ABSTRACT VOLUME

World Water Week
in Stockholm
28 August – 2 September, 2016

Water for Sustainable Growth

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Content

Seminar 1: Water as a driver for sustainable growth

Many players, one river: a hydro-economic model for the Kafue

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Keywords: Hydro-economic model, optimization, sustainable water management, Zambia

Highlights

A multi-objective hydro-economic model illustrates the trade-offs among alternative growth scenarios in the Kafue River Basin, in Zambia. Hydropower, agriculture, urban and rural water supply, industries, and the environment compete for the same water and a forward-looking water management is needed to harness sustainable growth opportunities in Zambia.

Introduction and objectives

The Kafue River is the lifeblood of Zambia: it hosts major urban centres, it delivers water to large dams and one hydropower station, it serves major agricultural and industrial areas, and it ensures the health of a precious wetland ecosystem and of a rich fishery sector.

The present study analyses the availability and allocation of the waters of the Kafue River within the boundaries given by the policy and legislative framework. Through a combined hydrologic and economic model the study finds the optimal allocation of water resources for multiple uses in a catchment for which limited data is available.

Methodology approach

A multi-objective hydro-economic optimization model is proposed here as a tool to analyse the competing demands for water in the context of developing countries. The model addresses the linkages between surface and groundwater supply and the economic use of water at river basin scale and considers economic, social, and environmental objectives. Competing demands for water in the urban, agricultural, industrial, mining, and environmental sectors are addressed and supporting models are used to provide the hydrological inputs and the agricultural water-yield functions.

Analysis and results

Zambia's development objectives are the increase in irrigated agriculture and the expansion of its hydropower capacity.

It will be possible to further develop hydropower resources on the Kafue River only if minimal agricultural expansions are achieved. This is particularly true in a dry hydrological year when the optimal allocation of water resources strongly depends on the policy priorities of the stakeholders.

Population growth across the Kafue Basin alone will put a strain on water resources. If the current population growth rate is upheld for the coming 10 years, keeping all the other parameters constant, basin-wide net benefits will be reduced by about 12 percentage points in a dry year. Reduction of water delivery system losses and increased efficiency in water use will be paramount if Zambia wants to guarantee sufficient access to safe water and sanitation for its population.

The mining sector is also closely connected to the management of the Kafue due to its considerable dewatering operations. Would dewatering cease, overall net benefits will be reduced by 20 percent with respect to the baseline case (today). It will be necessary to manage alternative sources of livelihood in the Copperbelt and ensure adequate supplies of quality water for the growing cities.

Conclusions and recommendation

Due to a changing and not yet fully implemented water governance framework, inter-sectoral competition already exists in the Kafue Basin, particularly in dry hydrological years. Lack of long-term, coordinated management of the Kafue waters might lead to suboptimal future allocations of water resources across sectors and Zambia risks to forfeit promising growth opportunities.

Policy makers must consider the impacts of development scenarios on all water using sectors and should adopt a holistic assessment of the intrinsic trade-offs between users' objectives to understand the impacts of alternative water allocation scenarios on the society, the economy and the environment.

Water-related economic drag: sector-level analysis in Ethiopia

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Keywords: Ethiopia, sector-level analysis, macroeconomic analysis, water-related economic drag, runoff variability

Highlights

- Novel sector-level analysis of the impacts of runoff on economic output
- Correlation between runoff and economic output is significant: water acts as a drag on multiple economic activities in the Awash basin.

Introduction and objectives

The Awash River basin, in central Ethiopia, is highly heterogeneous in terms of rainfall (ranging from 1,600 mm/yr), land use (from major urban areas of Addis Ababa, to pastoralist areas, and irrigated agriculture) and economic outputs. 14 million people and a range of economic activities rely on the highly variable flow. Irrigation accounts for 90% of the total water demand; other uses include mining, manufacturing and domestic. The aim of this study was to assess the risk posed by water insecurity to economic activities within the basin.

Methodology approach

Recent research (Sadoff et al., 2015) shows that hydro-climatic variables have an impact on countries' GDP. Building on this research, we use novel data on economic performance for different sectors to construct a dataset (1996-2006) of productivity for each of the 23 administrative zones in the basin. Gridded runoff from global hydrological models and rainfall reanalysis data are used to characterize hydrological conditions for the same period. A fixed panel regression methodology is used to quantify the relationship between economic productivity and hydro-climatic data both for the overall macroeconomy and for key sectors at the administrative zone level.

Analysis and results

This study demonstrates for the first time how water insecurity causes economic drag in different sectors in a basin. Results from the fixed panel regression show that agricultural output in the basin is correlated with runoff and rainfall availability, which were used as proxies for hydrological conditions and water availability. A similar statistically significant relationship between economic output and runoff/rainfall was identified for key manufacturing sectors. The macroeconomic analysis for the whole basin confirmed the correlation between economic performance and hydrological variables, providing the first quantitative evidence that hydrological conditions and variability act as a drag on sustainable growth in the Awash.

Results from the macroeconomic analysis were used to inform interviews with local actors to understand how this water-related drag materializes in practice for different sectors. Working in dialogue with interested actors and stakeholders, this analysis identified priority areas for water security interventions to decouple economic activities from runoff variability and enable sustainable economic growth in the basin.

Conclusions and recommendation

Hydro-climatic conditions have a statistically significant impact on multiple economic sectors in the Awash basin. This study demonstrates that economic expansion without adequate provision of water services, management of hydrological variability and protection from water-related risks leaves economic activities in the Awash exposed to the destructive impacts of water. This work is being used as a stepping stone to inform and appraise investments in water security in the basin. The methodology is transferrable to other river basins in Ethiopia to identify water's role in influencing economic growth.

Food Corridors: Exploring the Food, Water, Energy and Climate Nexus

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Keywords: Sustainable growth, agricultural development, food corridors, water-food-energy nexus, logistics chain management

Highlights

- An agricultural development model has been developed for Southeast Asia considering the resource availability and climate change.
- We explored the feasibility of modeling food logistics within the framework of international corridors, while taking into account the spatial and temporal variation of water resources.

Introduction and objectives

Water supplies and food production are becoming increasingly uncertain due to climate change, population growth, changes in dietary pattern and economic growth. While agricultural development has always been one of the main targets of international aid agencies to achieve sustainable growth, they have tended to focus more on infrastructure development and less on resource logistic management. This research is part of a larger study carried out in South East Asia. We explored the feasibility of modeling resource logistics within the framework of international and intra-national corridors while taking into account the regional comparative advantage of spatial and temporal variation of resource availability and climate uncertainty.

Methodology approach

For our application, we have developed a linear, deterministic, multi-modal transport, and transshipment optimization model in General Algebraic Modeling System (GAMS). Considering the constraints imposed by limited water supply, energy requirement, land availability and climate variability, the model is designed to examine the introduction of new crops in the production regions and into international trade. Different climate scenarios and water resource availabilities have been considered in the model. For the study area, we selected part of the Brunei, Indonesia, Malaysia, and the Philippines, East Asian Growth Area (BIMP-EAGA) to examine our approach. BIMP-EAGA has a combined population of 57.5 million and a land area of 1.6 million square kilometers.

Analysis and results

The case involves a hypothetical study of new agricultural development in the Indonesian Islands of Sumba/Sumbawa and in Mindanao in the Philippines. The model considers multiple crops and dairy production that could be produced in each of the two regions and includes potential internationally traded commodities. One unique aspect of our approach is we included temperature and precipitation variation with elevation as a way of adjusting to climate change in the model. The model shows the optimal allocation of cropping patterns and the tonnage of product and its destination. The model shows the number of rural employment under each agricultural scenario. Results also emphasize the economic importance of dairy products in this region. This is very encouraging with respect to producing more nutritious diets that improves the nutritional status of the poor, particularly children in the region.

Conclusions and recommendation

The case represents an alternative approach to accelerate the pace in sustainable growth. Taking an integrated view of the value chain allows estimation of various resource inputs (i.e. water and labor requirements) in agricultural development. Variation of temperature and precipitation with altitude can be used to adapt to climate change. Strong employment generation arising from the crop diversification would leave ample scope for sustainable growth. The model could be expanded to include more crops, producing and consuming locations, and time intervals. The model structure however would remain simple; the only limitation is the availability of reliable data to use with the model.

Managing water resources to reduce climate loss and damage

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Keywords: Climate change, water management, loss and damage, UNFCCC

Highlights

Mining through the global disaster database reveals that more than three out of every disaster are water-related. Albeit, managing the water resources has never been an agenda in the UNFCCC's climate change negotiations. This paper harnesses the potential of ecosystem-based options to minimise climate loss and damage from water infrastructures

Introduction and objectives

Water resources, as a sector, is primarily exposed to climate change loss and damage. Over the last few decades, the frequency and magnitude of the water-related hazards have been increasing alarmingly. Vulnerability and exposure further amplifies when the existing water management interventions (e.g., flood defense, drainage infrastructure) fails to prove the efficacy as sustainable adaptation option due to possessing long-term residual impact. Therefore, the main objective of this study to explore a range of ecosystem-based options, including the conventional risk reduction tools along with risk transfer and risk pooling instruments to reduce climate change loss and damage from water-related disasters.

Methodology approach

The method has three distinct parts. First, the authors calculated the loss and damage footprint of the hydrological disasters from the EMDAT dataset. Next, the status quo regarding the coverage of water resources management related concerns in the climate change negotiation process till the recently signed 'Paris Agreement' is evaluated. The potential of using the newly evolved work programme on 'loss and damage' as a window for the inclusion of IWRM principles is assessed. Finally, the authors evaluated a range of existing or innovative water management options through the lens of loss and damage for rejuvenating the hydrological environment.

Analysis and results

The frequency of the hydrological disasters is on the rise in the recent years. Moreover, standardised economic estimates account an average of USD 40 billion worth damage per year resulting from water-related disasters.In spite of the sharp decline in the human death toll and suffering, the economic damage estimates has increased by several folds in the recent decade, which might underscore the role of anthropogenic responses amplifying the infrastructural vulnerability. Other than the tangible economic dimensions, a significant intangible dimension includes the changes in the hydrological regime, particularly changes in the magnitude and seasonality characteristics of the flow system. Moreover, ecosystem services, including the agricultural production loss might rise significantly due to more intense low flow situation, early flood incidences and later recession of flood.

Despite such strong evidence base, water resources management has never been acknowledged as an adaptation option in the climate change negotiation since 1992. The recently evolved work programme on loss and damage might act as the platform for including water resources management in the joint political domain for combating negative impacts of climate change. A range of genaralised approaches are proposed including the conventional and innovative water management options to minimise climate loss and damage.

Conclusions and recommendation

Ecosystem-based adaptation options triggering minimum residual loss and damage need to be adopted. Otherwise, the infrastructural adaptation options might trigger more loss and damage in future along with the invasion of false sense of security among the particularly vulnerable communities. At the same time, the trade-off between securing agricultural production and ecosystem conservation need to be balanced effectively. An integrated basin-wide approach is long due to protect the health of the Transboundary Rivers in the greater GBM basins region. The cost of inaction and delayed action might cause irreversible loss and damage of ecosystem components and services.

Bulk water transfers: problem or solution

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Keywords: water, scarcity, transfer, bulk

Highlights

Bulk water transfers via pipelines or ship are becoming commonplace. Are these transfers from water-rich areas to water scarce areas a viable solution to water shortages? Or do they postpone inevitable adaptation to changing circumstances while creating problems in the transferring region?

Introduction and objectives

This presentation will describe bulk water transfers that take place in various locations -- Malaysia to Singapore, Lesotho to South Africa, and Turkey to Cyprus -- and will also discuss commercial proposals for shipping containers of water as well as domestic transfers. When one area relies on another for vital water needs, a power imbalance may arise. Further, the recipient may postpone taking required measures to adapt to less water, while the area providing the water may be disadvantaging future generations. Both parties may be affecting ecosystems and hydrological cycles.

Methodology approach

Desktop research on bulk water transfers.

