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Cultural, socio-economic and political constraints for virtual water trade: Perspectives from the Volta Basin, West Africa

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Cultural, Socio-Economic and Political Constraints for Virtual Water Trade: Perspectives from the Volta Basin, West Africa

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Abstract

Trade in virtual water, the substitution of the use of scarce water resources for agricultural production by imports from water-rich countries has been said to be a potential solution to water crises and water conflicts throughout water-stressed regions worldwide. While trade in foodstuffs may have helped to alleviate water stress in parts of the Middle East and Northern Africa and provides an efficient response to the periodic drought occurrences, it has to be doubted whether virtual water trade is a water governance option that can be applied in many countries of the South. As examples from the West African Volta River Basin suggest, cultural values focussing on agricultural and livestock production, socio-economic factors such as a low level of education and a strong dependency of livelihoods on subsistence agriculture, weak governments that are unable to trigger and finance large-scale reform processes, as well as dysfunctional and unfair market systems largely limit the widespread applicability of virtual water trade.

Keywords: virtual water trade, water stress in the Volta River Basin, socio-political and cultural values of food production

1. Introduction

Virtual water trade has been portrayed as an instrument which could have the potential to alleviate water stress, avoid resource conflicts and to reduce poverty and hunger in (semi-) arid regions world wide. Proponents of the virtual water approach, mostly using examples from the Middle East and Northern Africa (Allan, 1995; 2001) as well as from Southern Africa (Turton, 1999), have shown that water stressed countries from these regions have the potential to reduce the pressure on their scarce water resources. Water intensive food production is substituted by the import of foodstuffs from water-rich countries purchased on the world market. Thereby it is even possible to avoid overly costly and ecologically unsustainable technical solutions such as pipelines or large dams in order to provide water for food production. Especially with regard to the Middle East it has been argued that this strategy has been pursued, albeit somewhat covertly, since long. Given these experiences, it has been recently argued that virtual water trade, i.e. the trade in foodstuffs from water-rich to water-poor countries, could become the solution for national, regional and international water crises and could perceptively increase global water use efficiency.

While we agree that trade in foodstuffs has long been used to bridge differences in resource endowment on various scales and has provided the means to alleviate the consequences of short- and medium-term water scarcity, such as droughts, we nevertheless believe that the debate over the possible merits of virtual water trade suffers from some substantial flaws. Some of the flaws of the approach have been pointed out before. Merrett (2003: 3) has convincingly shown that the term 'virtual water' is rather metaphorical and masks that in fact real water used for food production is the subject matter of the virtual water trade debate. While we could live with the fact that the term is "misleading" or "unscientific" (ibid.: 3) and agree with Allan (2003: 9) that the "punchy term" has "already acquired an immovable place in the vocabulary of the interdisciplinary epistemic community that addresses the complexities of water policy-making". Nevertheless, the misleading nature of the term seems to go rather well with the often Malthusian, technocratic, and teleological nature of policy (Merret 2003) and management approaches developed within the international water scene. As an analytical approach, which is focussing on the water intensity of (food) production and water footprints of human populations, an emphasis on virtual water may indeed further the understanding of (seemingly) irrational patterns of water resource use. However, the application of the virtual water trade approach as water management tool and driver of (inter-)national water policies is questionable and inherently dangerous as the terminology, as well as the macro-level analysis of hydrological, economic and agricultural data that is usually applied by the proponents of the concept turns a blind eye on important cultural, socio-economic and political features that underlie and reign agricultural production patterns, water use and market exchanges at various levels. It was again Merrett (ibid.:3) who tried to caution us that if "one approaches agriculture from the perspective of water resources... a more rounded vision is lacking, one that understands that the water theme is only one amongst many, such as soil characteristics, land rights, labour skills, pest control, farm budgets and production patterns".

This list can easily be extended. A narrow focus on water resources and their scientific and 'rational' management neglects the cultural embeddedness of production patterns and may threaten the livelihoods of farming communities in (semi-) arid regions worldwide. It overestimates the financial and managerial capacities of many governments and administrations and turns a blind eye on economic path-dependency and the dysfunctionality and inherent inequality of many local, national, regional and global markets.

Furthermore, the macro perspective taken by the proponents of the virtual water concept, focussing solely on (crop) production water requirements, water availability, and the imports and exports of crops fails to acknowledge the way in which local farming and livestock systems are adapted to water scarce environments and seems to overlook the seasonal nature of precipitation, agricultural production and many markets.

