefit sharing scenarios therefore set the sources of water against the potential benefit or development categories. Terminologies differ – but the idea is the same. The Transboundary Water Opportunity Analysis (Phillips *et al.* 2008), is unique in that it considers more than just the blue water in the river itself- and this gives it a

critical methodological advantage. In the example below the "Social Capital" benefit category was introduced by staff of the NBI as it is seen as a critical factor in cooperation in the basin. A basic matrix design is shown below.

Fig. 2 -TWO Analysis - Basic Matrix Design

			Volumetric Based Scenarios - VBS					
Water Utility and Trade Scenarios - WUTS	**Benefit Category**	Sub category	Efficiency of Use	Water Re use	Inter basin transfers	Blue water	Green water	etc
	Economic	Hydropower						
		etc						
	Environmental	Wetland conservation						
		etc						
	Political	Rural Supply						
		etc						
	Social Capital	Human resources						
		etc						

Answering the second question, concerning benefits which do not directly arise from water, Sadoff & Grey's (2002) four part classification of benefits arising from cooperation on international rivers indicates the range across which benefits can be felt – and this is clearly broader than those directly related to water itself

Table 4: Types of cooperation and benefits on international rivers

Type	**The challenge**	**The opportunities**
increasing benefits to the river	Degraded water quality, watersheds, wetlands, and biodiversity	Improved water quality, river flow characteristics, soil conservation, biodiversity and overall sustainability
increasing benefits from the river	Increasing demands for water, suboptimal water resources management and development	Improved water resources management for hydropower and agricultural production, flood-drought management, navigation, environmental conservation, water quality and recreation
reducing costs because of the river	Tense regional relations and political economy impacts	Policy shift to cooperation and development, away from dispute/conflict; from food (and energy) self-sufficiency to food (and energy) security; reduced dispute/conflict risk and military expenditure
increasing benefits beyond the river	Regional fragmentation	Integration of regional infrastructure, markets and trade

Reproduced from Sadoff, C.W. and D. Grey. 2002. "Beyond the river: the benefits of cooperation on international rivers." *Water Policy* 4, No.5: 389-403.

An example of an indirect benefit could be a crop insurance scheme which underpins improved agriculture and watershed conservation. The benefits from water management activities are more likely to be realize if implemented alongside a crop insurance scheme. Therefore whilst suggesting the BSF should only concern itself with "water related issues" makes for a tidy theoretical approach – in practice broader synergies cannot be ignored. The BSF should therefore include these important indirect activities in the identification of opportunities, but that does not mean their implementation has to become the business of the NBI - as other more specialized stakeholder could be encouraged to pursue them instead.

The previous discussion covered three topics fundamental to establishing a common understanding of benefit sharing. An indicative list of the objectives to be achieved when establishing a common understanding is presented below:

Table 5: Issues Concerning a Common Understanding	
Issue	**Questions**
Geographical coverage of the Framework	Is the framework to be applied to the whole river basin or to separate sub units? A master matrix for the whole basin should be produced.
	How is benefit sharing between sub units to be addressed?
Hydrological coverage of the framework	Are the hydrological boundaries agreed?
	Which waters will be included in the analysis? Blue water, Green water, basin transfers, groundwater, water re use, water use efficiency, virtual water?
What is meant by transboundary sharing?	Are shareable benefits those shared within a single country, between two or more countries, or also with non riparians. What criteria will be used to identify a benefit as being shared?
What categories of benefits are to be included in the analysis	Economic Benefits including hydropower, agriculture, fisheries, tourism, mining, industry.
	Environmental Benefits including watershed management, wetland conservation, environmental flows, flood control, habitat protection.
	Political Benefits including meeting MDG targets, domestic and rural drinking water supply, stability and assurance of flows, integration, cooperation.
	Social Capital Benefits including increased human capacity, knowledge, training and skill sharing, common systems and approaches.
Clarification of terminology	Agreement upon the meaning of any technical terminology being used (French and English)
Planning Stage 2	Agreement on the methodology
	Agreement on responsibilities, logistics and timing.
	Agreement on a plan of work
	Agreement on reporting of Stage two outputs
Planning Stage 3	General agreement on the methodology and use of final results.

It is suggested that arriving at a common understanding is undertaken by a high level workshop, which addresses the objectives above and is fully documented to produce a reference report. That report should include a conceptual master matrix for the basin as a whole because that exercise familiarises everyone with the approach and captures key conceptual messages in a visual format. During the ToT workshop a first attempt was made at such a whole basin matrix. It is presented in Annex V as an illustration only and should not be considered to represent a final product. The technique used to compile the matrix is presented below.

Technique for Completing a TWO Master Matrix

The Master Matrix for the TWO Analysis represents the general importance of relationships between water sources and benefits **for a basin as a whole**.

At the whole-basin level the matrix is both general and conceptual, but generates important comparative illustrations of the importance of distinct forms of benefit sharing scenarios.

Water sources are simplified into three categories. “New water” is used to represent all sources of water other than virtual water and water gained through improved efficiency. It therefore includes Blue Water, Green Water, and certain forms of re-used water. The Efficiency of Water Use is self-explanatory. Virtual Water is water embedded in primary and secondary products.

It is important to notice that developing a benefit might affect water availability, and conversely water availability might directly affect the value of a benefit. For example, industry does not directly improve the availability of water, but making water available for industry has a significant effect on benefit levels. Alternatively, afforestation in certain cases

can either increase or decrease the availability of water, but Blue Water availability is not usually the means to develop afforestation benefits.

The matrix uses an arrow to show the direction of analysis

Education ⟶	Effect of the potential benefit on water
Education ⟵	Effect of water on the potential benefit

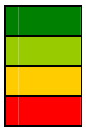
The first step in completing the matrix is to correctly capture the question being asked, and to record it.

The second step is to agree upon an answer to that question, and to record it.

The third step is to colour code the answer, to show how important it is.

For example, there is some link between improving water efficiency in industry and making additional water available for other uses; however in real terms, the amount of water is generally not great as it concerns recycling. This option is colour coded yellow in the example. However, where agricultural efficiency is improved, this can release significant volumes of water for industry. This option is colour coded dark green in the example. The purpose is therefore to show the relative importance of distinct combinations of potential benefits and components of the hydrological cycle.

The example uses a four colour coding system.



The easiest way to record the output is by using three spreadsheets, one to record the questions, one to record the answers and one to record the colour coded summary.

A preliminary TWO Master Matrix for the Nile Basin is presented in Annex V.

Fig. 3 - TWO Master Matrix: Compilation Technique

Fig.3 - TWO Master Matrix: Compilation Technique

Category	Sub-category and Direction	New Water	Efficiency of Water Use	Virtual Water	Analysis
Economic	Industry →	Can changes to industrial practices create New Water?	Can changes to industrial practices improve the EWU?	Is there a coherent link between VW and this sub-category?	Q
	Industry ←	Can New Water enhance industrial production?	Can changes to the EWU enhance industrial production?	Is there a coherent link between VW and this sub-category?	
	Industry →	Not directly	Yes, by minimizing water use through recycling, although volumes are minor	Not significant	A
	Industry ←	Yes, and this use of New Water is of high added value	Yes; inter-sectoral reallocation from agriculture greatly enhances returns	Not significant	
	Industry →				
	Industry ←				
Environmental	Soil erosion →	Can changes in soil erosion create New Water?	Can changes in soil erosion affect the EWU?	Is there a coherent link between VW and this sub-category?	Q
	Soil erosion ←	Can New Water affect soil erosion rates?	Can the EWU affect soil erosion rates?	Is there a coherent link between VW and this sub-category?	
	Soil erosion →	No	Yes, as turbidity affects the economic returns from water	No	A
	Soil erosion ←	Tangentially, through changes in flow patterns	Tangentially, through changes in flow patterns	No	
	Soil erosion →				
	Soil erosion ←				
Social Capital	Education →	Is education relevant to the enhancement of New Water volumes?	Is education relevant to improvements in the EWU?	Is there a coherent link between VW and this sub-category?	Q
	Education ←	Does New Water affect education?	Does the EWU affect education?	Is there a coherent link between VW and this sub-category?	
	Education →	Yes, for various forms of New Water	Yes, e.g. in crop selection	Yes, as a consensual basin-wide strategy is needed	A
	Education ←	Only marginally	Only marginally	Yes, as a consensual basin-wide strategy is needed	
	Education →				
	Education ←				

Additional objectives for a common understanding may concern the legal and institutional framework in which benefit sharing will be embedded. Given the present dynamic status of those frameworks they are only discussed briefly at this point.