Analysis and results

In addition to the transnational bulk water transfers in Asia and Africa, there are also examples of domestic bulk water transfers, such as China's South-to-North Water Transfer Project, Libya's Great-Manmade River, the re-routing of Punjabi rivers into the Indus River instead of the Ganges River, and the system of water transfers in California. Further, companies such as Alaska Bulk Water, Inc. have been established with the sole purpose of shipping tankers full of water to arid areas. Several issues arise with these transfers. First, they allow parched areas to postpone adapting to water scarcity. Secondly, areas contributing the water may need that resource at some point in the future. Thirdly, transferring water from one area to another could affect the regional hydrological cycle and the ecosystems in both areas. Finally, water transfers could make the receiving area dependent on the contributing area, leading to potential conflict should the supply of water be interrupted. For all of these reasons and in spite of technological advances, bulk water transfers should be carefully considered before being enacted.

Conclusions and recommendation

Bulk water transfers are becoming more common through a variety of mechanisms, such as re-routing rivers, using aqueducts and pipes, and shipping containers-full of the liquid. While such transfers may seem like a viable solution to problems of water scarcity, the consequences need to be carefully considered. While obtaining bulk water may seem simpler and more feasible than adapting to less available water, in some cases earlier adaptation to changed circumstances may avoid more serious consequences later.

‘Zero’ coming into fashion in the Indian textile industry

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Keywords: textile industry, ZLD, wastewater treatment

Highlights

India is seeking to counter impacts on freshwater availability from its textile industry through making the ‘zero liquid discharge’ approach to wastewater treatment mandatory. Lessons on BAT from Tirupur, which has been the frontrunner in testing feasible methods, are important to move towards sustainable production jointly with Western buyers.

Introduction and objectives

During the early 90s, garment exports from Tirupur, India, exploded and the district became an important generator of employment, wealth – and polluting effluents. In 2006, the Court ruled that a treatment approach regarded as best practice, Zero Liquid Discharge (ZLD), was to be achieved. Following a contempt petition, the Court in 2011 ordered closing of >700 dyeing units. 300,000 workers lost their jobs. Today, the local industry has invested in innovative infrastructure to reuse water and salts, but cannot externalize the costs. ZLD is now made mandatory in the whole of India; implementation lessons can be learned from Tirupur.

Methodology approach

This case study of Tirupur’s journey and the ZLD approach coming into fashion builds on field work, oral histories and qualitative interviews with representatives of the industry, authorities, the court system and academia, together with a review of the literature including relevant court cases and media comments. Going back some 25 years in time, it uses transition theory as the lens through which to understand the transformation that Tirupur and India's textile industry has undergone in recent history.

Analysis and results

Tirupur experienced freshwater stress in the 80s, caused by the local textile industry’s discharges. When effluent standards were not complied with, subsidies and authority directions to connect factories to common effluent treatment plants not heeded to, and early court interventions failed, other parallel steps were taken to rectify the situation. One was to pipe in treated water from upstream, another to require a combination of wastewater treatment methods. Together, reverse osmosis, RO reject management, evaporators and salt crystallisers would enable water and salt reuse and – ultimately – ‘zero’ discharge.

One textile unit owner paved the way to demonstrate the feasibility, inspired by the use of membrane technology in Europe and the Gulf. His entrepreneurship was awarded by the administration but not much welcomed by peers in the industry who preferred the old regime: Dilution is the solution to pollution. The ZLD approach requires high capital and operating expenditures, and along with high energy consumption and sludge management challenges come CO_2 emissions. Textile units in Tirupur continue to struggle with profitability and optimisation of processes, at the time when the federal government decides to frogleap to ZLD ahead of the industry feeling the pinch from risks connected to water scarcity.

Conclusions and recommendation

To build legitimacy and willingness to comply with reformed policy on textile wastewater treatment and thereby move towards sustainable growth and production, India needs to take into account that

- the zero discharge method should be defined so that it achieves around 90% efficiency;
- the current (negligible) cost of groundwater does not incentivise reuse;
- Western buyers are yet unwilling to take on indirect costs;
- closing of the water cycle can be achieved in a variety of ways, many of which are not spelled 'ZLD'.

Enhancing water availability for livelihood improvement in Karamoja region, Uganda

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Keywords: Livelihood, Water, vulnerability, capacity, policy

Highlights

The focus of Karamoja Livelihood Programme was to improve community livelihoods through building productive assets water infrastructure (rock catchments, valley tanks, subsurface dams and rain water jars). The aim was to improve crop and livestock production to address food insecurity, mitigate drought related risks at household level, and increase household income.

Introduction and objectives

The Karamoja Livelihood Programme (KALIP) was implemented by the Government of Uganda through the Office of the Prime Minister. The programme was funded by the European Union to address water scarcity in Karamoja, North Eastern Uganda. Water scarcity has severely affected crop and livestock production with negative consequences on people's livelihoods. Consequently, there was need to build communities capacity to be resilient to recurring droughts. Therefore, the project objectives were to: support communities in water infrastructure development, reduce vulnerability of communities against impacts of climate change and enhance the capacity of the communities to manage water resources.

Methodology approach

- Using participatory approaches to support and influence action of policy, plans and strategies
- Demonstrate and support innovative practices to address water insecurity and enhance stakeholder's uptake and up-scaling of water infrastructure
- Knowledge development and capacity building of institutions and local actors in water security through documenting and sharing lessons and best practices
- Continuous monitoring of community infrastructure works to ensure transparency and ownership/responsibility for the completed structures and reducing conflicts between the project and the community

Analysis and results

Overall, the programme provided water infrastructure facilities for production. These include protective rock catchments, valley tanks, subsurface dams, rain water jars, cattle troughs and Micro dams. The district staff and community Water Use Committees (WUC) were trained in operations and maintenance. Water conservation measures aimed at improving crop and tree survival were put in place. Other benefits of the programme included effective collaboration and coordination between KALIP and Government, reduction in trekking distances (greater than 5km) in search of water and pastures which eventually reduced livestock diseases, establishing linkages with other partners to support communities in fuel saving stoves which have been replicated.

The programe component (water for production) has contributed to the implementation of the National Water Policy of 1999 for Uganda which considers water as a social and economic good for all people.

The programme has increased water use amongst stakeholders, enhanced capacity building in community-based watershed management and general soil and water management practices. Also, the interventions

contributed to saving time for children to secure water for home and animals use, then go to school and for adults to engage in other income generating activities. In addition, there has been increased access to water by communities.

Conclusions and recommendation

Conclusion: KALIP was relevant and timely for the Karamoja water stressed region. Putting up strong water infrastructure has supported social and economic aspects, hence, improving community livelihoods. While on the other hand, the programme has contributed to the implementation of the national water policy.

Recommendation: Future programmes targeting the community should involve government. Appropriate measures such as training in operation and maintenance of infrastructure developments should be done to prolong duration of the assets and also to develop a sense of ownership. Therefore, budgets to undertake these tasks should be put in place by government with contribution from communities.

Optimal water allocation for rainfed agriculture and livelihoods in Ethiopia

Author: Ms. Catherine Grasham, University of East Anglia, United Kingdom

Keywords: Rural development, Sustainable livelihoods, Rural-urban linkages, Water governance, Common pool resources, Semi-arid, Ethiopia.

Highlights

This paper suggests that to increase agricultural output and improve rural livelihoods, scarce dry season water in developing countries should be used to protect rural town water supplies, not allocated to irrigation. This will support urban services and a dynamic rural economy for a large hinterland of rainfed farmers.

Introduction and objectives

This research seeks to answer the question: if scarce dry season water in semi-arid Ethiopia is allocated to rural towns, can this increase agricultural output more than if it is allocated to irrigation? It is concerned with a sustainable water allocation scenario for food security and improved livelihoods. It examines how rural livelihoods and rainfed agricultural practices are connected to a rural town water supply via urban services and livelihood diversification. It also questions the institutional viability of the idea by exploring the water governance framework in Ethiopia.

Methodology approach

The research paper adopts a comparative case study methodology of two rural towns in Ethiopia and four rural kebeles, two proximal to each town. It uses mixed qualitative and quantitative methods including: a rural household survey; focus group discussions with rainfed farmers; an urban water use survey of households and businesses; and semi-structured interviews with water governance stakeholders at all levels of government.

Analysis and results

Statistical analysis of the rural household surveys reveals that rural communities relying more keenly on agriculture for their income are yielding more from their land. Communities proximal to a rural town with a more diverse market trading in higher value crops are wealthier than those proximal to a less diverse market primarily trading grains. The urban water use survey reveals that a significant number of businesses suffer economic losses due to an insufficient, unreliable water supply. Water is a limiting factor for business expansion in rural towns in Ethiopia. There is evidence to suggest that this is having a negative impact on rural livelihoods, limiting expansion of the labour market and job opportunities for the rural poor. This is having a knock-on effect on rainfed agricultural practices as farming households do not have enough capital to invest in inputs. The interviews reveal that the idea of allocating scarce dry season water to rural towns over irrigation is politically favorable as drinking water is the highest policy priority for water resources management in Ethiopia. However, in practice, the institutional framework for water governance is fractured and water resource developments play out in an unregulated and unintegrated way.

Conclusions and recommendation

This research questions the dominant discourse that scarce dry season blue water should be allocated to irrigation to increase overall agricultural input. The allocation of such water to rural towns rather than irrigation can facilitate the intensification of rainfed agriculture to increase overall agricultural output, food security and foster sustainable livelihoods. For this to be institutionally viable, there needs to be a greater integration of water supply management and irrigation management institutions to ameliorate competition between irrigation and water supply for water resources and to ensure that future water resource developments are sustainable.

Impact of SDG's on Sustainable Development in the MEANA Region

Author: Dr. Luay Froukh, NGO, Water and Environment Consultant, Jordan

Keywords: Sustainable Development, Sustainable Growth, SDG's, MEANA, Multi criteria, Participatory Approach

Highlights

- SDG's targets and potential implementation
- Gaps in the sustainable development plans in MEANA region presenting the case of Jordan, Egypt and Morocco.
- How to bridge the gaps between national plans and SDG's
- Impact on Sustainable development and Growth in the above countries

Introduction and objectives

Water is identified as enabling resource in five other goals of the SDG. Consequently, unlike the MDGs, which were mainly focused on water supply and sanitation in relation to water under the heading of MDG7 (environmental sustainability), the independent goal under SDG with its proposed target areas of water provides for a significant increase in scope, opportunities and challenges.

Methodology approach

The study is based on conducting national workshops in Jordan, Egypt, and Morocco to study the SDG's impact on the national sustainable development plans. The participatory approach was used to identify the gaps in the current sustainable plans. All stack holders including political figures were involved in the discussions. The mutli criteria analysis tools was used to bridge the gaps between the current sustainable plans and SDG's and what will be the impact on the sustainable development growth in those countries.

Analysis and results

The water-related targets provide countries with common goals, and are as important as benchmarks and standards for progress, not only as aspirations, but as tools to mobilize concrete actions. Countries and stakeholders need robust evaluation systems to track the effectiveness of their institutions and actions in delivering the expected outcomes of the SDG 6, the water goal, and measure what needs to be improved.

The analysis of the workshops outcome showed that the three countries Jordan, Egypt and Morocco have general sustainable development plans in the political dimension and less linked with the following goals; water supply; sanitation; water quality and pollution; water use efficiency across all sectors; integrated water resources management; protection and restoration of ecosystems.

another result; there is considerable evidence that achieving SDG 6 will bring significant economic benefits that exceed the investment needed. For water and sanitation alone, research shows that benefits exceed the cost of an intervention by 3 to 6 times. The economic return on sanitation spending is US $5.50 per US dollar invested. The estimates suggest that achieving universal access to basic water, sanitation could cost roughly 70% of countries public finance.

Conclusions and recommendation

Most of the MEANA region countries still do not have clear sustainable development plans reflecting the SDG's and future sustainable growth. More work need to be done on the technical part to define the impact on the sub goals level especially the return in the following area.