This paper aims to make some of the analytical faults and limits of implementation that are inherent in the virtual water approach more explicit. In order to do so we will take a closer look at the West African Volta Basin. After a description of the main features of the Volta Basins hydrology, water availability and water stress, especially with regard to the two main riparian countries Ghana and Burkina Faso, some of the main questions that the virtual water trade raises as analytical tool as well as a water policy instrument will be proved. The focus will be on the cultural, socio-economic and political viability of the substitution of food production in (semi-) arid parts of the basin by the importation of food stuffs from water-rich parts of the basin or global markets.

2. Water Availability and Scarcity in the Volta Basin

The Volta Basin is located in West Africa and covers around 400.000 km² of the sub-humid and semi-arid savannah zone. The basin encompasses the majority of Ghana (70% of land area) and Burkina Faso (63%) and lesser proportions of Togo, Benin, Mali and Cote d'Ivoire, respectively. The Climate is influenced by the movement of the Inter-Tropical Convergence Zone (ITCZ). The average rainfall lies around 1000 mm/yr with a strong north-south gradient and regional and temporal variability. Especially in the Northern parts of the Basin in Northern Ghana and Burkina Faso precipitation is as low as 300-700 mm/yr. While this seems to be still high it has to be stated that most of this rain is concentrated during rainy season and during the rest of the year there are hardly any rains at all. Currently climatic patterns within the Basin are changing as the temperatures are rising, the rainy season is shifting and shortening and rains become less reliable (Kranjac-Brisavjevic et al, 1999: 8; Wiggins, 1999. 10). Unpredictable and unreliable precipitation makes rainfed agriculture a risky undertaking throughout much of the basin (Rodgers et al, 2006). Mean annual temperatures are around 30°C and humidity varies between 90% in coastal areas to below 20% in the North during the harmattan and the dry season (MoWH 1998, Andah and Gichuki 2003). Climate and land cover changes as a consequence of global climate change patterns and the increasing population density in the region led to significant changes in rainfall characteristics. In the past, the grave water deficiency during extensive droughts had ruinous consequences for the population concerned, and partially caused irreversible ecological damages (Kunstmann and Jung 2003). The large rainfall variability turns West Africa into a region with permanent climatic problems and frequent water stress. While the Volta Basin especially in the Northern parts of Ghana and in Burkina Faso is commonly perceived as a water-scarce environment, analyses by proponents of the virtual water paradigm seem to have a different view on this issue. In his seminal publication 'Virtual Water Trade', which attempts a quantification of global virtual water flows in relation to crop trade Hoekstra et al. (2005: 55-56) portray Burkina Faso and Ghana as water-rich countries with a water scarcity of 2,4 and 0,6% respectively.¹ This perception derives from

¹ National water scarcity is the function of annual renewable water resources and annual groundwater and surface water use. It is expressed in percentages. Low percentages characterize water-rich nation states, while high percentages characterize water-poor nation states (Hoekstra, 2005. 16).

the reliance on macro-level data sets, which cover the seasonal and erratic nature of water availability. Although the data create the impression of water abundance this is rather a myth. Runoff is dependent on rainfall, which has been shown to be prone to variations, and small variations in precipitation result in large changes in the amount of runoff. Those fluctuations in runoff frequently cause agricultural losses and threaten the hydropower production in Ghana (van Edig 2002a: 77). Population growth and economic development leading to a rising water demand, as well as already existing regional and sectoral water shortages, uncontrolled pollution and the inefficient management of drinking water supplies and the accompanying threats of local, sectoral or international conflicts are some of the main features of the Volta Basin (Laube et al. 2006).

Current water stress is going to increase significantly as deteriorating climatic and hydrological conditions and an ever increasing domestic, industrial and especially agricultural demand for water put increasing pressure on the basins water resources. In Ghana for instance the agricultural water demand, mostly for irrigation, is said to increase sevenfold from 617, 45 million m³ in 2000 to an predicted 4114.42 million m³ in 2020 (MoWH Ghana, 1998). In Burkina Faso the increase might be even more significant as more and more farmers are relying on irrigated agriculture to engage in cash crop production and alleviate the detrimental impacts of erratic and changing climatic conditions. Therefore, the Volta Basin, especially the Northern parts of Ghana and Burkina Faso, is an area that could qualify for the implementation of virtual water trade policies.

In the following we want to prove, which impact virtual water trade could have on the agricultural production patterns of the basin and which impediments this policy option would have to encounter. To do this we will first have to have a short look at the prevalent agricultural production patterns of the Volta Basin.

3. Subsistence Agriculture, Cash-Crop Production, Livestock, and Rural Livelihoods in the Volta Basin

By African standards, the Volta Basin is densely settled, with Ghana, at 90 inhabitants per km², possessing roughly three times the mean population density of Sub-Saharan Africa (SSA). Basin inhabitants are overwhelmingly rural. Agriculture is the most important economic factor, followed by services (in Burkina Faso even more important than agriculture) and industry (see Table 1).