Institutional Framework

The BSF does not require a special institutional framework of its own – but it must be possible to graft it directly into the long term framework which could emerge following finalization of the CFA. Given the present understanding of that framework the BSF would fall under the responsibilities of the TAC, and the TAC would need the authority to agree (or recommend) that the BSF can move through each stage. This means that routine management of the BSF would be put under the oversight of the NBI Secretariat who would assign responsibilities as required to subordinate institutions prevailing at the time. As will be discussed in Section 7, it may be necessary to assign some dedicated short term resources to enable the BSF to be operationalised but this is only to launch and embed the BSF – and not to make a project out of it.

It is of great importance that all riparians are aware of the activities being undertaken by the BSF and this has to be an explicit responsibility of a nominated body. Not only is this essential as a form of compliance with international watercourse law in general, but it also ensures that benefit sharing scenarios being analyzed at the sub basin level are known to all riparians.

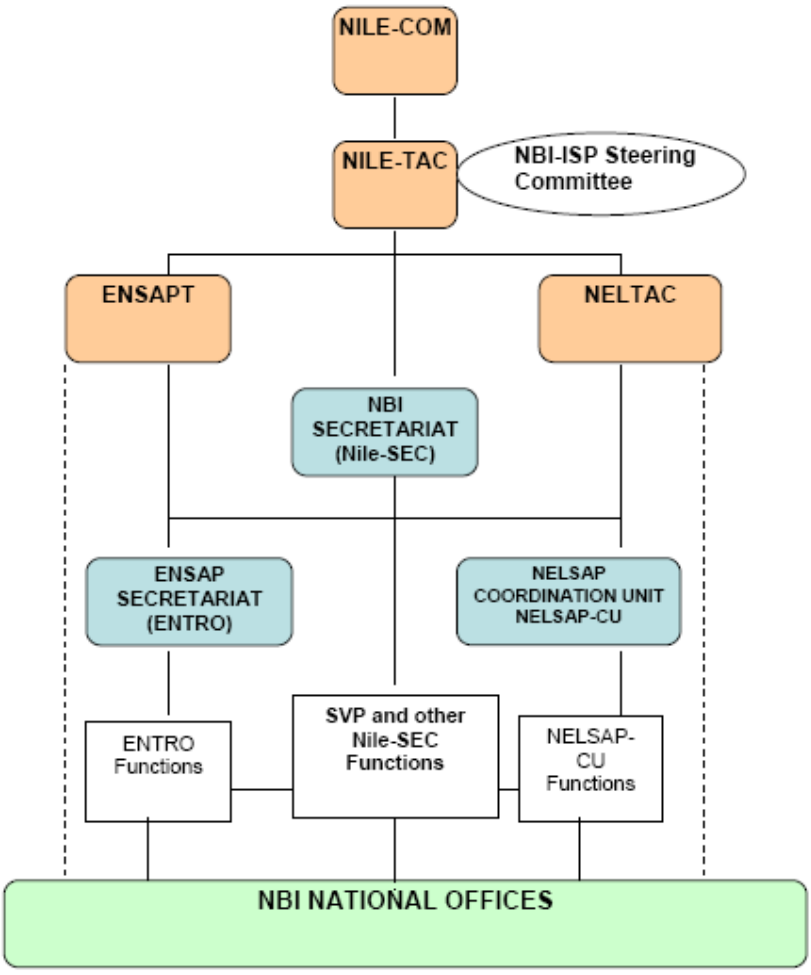


Fig. 4 - Institutional Framework

Legal Framework

A preliminary legal audit against the draft CFA indicates that there are unlikely to be any legal conflicts in implementing the BSF – but there may be some elements of compliance to be checked at the appropriate time in future. However it is important to realize that the BSF has no role in the formal acceptance, planning or approval of projects as it only serves to identify possibilities. Consequently the legal implications of operationalizing the BSF will probably be limited to compliance with the obligation to exchange information (e.g. Art 9 1997 UN Watercourses convention and Art 3.6 SADC revised protocol). There will be a need in future to ensure compliance with the obligation of prior notification (e.g. Art 12 1997 UN Watercourses convention and Art 4 SADC revised protocol).

There is also a very important and direct link between the legal obligation not to cause significant harm (e.g. Art 7 1997 UN Watercourses Convention and Art 3.8 (b) a SADC revised protocol) – the factors to determine reasonable and equitable utilisation (for example Art 6 of the 1997 UN Watercourses convention and Art 3.8 SADC revised protocol) – and the factors being developed to determine the magnitude of benefit sharing. Specific attention should be paid over time to enable these factors to be harmonised and this is of direct relevance to the work of the DSS.

However it can be seen that the responsibility to comply with the bulk of the provisions of a future CFA will be the responsibility of those bodies which seek to approve and implement actual projects – rather than the body which seeks to identify them in the first place.

4 STAGE 2 – THE SIGNIFICANCE OF BENEFITS

Purpose

The purpose of Stage 2 is to show the qualitative significance of a broad range of benefit sharing scenarios in a visual format such that positive sum outcomes can be identified and potential "baskets of benefits" proposed. This leads to "agreement" from the riparians to undertake the third stage of analysis providing a quantitative analysis of the general magnitude of the baskets of benefits.

The description given here of methodology is in overview, a more detailed methodology is presented in the Training Manual and case study.

Overview

Essentially the challenge in setting the scene for agreement upon potential benefit sharing scenarios has to decide whether agreement is likely to be achieved rapidly in the face of extensive factual data – or if it is more likely to be achieved progressively by starting from a more qualitative general level of analysis. Experience tends to favour the latter – especially given that quantitative analysis is costly and has to begin with a general basis of cooperation in any case. The bulk of analyses of transboundary issues begin at a general scoping level and present the findings in the form of a matrix which can be readily understood and analyzed visually and verbally. It is said that "emotion can overwhelm reason" when dealing with complex water issues such that an entirely separate "political" discourse takes over and obscures the possibility to see the benefits of cooperation. Consequently identification and approval of a broad scoping of potentially significant benefits is more likely to result in progress- than attempting to begin by getting approval on the basis of a complex set of quantitative data. The key is to build up cooperation through progressive stages of agreement such that this cooperation becomes robust enough to tackle increasingly difficult decisions.

The Matrix Approach

Establishing the analytical matrix begins by setting the possible volumetric scenarios or sources of water against the possible beneficial uses of that water. This has to be done for each of the benefit sharing sub categories and has to include a short narrative for each country in the basin. An example of an empty matrix for agriculture is given below.

Fig. 5 -TWO Analysis - Agriculture

			Volumetric Based Scenarios VBS					
Benefit Category	Benefit Sub-category		Efficiency of use	Water Re use	Inter basin transfers	Blue water	Green water	etc
ECONOMIC	Agriculture	Burundi						
		DRC						
		Egypt						
		Ethiopia						
		Kenya						
		Rwanda						
		Sudan						
		Tanzania						
		Uganda						

The next step is to fill in the matrix with narrative statements showing the potential use of water sources at the country level to realize the benefits. Examples of sources of data from which to provide these statements include:

National sectoral study papers
Comparative Regional Assessments
UN data bases and country assessments & Tools in use /under development in the NBI

An outline narrative matrix for the economic benefits of agriculture in the Jordan River Basin is presented below- that matrix was modified to reflect the actual water sources and opportunities. The matrix describes how water source use

Fig. 6 -TWO Analysis – Narrative Matrix

Benefit Sub Category	*Riparian*	*Efficiency of Use*	*Flow Management*	*Desalination*	*Wastewater Re-use*	*Inter-basin Transfers*
Agriculture	Lebanon	The efficiency of water use in the agricultural sector can be improved in all of the riparians, the one (partial) exception being Israel.	Flow management can be improved in the three upper riparians by considering Green Water and Blue Water in concert. This will enhance Blue Water flows to the two downstream riparians, improving equity in relation to Blue Water allocations.	The desalination of brackish or marine flows is not appropriate as an option to enhance Blue Water volumes for agricultural use, due to high cost and the inappropriate quality of the water produced.	No requirement, due to high Blue Water availability.	Any scheme is likely to require the cooperative inclusion of all five riparians. Israel is already considering this option, but Jordan and Palestine have the most urgent needs. Turkey is the most likely source of flows, probably from the Seyhan/ Ceyhan systems.
	Syria				Should be expanded throughout the country.	
	Israel				Already very high, and continuing to increase.	
	Jordan				Moderate presently; could be expanded.	
	Palestine				Should be introduced after treatment levels are upgraded.	

Matrix reproduced with permission of D.J.H. Phillips. PRA Associates Namibia

The next task involves converting the narrative statement into a simple visual format to indicate the significance of the scenarios. The Transboundary Water Opportunity Analysis being developed by Phillips et al (pers com. 2008) proposes a simple traffic light system of three colours to indicate the significance of opportunities, this was modified by the ToT workshop participant to become a four colour system as shown below. A dark green colour would indicate that there is an important link between a particular source of water and achieving a particular benefit in a country or countries. Improving the efficiency of water use in a mid stream agriculturally productive country is likely to be more important than in an upstream country where there is little agriculture.