- Reduced health risk from water related diseases
- Protection of environment and ecosystem
- stability in socioeconomic aspects and minimize migration
- Social protection floors tailored to national needs and capacities promoted
- Promotion of entrepreneurship and sustainable enterprise development

Seminar 2: Water security in a changing world: coping with threats

Can third parties resolve transboundary conflicts in the Ganges-Brahmaputra problemshed?

Author: Ms. Paula Hanasz, Australian National University, PhD scholar, Australia

Keywords: Transboundary, Water conflict, Cooperation, Track Two dialogue, World Bank

Highlights

This presentation challenges the popular notion that transboundary water cooperation can be built between conflicted riparians in the developing world through Track II dialogue facilitated by a third party such as an international organisation or aid donor.

Introduction and objectives

The Ganges-Brahmaputra problemshed is vulnerable to water related shocks and conflicts. There are many pressing transboundary issues, but governance is weak and the water interaction between India, Nepal, Bhutan and Bangladesh is fraught. At the same time, the fear of socio-political conflicts caused or exacerbated by water issues has created impetus for increasing water cooperation the world over.

This has driven third parties into the Ganges-Brahmaputra problemshed. The primary method of the World Bank-led South Asia Water Initiative for mitigating transboundary water conflict here is through facilitating Track II dialogue. But is it sufficient for creating transboundary water cooperation?

Methodology approach

This study asks two questions: what are the necessary and sufficient conditions for transboundary water cooperation? How can third parties intervene more effectively to improve transboundary water interaction?

This paper examines the presence and absence of three conditions (Track II dialogue facilitated by third parties, political will for cooperative water governance, and trust between riparians) in three case studies; India-Nepal, India-Bhutan, and India-Bangladesh.

This study is based on a critical realist methodology, which assumes that transboundary water cooperation is an emergent property of multiple conditions, but that these conditions may not have the same effect in different contexts or configurations.

Analysis and results

The effect of third party interventions on the water interaction between India-Nepal, India-Bhutan, and India-Bangladesh illustrates that transboundary water cooperation cannot simply be imposed from the outside or through a short-term program of Track II dialogue. Instead, these cases suggest that transboundary cooperation is a complex phenomenon, which can only emerge when multiple conditions are met – and even then it cannot be guaranteed.

Nonetheless, third parties could play a role – albeit a highly circumscribed one – in creating the conditions necessary for transboundary cooperation to emerge. If there is trust between riparians and political will to take action, then there is no need for facilitated Track II dialogue. Track II dialogue becomes an option for facilitated dispute resolution only when those two factors are missing. Yet the absence of trust between riparians and lack of political will for building transboundary water cooperation is also what undermines Track II dialogue. Third parties are more likely to succeed if there is trust between riparians, or when there is political will for transboundary water cooperation. Certainly, Track II dialogue may contribute to the development of one or both of those conditions, but that is a long-term enterprise and unpredictable.

Conclusions and recommendation

Third parties cannot bring about transboundary water cooperation, but they may play a limited role in supporting conditions in which positive interaction may flourish. This role is largely limited to building trust and political will by addressing historical grievances and power asymmetry between riparians. This may be done through Track II dialogue, but Track II dialogue alone (i.e., dialogue that does not expressly focus on building trust or political will) is unlikely to bring about transboundary water cooperation. Third parties such as the World Bank should take this into account in their strategic planning and program evaluations.

A Systemic Analysis of Retro-Innovation in Agricultural Water Harvesting Practices in Jordan

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Keywords: Technological Innovation Systems, Water harvesting, Innovation adoption, Retro-innovation, Jordanian agriculture

Highlights

This research identifies the mechanisms through which water harvesting practices in Jordanian agriculture are developed, improved, and accessed by farmers. Using Technological Innovation Systems analysis, it assesses barriers and opportunities throughout the agricultural system, from government and international donors to farmers, to widespread integration of these practices into Jordanian agriculture.

Introduction and objectives

Jordan is one of the most water scarce countries in the world. Current agricultural methods are insufficient for ensuring agricultural sustainability. Water harvesting, which diverts rainfall from non-productive to productive land, has been practiced for centuries but was largely supplanted by 20th century agricultural techniques. Adapting, refining, and integrating these ancient practices into modern agricultural systems is termed 'retro-innovation', and has proven results for sustainable crop production. Despite extensive efforts to expand water harvesting, widespread use remains low. This research assesses how different constraints function in the broader system that influences water harvesting innovation, and provides recommendations for overcoming them.

Methodology approach

We utilize the Technological Innovation Systems analysis approach to assess the functioning of the innovation system in Jordan for the integration of water harvesting practices into the rainfed agricultural system. This analysis uses semi-structured in-depth interviews, survey data, and secondary data. Through this mixed-methods approach, constraints to widespread adoption of water harvesting and key intervention points for overcoming obstacles to retro-innovation are identified. Key-informant interviews are ongoing through May 2016. Secondary farmer survey data and public documents enrich these data for developing policy recommendations.

Analysis and results

Preliminary research and data collection began in Jordan in April 2015, and is ongoing as interview responses continue to be received.

Based on analysis of current data, some key preliminary findings have been identified: 1) Donor countries and organizations have a major impact on water management in agriculture and on the priorities of the ministries responsible for agriculture, research, water management, and the environment; 2) The influence that donors have on defining development and policy priorities has, in some cases, complicated the development of a unified national plan for development. Because each donor has its own priorities, geopolitical agenda, and favored agricultural technologies, the projects they fund may not coordinate with those of other donors, and in some cases may inadvertently work against each other; 3) The power structure created by donors has contributed to the weakening of power in some ministries; 4) Coordination between agricultural research and extension branches of the Ministry of Agriculture is limited; 5) The national agricultural research community, generally speaking, has limited human cap acity.

Conclusions and recommendation

Based on available data, initial recommendations include: 1) Coordination between government ministries, donors, and NGOs should be increased; 2) The Jordanian government should develop a master agricultural and water resources development plan; 3) Human capacity within research and extension should be increased through additional training; and 4) Power dynamics between the multiple stakeholders should to be better understood by those working to expand the adoption of water harvesting practices. Formal recommendations will be presented at World Water Week after research is complete.

Achieving sustainable growth in post-conflict and refugee-hosting countries

Author: Mr. Shigeyuki Matsumoto, Japan International Cooperation Agency, Senior Advisor, Japan

Keywords: Post-conflict countries, Refugee-hosting countries, Sustainable growth, Capacity development, development assistance

Highlights

This paper examined three good practices of development assistance in post-conflict and refugee hosting countries; namely Cambodia, Sudan and Jordan. Common challenges to secure water in the crisis situations were discussed. Then, six effective approaches were recommended, such as quick impact, multi-sectoral intervention, human resources development, and long-term planning.

Introduction and objectives

There are countless numbers of people suffering due to war. Many of those who have survived conflict then find themselves in difficult circumstances. Water supply and sanitation are one of the most essential services to be re-established urgently. In addition, families in conflict countries seek refuge in neighbouring countries and elsewhere. Unexpected increase of refugees further affects the condition of water and wastewater service in refugee-hosting countries. The objective of this paper is to explore how we can address serious issues in fragile countries in order to ensure reconstruction and achieve economic growth through development assistance in the water sector.

Methodology approach

Following successful interventions are compared to identify common issues and extract key lessons learned:

(1) Cambodia: Phnom Penh is regarded as one of the most remarkable success stories which has achieved significant improvement of water supply service from the devastation of the lengthy civil war which ended in 1991.
(2) Sudan: Kassala State shows steady reconstruction from the Eastern Conflict intensified from 2005 to 2006.
(3) Jordan: Since 2011, influx of Syrian refugees is exerting the overwhelming pressure on water and sanitation in Jordan. Especially, the northern governorates, which already suffer from limited water resources, are coping with the crisis.

Analysis and results

Common challenges were observed as shown below:

(1) Unstable security situation, frictions between local people and refugees,
(2) Expectation to quick benefit from peace,
(3) Lack of budget and financing mechanisms,
(4) Weak institutions and human resources, and
(5) Lack of blueprint, data and record.

Phnom Penh Water Supply Authority promoted reforms under the strong leadership of General Director. A master plan prepared in 1993 played a pivotal role to show a roadmap for reconstruction and management improvement targeting 2010, and its implementation was supported by coordinated donor assistances. Capacity building was emphasized in parallel with facility reconstruction.

Kassala State Government launched a project for human resources development in 2011. A major factor for the success of this project was multi-sector approach which covers not only water but also planning, agriculture, health, and vocational training. The project also showed tangible effects by pilot activities to bring visible impacts to the local communities.

Water Authority of Jordan is now implementing a program to improve water services for the host communities of Syrian refugees. The program was properly designed to include master plan formulation, pilot activities and design work for urgent construction, in order to bring both quick impact and long-term perspective.

Conclusions and recommendation

Following approaches are recommended to make development assistance effective in the context of post-conflict and refugee-hosting countries:

(1) Quick interventions to meet urgent local needs in order to let people feel the benefit of peace,
(2) Multi-sectoral approach to maximize beneficiary, synergy effect, and coordination,
(3) Inclusiveness to target both governments and communities,
(4) Long-term planning with bold projection to lay the foundation for both facility reconstruction and management improvement,
(5) Human resources development and institutional building to establish operational basis, and
(6) Coordinated and continuous support by international community in terms of both financial and technical assistance.

The Grand Ethiopian Renaissance Dam and Challenges of Climate Change

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Keywords: The Eastern Nile, Renaissance Dam, Climate Change, Benefits, and Costs

Highlights

This study sheds the light on the benefits and costs of the Grand Ethiopian Renaissance Dam (GERD) in relevance to the challenges of climate change. According to the way the Eastern Nile's riparians will manage the GERD's stalemate, the project may either mitigate such climatic threats or exaggerate them.

Introduction and objectives

Dams constructed on international waterways generate different benefits and costs that vary in their environmental, socio-economic and political dimensions. The ways such projects are constructed and the distribution of their externalities among riparian states can both catalyze cooperation and trigger disputes between them. Potential variabilities and vulnerabilities associated with various scenarios of climate change substantially complicate the whole process of planning, construction, and operation. The GERD, the first huge hydraulic project to be constructed upper the Blue Nile, is an explicit case. This study investigates how climate change influences the challenges facing riparians concerning the project.

Methodology approach

The study follows the cooperative framework of C. Sadoff and D. Grey to categorize the expected benefits and costs of the GERD and to trace their distribution among riparians. Benefits and costs, to the river (environmental), from the river (direct socio-economic), because of the river (hydropolitical), and beyond the river (indirect economic and geopolitical), are extracted from the final report of the International Panel of Experts (IPoE) in addition to other specialized studies. The analysis mainly highlights the consequences of the GERD's benefits and costs in mitigating and exaggerating possible risks of climate change.

Analysis and results

As concluded by the IPoE's report, many of the GERD's essential prefeasibility studies do not befit the massive magnitude of the project. The main reason that the GERD's planning phase was not managed in a cooperative and transparent way is the long history of mutual mistrust in the Eastern Nile Basin. This politically induced process generated serious uncertainties about the project's benefits and costs generally, and its correlation to climate change risks particularly. Specifically, the dam's 74-BCM reservoir will increase the basin's water storage capacity, and thus, enhance its resilience to unusual floods and droughts. The dam's generated hydropower presents a clean energy alternative to riparians and the whole region. The project present direct benefits to Sudan that will strengthen its capability to mitigate risks of climate change, such as flood protection, reduction of reservoirs' sedimentation, and year-round agriculture. On the other hand, vast areas of the vegetation cover to be submerged under the dam's reservoir will produce greenhouse gas emissions. Dams' failure due to structural or geological reasons, specially for extreme flood events and high rates of sedimentation, will lead to disastrous consequences on downstream communities. Adverse impacts on water and energy security in Egypt are possible as well.