Table 1: World Development Index for Ghana and Burkina Faso (2004)

COUNTRY	Development Index	Year 2004
Burkina Faso	Agriculture, value added (% of GDP)	30.79
Burkina Faso	Industry, value added (% of GDP)	19.86
Burkina Faso	Services, etc., value added (% of GDP)	49.35
Ghana	Agriculture, value added (% of GDP)	37.91
Ghana	Industry, value added (% of GDP)	24.73
Ghana	Services, etc., value added (% of GDP)	37.36

(Source: WDI 2006)

Today 70% (in Ghana) – 90% (in Burkina Faso) of the population in the Volta Basin depends on subsistence and cash crop farming. Like in many parts of Africa the agricultural productivity is low in comparison to other regions in the world (WDI 2004). Nevertheless, in spite of climatic uncertainties, agriculture is a driving force of economic growth and is actively promoted by governments both in Ghana and Burkina Faso. While the secondary and tertiary sectors are becoming more important, especially in Ghana, this development is largely limited to the South of the country where some degree of industrial development is taking place and most of the raw materials such as gold, diamonds or bauxite are mined.

Apart from the production of foodstuffs for local national and regional markets both countries are largely depending on the production of cash-crops for international markets. In Ghana cocoa farming is accounting for 30-40% of the export revenues and contributes with 13% to the national GDP. Cocoa farming is dominated by small-scale farmers and roughly 1,5 million cocoa farmers produce more than 700.000 tons of cocoa annually (International Cocoa Organization (ICCO) 2005). Apart from cocoa, palm nuts, rubber and pineapples are agricultural products, which are sold at global markets. These cash crops are all grown in the Southern, tropical parts of the country where water is abundant. The clear focus on cash crop production has led to a situation in which Ghana has become dependent on food imports, mainly in the form of rice and wheat flour, already since colonial times (Agbodeka, 1992). Food imports have since long posed a serious threat to the Ghanaian economy as it heavily burdened the foreign exchange balance of the country. Therefore, various Ghanaian governments, including the colonial administration of the Gold Coast Colony, have tried to promote an increase in food production (Konings, 1986). As the country is, apart from the export of gold, timber and minerals, heavily depending on the revenue derived from the sale of agricultural cash crops, those programs mainly focussed on the intensification of food crop production in the semi-arid Northern parts of the country, where local peasants mostly engage in subsistence agriculture and frequently supplement their livelihoods through labour migration (Kasanga et al, 1988). Elite capture of resources, disappropriation of land and the forceful introduction of new crops and agricultural techniques led to the withdrawal of many peasants, who only slowly began to adopt the innovations (Bates, 1981; Konings, 1986). When agricultural subsidies were cut most commercial farmers abandoned farming as they were only thriving on the capture of public resources. Nevertheless, since the mid-1990s many more farmers have started to supplement increasingly insecure rain-fed agriculture through the irrigated cultivation of mostly vegetables and rice, which are sold at the national markets. Irrigated agriculture enables them to farm during the long dry season and to avoid labour migration to the South.

In Burkina Faso cotton production has a similar economic importance as cocoa production in Ghana. It is accounting for approximately 30% of the total export earnings and 60% of the agricultural exports. The cotton industry has played a key role in building up the country's infrastructure and social services (Cibambo et al., 2004). Cocoa as well as cotton production are adjusted to the climatic conditions of the region but do face major challenges. Due to adjustment programs both, in Ghana and Burkina Faso, market reforms, which were implemented since the early 80s, have had an impact on production conditions of small-scale farmers. While cotton and cocoa growing has always been a family affair the liberalization and privatization of these sectors as well as reduced subsidies on inputs has made it more difficult for small-scale farmers to compete with emerging private companies.

Apart from cotton vegetable farming, especially the production of tomato for the Ghanaian market has become increasing importance. Competing with farmers from Ghana's North many Burkinabe farmers are taking advantage of the ever increasing number of mostly small dams to produce tomato during the dry season. By then rains in Southern Ghana render

tomato production impossible and both Northern Ghana and Burkina Faso are using this seasonal advantage to profit from the large demand in the South of the basin.

As can be seen it is especially in the water-scarce Northern parts of the Volta Basin that agricultural production, especially irrigated dry-season farming plays a crucial role for the generation of the overwhelmingly rural livelihoods through subsistence agriculture and the production of cash crops for regional and global markets. As climatic patterns are changing and rain-fed agriculture is becoming increasingly risky, water-intensive irrigated agriculture, both promoted by national governments, donors and NGOs and expanded through farmers' initiative, are becoming increasingly important (Rodgers et al., 2006).