Fig. 7- TWO Benefit Significance Coding " The traffic light system"

IMPORTANT	POSITIVE	SOME LNK	INSIGNIFICANT

A hypothetical completed matrix for agriculture which has been colour coded is shown below.

Fig. 8- TWO Analysis –Colour Coded Matrix

	Volumetric Based Scenarios VBS						
Benefit Category & Sub Category	Benefit Sub-category	Efficiency of use	Water Re use	Inter basin transfers	Blue water	Green water	etc
ECONOMIC Agriculture	A-Land	Efficiency can be improved n all 3 states and would result in major water savings. High Priority	Limited potential at present	No potential	Limited utilisation, agriculture is mainly rain fed and subject to frequent droughts. High priority to secure more sustainable water sources.	Dependence on rain-fed agriculture. Important priority to increase availability of green water.	
	B-Land		Significant potential on major irrigation schemes – high priority	No potential	Moderate use high productivity but low efficiency.	High priority to increase green water availability	
	C-Land			Possible out of basin transfer –	Very high use and dependency. High priority to develop	No alternatives to increase green water availability.	

				low priority	alternatives	Low priority	

Once a matrix has been fully colour coded and shows the significance of the benefit sharing opportunities for each country against the volumetric based scenarios - it is analysed through discussion. By looking at the significance of scenarios relative to each country, possible cooperation options can be examined and the potential for Positive Sum Outcomes discussed. Benefit categories and sub categories can be analysed in parallel to explore broader possibilities for cooperation and positive sum outcomes. For example it would be possible to compare hydro power generation with urban development to suggest where cooperation might be possible and new approaches to water management emerge – particularly where this indicates positive sum benefit sharing.

In the matrix example given above for example the implication of increasing water re use in B-Land and C-Land could mean increased productivity as well as less demand on blue river water. This means some new scenarios can start to be considered. For example if A-land is to increase agricultural productivity it will need to find an alternative to rainfall – although it must first increase its water use efficiency and the availability of green water. Even so it may be that occasional critical use of blue water for irrigation in A-land is negotiable. A-land may however see another alternative in which it generates hydro-power as a complimentary activity to down stream water savings in agriculture – and where the power produced could be shared with all of the countries.

It is expected that many combinations of benefit matrices could be compared alongside each other to identify a range of potential benefit sharing scenarios.

It is through this comparative analysis across benefit categories and sub categories that a basket of benefits is established. For example it could be possible to show that hydro power production might yield additional benefits in industrial development if additional levels of cooperation and water management are considered. Because those benefits could arise in several countries the perception of individual components – such as a particular dam or city's development - begins to shift away of competition and towards cooperation and benefit. It is the task of stage 2 to produce a description in overview of these baskets of benefits. The baskets of benefit scenarios can be represented in the form of a diagram as shown below.

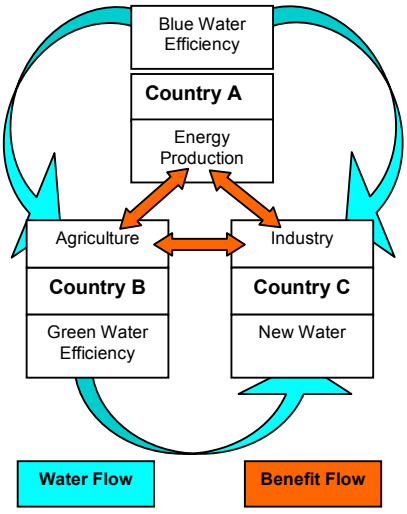


Fig. 9 - Benefit Flow Diagram - outline

The critical outputs of stage 2 are therefore colour coded benefit matrices and basket of benefit diagrams and these will be compiled into benefit sharing portfolios. The purpose of those portfolios is also to seek agreement to proceed with quantitative analysis under stage

3. This agreement component is essential for building understanding and cooperation. It does not represent approval for implementation – it represents approval for further investigation.

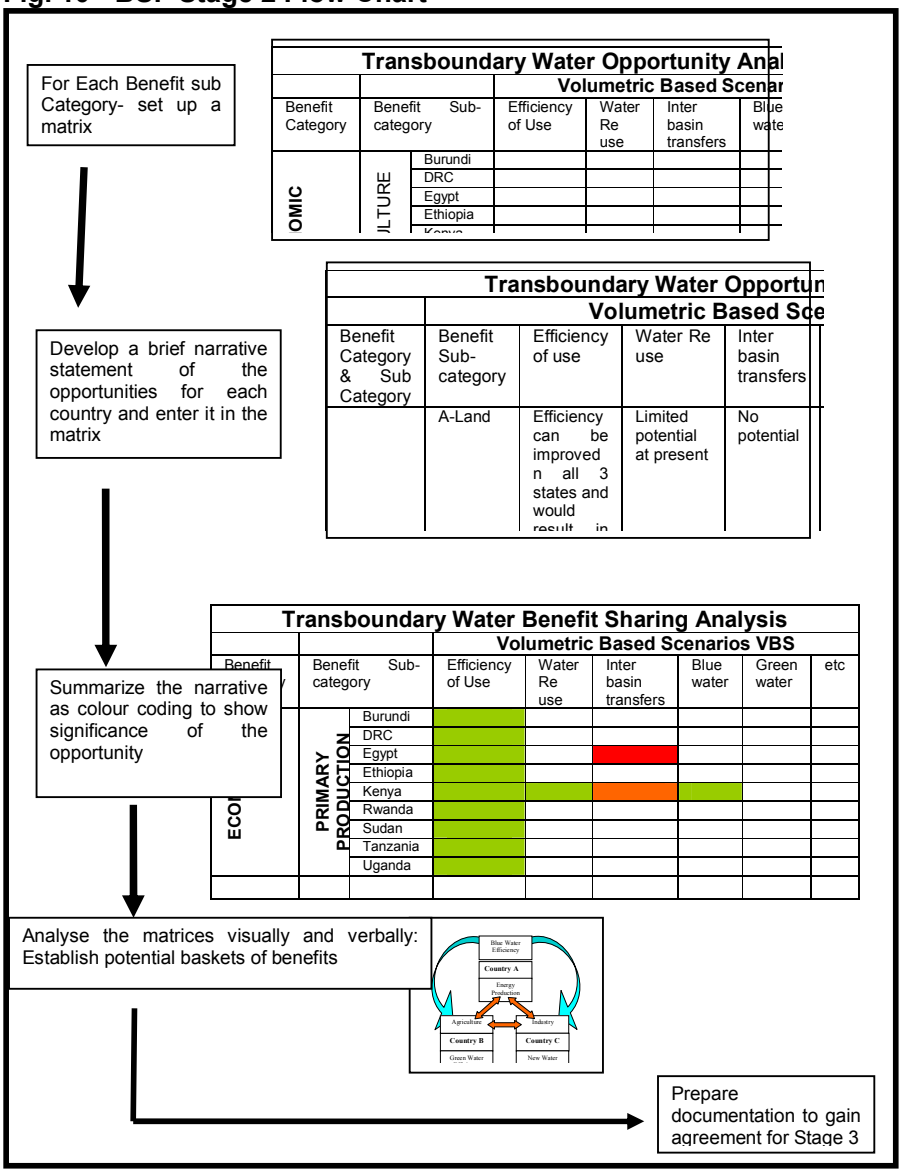
Because the Stage 2 analysis is essentially conceptual and qualitative it has to contend with a great deal of inherent uncertainty. It is likely that a degree of iteration is needed to return to scenarios and re- examine them and to consider different components in the baskets.

Documentation of Stage 2

Reporting on Stage 2 serves two purposes. Firstly it consolidates a view of the scope and components of benefit sharing scenarios. Secondly it provides the documentary basis upon which the riparians can agree to proceed to a further level of analysis in stage 3. Much of the content of this stage 2 reporting should contribute directly to the final reporting of the BSF and the benefit sharing portfolios. The stage 2 report should aim to have a high impact with few words, and use visual representations – such as matrices- to convey the concept of benefit sharing.

A combined flow chart for Stage 2 is given below:

Fig. 10 - BSF Stage 2 Flow Chart



5 STAGE 3 – THE MAGNITUDE OF BENEFITS

"Science is perhaps the only human activity in which errors are systematically criticized and ….in time corrected" Karl Popper

Purpose

The purpose of Stage 3 is to show the quantitative magnitude of "baskets of benefits scenarios" under a range of modelled situations. This refines the understanding of scenarios such that their potential benefit, costs and implications to water management can be seen at a general level. The BSF ends at the point, where scenarios are recommended for formal consideration by the countries concerned. Information on the scenarios is compiled in benefit sharing portfolios.