Conclusions and recommendation

Although the GERD's construction is to be completed by 2017, there still a chance for the three riparian states to manage the process more cooperatively. Technical studies, recommended by the IPoE regarding the environmental, socio-economic, hydrologic, and structural aspects, should be accomplished in time and respected by all sides. The Nile is the sole source of freshwater in Egypt. At the same time, Ethiopia urgently needs energy for development and poverty alleviation. Sudan, as well, faces similar challenges, particularly in the energy sector. Thus, threats of climate change should push all of them to reach a collectively acceptable win-win scenario.

Leveraging private sector stewardship for rural supply chain water security

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Co-Authors: Dr. Guy Pegram, Pegasys, South Africa

Keywords: Corporate water stewardship, Supply chains, Water and climate security

Highlights

The private sector are increasingly recognizing the risk that inadequate water security poses to their future business. In response, some companies have begun to improve the resilience of their businesses to water risks. This has included engagement with rural agricultural supply chains, improving their climate and water security.

Introduction and objectives

Larger retail or agro-processing companies are seen investing in improving the water and climate change security of their supply chains as a form of corporate stewardship and ensuring their long-term sustainability. In areas where these supply chains are supplied by smallholder/out grower farmers, they are particularly at risk to water insecurity and climate vulnerability.The objective of this presentation is to highlight cases that improve smallholder or out grower farmers' water and climate security through leveraging private sector business interest in their supply chains, in turn supporting the SDGs on water security.

Methodology approach

1. Understand the drivers for private sector appetite in mitigating water (and climate) security risks through partnership and investment into their smallholder/out grower supply chains by looking at a number of previous cases.
2. Develop a business case for the above understanding for leveraging private sector interest to deliver water security to their supply chain and employees across other private companies and relevant case study countries.

Analysis and results

Cases are yet to be investigated in full. The project will identify opportunities to get corporates to enhance water security of small scale/out grower farmers in their value chains. This may include coffee or high-value small scale agriculture for export such as in Kenya, food and beverage growers including livestock for milk. Improving the productivity of the smallholder out growers contributes to water security and resilience. Water security may be reduced through a number of processes that will be explored. These include a trust fund, such as in Naivasha, which was put together to support upstream initiatives to improve smallholder farmers productivity and sustainable water use.

Cases that have already been investigated at high level include Naivasha in Kenya, and the involvement of horticulture retailers in Europe, Illovo in Southern Africa and SAB Miller in Taung, South Africa. In all of these cases, supply chains are being supported through the retailer to reduce climate and water risks. This supports the communities in their resilience to climate change.

Conclusions and recommendation

Keystone industries play a fundamental roles in the sustainability of the surrounding rural communities. In some cases, they offer the majority of employment opportunities in the region. These private companies have a significant opportunity, in being able to improve the water security for their supply chains, both improving the resilience of the surrounding communities, in addition to improving the resilience of their supply chains. This has both a physical and business benefit, in addition to an improved social license to operate within the community. Corporate supply chain risk needs to be used in developing smallholder climate and water resilience.

Water Scarcity and Violent Extremism in Nigeria

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Keywords: Water Security, Climate Change, Conflict, Extremism

Highlights

This project examines linkages between water scarcity, possibly enhanced by climate change, and extremist violencein case studies including Syria and Iraq, Somalia and Nigeria. I presented research on the Syrian Civil War in 2015

Introduction and objectives

There is a contentious literature attempting to explain the connections between climate change-driven scarcity and conflict. Political scientists are now using meta-analytical multivariable quantitative approaches to explore this connection. This has inspired me to examine individual case studies using fewer variables, single groups, and more confined geographical areas. Thus I have chosen water scarcity as a single impact and discrete extremist groups as variables for my case study on Nigeria.

Methodology approach

The case studies test two hypotheses: 1.) Water scarcity is a causal factor for outbreak of violent conflict. 2) Purposeful manipulation "weaponization" of water accelerates or perpetuates these conflicts. Using a proven methodology we establish a theoretical framework through a desk study of academic, grey literature and media. Next we perform discourse analysis of primary source documents from extremist groups. Third we analyze and display of subnational geospatial, hydrological data using GIS to build interactive maps. Results are validated using semi-structured interviews.

Analysis and results

Research is in the initial stages but our results will be available by August. At this point we can say that water scarcity has played an important and consequential role the conflict involving Boko Haram by diminishing the resilience of the local populations to their attacks. Detailed and perhaps generalizable results from the Syria study are summarized in Washington Quarterly Journal WINTER 2016 | Volume 38 | Number 4 at http://twq.elliott.gwu.edu/

Conclusions and recommendation

The conclusions inform policy questions such as whether development approaches that alleviate of water scarcity are effective approaches for conflict stabilization, post-conflict reconstruction and peace-building. For defense and intelligence organizations we analyze control of water resources as counterinsurgency strategy.

Reducing transboundary frictions through an assessment of intersectoral links, trade-offs and benefits

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Keywords: transboundary cooperation, water resources, assessment, intersectoral issues, water-food-energy-ecosystems nexus

Highlights

The assessment process presented involved the development of an intersectoral, participatory methodology for transboundary settings and its systematic application to four transboundary basins. The results demonstrate that transboundary cooperation is needed to tackle nexus challenges, and that the approach developed does so in a manner that is non-prescriptive and inclusive.

Introduction and objectives

Securing the availability, quality and manageable variability of water resources is too commonly thought to be best achieved through national means, though transboundary cooperation and intersectoral coordination may be the most effective strategies to that end. Water security is linked to the security of other resources — notably food and energy — as well as environmental security, and these interlinkages need to be taken into account in planning and management of these resources to attain overall sustainability and conflict reduction. An assessment of the water-food-energy-ecosystem nexus in selected transboundary basins was carried out under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) to foster cooperation by identifying intersectoral synergies and measures to reduce trade-offs.

Methodology approach

The methodology involved zooming in from the general basin conditions and socioeconomic context to analysing the priority intersectoral issues. The governance analysis considered the legal and regulatory basis, organizations and policies. The technical sector analysis looked at water, energy and land resources and ecosystem services, their uses and the status of interdependencies. Impacts of climate change and socioeconomic trends were also considered. Participatory, intersectoral workshops were organized to bring together sectoral stakeholders from the riparian countries for an identification of and dialogue on the main issues, future developments and possible solutions. On this basis, selected improvement opportunities were outlined.

Analysis and results

Although the four basins assessed — the Alazani/Ganykh in the Caucasus, the Syr Darya in Central Asia and the Sava and the Isonzo/Soča in Southern Europe — demonstrate particular combinations of intersectoral issues, hydropower emerged as one common challenge, involving complex interests. For example, the Sava countries increasingly need to strike a balance between energy generation and climate and energy policy targets resulting from their affiliation with the European Union and/or the Energy Community, as well as maintaining a good status of their waters. Transboundary cooperation could increase countries' energy security and decarbonize their energy systems, but also increase their preparedness for extreme hydrological events.

[1]The views expressed in this article are those of the author and do not necessarily represent the views of the United Nations or its Member States.

The diverse solutions found in the basin assessments are related to institutions, instruments and infrastructure, for example: facilitating access to modern energy sources and energy trading to reduce the effects of biomass use (Alazani/Ganykh); developing hydropower sustainably and integrating other renewable energies (Sava); and restoring and revitalizing the energy market and improving efficiency in energy and water use (Syr Darya). In these examples, international cooperation emerges as a key means for addressing resource issues, although the situations of the cooperation arrangements between the riparians — trust, mandates etc. — can limit the possibilities.

Using water as an entry point, the Water Convention nexus assessment approach invites policy makers to consider the threats and impacts on water resources broadly — not just in terms of water uses and discharges, but how sectoral policies indirectly influence the dynamics and where improved sustainability can be achieved through joint action.

Conclusions and recommendation

Integration across sectors and reconciling resource uses is challenging, but the possibilities for improving coordination, consultation and consideration of different interests in specific basin contexts are concrete, and existing multisectoral structures and processes can be built on. The Water Convention's nexus approach provides a good basis for identifying cooperation opportunities, e.g., for broadening or restarting a transboundary dialogue. To inform developing cooperation or policy, trade-offs and benefits can be quantified with adequate data and tools. In undertaking a nexus assessment, there is a risk that the result may be controversial to a particular sector or country; consequently the process design and institutional framework are important.

Drought Mitigation measures implemented in Kwazulu Natal, South Africa 2015-2016

Author: Ms. Manisha Maharaj, DD: Planning, Department of Water and Sanitation: KwaZulu-Natal, South Africa

Keywords: Drought, mitigation, planning, water resource management, water policy

Highlights

According to the Department of Water and Sanitation's (DWS) climate change adaptation strategy, increased atmospheric moisture will likely result in increased rainfall intensity with increased frequency of droughts and flooding in Kwazulu Natal. An effective drought monitoring system is essential for efficient drought management. It is essential that a combination of drought mitigation measures be developed and utilised based on the characteristics of the water supply area. There are proactive measures that can be implemented prior to drought which will lower the risk and impacts of a drought. The recent drought has emphasized the need for a more proactive, risk management approach to drought management that would place greater emphasis on planning and timely implementation of mitigation measures.

Introduction and objectives

The globally averaged temperature over land and ocean surfaces for 2015 was the highest among all years since record keeping began in 1880. According to the Department of Water and Sanitation's (DWS) climate change adaptation strategy, increased atmospheric moisture will likely result in increased rainfall intensity with increased frequency of droughts and flooding in Kwazulu Natal.

In November 2014 the Premier of Kwazulu Natal declared a Provincial State of Disaster in terms of the Disaster Management Act due to the continuing drought in the Province. The current and long term impacts of drought on the physical , economic and social environments has increased awareness for the necessity of planning to mitigate the risk and urgent response to drought. Response measures include but not limited to water supply development, water conservation and demand, water resource management, economic and social empowerment to which priority may differ but there is consensus on the necessity of a comprehensive approach.

Methodology approach

Literature review of drought mitigation measures. Review of existing drought management plans and their effectiveness in the current drought. This paper reviews the drought mitigation measures implemented in Kwazulu Natal. Analyses of the impact of the implemented measures are undertaken.

Analysis and results

The drought mitigation measures implemented included both proactive and reactive measures. The establishment of drought operating rules for stand-alone dams and schemes in 2010 enabled the management of the resource(s) in order to protect them from total failure by restricting lower priority water use during drought periods to prevent uncontrolled total failure of supply. The rules assisted in determining the timing and level of restrictions required. Drought mitigation measures implemented included:

a) Water restrictions
b) The development and refurbishment of water supply boreholes
c) Purchase and hiring of water tankers.
d) Water conservation and demand management

e) De-silting of dams
f) Provision of rainwater harvesting tanks
g) Development of additional storage dam
h) Awareness campaign

In 2014 the DWS assisted the Water Service Authorities in the development of specific water conservation and water demand master plans which provided a base for the implementation of water conservation and demand management mitigation measures. It was found that although there where intensive local and nationwide awareness champagnes through television adverts, radio and print media very little was achieved in reducing the water demand. The best results where achieved through physical restriction of the water infrastructure. R 506 million rand has been committed by DWS for drought invention measures. R 67 million has been utilised for the purchase and hiring of water tankers, R 9.2 million utilised for rainwater harvesting tanks, R 167 million for the refurbishment of water infrastructure, R 42 million for the development of boreholes and R 14 million for spring protection.

Conclusions and recommendation

An effective drought monitoring system is essential for efficient drought management. It is essential that a combination of drought mitigation measures be developed and utilised based on the characteristics of the water supply area. Regular joint operating forums where found to be a useful tool in developing the combination of mitigation measures to be implemented, for monitoring the effectiveness of the mitigation measures, taking corrective action and ensuring a unified communication strategy. It was also found that timely implementation of resource developments as well as proper water infrastructure maintenance would lower the impact of future droughts .