Apart from farming the production of livestock is an important additional source of rural livelihoods in the Northern parts of the basin. The prevalence of tsetse flies and the spread of trypanosomiasis throughout the tropical part of the basin have kept the level of animal production very low in the South. Therefore, the Northern parts of the basin enjoy a comparative advantage for the production of livestock, and traditionally livestock is imported from the semi-arid and arid parts of the basin. Especially Burkina Faso and, to a lesser extent, Northern Ghana provide a large share of the cattle, sheep and goat brought to Southern markets and slaughterhouses. Although the export of livestock in Burkina Faso has, due to the civil war in the Ivory Coast, which used to be the main importer of Burkinabe livestock, seen some sharp decline in recent years, livestock exports to Ghana are nevertheless important for many farmers and herders in Burkina Faso (Table 2)

Table 2 Livestock Exports from Burkina Faso, 1997 -2004

Type	Exports	1997	1998	1999	2000	2001	2002	2003	2004
Cattle		179	135	134	144	242	204	39	19
	Heads (1000)								
	Value (Million US\$)	14	14	13	8	17	15	5	3
Goats		87	71	123	45	101	61	34	10
	Heads (1000)								
	Value (Million US\$)	2	2	1	0.8	1	0.5	0.6	0.1
Sheep		224	130	189	97	195	131	35	47
	Heads (1000)								
	Value (Million US\$)	4	5	5	4	3	3	0.5	0.9

(Source: Faostat, 2006)

Like cash crop production, the livestock sector is mainly dominated by small-scale producers, who rely on livestock as additional income source, storage of wealth and to alleviate the impact of droughts. Livestock production is dominated by a specialised semi-nomadic ethnic group, the Fulani or Peul, who almost entirely depend on the keeping of livestock they either own or keep in contract for sedentary owners in farming communities. Especially the production of livestock, and meat as for that, is denounced as water intensive by the advocates of virtual water trade. One of the arguments refers to the huge amount of water meat needs to be produced. Therefore, it is argued that meat should not be exported from water scarce environments to water rich environments. While a look at gross statistics may support that

view, it still remains true that pastoralism is one of few economic activities that is highly adapted to (semi-) arid environments. In Africa and beyond pastoralists are usually found in dry savannah areas which do not easily lend themselves towards farming. An intimate knowledge of the particular environment and a large degree of mobility has made pastoralism a highly successful coping strategy in water scarce environment although huge amounts of water may be needed to produce one kilo of meat. This fact is easily glossed over, when the focus is only on macro statistics fictive water requirements for production.

4. Challenges for Virtual Water Trade in the Volta Basin

Virtual water trade is not likely to be of major importance for the governance of water resources and the solution of water scarcity and water related conflicts in the West African Volta Basin. Apart from the alleviation of the detrimental effects of droughts, which already occasionally have necessitated large imports of foodstuffs, mostly in the form of food aid, there is no reason to believe that any major reduction of agricultural production that will be replaced by the import of foodstuffs will be instigated within the (semi-) arid and increasingly water scarce Northern parts of the Volta Basin. There are ample cultural, socio-economic and political impediments that would preclude that virtual water trade would become a viable water governance option in the foreseeable future. In the following we want to outline the major factors that let us come to this conclusion.

4.1 Cultural constraints

Economic activities and the patterns of production are not only means to produce foodstuffs, make a living and accrue wealth but are, especially in the context of the Volta Basin, and also in many other rather 'traditional' societies around the globe, deeply embedded in the cultural and religious systems of those societies. Farmers do not only farm and rear livestock in order to secure meagre livelihoods and to meet their nutritional demands, but also do so as agriculture and the rearing of livestock is a deeply rooted part of their ideational lifeworld, provides them with the means, which allows them to engage in important social and spiritual activities and grants them access to status and social acclaim. In Northern Ghana, for instance, many farmers, despite or because of the experience of labour migration to the South express a deep affiliation to their agricultural activities. They are still able to remain as relatively independent producers, who construe their identity around farming and take pride in their, however little economic achievements. The production and rearing of especially millet, fowl and cattle provides farmers with the means to perform fundamental rituals and to engage into marriage and the reproductive cycle at large. Possession of larger numbers of cattle goes along with high social status and hardworking and successful farmers are held in high esteem. While often deprived of access to (higher) education and alternative forms of social mobility, farming and livestock rearing provides non-alienated means to lead spiritually secure, socially embedded and personally satisfactory lives. Furthermore, locally produced 'traditional' foodstuffs are often preferred for consumption as they are perceived to be more healthy and tasty. Another example in case are the semi-nomadic Fulani, who traditionally have adopted their lifestyle to the needs of livestock rearing in a (semi-) arid environment, in which access to pasture is problematic and transhumance is highly adapted to the specific local climatic patterns. For at least parts of the Fulani social and spiritual life is still largely organized around the 'traditional' schedule of their

semi-nomadic lifestyle. Cattle rearing remains an indispensable part of their identity as well as spiritual and social activities.