In essence the task is to put numbers on the benefit sharing scenario diagrams and so capture positive sum outcomes. Non quantifiable benefits should also be shown. The completed benefit sharing portfolios can also be given a suggested priority which can be related to available budget and scheduling.

Modifying Baskets of Benefits

The logic behind considering baskets of benefits is two fold. Firstly it is the way to achieve a positive sum outcome such that the benefits of using waters cooperatively are greater than using them separately. Secondly agreement to proceed is more likely to be achieved when negotiating several opportunities rather than single opportunities. Consequently the role of the BSF in setting up baskets of benefits critically prepares the ground for a successful outcome.

In broad scoping terms baskets are established in stage 2 – stage 3 provides an opportunity to modify those baskets in the light of a general analysis of the magnitude of the benefits. This enables the contents of the baskets to be adapted such that a balance might be achieved between the potential for successful cooperation and the optimization of benefits.

For example quantitative analysis might reveal a skewed distribution of benefits arising from shared use of water for an agricultural development, but as a result of considering additional developments along side agriculture a more equal balance of benefits could be proposed. The process of modifying the baskets should therefore be innovative and creative.

Determine the Magnitude of Benefits

The BSF aims to incorporate existing techniques as well as tools being developed and adapted by the NBI for quantification of benefits. The BSF itself does not intend to develop or adopt separate tools or mechanisms for quantification, but seeks to utilize techniques which emerge as common best practice across the basin. Existing reports - especially CRA documents- are a valuable source of data. The Decision Support System [DSS] is therefore recognized as a key resource in this regard.

The DSS is presently in its initial design phase and it is estimated that it may take 30 months before it becomes operational. Close cooperation is therefore essential if the BSF is to be able to fulfil its purpose through the use of that resource. As it is likely that the BSF will be operational in less than 30 months an interim period is anticipated during which the BSF will have to use the "best currently available" techniques to determine the magnitude of benefits. But it is fully expected that common tools are adopted as soon as this is possible. Annex III provides a comparison between potential DSS output criteria and BSF output criteria.

There is no doubt that realizing useful practical tools and procedures to determine and compare the magnitude of benefits is a very significant challenge and represents the largest hurdle to operationalizing the BSF. Consequently recommendations concerning approaches to operationalizing the BSF are presented in Section 7. In addition the means to consolidate and compare qualitative and quantitative determinations has to be found, and this may gravitate in

the longer term towards the factors elaborated under the legal principle of reasonable and equitable utilization.

Analysis

A key tool which has to be developed for Stage 3 is a protocol. That protocol should indicate which tools are to be used for which sort of analysis and to what depth of analysis. It is important that the means to determine and compare magnitude in stage 3 are both acceptable to all of the parties as well as being sufficiently light and cost effective to apply at this point.

The protocol therefore guides the analysis through the choice of tools and criteria; the degree of analysis required and also identifies the point to stop exploring quantities and to begin making comparisons. That protocol has to provide guidance for the analysis not only of idealized present scenarios but through simulations of future change such as demography, climate and competing resource demands. Benefit sharing matrices and benefit sharing diagrams will of course change over time and so it is possible to compare say the agriculture benefit sub category as it is conceptualised for the present day against future modelled scenarios including climate change.

Documentation of Stage 3

The key reported output of the BSF is to take the form of Benefit Sharing Portfolios. These documents combine the main information arising from stage 2 and stage 3 analyses which led to the identification of balanced baskets of options and positive sum outcomes. The purpose of the Benefit Sharing Portfolios is to present:

- A concise overview of the main components and benefits arising from proposed scenarios
- The rationale for recommending the scenario
- An outline of the components, their valuation and synergies
- A checklist of design criteria and components suggested during BSF analysis

In essence then the Benefit Sharing Portfolio encapsulates the rationale, main components and reasoning for considering a particular basket of benefits. It aims to consolidate and focus interest in a set of activities and facilitate further cooperation between affected states at a more practical level.

Wherever possible benefit sharing scenarios should be presented diagrammatically -, since this greatly enhances understanding. A simple quantified benefit flow diagram is shown below.

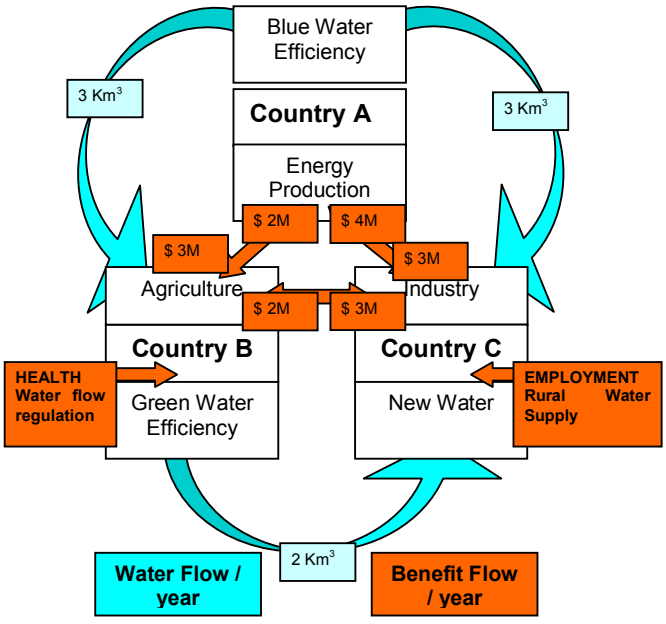


Fig. 11 - Benefit Flow Diagram - Quantified

Recommendation of Scenarios

The Benefit Sharing Portfolios are to be put forward for recommendation. Recommendation results in the portfolio being handed to the relevant parties for practical consideration. The countries concerned might then be expected to begin formal investigation of the scenario involving feasibility, engineering, economic and environmental studies and move the scenario towards its practical realization and formal approval. The role for the BSF however ends at the point of recommendation. As has been mentioned, the process of recommendation can include forms of prioritisation, for example regarding the timing of particular scenarios – or components within a scenario, the general costs of a scenario can be used to indicate priority with respect to available financing.

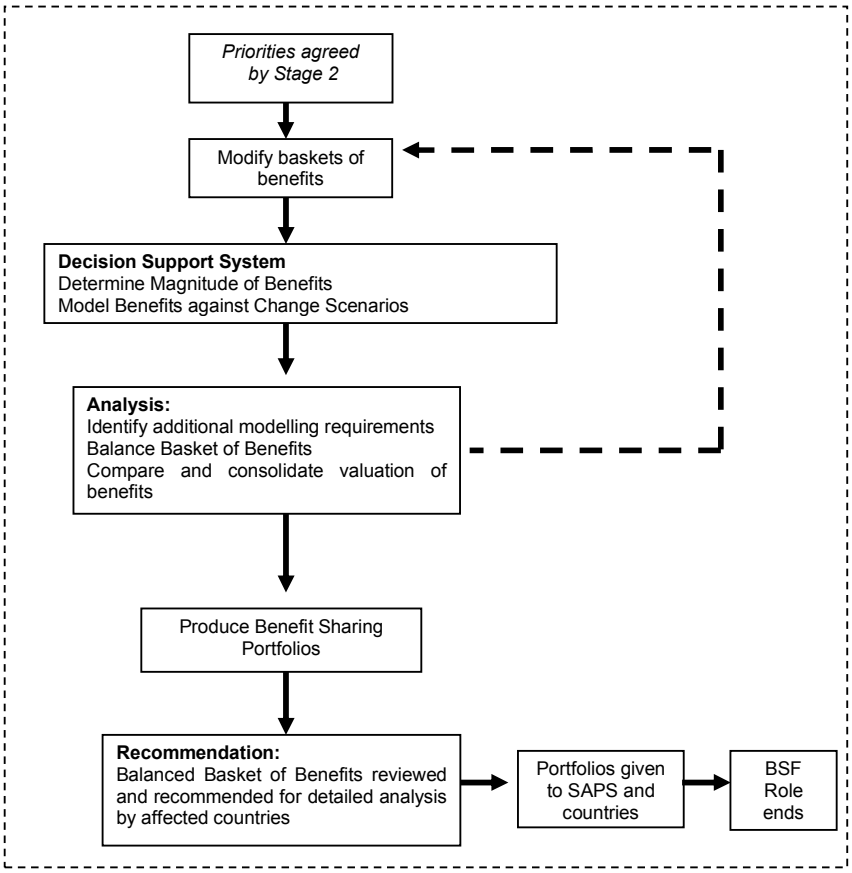


Fig. 12 - BSF Stage 3 Flowchart

6 FRAMEWORK MAINTENANCE

Purpose

The Benefit Sharing Framework will be maintained by a rolling programme of improvement over time which will ensure that it continues to meet the needs of the users, fully reflects legal and institutional developments in the Basin and accommodates new knowledge and procedures which emerge from field practice. Because of this flexibility the Benefit Sharing Framework is able to progressively integrate and harmonise with the overall work and structures emerging in the Basin.