Watershed Management in the face of Climate Change, Peru, Colombia

Author: Dr. Sergio D. Claure, AECOM, Chief of Party, United States

Keywords: Watersheds, Climate Change, Glaciers, Adaptation

Highlights

The USAID funded and AECOM implemented PARA-Agua project provides urgently needed technical assistance in the northern Andean region by linking the best climate science on glaciers to watershed management decision-makers to help tens of millions of people preserve and better utilize water resources under severe threat because of climate change.

Introduction and objectives

Climate change is negatively impacting water resources, agriculture and ecosystems, and this is especially evident in the Andes. Increasing temperatures are altering hydrological cycles, affecting crop productivity and biodiversity, and causing more frequent extreme weather events, leading to flooding and drought. . The objective of the PARA-Agua project is to bridge the gap between scientists, decision-makers and communities across the region to strengthen resilience to climate change and help better understand climate change impacts on key water resources. PARA-Agua works in key watersheds in Peru and Colombia to identify structural and non-structural adaptation measures for better water resource management.

Methodology approach

PARA-Agua works in five target watersheds to create innovative platforms for sustained dialogue and information sharing between the research community, policy makers, watershed stakeholders and the private sector to mainstream the use of relevant scientific data. The project employs the Water Evaluation and Planning (WEAP) model for integrated assessment of climate change impacts and promotes a dynamic exchange between policy, law and action with the ultimate goal of helping to identify and implement climate adaptation measures in watersheds. Through a gender-focused approach PARA-Agua enables both women and men to influence policy and decision-making, and employ strategies responding to gender-based vulnerabilities.

Analysis and results

PARA-Agua has established twinning partnerships with watershed stakeholders in the United States and in Peru and Colombia to promote sustainability. After generating climate scenarios with the help of state-of-the-art climate models, and identifying vulnerabilities to extreme events and associated natural phenomena, PARA-Agua used this information to help develop adaptation strategies to build resilience in the target watersheds. Based on these strategies, the project helped prioritize bankable projects with an adaptation component, and is currently helping to identify viable sources of national and international financing, providing guidance on the requirements and supporting the application process to access these funds and eventually promote economic growth.

To achieve the long-term objective of sustainability the project established a regional legacy consortium to carry out activities once the project ends. The project identified reputable regional organizations for the consortium and plans to consolidate the partnership during year three of the project. In addition, the project helped establish a regional fund for water conservation and assisted to set up a public-private mechanism for management of the fund and for collegiate decision-m aking. PARA-Agua combines country-based activities

with regional cooperation approaches that catalyze change through replication of best practices between countries, or scale-up within a country.

Conclusions and recommendation

The project has made significant progress in helping bridge the gap between science and decision-making at the watershed level, and in building capacity for integrated watershed management using innovative modeling tools. Because of the project's success, it is recommended that the project continues to help with identifying international and national sources of financing to help scale up activities and implement green and gray climate adaption actions, or, structural and non-structural measures. Finally, it is highly recommended that efforts are continued to raise awareness and incorporate women in watershed management to help build resilience to the inevitable impact of climate change.

Managing Adaptation within International Rivers: The Role of International Donors

Author: Dr. Sabine Blumstein, Helmholtz-Centre for Environmental Research - UFZ, Germany

Keywords: Transboundary rivers, river basin organisations, environmental change, adaptation, donors

Highlights

International River Basin Organisations (RBOs) are increasingly facing challenges of environmental change within the river basins they govern and therefore have to provide for adaptation in order to address these environmental alterations. The paper addresses the question whether and how international donors can support adaptation capacities of RBOs.

Introduction and objectives

The aim of the paper is to identify first assumptions on the conditions under which donor support to RBOs could potentially support adaptation to environmental changes and contribute to the resilience of international water basins. It focuses on two cases in Southern Africa, including the Orange-Senqu Basin and the Orange-Senqu River Commission (ORASECOM) as well as the Cubango-Okavango Basin and the Permanent Okavango River Basin Water Commission (OKACOM).

Methodology approach

In a first step, the paper develops a definition of adaptation capacities of international RBOs and further operationalizes this definition along two dimensions (environmental protection and livelihoods development). This is followed by a case study comparison of the two RBOs. Each case is first analysed with respect to its adaptation capacities, followed by an assessment of the role of international donors in contributing towards developing these capacities. The analysis of the two case studies is based on document analysis as well as 40 semi-structured interviews the author conducted in Southern Africa between July 2011 and June 2012.

Analysis and results

Hydropolitics research addressing adaptation capacities of international RBOs has so far primarily attributed differences in adaptation to the design of water treaties which RBOs are based on and largely neglected other potentially influential factors. Considering the prominent role of international financing institutions in transboundary river basins governance (particularly in the Global South), this paper examines the specific role of these actors in influencing RBOs' adaptation capacities towards environmental changes. The analysis of the two river basins and their respective RBOs shows that both contribute towards adaptation in their respective river basins – although to varying degrees and in both cases limited to the environmental protection dimension. It furthermore demonstrates that international donors influence these capacities, although their role seems to be somewhat ambivalent. While they provide important means for adaptation in form of knowledge, financial and technical resources, the OKACOM case study also shows that a breakaway of this support can have negative implications for the sustainability of adaptation activities. The case of ORASECOM furthermore outlines the benefits that can be derived from improved donor coordination.

Conclusions and recommendation

Overall, the paper shows that international donors influence the adaptation capacities of the two examined RBOs and furthermore suggests that some degree of diversification of funding as well as the presence of an RBO coordination mechanism for donor activities can positively influence adaptation capacities.

Water Services to assist decision makers in Africa

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Keywords: Africa, data, modeling and communication tools

Highlights

Droughts and floods are becoming recurrent phenomena in many African countries and are causing threats to their economic development and growth.

Introduction and objectives

Hydrological extremes are one of the leading impediments to development in Africa. Much of the continent is dependent on rain-fed agriculture, which makes it particularly susceptible to climate variability. Prolonged and frequent occurrences of drought present significant challenges to agriculture, forestry, water resources management, urban planning, and food security in Africa.

Monitoring drought and providing timely near-real time and seasonal forecasts are essential for an integrated drought risk management and reduction in Africa. Drought monitoring over Africa is challenging because of the sparseness of observational data, either historically or in real time.

Methodology approach

Transferring, testing and validating tools from research setting to be use later as operational tools for decision makers to address challenges on hydrological extremes in Africa.

Analysis and results

Current available approaches in Africa are very limited, because of unreliable monitoring networks. Operational seasonal climate forecasts even though developed and used for many years in Africa are still provided in probabilistic form difficult for direct use, often reliant on statistical regressions, which are unable to provide detailed information relevant for drought assessment. However, the wealth of data from satellites and recent advancements in large scale hydrological modeling and seasonal climate model predictions have enabled the development of state-of-the-art monitoring and prediction systems that can help many of the problems inherent to drought prone regions. Satellite remote sensing combined with ground truth data is capable of overcoming differences in data availability across political boundaries that have historically hindered monitoring of regional phenomena such as drought.

To address the problem of drought and to mitigate its impacts, proper diagnosis is needed. The monitoring system is needed to assist decision makers in finding the proper treatment. The session will showcase IHP's work on Data tools and methodologies including African Drought Early Warning System Expansion to Southern Africa and the SMHI's experience of large scale modeling in Africa in order to support the decisions makers with the best available water and climate information.

Conclusions and recommendation

Africa drought monitor will continue to be tested and validated by different meteorological and hydrological services for operational use.

The WACCA programme from SMHI is designed to strengthen development and accessibility of water and climate information and early warning services for Africa. It will cover the whole chain of information from global numerical modeling to adaptation measures based of best available information about future climate and best practices in term of solutions for adaptation. The three components of the programme are: Education and training, Integrated Water Resource Management and Climate information services.

Climate, Drought, and Drinking Water: Survey Results from California Utilities

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Keywords: Drought, Drinking water, California, Utilities, Climate change

Highlights

A survey of California water utilities responsible for drinking water provision revealed the extent to which respondent utilities perceived that the current drought impacted water supplies and quality.
Respondents also reported that the drought is the dominant weather-related pathway that intensifies existing quality threats.

Introduction and objectives

California's drinking water supplies and utilities are vulnerable to drought related water quality and quantity impacts. Despite the persistence of droughts in the state's history, there are few requirements for drought hazard planning and mitigation for drinking water utilities, in particular for responding to water quality threats. The 2015 survey and planned case studies investigate how utilities are differentially vulnerable, prepared for, and adapted to drought and climate impacts. What characteristics of a water system enable drought preparedness and build adaptive capacity? How can these identified characteristics inform current and future drought-risk reduction policies and strategies?

Methodology approach

As part of a three year, US EPA funded study, this poster reports results of a summer 2015 statewide survey evaluating how far along California water utilities are in preparing for the projected climate change impacts on drinking water quality and challenges presented by the state's four year drought. More than 750 utility staff were invited to participate, 35% (259) completed a substantive amount of the survey. Case studies underway during summer 2016 will investigate the needs and capacity of utilities to prepare for and adapt to the projected water quality and supply impacts from increasing extreme events, like drought.

Analysis and results

Faced with the on-going drought, California water utilities currently are managing for the impacts of an extreme event. Respondents reported that the drought is the dominant weather-related pathway that intensifies existing quality threats. Close to 40% of survey respondents reported that the drought impacted water quality to some degree (97/245). Large water utilities are required to submit Urban Water Management (UWMP) Plans to the state, and UWMPs are required to include a section on drought and water shortage contingencies. Of the respondents who reported having a written drought or water shortage contingency plan, nearly 34% of respondents said that their plan was insufficient for managing water quality impacts from the drought, and 24% felt their plan was insufficient for managing water supply impacts. This may suggest that water quality is not sufficiently being accounted for in drought preparedness plans, and that plans only oriented around managing limited supplies are not sufficient in the face of future extreme drought events.

Conclusions and recommendation

Climate projections show that the frequency and intesnity of droughts in California may increase. Utilities would benefit from a specific focus on water quality in drought planning in the context of a changing climate. Identifying which utility characteristics enable coping, responding, or adapting through current and future droughts can be used to start informing and building drought resilience among utilities that are currently struggling to manage impacts experienced due to the last several years of drought.

Drought relief and bulk water distribution strategies for South Africa

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Keywords: Drought, supply shortfall, strategy, evaluation, action plan

Highlights

South Africa presents a unique socio-economic environment of rural and developed areas. The arid natural environment requires effective bulk water distribution to ensure sustainable development. A combination of tailored strategies is developed to augment present policies that will most effectively mitigate present drought risk and future supply shortfalls.

Introduction and objectives

Amidst a drought during 2015, water supply and distribution in South Africa is heavily constrained. The pressing drought also highlights possible future supply risk pertaining to growing demand and unique socio-economic circumstances (a combination of rural and well developed areas) in the arid South African environment, presenting a short, medium and long term threat. The combination of risks requires sound water supply, distribution and demand intervention strategies to ensure continued development and rural upliftment. This paper compares and evaluates different strategies for risk and drought mitigation as a precursor to constraints caused by rapid demand growth.

Methodology approach

Various water risk mitigation strategies are identified in literature and further developed. The mitigation strategies are divided into four focus areas: Water supply side; -distribution; -demand side and; return flows. Evaluation criteria for intervention effectiveness are compiled using national and regional data characterising the unique socio-economic and physical environment in South Africa. Common pitfalls in the South African context are also emphasised and used as a further strategic evaluation. The results of the evaluation are used to develop tailored strategies with highest effectiveness and to compile a step-wise action plan to augment present policies.

Analysis and results

Water demand management by means of price regulation will not be an effective solution for drought mitigation as 36% of national users, primarily located in crisis areas do not pay for water. Water consumption regulation will also show limited results due to lack of enforcement. Wide spread public awareness champagnes have proven effective. Water supply limitation will prove most effective but generates public dissatisfaction. Rebate programs will also be effective in reducing household reliance on supplied water.