Furthermore Fulani pastoralists practice since pre-colonial times an economically feasible exchange of products and services with their farming Bisa neighbours. The different ethnic and economic groups are using so-called herding contracts (entrustment system) as a more or less formal arrangement between them, in which farmers leave some of their animals in the custody of the pastoralists for shorter or longer periods of time (Reenberg et al 2003). In return farmers give products like grain and milk to the pastoralist. The integration of animal husbandry into the farming system shows not just the cultural and social dimension and complexity of economic activities in the region but also the adaptation of different ethnic groups to water scarce environments. It also shows the interrelationship and the way in which rural people in one of Africa's most disadvantaged regions have constructed a livelihood system that is a response to local constraints and opportunities, and to broader patterns of income generating (Batterbury 2001). Virtual water trade would have a negative impact on the entrusting system by reducing the role of pastoralists for meat provision and by withdrawing the only economically feasible option for integrating animal husbandry into the farming system of local communities.

While cultural values and patterns of production are changing and parts of the population disengage or are forced to disengage from their traditional economic production patterns and lifestyles, as they for instance sedentarize, engage in labour or migrate to the larger cities, the resilience of 'traditional' lifestyles, identities and cultural and religious patterns should not be underestimated. Any external initiatives that would aim at the abolition or limitation of farming would therefore certainly be met with fierce opposition or, as effective, strategies of evasion (Scott, 1985). The ability of local populations, especially peasants, to evade external policies has been hotly debated throughout the 1970s and 1980s and the lessons learned should not be forgotten (see for instance Lemarchand, 1989).

4.2 Socio-Economic Constraints, Dysfunctional Markets and the Detrimental Conditions of Global Trade

While a change of agricultural production patterns may run counter cultural and religious systems and therefore met with resistance, it remains completely unclear how such large economic changes should be achieved from a purely economic perspective. As has been shown above, the population in the (semi)-arid parts of the Volta Basins is largely (up to 90% of the economically active population) engaged in agriculture. It remains entirely unclear how these people are supposed to make their living, if not as farmers and pastoralists. Economic transformation, away from a reliance on agriculture and the exploitation of natural resources has been the objective of almost endless development initiatives and adjustment programs throughout many countries of the South. While some countries, mainly in South East Asia or in Latin America may provide success stories, most of the countries of the South are, despite major efforts to the reverse, still characterized by huge parts of agricultural population and predominantly agricultural production patterns. In these countries food production is likely to further depend on local (subsistence) production (Applegren 2004). Looking at the Volta Basin any other expectation seems to be completely unrealistic. Given the rural character of large parts of the population, a low degree of educational and vocational achievement and the rather slow development of alternative economic activities in the secondary and tertiary sectors of the economy water governance based on virtual water trade are entirely unrealistic. Both, Burkina

Faso and Ghana are lacking the economic resources and human capacities to engage into large scale industrialization or the large expansion of the service sector. While Burkina Faso is due to human development indicators amongst the poorest countries worldwide (UNDP, 2003), Ghana, which is relatively well endowed with natural resources, is nevertheless rated as Highly Indebted Poor Country (HIPC) and has just received, like Burkina Faso, a multilateral debt reduction by major lending countries (IMF Fact Sheet, 2006). Additionally, it is the international financial and economic regime, which is imposed by the Bretton-Woods institutions and international donors, which preclude any large investment initiatives by the state. As major (international) private investment is small at best no major economic development outside the agricultural sector is to be expected in the near future. Looking at the development visions (GoG 1995) agriculture is seen as integral part or even driving force of future economic developments. The expansion of agricultural and hydraulic infrastructure is high on the development agenda since economic alternatives apart from agriculture are largely missing. Given the fact that in Ghana, for instance, unemployment has reached 20%, the promotion of food imports in the framework of virtual water trade would throw further parts of the population into extreme poverty.