Role of the NBI

Framework maintenance needs will arise once the framework is operational and will be an ongoing requirement. At present the role of "caretaker" for this maintenance is seen to reside with the NBI.

Responsibilities of framework maintenance include
- Procedures for users to communicate concerns with caretakers
- Mechanism to modify the BSF
- Requirements for evaluation of the BSF
- Responsibility to communicate major concerns about the BSF to an executive body

7 OPERATIONALIZING THE BSF

This section recognises that operationalizing the BSF cannot take place without some degree of intervention to at least launch it. This section does no attempt to propose how this is done – but limits itself to an elaboration of relevant factors.

Turning the BSF from a concept into a practical tool can be realised in terms of achieving short term objectives over the first 12 to 18 months corresponding to stage 1 and stage 2 outputs and achieving long term objectives over a possible 36 month period corresponding to stage 3 objectives. This does not mean that the BSF cannot be used in the mean time, stage 1 and 2 can start to be operationalised immediately – but stage 3 will require significant development before it is properly applicable.

Table 6: BSF timeline

Short term objectives: 12 – 18 months	Long term objectives: 36 months
Stage 1	**Stage 3**
• Joint meetings to finalise common understanding	• Collaboration with the DSS • Inventory and availability of existing tools • Analytical protocol • Comparative protocol for quality and quantity. • Application and training in valuation techniques
Stage 2	
• On the job training in using the matrix approach • Development of additional techniques to show significance of benefits in matrix	
Framework Maintenance and evaluation	
• Ongoing development	

A prospective timeline to operationalise the BSF is given below.

Table 7: BSF Implementation Timeline

Nov 08	Dec 08	Jan 09	Feb 09	Mar 09	To Mar 2010	To Jul 2011
BSF Draft 1 complete	BSF Training module finalised	BSF Training Addis		TAC meeting? Adopts BSF implementation strategy	BSF stage 1 and 2 completed	DSS operational
BSF Training modules developed		BSF finalised		DSS development : continues	BSF interim strategy for quantification adopted. BSF Stage 3 underway	DSS and BSF harmonised
		Present consultancy completed		BSF implementation		Legal basis for Institutional Framework Agreed. Final "home" for BSF adopted

Whilst it is possible that stage 1 and 2 of the BSF could be operationalised through in-house NBI structures and a mix of external resources, operationalizing stage 3 will call for a dedicated approach to complete the development of objectives, tools and training and a mix of expert inputs.

It is essential to consider how this challenge to operationalise stage 3 can be approached. It is suggested that the end point of that approach should:

- Meet all technical objectives regarding the development of tools, protocols and methodologies and should also evaluate the end product.
- Ensure that there is an adequately trained and available human resource base to utilise the BSF
- Avoid establishing any structures which incur costs and human resources which cannot be financially sustained.

It is worthwhile considering a range of possibilities from an in-house short term programme of activities through to completely outsourcing the task to reach that end point. Advantages and disadvantages of these approaches are presented below:

Table 8: Comparison of in house and outsourced approaches to operationalizing the BSF

	In House	Outsourced to PSP
Advantages	• A "champion" / dedicated support team is identified • Strong reliance on internal systems and tools for operation • Ability to innovate and adapt	• Choice to buy in the best available expertise for precise tasks over precise timelines and costs • External actors are potentially neutral as regards selection of scenarios
Disadvantages	• Responsibilities must be reflected in job descriptions and not be "implicit" • Some external expertise may still be required. • Potential for bias • Risk of turning BSF into a project	• Risk that PSP fails to transfer knowledge of how to use the BSF • PSP may stick too rigidly to TOR and so limit innovation • If PSP fails -have to remobilise an alternative

The BSF should emerge as a tool embedded into the long-term institutional framework of the Nile Basin. Consequently operationalizing that tool has precise objectives which can be readily turned into time bound Terms of Reference. The relative merits and balance between fulfilling those Terms of Reference as an in-house or outsourced activity must be decided upon quickly such that work can begin. There are many possibilities to formulate this approach and an open minded debate will lend itself to innovation and possible success of the activities. What is essential is that responsibilities and tasks are clearly assigned against deadlines and that there is sufficient dedication and continuity to ensure the task is completed properly. The technical demands in fulfilling these tasks should not be underestimated.

Overtime how the utility of the BSF is likely to change. During its immediate application it will primarily represent a means to galvanise State cooperation around new ideas. But as that approach gains in fluency the use of tools and techniques of the BSF are likely to see additional application in the form of facilitating investment for major regional projects with internal and external partners including IFIs and the private sector. The common factor here is a mechanism to enable cooperation and the discussion of investment possibilities.

There is presently discussion about such directions in river basins in SADC and whether a role of investment facilitation should be a function of a River Basin Organisation or of a partner special purpose facility which aims to be self-financing. Considering such possibilities at this stage could make a useful contribution to the ISP.

It was observed during the course of this consultancy that operationalizing the BSF will call for two key personal characteristics in the people responsible. Firstly they must have the ability to understand, develop and use the practical methodology and secondly they must have the skill to deliver the BSF in a range of multi riparian fora. The high calibre of the present NBI staff does not go unnoticed and is clearly a result of good recruitment and considerable investment in staff development. They are certainly well positioned to carry forward the work of operationalizing the BSF.

8 ANNEX I: NON TRANSBOUNDARY CHECKLIST

Even where the benefits of an activity only accrue to the State developing the project, other riparians will be concerned about potential negative effects experienced across borders. A key tool to decide if an activity is truly non transboundary in nature is to find if it may have any negative impacts on other countries directly attributable to that project. Should such impacts exist then the implementing state is seen to have obligations to other riparians under international law. These concern the obligation not to cause significant harm. Utilising the BSF to identify benefit sharing scenarios will therefore provide an indication where significant harm might arise. A preliminary checklist for identifying such effects s given below.

Benefit Category	**Transboundary effect**
Economic	Impacts on neighbouring markets for goods and services
Environmental	Impacts on flow regimes
	Impacts on water reserves
	Impacts on quality of water and environment
Political	Is the purpose of utilisation reasonable?
	Are there political dimensions to a particular development which affect cooperation?
Social Capital	Are there disadvantages for human knowledge, skills development and training in other countries?

9 ANNEX II: BENEFIT SUB CATEGORIES

Whilst the BSF establishes four major categories of benefits for analysis - sub categories can in effect be chosen depending upon prevailing circumstances and opportunities. The following is a list of suggested sub categories developed at the ToT workshop.

Political	Legal instruments/mechanisms
	Basin-wide legal alignment
	Political stability
	Political cohesion
	Basin-wide institutions
	Rural water supply

Economic	Hydropower: Construction
	Hydropower: Distribution
	Agriculture
	Agricultural processing
	Livestock
	Industry
	Navigation
	Fisheries
	Tourism
	Urban development
	Infrastructure
	Trade
	Technology transfer
	Climate

Environmental	Wetland conservation
	Soil erosion
	Water flow regulation
	Forestry
	Water quality
	Biodiversity
	Watershed management
	Air quality
	Climate

Social Capital	Technology transfer
	Knowledge transfer
	Skill resources/mobility
	Education
	Indigenous knowledge
	Employment
	Health
	Language

10 ANNEX III: DSS OUTPUTS VS BSF OUTPUTS

The table below is indicative at this stage – it compares the possible output criteria of the DSS as identified in design reports- against possible output criteria of the BSF.
(*Source: Nile Basin Decision Support System: Final Requirement Analysis and DSS design Report: Hydrophil et al 17 March 2008 Table 5.3 at pp 24 to 28*)