Medium term mitigation in distribution and return flow by means of distribution management, strategic bulk water transfer between schemes and leakage mitigation will also prove to be very effective. However, growing demand will consume created virtual excess supply capacity leading to persisting long term supply constraints. Medium term interventions will generate excess capacity which will allow an accelerated bulk supply and distribution infrastructure construction and aging infrastructure refurbishment and reconstruction campaign to alleviate long term supply constraints. Infrastructure that is developed must, however, be re-evaluated to apply emerging, better suited technologies that reduce reliance on a heavily constrained energy/electricity supply and local availability of fresh water (including energy independent desalination and rainwater harvesting

Conclusions and recommendation

The present drought in South Africa has strained the water sector and highlight possible future supply shortfalls. Short, medium and long term strategies are compiled and evaluated for specific application effectiveness in the South African context. The different strategies are combined to compile an action plan for the alleviation of possible supply shortfall risk and improve possible future development of bulk water infrastructure. It is recommended that present water conservation and development strategies be augmented with the present findings and the results be monitored continuously to re-evaluate intervention effectiveness on frequent basis.

Civil society engagement in sustainable transboundary water governance

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Keywords: Civil society, Mekong river, Rules and norms, Cambodia, Vietnam

Highlights

This study aims to identify opportunities and barriers civil society actors face when engaging themselves in the governance of trandboundary rivers. The research analyzes how formal and informal rules and norms influence advocacy strategies of NGOs over a hydropower development on the Mekong River, comparing cases in Cambodia and Vietnam.

Introduction and objectives

Civil society actors are key agents in the governance of sustainable transboundary water and water security. The uprising of the Islamic States in the Middle East was partially caused by mismanagement of water and disengagement of public in water governance. The objective of this study is to identify opportunities and barriers affecting civil society actors' engagements in governance of transboundary water. Specifically, the study aims to analyze how formal rules and informal norms influences advocacy strategies of Nongovernmental organizations operating within transboundary rivers.

Methodology approach

In order to analyze the influence of formal and informal rules and norms on NGO advocacy strategies, analytical framework was developed based on review of literature. As a method, a comparative case study analysis on 2 NGO networks advocating against the Xayaburi hydropower dam planned on the Mekong River was conducted: namely the Rivers Coalition in Cambodia (RCC) and the Vietnam Rivers Network (VRN). A total of eighty interviews were conducted to the network members, government officials, experts and other people within the Mekong region. Data was analyzed using the approach of grounded theory.

Analysis and results

Four types of NGO advocacy strategies were identified including:

1) advocacy targeted at regional decision-makers
2) advocacy targeted at national decision-makers
3) advocacy targeted at stakeholders in potentially affected areas and
4) general public.

The analysis illustrated that formal and informal rules and norms interacted in various ways. For example, the VRN's media strategy targeted at general public was affected by media embargo on the Xayaburi dam, which is an informal guidance from the Vietnamese authorities on media. This informal rules contradicts formal rules that guarantees freedom of speech and media (such as Law on Media and the Constitution). However, the same formal rules are also used to support informal rules, as some of the clauses of Law on Media and Penal Code allows prosecution of journalists who report on any issues that infringes national security, threatening journalists to follow the guidance.

Illustrated in this example, formal rules and informal rules and norms interacted contradictory as well as complimentary to each other, and influenced the strategies of the VRN.

Conclusions and recommendation

The study identified barriers and opportunities facing NGOs in the Mekong. While formal rules are often designed to protect people's rights, when they are in competing relationships, informal rules and norms tend to take precedent and create barriers in exercising rights. Complementary relationships between formal and informal rules and norms assist NGO actors in strategy implementation. The study also identified the lack of pathways for civil society actors to engage and influence decision-making over transboundary water management. Adopting clauses from existing legal framework such as the Aarhus Convention, ESPOO Convention and the UN Watercourses convention could improve their engagements.

Water stewardship in securing our shared water for future

Author: Mr. Sibusiso Xaba, Department of water and sanitation, South Africa

Keywords: Partnerships, Water Stewardship, Management, Sustainable, Water Resource, Risks

Highlights

World Economic Forum Global Risk Report2015,water crisis is ranked as number one risk facing the global economy in terms of its impact. In order to ensure the availability, water supply at national level, facilitate equitable and sustainable socio-economic development,need to think innovatively about new ways of making water available.

Introduction and objectives

Water remains a shared resource critical for human health, driving economy and maintaining fresh water species. In this context, and given the climate change impact on water availability, it is important for everyone (government, industry and community etc.) in the country to collaborate and show responsibility in sustainably managing these shared and public water resources to ensure a secured future for all. Water stewardship has been identified as a viable mechanism and emerging policy option to deal with deteriorating water quality and increased water demand. Water Stewardship is about taking care of something that you do not own.

Methodology approach

The Stewardship adopts a voluntary-based applicable system approach and participation with the aim of changing the behaviour and practices of all water users towards sustainable water protection and management. Joint financial resources amongst the participants within the catchment will be encouraged. From the business perspective it is part of investment to the depleting capital resource that contributes to the day-to-day operation of the business. In South Africa (Other countries) there are private businesses, Non-Governmental Organisations and Communities that have already started practicing good water stewards and their contribution needs to be acknowledged and this practice be institutionalized and regulated.

Analysis and results

Water Stewardship is about recognising water resource as a shared risk and opportunity for all role-players in terms of economic, environmental and social development and sustainability. Far-reaching policy, legislation and institutional changes in water-related governance have occurred. Responsible leaders have ensured that a paradigm of integrated water resource management (IWRM) is firmly entrenched in the above policy, legislation and institutional arrangements. IWRM in turn demands a level of interaction between government, industries and communities that multi-sector, multi-level stakeholders can collectively, timeously, wisely and cost-effectively visit the consequences of their proposed, present and past actions. Improving the management of water resource to support sustainable economic development whilst securing social equity and biodiversity conservation is one of our most urgent global priorities.The benefits can be also related to the Water Stewardship Standards that are designed to achieve four water stewardship outcomes: (1) good water governance, (2) sustainable water balance, (3) good water quality status and (4) healthy status of important Water-Related Areas. Amongst others are: Reduced costs and efficiency gains; Reduced operational water risks; Reduced regulatory and reputational risks;Generation of intellectual and political capital;Securing certain markets and accessing new ones.

Conclusions and recommendation

To promote and support the up scaling of water stewardship partnerships based on the successes of the current pilot projects and further identification of similar initiatives is critical. Leveraging support and buy-in from the private sector in water stewardship and any other forms of partnerships that will yield results relating to increased water resource conservation and improved demand management. Investment in ongoing research and lesson learnt sharing with other countries implementing similar partnerships. Continuous investment in community education and awareness and harness their role in water resource management and protection and understanding the risks and their contribution.

Groundwater under the pressures of humanity and climate change

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Keywords: Groundwater, Climate Change, Adaptation, Mitigation

Highlights

The United Nations Educational, Scientific, and Cultural Organisation (UNESCO) International Hydrological Programme (IHP) initiated the Groundwater Resources Assessment under the Pressures of Humanity and Climate Change (GRAPHIC) project in 2004 to better understand the effects of climate change on global groundwater resources.

Introduction and objectives

The purpose of this paper is to highlight the important role groundwater has in meeting the demands for drinking water, agricultural and industrial activities, and sustaining ecosystems, particularly in the context of adaptation to and mitigation of the impacts of climate change.

Methodology approach

GRAPHIC uses a multidisciplinary scientific approach that extends beyond physical, chemical, and biological investigations to include human systems of resource management and governmental policies. GRAPHIC has been divided into subjects, methods, and regions. The subjects encompass (i) groundwater quantity (recharge, discharge, and storage), (ii) quality, and (iii) management aspects.

GRAPHIC uses many scientific methods, including analysis of field data, geophysics, geochemistry, paleohydrology, remote sensing, and modelling. GRAPHIC has regional studies in Africa, Asia and Oceania, Europe, Latin America, and the Caribbean and North America.

Analysis and results

ROLE OF GROUNDWATER IN ADAPTATION TO CLIMATE CHANGE:

- Groundwater is crucial for society's adaptation to climate change
- Groundwater is a key resource for human development
- Groundwater and climate policies account for important differences between the developed and developing world
- Groundwater is an integral component of the water-energy-food-climate nexus

GROUNDWATER GOVERNANCE:

- Improved governance is needed for sustainable groundwater resources
- Adaptative groundwater management needs to integrate regional water and agricultural
- policies
- Continued need for programs that empower women and advance gender equality

ASSESSMENT OF GROUNDWATER AVAILABILITY AND SUSTAINABILITY:

- Stronger links between science and policy are needed to better quantify groundwater withdrawal and sustainable yield
- Knowledge is fragmented regarding climate change impacts on groundwater quality
- Groundwater systems are highly vulnerable on Small Island Developing States (SIDS)
- Managed Aquifer Recharge (MAR) is a promising adaptation approach
- Need to improving groundwater monitoring

GROUNDWATER MANAGEMENT STRATEGIES TO REDUCE VULNERABILITIES:

- Sustainable groundwater is an issue of national and international security
- Integrated water resources management needs to be adopted more universally
- Need to collaborate with programs and agencies with specialized knowledge (NASA's Gravity Recovery And Climate Experiment (GRACE) satellite mission)

Conclusions and recommendation

Groundwater is critical for mitigating climate change impacts because many efforts to reduce greenhouse gas emissions depend on reliable access to sustainable water resources. Strategic management for climate resilient groundwater resources is the foundation for long-term adaptation and mitigation plans. Moreover, as water related hazards exacerbate inequalities, which are disproportionally felt by developing and vulnerable communities, climate resilient groundwater infrastructure is a key for development and poverty reduction. Explicit consideration of the global groundwater crisis and the role of groundwater resources in climate change adaptation and mitigation are therefore essential in climate change negotiations and mitigation solutions.

World Water Security: an approach for a governance

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Keywords: Global risk, water security, governance, international regulatory, actors, methods, mechanisms.

Highlights

Since Beck said that the planet does not control the hazards generated modernity anymore (Beck, 2008), ensuring security is the corollary of the risk society. It is urgent the implementation of organizational joints that encourage sustainable development and, in that sense, it is possible to move towards a multi-sectoral governance.

Introduction and objectives

Water has been ranked first among the top five global risks in terms of social impact. This paper proposes an approach of global water governance based on water security (WS), to respond the increasing water shortage on the planet. Secondarily, the study performs a brief review of the international regulatory framework, assesses the current global freshwater management structure, and makes proposals for new management mechanisms, both at a global level and at a more regional perspective.

Methodology approach

The study can be classified as descriptive and the approach was developed in a qualitative perspective. This procedure was accomplished in two stages. At first, through the analysis of regulatory documents related to the regulation of international water management. In a second step, it was aimed to collect the perspective of acting water specialists both within the public and private management sector (03 experts) and in the regulation area (02 experts), in Brazil and France. A semi-structured script containing open questions was used as a collection tool.

Analysis and results

As a result it was recommended some axis of structural articulation:

First - risk, uncertainty and precaution as water management paradigms. The precautionary practice of international risk-oriented management is still far from common practice. An institutional linkage to risk requires a sense of information based monitoring;

Second - review of the international regulatory framework and creating a United Nation specialized agency for WS. The international normative basis for water faces a fragmentation process, representing a major bottleneck. Yet, it does not have a global legal instrument that in a situation of weather worsening would facilitate water management, considering its complex and multifaceted perspective. It is believed that the fragmentation could also be mitigated by the creation of a UN Agency specialized in WS;

Third - transversal link for WS between different actors. A redesign with a transversal perspective may be feasible;

Fourth - adoption of new analytical methods. The relationship between water, energy, and production systems inspires a complete overhaul in the way how organizations deal with that issue;

Fifth - applying WS mechanisms in river basins to implement different possibilities of joint organizational in the maintenance and recovery of ecosystems.

Conclusions and recommendation

It is believed that the biggest bottleneck in today's global water management is the fragmentation process and it is necessary to point out that this situation has also happened internally in the countries. Even though in some of them water management is well structured, the model used has not guaranteed WS, which has a clear strategic sense and should be an effort of multiple agents. They seem to require broader actions of governance and security, through intense participation of governments, civil society, and companies to ensure the availability of water quality and quantity, including future generations.