Apart from a lack of capital and human resources it is the unequal terms of trade, which frequently render initiatives towards the diversification of the Basin's economies impossible. While import duties for raw materials in the North remain as low as the world market prices for these goods, which have rapidly declined during the last 30 years (e.g. cocoa minus 30%), the industrialized countries protect their markets from imports of agricultural products and processed goods (Bradford, 2003). This largely inhibits the development of a local processing industry. This is even more so, as the high level of subsidies for agricultural products and their processing in especially the EU and the US negatively affects local markets in the Basin. Large imports of rice and wheat as well as tomato paste at extremely low prices have rendered most local initiatives for the construction of processing plants unprofitable (Christian Aid, 2002a; 2002b). Furthermore, agricultural subsidise and trade barriers cut the possible profits from agricultural exports. Burkina Faso has been trying since long to arrive at better market access for its cotton and livestock products in the US and EU (WTO, 2001). While locally resources and capacities for an economic transformation are lacking and unfair terms of international trade persist it seems almost cynical to advocate for virtual water trade. Better terms of trade rather than virtual water trade would allow many countries of the South to reduce levels of production, engage in the processing of goods and thus to save water.

But it is not only international markets that are of problem. The markets within the basin are partly dysfunctional. Trade is impeded by innumerable checkpoints, which do not just exist between but also within states, where police force and other custom officers charge legal but also illegal customs. Corruption and institutional disintegration largely increase the transaction costs of trade. Additionally many markets within the basin are controlled by highly organized cartels that often act with political backing. In Ghana for instance, market queens largely control the trade in foodstuffs from rural areas into the urban centres and frequently are able to manipulate producer as well as consumer prices. They often act with political backing as through their control of prices they are effectively able to steer public opinion. Furthermore, political interference and a focus on self sufficiency have led to a situation in which virtual water trade does not seem to be easily implemented. It is furthermore questionable if the promotion of liberalization and privatization strategies, introduced in both countries in the framework of adjustment programmes, and therewith accompanied by the reduction of the states role in economy, does actually meet the requirements for necessarily planned virtual water markets.

At the example of ECOWAS, the Economic Community of West African States, to which all riparian states of the Volta basin belong to, the constraints in implementing cross-national

terms of trade can also be demonstrated. ECOWAS was established in 1975 to strengthen cooperation and market integration and to create an economic and monetary union for promoting economic growth and development in West Africa. Till today ECOWAS is facing many problems in the process of integrating West Africa economically, including: political instability and lack of 'good governance' that has plagued many member countries; the insufficient diversification of national economies; the absence of reliable infrastructure; and the multiplicity of organizations for regional integration with the same objectives (EIA 2003). The African Development Bank stated in 2004, that just 10% of the entire West African trade is taking place within the member states (Kempf 2005). This frustrating trade balance is conferrable to the situation in the Volta basin. Thus, in 2004 just 4,7% of Burkina Fasos exportations did go to Ghana. Respectively, Burkina Faso is not considered as a relevant trading partner for Ghana (World Fact Book 2006).

However, any attempt to introduce virtual water trade as a strategic instrument to optimize water use in a cross-boundary region like the Volta basin relies on a comprehensive and functional institutional set-up. In the Volta basin there is presently not such an overlapping institution with market supervision functions at place.

4.3 Political and institutinal constraints

Apart from cultural and economic constraints it is the specific political and institutional situation in many countries of the South that precludes the implementation of the virtual water approach as effective means of water governance. In many countries the state is not only financially incapable of triggering large scale economic transformations, but also lacks the political authority to embark on controversial policies that would affect large parts of the population. In Burkina Faso as well as in Ghana the various levels of governance, the state, the region and the districts have only a limited ability to control the activities of the population. State laws and regulations are only one of a number of traditional, customary, religious and local institutions that may become the framework of reference for human agency (von Benda-Beckmann et al., 1992). The state frequently lacks the resources, power, local legitimacy and even the will to impose widespread compliance with its institutions. It reigns through alliances with 'traditional' authorities, religious leaders and local 'big men' that allow for a certain degree of control of the flow of resources, which allows the government to stay in power, but equally are able to locally adapt, modify or even ignore official institutions (Barry, 1993). Governance, on different levels, is characterised by a significant degree of political patronage, nepotism and outright corruption which again render the implementation of policies ineffective and therefore allows the societal actors a strong impact on the policies of a rather weak state (Migdal, 1986). Especially, in the largely rural states of the Volta basin, governmental policies that have a detrimental effect on the large number of farmers are usually avoided. Whether democratically elected as in Ghana or rather authoritarian as in Burkina Faso, national governments usually have to be careful not overly confront rural constituencies with controversial policies, as they constitute an important factor in the often fragile balance of power of developing states.

All this factors combined make it extremely unlikely that virtual water trade becomes a means of water governance that will have a considerable influence on agricultural production patterns in the Volta basin and beyond. If promoted by international agencies it might attract some degree of rhetorical commitment, but it has to be doubted that it will find widespread implementation.