Area of Concern	DSS Output Criteria	Likely BSF Output Criteria requirements
Water Resources Development	Bio-Physical/Environment Change in volume of water available: 1. System wide (water balance) 2. At designated points in the river network (such as environmental hotspots, other points of interest) Change in sediment movement downstream Effect on navigable water reaches (draft, length of reaches, etc) Change in annual dead storage volumes due to upstream sediment trapped etc. Socio-Economic FIRR/EIRR (or B/C) of alternative; or economic and financial unit costs of increased water Impacts on Navigation (gain/loss of revenue as a result of implementing alternative) No of people to be located (from reservoir area)	Need to know relative significance and magnitude of benefits arising from volumetric based scenarios on a country by country and source by source basis. Source includes: • Improved water efficiency • Inter basin transfers • Other "new " waters • Water re-use " grey water" • Blue water • Green water • Groundwater • Virtual water • Relative effect of flow management regimes on benefit outputs. Need to be able to compare how the choice of source affects benefits relative to the riparians states and other benefit scenarios. Eg would it be more beneficial for Kenya to grow crop A by improving efficiency and water reuse, than crop B…relative to what Tanzania might do. BSF will need to know "relative costs / benefits" with respect to source alternatives.
Optimal water resources utilization	Bio-Physical/Environment Net gain in water availability at basin and specific locations Impact (+/-) of contemplated alternative on downstream water flow Socio-Economic Net financial and economic productivity of water at basin level FIRR/EIRR (or B/C) of alternative; or economic and financial unit costs of increased water	Again the BSF is not only concerned with blue water use. Optimisation for the BSF concerns, considering all possible water sources and how to best use them. Comparative analysis is needed with respect to what the various countries do. This is both in terms of the effects on the overall water budget and the economy / environment.
Coping with Flood	Bio-Physical/Environment Peak flow conditions at designated points along the river network Changes to inundation patterns at designated flood prone areas Changes to the annual hydrograph and regime cycles that would impact capture fisheries Socio-Economic FIRR/EIRR (or B/C) of alternatives	This is likely to be considered as an "economic benefit" by the BSF

Coping with Droughts	Bio-Physical/Environment Information on severity of drought (Drought index and comparisons with earlier events) Predictions of flow conditions for short to medium term Operational updates on status of water availability in the basin (reservoirs, lakes, river flows, etc) Effect on availability of water during times of drought Socio-Economic FIRR/EIRR (or B/C) of alternatives	This is likely to be considered as a sub category of "economic benefit" by the BSF
Energy Development	Bio-Physical/Environment Increase in energy supplies (GWh/y); contemplated alternative and system wide Socio-Economic Unit costs of energy FIRR/EIRR (or B/C) of alternatives including tradeoffs with other alternatives (thermal, etc) and sectors	This is likely to be a specific category of benefit under the BSF.
Rainfed and Irrigated Agriculture	Bio-Physical/Environment Distribution of crop growing areas (rain fed and irrigated, spate) Crop water requirements for selected points of interest Effect in flow at designated points (environmental stream flow) and overall system water balance Socio Economic Impact on human livelihoods Economic productivity of water at basin or sub-basin level FIRR/EIRR (or B/C) of alternatives	This is an Economic Benefit -sub category "primary production" under the BSF The BSF would need to show comparative significant of developing rainfed vs other approaches…..as modelled against climate change and environmental protection.
Watershed and Sediment Management	Bio-Physical/Environment Change in sediment movement (quantity) Change in reservoir/canal sedimentation downstream Changes in channel morphology downstream Change in erosion rate Effect on water availability 1. System wide water balance 2. Change in peak/minimum flow downstream Socio Economic FIRR/EIRR (or B/C) of alternatives	This is likely to be in the Category Environmental Benefit under the BSF.
Navigation	Bio-Physical/Environment Impacts on navigation potential of navigable reaches and water bodies Socio Economic FIRR/EIRR (or B/C) of alternatives	This is likely to be in the Economic Benefit category of the BSF with spill over into Environment.

The BSF will be concerned with a wider range of concerns than those articulated by the Stakeholders in the DSS design mission. Additional elements required under the BSF could include

- Rural water supply provision
- Urban development and growth
- Ecosystem services

In essence the BSF is not only about responding to present concerns, it is also about identifying new opportunities in which countries working together realise new and additional benefits.

It would be very useful if the DSS could:

- Identify impact and benefit on a country by country basis, and not just for the river system as a whole. These data would enable comparative merits to be shown.
- Investigate new scenarios and not just those articulated by the stakeholders. For example water is needed for cooling thermal power production. The relative benefits of future "agricultural" scenarios whilst modelling different crops on the available water etc.

Over time the water allocation regime for the Nile will be defined by a legal instrument applying the principles of Reasonable and equitable utilisation, and obligation not to cause significant harm. The DSS ought therefore to be able to quantify and qualify these factors relative to the various intended uses of the water. The BSF will also move to progressively base determinations on those factors.

11 ANNEX IV: REFERENCES

Phillips, D.J.H. *et al* 2006 Transboundary Water Co-operation as a tool for Conflict Prevention and Broader benefit Sharing. Global Development Studies No 4. Swedish Ministry for Foreign Affairs.
Available at : http://www.egdi.gov.se/pdf/44699_om_web.pdf

Phillips, D.J.H. *et al* 2008. The Transcend –TB3 Project: A Methodology for the Trans-boundary Waters Opportunity Analysis (the TWO Analysis). For Swedish Ministry for Foreign Affairs.
Not yet available on the internet.

Sadoff *et al*. Africa's International Rivers: An Economic Perspective.
Abstract available at:
http://www.iwlearn.net/abt_iwlearn/events/ouagadougou/readingfiles/worldbank-africas-international-rivers-part1.pdf

Sadoff, C.W. and D. Grey. 2002. "Beyond the river: the benefits of cooperation on international rivers." *Water Policy* 4, No.5: 389-403.
Available at http://siteresources.worldbank.org/EXTABOUTUS/Resources/BeyondtheRiver.pdf

Sadoff, C.W. and D. Grey. 2005. Cooperation on International Rivers. *A Continuum for Securing and Sharing Benefits. Water International*, Volume 30, No. 4
Available at http://siteresources.worldbank.org/INTWRD/Resources/0509_Continuum_WI.pdf

Turton, A.R. (2005) A critical assessment of the basins at risk in the Southern African Hydropolitical Complex. Paper presented at the Workshop on the Management of International Rivers and Lakes, hosted by the Third World Centre for Water Management and the Helsinki University of Technology, 17-19 August, Helsinki, Finland.

Quaddumi 2008 *Practical Approaches to transboundary water benefit sharing. ODI working Paper 292. 2008*
Available at http://www.odi.org.uk/resources/odi-publications/working-papers/292-transboundary-water-benefit-sharing.pdf

12 ANNEX V: NILE BASIN TWO MASTER MATRIX PRELIMINARY

A Preliminary Nile Basin TWO Analysis is presented below. This was developed at the ToT workshop and subsequently modified. The purpose of presenting it here is to show how this matrix s developed and to give a general indication of the importance of relationships between water sources and benefit categories.

The technique for completing the matrix is given n Section 3 of this report.

The matrix – would normally be in the form of spreadsheets but is presented here as separate documents as follows

Benefit Category	**Document**
Economic Development	Colour Coded Matrix
	Matrix Questions
	Matrix Answers
Environmental	Colour Coded Matrix
	Matrix Questions
	Matrix Answers
Political & Social Capital	Colour Coded Matrix
	Matrix Questions
	Matrix Answers

Colour Coding	
	Important
	Positive
	Some link
	Insignificant

The Matrix can be interrogated as follows

- The colour coded matrix shows the relative importance of a water source to realising a benefit and the importance of a benefit to realising water availability.
- The core questions asked to determine importance are summarised in the questions document
- Summary narrative responses to the questions are presented in the answers document.

For example

In the Economic Development category, the importance of water availability as a result of the efficiency of water use is determined by answering the question “Can new Hydro Power Construction create New Water?” That question is answered with “Yes, due to Blue Water loss by evaporation from impounded dams.” Because efficiency would reduce such losses this could be is an important source of new water and is colour coded dark green in the coded matrix.