Offshore Aquifers: Enhancing Water Security or Creating Unseen Problems?

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Keywords: aquifer, offshore, development, governance, climate change

Highlights

Offshore aquifers have been discovered under continental shelves around the world, and scientists predict that vast quantities of fresh to slightly brackish water are waiting to be developed. However, key issues need to be addressed, such as governance regimes and the wisdom of bringing more water to the surface.

Introduction and objectives

In the 1970s two fresh water aquifers were discovered off the east coast of the US, and since then similar aquifers have been discovered under the continental shelves of every continent. Thus far, all of the offshore aquifers have belonged to one country, but future discoveries may reveal transboundary offshore aquifers. In that case, what governance regime should apply -- that of the offshore hydrocarbon industry or land-based water laws? Given that water is a powerful greenhouse gas, should water security concerns prevail over climate change concerns?

Methodology approach

This analysis has proceeded through desk-top research into the science of offshore aquifers, the governance regimes of offshore hydrocarbon development, the Law of the Sea, governance regimes of land-based water (particularly transboundary aquifers) and climate science.

Analysis and results

Offshore aquifers have been discovered around the world and were emplaced during the last glacial maximum when continental shelves were exposed to meteoric conditions. Should humanity reach the point where development of offshore aquifers is deemed to be technically feasible and cost- effective, water security will doubtless be a primary global concern, and conflicts over water resources may be common. In such a scenario, how should any transboundary offshore aquifers be governed? Offshore hydrocarbon development utilizes unitization and joint development regimes, where nations agree to use only one operator and to share in the revenues from any resources that are developed. Land-based aquifers have not yet benefited from joint development regimes, often leading to wasteful practices. Thus, governance regimes from another industry that develops offshore natural resources should be considered for offshore fresh water aquifers. However, unitization and joint development are not incompatible with international water law principles of reasonable and equitable use, no significant harm and information sharing.

Conclusions and recommendation

Should water security reach such a crisis stage that development of offshore aquifers becomes necessary, nations sharing those aquifers should look to the offshore hydrocarbon industry when developing governance regimes. Offshore hydrocarbon development proceeds on a joint and coordinated basis, which saves money and time, maximizes recovery of the precious resource and conforms to key international customary water law principles.

Water related crimes and threats in Europe

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Keywords: crime, corruption, terrorism, theft

Highlights

Presenting the results of ongoing studies on offences, risks and criminal threats related to water resources in Europe, based on judicial cases, current investigations, and CSOs reports on environmental crime across European Countries.

Introduction and objectives

Typical water related crimes go from the pilfering of water from pipelines, to illegal waste management, up to marine pollution by oil spills. Water related crimes are often linked to other offences - such as fraud, corruption, trafficking, falsification of documents (e.g. manipulating daily waste-water sampling methods to reduce treatment costs). Furthermore, both physical and logical water management infrastructures are exposed to cyberattacks and traditional terrorist threats, (EUROPOL, 2014; ENISA, 2014).
Since water related crimes have never been systematically analysed and reported in Europe, this paper aims at filling this gap by presenting a comprehensive overview of this phenomena.

Methodology approach

The work is a comprehensive analysis of water related crimes in Europe. Data are collected through focus groups, desk research, surveys, and elite interviews, from EU Countries. The study includes an in-depth analysis on water crimes in four EU pilot Countries.
The rational is to provide the first strategic analysis on crime related risk in the water sector in Europe, through: a) an inventory of the various forms of crime that threaten this fundamental good, its management, the related supply chains and infrastructures; b) an analysis of the potential impact and the risks of these crimes in Europe.

Analysis and results

The study is ongoing and its first results will be presented at the conference, showing the first criminological assessment of water crimes in Europe. As a follow up, researchers will develop a mid-term outlook of the trends of these crimes in Europe, and provide key recommendations for policy makers and law enforcement to mitigate such risks.
The interest on water, and its value in terms of distribution, management, and treatment, will grow rapidly in the next future, attracting more and more criminal interests. No studies report yet the interest of organised crime for water, but water demand (and price) is expected to increase by 55% worldwide between 2000 and 2050, with some industries increasing much more, such as manufacturing by 400% and electricity production by 140% (OECD, 2012). This will bring water in the radar of Organised Crime, and is worth noting that historical activities of Mafia included the control of water sources in Sicily. Also terrorist threats might target critical infrastructures related to water distribution. The outcomes of this study will support the development of countermeasures to protect European citizens and critical infrastructures from criminal activities.

Conclusions and recommendation

The study explores an area of environmental crime that deserves more attention. The results will help law enforcement and water management authorities in preventing and detecting such crimes, in gathering statistics and intelligence for threat and risk analysis, in collecting good practices, and also in detecting links with other forms of crime (in particular fraud and other economic crimes, terrorism and cybercrime).

Seminar 3: Water and job opportunities: a critical nexus for growth

Building the workforce through WASH capacity building: challenges and strategies

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Keywords: Capacity building, capacity development, WASH practitioners, training, competency validation

Highlights

Investing in local expertise and training centers builds the capacity of WASH practitioners and increases implementation quality and scale. However, staff with increased capacity are often lost to other opportunities. Strategies have been developed to reduce turnover and train new staff, particularly competency validation to maintain the standard of training.

Introduction and objectives

There is growing recognition of the need for increased investment in capacity building for water, sanitation and hygiene (WASH). The sustainable development goals highlight capacity building as a means of implementation of Goal 6. Organizations that invest extensively in capacity building benefit from improved implementation quality and sustainability. They may, however, lose staff with increased capacity to other opportunities, which is a boon to the sector but a challenge for the investing organization. We explore the approaches employed by organizations to mitigate the retention challenge as well as what individuals who leave do with their acquired skills.

Methodology approach

CAWST has spent 10 years building the capacity of Water Expertise and Training (WET) Centers in 8 countries through transfer of technical knowledge, training and education capacity development, and one-on-one coaching on WASH program management (interpersonal skills, finance, scheduling). Following a focus group with the WET Centers, CAWST identified those with the highest and lowest retention rates and held semi-structured interviews to learn about their approaches for retaining employees, managing turnover and succession planning. CAWST surveyed former staff of WET centers to learn what jobs they now have and what transferable skills CAWST's capacity building contributed to their current position.

Analysis and results

Investing in local expertise and training centers builds the capacity of WASH practitioners and increases WASH implementation quality and scale; CAWST's 8 WET Center partners reached 2.6 million people with better WASH from 2012 - 2015. However, good managers and individuals with WASH technical knowledge and strong capacity building skills are regularly lost to other jobs. Some WET centers attempt to reduce turnover by increasing salaries when possible and adjusting salaries for inflation; they have also increased non-financial motivators such as participation in decision-making and professional development opportunities. WET centers generally have good systems for training new technical trainers and passing on institutional knowledge, in large part due to the competency validation framework that CAWST transferred to the WET centers. This framework standardizes skills sets and apprentices staff from onboarding, to support trainer, to co-trainer and finally to lead trainer, with trainers validated at each level to maintain the standard of training. Leadership transition is more challenging for WET centers and requires CAWST's support to build a new manager's capacity. It entails a one-on-one coaching process dependent on the context and each

individual's needs, which is difficult to institutionalize, making it an ongoing challenge for WET center independence and sustainability.

Conclusions and recommendation

Capacity building comprised of short-term technical training, apprenticeship of training and education skills, and longer term individual coaching contributes to the quality and sustainability of WASH implementation, but also provides increased job prospects for the individuals whose capacity has been increased. These impacts are beneficial for the individual and for the WASH sector but can be a challenge for the investing organization. Systems can be put in place to increase retention and to manage turnover of technical trainers, but the loss of managers is a greater challenge requiring continued external support.

SMART Centres. Water and jobs by training local entrepreneurs

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Keywords: Business development, Local employment, Market-based products, SMARTechs, SMART Centres

Highlights

The SDG 6 promises water for all but how to reach the small rural communities and sustainable water points? One option is to apply SMARTechs; Simple, Market-based, Affordable, Repairable Technologies. Training local entrepreneurs in these options can be done by SMART Centres resulting in increased water access and more jobs.

Introduction and objectives

With the fast growing population and limited funds for Water and sanitation it will be a challenge to reach the WASH related SDGs in Africa. One of the solutions can be the wide scale application of so called SMARTechs. An example is the Rope pump, a simple and low cost hand pump that is produced locally. There now are some 110.000 Rope pumps world wide used by small communities and families. To scale up the application of this and other SMARTechs requires the development of supply chains of these market-based products and services.

Methodology approach

To improve existing or create new supply chains of SMARTechs, demonstration of these technologies and the creation of critical masses is needed by means of examples in real situations. The products and technologies should be of good quality and have an after sales service which requires skilled and qualified companies. In Tanzania and other countries the training of companies is realized by means of so called ”SMART Centres”. They train local entrepreneurs in production, maintenance, marketing and business skills.

Analysis and results

To improve existing or create new supply chains of SMARTechs, demonstration of these technologies and the creation of critical masses is needed by means of examples in real situations. The products and technologies should be of good quality and have an after sales service which requires skilled and qualified companies. In Tanzania and other countries the training of companies is realized by means of so called ”SMART Centres”. They train local entrepreneurs in production, maintenance, marketing and business skills.

Conclusions and recommendation

Effects of SMARTechs are

- -Cost reduction and increased sustainability of Communal rural water supply
- -Increase the range of options that are affordable for Self-supply
- -Self-supply results in increased incomes and food security

Effects of SMART Centres for local companies can be;

- -Increase the range of products they can sell
- -Improved product quality
- -Increased incomes
- -Profit based sustainability
- -Increase of local employment

Technologies are in place, effects are clear and lessons are learned.
A challenge now is a drastic scaling up of SMARTechs and a sustainable way to do that is via SMART Centre like in Tanzania

Technical Standards Are A Vehicle For Workforce Development and Growth

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Keywords: Governance, Workforce Development, Standards, Training

Highlights

Developing countries face systemic challenges in building the professional workforce necessary to construct and maintain adequate water and sanitation services. Effective implementation of technical standards by public and private institutions plays a foundational role in the sustainable recruitment and training of skilled labor at each stage of the value chain.

Introduction and objectives

Effective adoption of technical standards is a prerequisite to the development of personnel training and certification schemes leading to the expansion of water and sanitation services. Developing a skilled workforce is critical as communities face challenges compounded by urbanization and population growth that is projected to add 2.5 billion people to the urban population by 2050 – placing added burden on underdeveloped systems. Examining research related to standards – and recent case studies from Africa and Asia – there are recognized best practices that help communities build strong policy frameworks and institutional infrastructure to support the growth of skilled labor.

Methodology approach

The focus of this study was to examine strategies that advanced a nation's ability to train and certify the various levels of professionals required to construct and sustain water and sanitation services. It then contrasted these approaches with other developing economies to identify barriers to sector growth as well as public and private sector actors that must be mobilized. It utilizes information collected from recent industry case studies from India, Indonesia, Jordan and the Philippines to develop a roadmap that can be followed to help catalyze the growth of a skilled workforce.

Analysis and results

The design, installation and maintenance of efficient water and sanitation systems requires formally trained professionals. The study found that frequently NGOs and industry organizations interested in workforce development often do not coordinate activities nor do they engage the appropriate institutional stakeholders who have the responsibility for personnel training and certification programs related to construction. These stakeholders often require specific technical assistance in order to create industry-specific curriculum as well as personnel certification schemes. In this process, the study found that technical standards play an important role in the development of skilled labor training programs. These standards are the foundation upon which training curriculum and content are based.

Technical standards serve as a framework for moving populations up water and sanitation value chains. When enforced, they become a national plan to which labor, manufacturers, and government agencies can respond and act. Effective regulations are based on international standards and also create a formal pathway where transformative technologies, best suited to an individual country's needs, can readily be adopted. Development and enforcement of these regulations often include a variety of stakeholders including national standards bodies, national construction boards, professional associations, and government regulators from ministries of labor, public works, housing, and environment.