5. Conclusion

It has been shown that the concept of 'virtual water trade' is derived from the macro-analysis of water productivity in agriculture and animal husbandry. The analysis of (international) food flows lacks the potential to be a widely implemented instrument for water governance, especially in countries where adjustment programs have led to the reduction of states role in the supervision of market forces. Nevertheless, the heuristic value of the analysis of virtual water flows is not disputed and the debate has certainly opened interesting vistas on the seemingly irrational wastage of precious water resources in water-scarce regions. What is problematic is the fact that the sole focus on water productivity and food trade introduces a logic that is entirely driven by hydrological and agronomic considerations at the macro level. Thereby, locally adapted production patterns that make use of comparative advantages granted, for instance, by the differential prevalence of disease or seasonal production and marketing advantages, are falsely discredited. Furthermore, important cultural, socio-economic, market and politico-institutional factors is entirely glossed over. Using examples from the Volta basin it could be shown that these neglected factors are actually the ones, which drive economic development and policy processes. It therefore seems naïve at best and dangerous at worst to believe that the 'virtual water trade' concept could become a driver of water governance. It is naïve, because cultural, economic and political factors seem to preclude the widespread application of hydrological rationality in the design of economic policies. It is dangerous, because 'virtual water trade', if promoted as water governance policy by international donors and policymakers, may become just another well-meaning but failed attempt to 'rationally' manage resources, which may nevertheless have potentially disastrous effects on the livelihoods of rural populations as well as the political stability of developing states. Examples for failed top-down development and resource management strategies, for instance of the counterproductive implementation of land reforms are ample (Deininger et al., 2001, Benjaminsen et al., 2002) and water sector professionals should try to learn from it.

References

- Agbodeka, Francis (1992). *An Economic History of Ghana. From the Earliest Times*. Accra: Ghana University Press.
- Allan J. A. (1995). *Water Deficits and Management Options in Arid Regions with Special Reference to the Middle East and North Africa*. In *Water Resources Management in Arid Countries*, Muscat: Ministry of Water Resources.
- Allan J. A. (2001). *The Middle East Water Question: Hydropolitics and the Global Economy*. London: I B Tauris.
- Andah, Winston and Francis Gichuki (2003). *Volta Basin Profile: Strategic research for enhancing agricultural water productivity (Draft)*. Accra: International Water Management Institute, Challenge Program on Water and Food.
- Bates, Robert H. (1981). *Markets and States in Tropical Africa*. Berkley: University of California Press.
- Batterbury, S. (2001). *Landscapes of diversity: a local political ecology of livelihood diversification in southwestern Niger*. *Ecumene*; 8(4): 437-464.
- von Benda-Beckmann, Franz, van der Felde Menno, (ed.) 1992. *Law as resources in agrarian struggles*. Wageningen: Wageningen Agriculture University.
- Benjaminsen T. A., L and C. (2002). *Formalisation and Informalisation of Land and Water Rights in Africa: An Introduction*. *The European Journal of Development Studies*; 14(2):1-10.
- Berry, Sara (1993). *No condition is permanent: the social dynamics of agrarian change in Sub-Saharan Africa*. Madison: University of Wisconsin Press.
- Bradford, S. (2003). *Paying the Price: Final Goods Protection in OECD Countries*. *The Review of Economics and Statistics*; 85(1):24-37.
- Christian Aid (2002a). *A level playing field? Rice farming in Ghana*. <http://www.christian-aid.org.uk/campaign/trade/stories/ghana1.pdf>.
- Christian Aid (2002b). *A rotten trade. Ghana's tomato farmers face unfair EU competition*. <http://www.christian-aid.org.uk/campaign/trade/stories/ghana2.pdf>.
- Deininger, Klaus and Hans Binswanger (2001). *The Evolution of the World Bank's Land Policy*. In *Access to Land, Rural Poverty and Public Action*. Alain de Janvry, ed. Oxford: Oxford University Press.
- EIA (2003): *Economic Community of West African States (ECOWAS)*. <http://www.eia.doe.gov/cabs/ecowas.html>.
- Encyclopedia of World History (2001). *Historical Trends in Africa*. <http://www.bartleby.com/67/343.html>.

FAO (2006). FAOSTAT data. <http://faostat.fao.org>.

Government of Ghana (1995). Ghana – Vision 2020: The First Step 1996 - 2000. Accra: Assembly Press.