Economic Development - Colour Coded Matrix

Category	Sub-category and Direction	New Water	Efficiency of Water Use	Virtual Water
Economic	Hydropower: Construction >			
Development	Hydropower: Construction <			
	Hydropower: Distribution →			
	Hydropower: Distribution ←			
	Agriculture →			
	Agriculture ←			
	Agricultural processing →			
	Agricultural processing ←			
	Livestock →			
	Livestock ←			
	Industry →			
	Industry ←			
	Navigation →			
	Navigation ←			
	Fisheries →			
	Fisheries ←			
	Tourism →			
	Tourism ←			
	Urban development →			
	Urban development ←			
	Transport Infrastructure →			
	Transport Infrastructure ←			
	Trade →			
	Trade ←			
	Technology transfer →			
	Technology transfer ←			
	Climate →			
	Climate ←			

Economic Development – Questions Matrix

Category	Sub-category and direction	New Water	Efficiency of Water Use (EWU)	Virtual Water
ECONOMIC DEVELOPMENT – QUESTIONS	Hydropower: Construction →	Can new H:C create New Water?	Can H:C affect the EWU?	Is there a coherent link between VW and this sub-category?
	Hydropower: Construction ←	Can New Water affect hydropower construction?	Can the EWU affect hydropower construction?	
	Hydropower: Distribution →	Can improved H:D create New Water?	Can H:D improve the EWU?	
	Hydropower: Distribution ←	Can New Water affect hydropower distribution?	Can the EWU affect hydropower distribution?	
	Agriculture →	Can altered agricultural practices create New Water?	Can altered agricultural practices improve the EWU?	
	Agriculture ←	Can New Water enhance agricultural returns?	Can the EWU be increased in agriculture?	
	Agricultural processing →	Can altered agricultural processing create New water?	Can agricultural processing affect the EWU?	
	Agricultural processing ←	Can New Water improve agricultural processing?	Can changes to the EWU improve agricultural processing?	
	Livestock →	Can changes to livestock production create New Water?	Can changes to livestock production improve the EWU?	
	Livestock ←	Can New Water improve livestock production?	Can changes to the EWU improve livestock production?	
	Industry →	Can changes to industrial practices create New Water?	Can changes to industrial practices improve the EWU?	
	Industry ←	Can New Water enhance industrial production?	Can changes to the EWU enhance industrial production?	
	Navigation →	Can navigation issues create New Water?	Can changes to navigation improve the EWU?	
	Navigation ←	Does New Water affect navigation?	Can changes to the EWU enhance navigation?	
	Fisheries →	Can changes to fisheries create New Water?	Can changes to fisheries improve the EWU?	
	Fisheries ←	Can New Water enhance fisheries production?	Can higher EWU enhance fisheries production?	
	Tourism →	Can changes to tourism create New Water?	Can changes to tourism improve the EWU?	
	Tourism ←	Can New Water enhance income from tourism?	Can the EWU be improved to enhance tourism?	
	Urban development →	Can changes to urban development create New Water?	Can changes to urban development improve the EWU?	
	Urban development ←	Can New Water enhance urban development?	Can higher EWU enhance urban development?	
	Transport Infrastructure →	Can changes to the transport infrastructure create New Water?	Can changes to the transport infrastructure improve the EWU?	
	Transport Infrastructure ←	Is New Water important for transport infrastructure development?	Is the EWU important in transport infrastructure development?	
	Trade →	Can changes to trade patterns create New Water?	Can changes to trade patterns improve the EWU?	
	Trade ←	Can New Water enhance profits from trade?	Can higher EWU improve profits from trade?	
	Technology transfer →	Is technology transfer important in generating New Water?	Is technology transfer important in improving the EWU?	
	Technology transfer ←	Is New Water relevant to technology transfer?	Is the EWU relevant to technology transfer?	
	Climate →	Can changes to climate create New Water?	Can climate change affect the EWU?	
	Climate ←	Can New Water affect the climate?	Can changes to the EWU affect the climate?	

Economic Development – Answers Matrix

Category	Sub-category and direction	New Water	Efficiency of Water Use	Virtual Water
ECONOMIC DEVELOPMENT – ANSWERS	Hydropower: Construction →	Not in isolation	Yes, due to Blue Water loss by evaporation from impounded dams	No
	Hydropower: Construction ←	Not in isolation	No	No
	Hydropower: Distribution →	Yes (e.g. pumping previously unused groundwater; desalination)	Yes, because some applications require pumping	No
	Hydropower: Distribution ←	Yes, as HP distribution is needed to areas where New Water can be created	Yes, as HP distribution is needed to areas where the EWU can be improved	No
	Agriculture →	Yes, by improving Blue Water flows downstream	Yes, by improving Blue Water flows downstream	Yes, because agricultural products include VW
	Agriculture ←	Yes, e.g. through wastewater re-use or use of freed-up Blue Water	Yes, e.g. through drip irrigation techniques	Yes, because agricultural products include VW
	Agricultural processing →	No	Not directly	Yes, because changes to food imports affect processing needs
	Agricultural processing ←	No	No	Yes, because changes to food imports affect processing needs
	Livestock →	No	Yes; decreases in livestock production improve the EWU	Yes, because livestock include large VW volumes
	Livestock ←	Yes, but this use is not generally desirable	Yes, but this use is not generally desirable	Yes, because livestock include large VW volumes
	Industry →	Not directly	Yes, by minimizing water use through recycling, although volumes are minor	Not significant
	Industry ←	Yes, and this use of New Water is of high added value	Yes; inter-sectoral reallocation from agriculture greatly enhances returns	Not significant
	Navigation →	No	No	No
	Navigation ←	Only tangentially by changing flow dynamics in the river	Only tangentially by changing flow dynamics in the river	No
	Fisheries →	No	No	Not significant
	Fisheries ←	Possibly, by changing flow dynamics in the river	Possibly, by changing flow dynamics in the river	Not significant
	Tourism →	No	Yes; tourism generates very high value returns from water	Not major
	Tourism ←	Yes, and this provides very high value returns from water	Yes, through reallocation of water from other lower-value uses	Not major
	Urban development →	No	A tangential link exists	No
	Urban development ←	A tangential link exists	A tangential link exists	No
	Transport Infrastructure →	No	A tangential link exists	Yes, because virtual water imports rely on transport infrastructure
	Transport Infrastructure ←	A tangential link exists	A tangential link exists	Yes, because virtual water imports rely on transport infrastructure
	Trade →	Yes, because of the link to Virtual Water	Yes, because of the link to Virtual Water	Yes
	Trade ←	Yes, because of the link to Virtual Water	Yes, because of the link to Virtual Water	Yes
	Technology transfer →	Yes, e.g. through wastewater re-use; desalination	Yes, e.g. through crop selection; drip irrigation; industrial applications	No
	Technology transfer ←	No	No	No
	Climate →	Yes, as volumes in the basin will change	Yes, because of the Green/Blue Water linkage	Yes, as trade will change in response to climate change
	Climate ←	Only tangentially and probably not in a major fashion	Only tangentially and probably not in a major fashion	Yes, as trade will change in response to climate change

Environmental Benefits – Colour Coded Matrix

Category	Sub-category	New Water	Efficiency of Water Use	Virtual Water
Environmental				
	Wetland conservation →			
	Wetland conservation ←			
	Soil erosion →			
	Soil erosion ←			
	Water flow regulation →			
	Water flow regulation ←			
	Forestry →			
	Forestry ←			
	Water quality →			
	Water quality ←			
	Biodiversity →			
	Biodiversity ←			
	Watershed management →			
	Watershed management ←			
	Air quality →			
	Air quality ←			
	Climate →			
	Climate ←			

Environmental Benefits – Questions Matrix

Category	Sub-category and direction	New Water	Efficiency of Water Use (EWU)	Virtual Water
Environmental Questions	Wetland conservation →	Can changes in wetland conservation create New Water?	Can changes in wetland conservation enhance the EWU?	Is there a coherent link between VW and this sub-category?
	Wetland conservation ←	Is New Water important for wetland conservation?	Can changes in the EWU affect wetland conservation?	
	Soil erosion →	Can changes in soil erosion create New Water?	Can changes in soil erosion affect the EWU?	
	Soil erosion ←	Can New Water affect soil erosion rates?	Can the EWU affect soil erosion rates?	
	Water flow regulation →	Can water flow regulation create New Water?	Can water flow regulation affect the EWU?	
	Water flow regulation ←	Can New Water affect water flow regulation?	Can the EWU affect water flow regulation?	
	Forestry →	Does forest extent and cover affect New Water?	Does forest extent and cover affect the EWU?	
	Forestry ←	Can New Water affect forest extent and cover?	Can the EWU affect forest extent and cover?	
	Water quality →	Is the quality of New Water critical?	Are water quality concerns connected to the EWU?	
	Water quality ←	Can New Water affect water quality in the basin?	Can the EWU affect water quality in the basin?	
	Biodiversity →	Can changes in biodiversity create New Water?	Can changes in biodiversity affect the EWU?	
	Biodiversity ←	Is biodiversity affected by New Water?	Is biodiversity affected by the EWU?	
	Watershed management →	Can watershed management changes create New Water?	Can watershed management changes affect the EWU?	
	Watershed management ←	Is watershed management inflenced by New Water?	Does the EWU affect watershed management?	
	Air quality →	Can changes in air quality create New Water?	Can changes in air quality affect the EWU?	
	Air quality ←	Can New Water affect air quality?	Can the EWU affect air quality?	
	Climate →	Can climate change create New water?	Can climate change affect the EWU?	
	Climate ←	Can New Water affect climate change?	Can the EWU affect climate change?	

Environmental Benefits – Answers Matrix

Category	Sub-category and direction	New Water	Efficiency of Water Use (EWU)	Virtual Water
Environmental - Answers	Wetland conservation →	No	No	No
	Wetland conservation ←	Not significantly	Yes, as water must be reserved for wetland conservation	No
	Soil erosion →	No	Yes, as turbidity affects the economic returns from water	No
	Soil erosion ←	Tangentially, through changes in flow patterns	Tangentially, through changes in flow patterns	No
	Water flow regulation →	Yes, for example by ensuring Blue Water flows downstream	Yes, as the water balance in the basin changes	Changes to trade patterns could affect water flows
	Water flow regulation ←	Yes, as the water balance in the basin changes	Yes, as the water balance in the basin changes	Changes to trade patterns could affect water flows
	Forestry →	Yes, because of the Green/Blue Water interface	Yes, as the water balance in the basin changes	No
	Forestry ←	Only tangentially and not significantly	Yes, because of the Green/Blue Water interface	
	Water quality →	Water quality constraints exist, according to end use	Water quality constraints exist, according to end use	No
	Water quality ←	Only tangentially and not significantly	Yes, as upstream changes in the EWU affect downstream reaches	
	Biodiversity →	Yes, to the extent that the basin water balance changes (e.g. draining the Sudd)	Yes, to the extent that the basin water balance changes	No
	Biodiversity ←	Yes, to the extent that the basin water balance changes	Yes, to the extent that the basin water balance changes	
	Watershed management →	Yes, especially through the Green/Blue Water interface in upstream reaches	Yes, especially through the Green/Blue Water interface in upstream reaches	Changes to trade patterns could affect watershed management
	Watershed management ←	Yes, to the extent that the basin water balance changes	Yes, to the extent that the basin water balance changes	Changes to trade patterns could affect watershed management
	Air quality →	No	Yes, e.g. such changes affect agricultural yields	Yes, because greenhouse gases affect plant growth
	Air quality ←	Not substantively	Somewhat, as forest cover etc. affects carbon dioxide concentrations	Yes, because greenhouse gases affect plant growth
	Climate →	Yes; current evidence suggests parts of the basin will get wetter	Yes, as agricultural yields will be affected	Yes, as trade will change in response to climate change
	Climate ←	Yes, as a secondary effect of e.g. land cover	Yes, as a secondary effect of e.g. land cover	Yes, as trade will change in response to climate change

Political & Social Capital Benefits – Colour Coded Matrix

Category	Sub-category	New Water	Efficiency of Water Use	Virtual Water
Political	Legal instruments/mechanisms →			
	Legal instruments/mechanisms ←			
	Political stability/cohesion →			
	Political stability/cohesion ←			
	Basin-wide institutions →			
	Basin-wide institutions ←			
	Rural water supply →			
	Rural water supply ←			
Social Capital	Technology transfer →			
	Technology transfer ←			
	Knowledge transfer →			
	Knowledge transfer ←			
	Skill resources/mobility →			
	Skill resources/mobility ←			
	Education →			
	Education ←			
	Indigenous knowledge →			
	Indigenous knowledge ←			
	Employment →			
	Employment ←			
	Health →			
	Health ←			
	Language →			
	Language ←			

Political & Social Capital Benefits – Questions Matrix

Category	Sub-category and direction	New Water	Efficiency of Water Use (EWU)	Virtual Water
Political - Questions	Legal instruments/mechanisms →	Can LI/M assist in creating New Water?	Can LI/M assist in enhancing the EWU?	Is there a coherent link between VW and this sub-category?
	LMI ←	Can New Water affect LI/M?	Can the EWU affect LI/M?	
	Political stability/cohesion →	Does political stability/cohesion help to create New Water?	Does political stability/cohesion help to improve the EUW?	
	Political stability/cohesion ←	Does New Water affect political stability/cohesion?	Does the EWU affect political stability/cohesion?	
	Basin-wide institutions →	Are basin-wide institutions needed to create New Water?	Are basin-wide institutions needed to optimise the EWU?	
	Basin-wide institutions ←	Does New Water affect the need for basin-wide institutions?	Does enhancing the EWU affect the need for basin-wide institutions?	
	Rural water supply →	Does improved RWS depend on New Water?	Does improved RWS depend on enhanced EWU?	
	Rural water supply ←	Is New Water relevant to a political objective to improve RWS?	Is the EWU relevant to a political objective to improve RWS?	
Social Capital- Questions	Technology transfer →	Is technology transfer important in generating New Water?	Is technology transfer important in improving the EWU?	Is there a coherent link between VW and this sub-category?
	Technology transfer ←	Is New Water relevant to technology transfer?	Is the EWU relevant to technology transfer?	
	Knowledge transfer →	Is knowledge transfer needed to enhance New Water volumes?	Is knowledge transfer needed to enhance the EWU?	
	Knowledge transfer ←	Does New Water influence knowledge transfer?	Does the EWU influence knowledge transfer?	
	Skill resources/mobility →	Are skill resources/mobility of relevance to New Water?	Are skill resources/mobility of relevance to the EWU?	
	Skill resources/mobility ←	Does New Water influence skill resources/mobility?	Does the EWU influence skill resources /mobility?	
	Education →	Is education relevant to the enhancement of New Water volumes?	Is education relevant to improvements in the EWU?	
	Education ←	Does New Water affect education?	Does the EWU affect education?	
	Indigenous knowledge →	Is indigenous knowledge relevant to New Water?	Is indigenous knowledge relevant to the EWU?	
	Indigenous knowledge ←	Is New Water relevant to indigenous knowledge?	Is the EWU relevant to indigenous knowledge?	
	Employment →	Can employment levels affect New Water?	Can employment levels affect the EWU?	
	Employment ←	Does New Water increase employment levels?	Do improvements in the EWU improve employment levels?	
	Health →	Can health affect the creation of New Water?	Can health affect the EWU?	
	Health ←	Would New Water improve general basin health levels?	Would improvements in the EWU improve basin health levels?	
	Language →	Are language barriers important in relation to New Water?	Are language barriers important in relation to the EWU?	
	Language ←	Does New Water affect language?	Does the EWU affect language?	

Political Benefits – Answers Matrix

Category	Sub-category and direction	New Water	Efficiency of Water Use (EWU)	Virtual Water
Political- Amswers	Legal instruments/mechanisms →	Aligned basin-wide legislation would assist, but is not essential	Aligned basin-wide legislation would assist, but is not essential	No, although policy alignment would be preferred
	Legal instruments/mechanisms ←	Not particularly, although alignment would be preferred	Not particularly, although alignment would be preferred	No, although policy alignment would be preferred
	Political stability/cohesion →	It is not essential, but assists	It is not essential, but assists	A basin-wide approach to virtual water would be best
	Political stability/cohesion ←	To some degree, through 'spillover' from water cooperation to High Politics	To some degree, through 'spillover' from water cooperation to High Politics	A basin-wide approach to virtual water would be best
	Basin-wide institutions →	No, although they might assist in creating an aligned approach	No, although they might assist in creating an aligned approach	A basin-wide institution could assist in delineating a policy
	Basin-wide institutions ←	No, although they might assist in creating an aligned approach	No, although they might assist in creating an aligned approach	A basin-wide institution could assist in delineating a policy
	Rural water supply →	A tangential link exists	A tangential link exists	Yes, as shortages in RWS could be balanced by VW
	Rural water supply ←	A tangential link exists	A tangential link exists	Yes, as shortages in RWS could be balanced by VW

Social Capital Benefits – Answers Matrix

Category	Sub-category and direction	New Water	Efficiency of Water Use (EWU)	Virtual Water
Social Capital- Answers	Technology transfer →	Yes, e.g. through wastewater re-use; desalination	Yes, e.g. through crop selection; drip irrigation; industrial applications	No
	Technology transfer ←	No	No	No
	Knowledge transfer →	Yes, for various forms of New Water	Yes, e.g. in crop selection	Yes, as higher in-basin production reduces VW imports
	Knowledge transfer ←	No	No	Yes, as higher in-basin production reduces VW imports
	Skill resources/mobility →	Yes, for various forms of New Water	Yes, e.g. in crop selection	No
	Skill resources/mobility ←	Only marginally	Only marginally	No
	Education →	Yes, for various forms of New Water	Yes, e.g. in crop selection	Yes, as a consensual basin-wide strategy is needed
	Education ←	Only marginally	Only marginally	Yes, as a consensual basin-wide strategy is needed
	Indigenous knowledge →	No	Only in a few instances	No
	Indigenous knowledge ←	No	No	No
	Employment →	No	No	Not significantly
	Employment ←	Only slightly	Only slightly	Not significantly
	Health →	No	No	Yes, through nutrition in imported foods
	Health ←	Yes, by improving nutrition	Yes, by improving nutrition	Yes, through nutrition in imported foods
	Language →	Only slightly	Only slightly	No
	Language ←	No	No	No