Hoekstra A. Y. and P. Q. Hung (2002). Virtual Water Trade. A quantification of virtual water flows between nations in relation to international crop trade. Value of Water Research Report Series No. 11. <http://www.ihe.nl/downloads/projects/report11-hoekstra-hung.pdf>.

IFPRI (2006). West Africa Strategic Analysis and Knowledge Support System (SAKSS). <http://www.ifpri.org/themes/sakss/images/waimg3.gif>.

IMF (2006). IMF Fact Sheet April 2006. <http://www.imf.org/external/np/exr/facts/hipc.htm>.

International Cocoa Organization (2005). ICCO Annual report 2003/2004. <http://www.icco.org/anrep/anrep0304english.pdf>.

Jung, Gerlinde (2003). Impact assessment of climate and climate change as predicted by MM5 climate runs. http://www.glowa-volta.de/research/results_phase1/resultp1_a4.htm.

Kasanga, Kasim and Martin Avis (1988). Internal Migration and Urbanization in Developing Countries. Findings from a Study in Ghana. Reading: University of Reading, Department of Land Management and Development.

Kempf, S. (2005). The Economic Community of West African States (ECOWAS). <http://www.weltpolitik.net/print/2341.html>.

Konings, Piet (1986). The state and rural class formation in Ghana: A comparative analysis. London: Kegan Paul Intl.

Kranjac-Berisavljevic G., Blench R., Bayorbor T. B., Turton C. N., Abdulai A. S., Boyed C., Obeng F., Drake E. (1999). Rethinking Natural Resource Degradation in Semi-Arid Sub-Saharan Africa: The Case of Semi-Arid Ghana. London: Overseas Development Institute and Faculty of Agriculture UDS. Tamale. http://www.odi.org.uk/RPEG/soil_degradation/ghlit.pdf.

Lemarchand, René (1989). African Peasantries, Reciprocity and the Market. The Economy of Affection Reconsidered. *Cahiers d' Études Africaines*; 29(1):33-67.

Merrett, Steve (2003). Virtual Water' and Occam's razor. Occasional Paper No. 62. SOAS Water Issues Study Group, University of London. <http://www.soas.ac.uk/waterissues/occasionalpapers/OCC62.pdf>.

Ministry of Works and Housing (MoWH) (1998). Ghana's Water Resources: Management Challenges and Opportunities. Accra: Ministry of Works and Housing.

Reenberg A., Oksen P., Svendsen J. (2003). Land use change vis-à-vis agricultural development in Southeastern Burkina Faso: the field expansion dilemma. *Geografisk Tidsskrift, Danish Journal of Geography*; 103(2).

Rodgers C., van de Giesen N., Laube W., Vlek P. L.G., Youkhana E. (2006). The GLOWA Volta Project: A Framework for Water Resources Decision-Making and Scientific Capacity Building in a Transnational West African Basin. *Water Resources Management*; special issue, accepted.

Scott, James C. (1985). *Weapons of the Weak. Everyday forms of Peasant Resistance*. New Haven and London: Yale University Press.

Tiffen, Pauline (2006). The liberalization of the Cocoa market in Ghana. <http://www.divinechocolate.com/Templates/Internal.asp?NodeID=89987&int1stParentNodeID=89776&int2ndParentNodeID=89707&int3rdParentNodeID=89986&strAreaColor=>.

Turton, Anthony R. (1999). *Precipitation, People, Pipelines and Power: Towards a Virtual Water Based Political Ecology Discourse*. MEWREW Occasional Paper No. 11. SOAS Water Issues Study Group, University of London. <http://www.soas.ac.uk/waterissues/occasionalpapers/OCC11.PDF>.

Turton, Anthony R. (2001). A strategic decision-makers guide to virtual water. http://www.wca-infonet.org/servlet/BinaryDownloaderServlet?filename=1070022461169_scarcity.pdf&refID=122068.

UNDP (2003). *Human Development Indicators 2003*. http://hdr.undp.org/reports/global/2003/indicator/cty_f_BFA.html.

UN World Development Report (2003). *Water for People – Water for Life*. <http://unesdoc.unesco.org/images/0012/001295/129556e.pdf>.

Wiggins, Steve (1999). *Setting the Scene: Recent Change in West African Farming and Natural Resource Management*. In *Natural Resource Management in Ghana and its Socio- economic Context*, Roger Blench, ed. London: Overseas Development Institute.

World Bank (2006). *World Development Indicators, 2006*. <http://devdata.worldbank.org/data-query/>.

World Fact Book (2006). *Country Report Ghana and Burkina Faso*. <http://www.cia.gov/cia/publications/factbook/>.

WTO (2001). *Proposal by Burkina Faso on the Negotiations on Agriculture*. Committee on Agriculture Special Session.

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