Conclusions and recommendation

Countries who have exhibited the most success in developing sustainable workforce development programs have first adopted industry-specific technical standards. These standards have served as the basis upon which the training programs are built. This coupled with the training of regulators and the enforcement of technical standards has been shown to directly correlate with the long-term reliability of constructed water and sanitation services. These steps have also been found to benefit supply chain mechanisms. International trade of industry products benefits from a reliable regulatory framework and the alignment of international standards to ensure adequate market access.

The Hidden Employment Opportunities in Agriculture

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Keywords: agricultural employment, business models, manufacturing

Highlights

The major highlight of this research is the revelation that the overwhelming majority, 88%, of people who work in the agricultural sector in the developed world are employed in gender-neutral, non-farm activities such as; manufacturing, administrative, financial, transportation, warehouse, human resources, and retail and wholesale sales jobs

Introduction and objectives

The LDC Report of 2013 identifies three major employment sectors :agriculture; industry; and services, and analyze employment trends according to movement from one sector to the other. According to the report, "the main source of employment for the growing LDC population has been agriculture, largely through people cultivating new land". The objective of this research was to identify employment opportunities in agriculture that promote intensive farming which is a centerpiece of climate-smart agriculture. Currently employment growth in LDCs lags behind GDP growth and below population growth. The issue demands a paradigm shift in thinking

Methodology approach

This research identified the employment trends in all 49 LDCs and made a desk top study of employment trends in developed countries, concentrating in the US agricultural sector. Data were derived from World Bank and UNCTAD studies and from the United States Department of Agriculture. In addition, the author interviewed managers and purchasing managers of irrigation distributors in California and in Kenya. Finally, the author has worked in the irrigation industry in the United States and the Middle East for 40 years and provides first person observations

Analysis and results

Of the 25 million people employed in agriculture in the United States, 22 million work in non-farm jobs. All of these jobs are gender-neutral. The Green Revolution not only improved agricultural yields but it produced a plethora of new manufacturing facilities that require support or jobs, in; retail and wholesale sales , warehouse, transportation, design, administration, etc. There are no such manufacturing facilities in the LDCs in Africa. This paradigm is robust and has existed in the developed world for decades and the results of this research indicates that the model is replicable and generalizable.

Conclusions and recommendation

The employment opportunities in agriculture not only provide positive and significant drivers for poverty reduction among those gainfully employed, but the outputs of expertise in these fields yield positively and significantly improvements to farm production. Additionally, manufacturing facilities provide tax bases which are the key to improving civil society and opportunities for significant improvement in women's employment. A larger and more predictable tax base will lead to improved infrastructure and marketing opportunities for the farming communities.

Youth-LED Approach to Skills and Professional Development in Water Utilities

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Keywords: youth, water, development, skills and sustainability

Highlights

Aging workforce and skills demand in the sector and by other sectors are threating the sustainability of water utilities and their ability to contribute meaningfully to the Sustainable Development Goals in Africa. New innovative policies and strategies are being implemented involving the youth in South Africa.

Introduction and objectives

This papers focuses on the establishment of youth forums in two of Africa's leading water utilities (Umgeni Water and Rand Water in South Africa) in order to enhance the organizations' extensive developmental programmes. The paper also discuss the experience of these utilities in creating meaningful employment for local communities where Capital Expenditure projects are being implemented whilst up skilling the local Youth in areas of entrepreneurship, labour intensive construction, environmental river clean-ups amongst others.

Methodology approach

Two newly established youth forums, namely, Rand Water Young Professionals (since 2007) and Umgeni Water Young Professionals (since 2014) focuses on skills and professional development of young professionals within water utilities and socio-economic development for the youth outside the water sector (mainly high school learners and unemployed youth) with the aim of creating a sustainable supply chain of skilled and passionate professionals for the sector. The forums have also organized a series of educational modules, workshops and conferences to improve the skills of the youth within the water utilities.

Analysis and results

To date, the forums have positively impacted at a national level by assisting the Ministry of Water and Sanitation in drafting the South African National Water and Sanitation Youth Strategy. The forums have assisted over 25 000 high school learners with information about careers in water and sanitation sectors and also their application for support to fund their studies.

The results within the organizations, in the sector and other sectors are a better skilled, more engaged workforce aware of the challenges and opportunities in the water sector.

The organizations have taken robust approach to development of young people within the sector. A total of 103 employees have been trained in management and leadership development, 62 artisan traineeships, 36 apprenticeships, 180 Process controllers, 60 bursaries, 90 graduate traineeships we supported in the 2014/2015 financial year alone.

The two organizations are also assisting local Water Services Authorities in three of the nine provinces in training and the development of unemployed graduates in generating a pipeline of skills for local municipalities. A total of 164 graduates were undergoing training in the 2014/2015 financial year.

In 2014/2015 financial year alone, a total of 4097 jobs for local youth through the implementation of capital expenditure programmes and the work of the foundation. To support entrepreneurship, mainly youth led, Umgeni Water has signed 52 contracts (totaling to R1.381 Billion reserved for SMME) and Rand Water supports 70 SMME's in (2014/2015 financial year).

Conclusions and recommendation

The future is bright for the water sector in Africa and the Sustainable Development Goals will be achieved if the youth is fully engaged and involved.

Experiential learning to engage the architects of our employment future

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Keywords: Citizen Science, organisational learning, organisational culture, economic growth, professional development

Highlights

Fresh Water Watch (FWW) has been developed by Earthwatch to create deeply engaging learning programmes enabling organisations to engage and develop their employees, create an organisational culture which prioritises sustainability, and consider how they can contribute to a future equitable and sustainable business and employment environment.

Introduction and objectives

Increasingly, corporate organisations outshine nations in their sustainable growth objectives and employees favour engagement with Corporate Social Responsibility aims to gain skills knowledge and professional development. However, appropriate programmes encompassing business objectives and sustainability goals are lacking. Corporate learning programmes built around the FWW citizen science project engage deeply with individuals and organisations, e.g. in the banking sector, who have the influence and resources to inform the development of businesses and industry sectors. imultaneously, the project provides a firm evidence base to guide all stakeholders, including corporates, in decisions around water management, policy and sustainable growth.

Methodology approach

Training in water quality sampling is included in a modular programme, providing novel experiences around which deep learning is acquired. Concrete links with development goals, e.g. using water-based projects to practice leadership competencies, are combined with an experience/reflection cycle facilitating attitudinal change.

Learning interventions differ in length and focus, depending on cohort objectives, but all include action planning for extended engagement with water issues, practical application of learning and wider dissemination of the programme messaging.

Learners continue to contribute to global water quality data, which is open source, allowing the widest possible application in policy, management and further research.

Analysis and results

Learners attending short duration employee engagement programmes almost unanimously report increased awareness of freshwater challenges and intention to change personal behaviours. Many commit to data collection and company sustainability efforts, including addressing business footprint.

Participants on longer programmes generate larger scale sustainability and professional development projects; within their own organisations, including global facilities projects, and more widely, considering their part in shaping the future global business environment.

Learning interventions with a citizen science activity at their heart engage participants and encourage them to engage in behavioural change and sustainability projects. They also bring about attitudinal changes which lead people to adjust their outlooks, personal and professional direction and help to position awareness of sustainable growth at the very centre of large and powerful organisations.

Data collected by participants is helping to develop a coherent picture of the impacts of urbanisation, and has been directly used by participants themselves to force water management change at a local level.

Additionally, the impact of the learning interventions, and the application of the data collected continues to help Earthwatch to fulfill its mission '… to promote the action and understanding necessary for a sustainable environment'.

Conclusions and recommendation

We will build on the successes of these programmes to create an ever growing suite of learning offerings to enable corporate organisations to embed sustainability in their operations and culture.

The opportunities around this vary as much the opportunities and risks of the nexus between fresh water and business. As data are collected, this opens up new prospects for collaboration with corporate partners to design their own learning / citizen science / operational projects in areas as diverse as, for example, sustainable cities, innovation and supply chain optimisation, while simultaneously meeting their own needs for employee engagement and professional development.

Hand Pump Mechanics Associations for job opportunities and water services

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Keywords: water services, business opportunities, jobs

Highlights

In 2011, the Ministry of Water and Environment in Uganda adopted Hand Pump Mechanics Associations (HPMA) so that hand pump mechanics (HPMs) support communities with operation and maintenance (O&M) of water facilities. HPMAs improve functionality; sustain HPMs' jobs; enables HPMs to venture into WASH-related business beyond source repairs.

Introduction and objectives

HPMs are key to the O&M of water supply facilities. They work with stakeholders at local government and community level, to ensure that when sources break down, they are repaired in a timely manner. For HPMs, O&M is a livelihood. The formation of HPMAs was primarily to increase functionality of water sources, but also an opportunity to improve the HPMs' trade and ensure that they are motivated to keep providing O&M services. This paper aims to show how HPMAs can ensure business opportunities and job security for hand pump mechanics whilst also improving the functionality of water systems.

Methodology approach

IRC under the Triple-S Initiative applied action research in Kabarole and Lira districts, to support the newly-formed HPMAs to turn into viable business entities and provide O&M services for water supply facilities. IRC also undertook process documentation to capture key outputs and outcomes. In both districts, IRC led the process of formation and operationalisation of the HPMAs and supported them with capacity building and development of business models that would ensure their viability. Throughout the process, key lessons were being captured and these are being shared with other districts which have chosen to embark on a similar journey.

Analysis and results

Since the HPMA undertaking in 2011, 80% of the 112 districts in Uganda have formed associations - 30% are operational. The associations have contributed to the improvement of functionality of water supply facilities. In Kabarole district, functionality increased from 80% in 2011 to 82% in 2014; and from 73% to 82% in Lira district. This has contributed to the improvement in national functionality rate from 83% in 2011 to 88% in June 2015. Apart from their primary jobs of repairing shallow wells and boreholes, HPMAs have been contracted to extend piped schemes; conduct district-wide assessment of water supply facilities; and collect data to update district statistics. Members have distributed themselves evenly such that each sub county has at least two HPMs. That has taken them closer to the communities who can now easily reach them whenever a source needs repair. HPMAs are looking to do even more WASH-related jobs in the promotion of sanitation and hygiene and management of sanitation in public places. HPMAs can indeed support government to improve water services. Most importantly, HPMAs increase chances for members to get more business and job opportunities which contributes to the reduction of unemployment in the country.

Conclusions and recommendation

HPMAs present benefits for all stakeholders. The associations can attract work to keep individual members engaged, whilst building a cadre of skilled technicians to provide timely technical support for O&M of water supply facilities. It is recommended that:

- Through affirmative action, government gives HPMAs more responsibility to manage water supply facilities. Government issued a guideline for local governments to prioritise HPMAs when rehabilitation work is available.
- Support the HPMAs to hone their business acumen to enable them comply with conventional business and professional standards
- HPMs and artisans should join associations to benefit from collective bargaining

How can human resources development be sustainable? – Exploring ownership

Author: Mr. Shigeyuki Matsumoto, Japan International Cooperation Agency, Senior Advisor, Japan

Keywords: human resources development, ownership, sustainability, capacity development, development assistance

Highlights

Development assistance for human resources development sometimes faces difficulty in sustaining outcomes of projects. In order to overcome this long-standing issue, ownership is a key concept. By comparing three technical cooperation projects in African continent, this paper extracted seven useful approaches to strengthen ownership of the recipient country.

Introduction and objectives

Human resources development is vitally important to improve management of water services in developing countries. Target 6.a of SDGs also urges the international community to expand international cooperation and capacity-building support. Although development assistance provides many opportunities, sustainability is a challenge. A sense of ownership is a key to create enabling environment for developing countries to proactively continue their own initiatives for human resources development. This paper aims to examine some projects supported by the Japan International Cooperation Agency (JICA) and answer to a question about how human resources development can be more sustainable, by focusing attention on the ownership.

Methodology approach

Following technical cooperation projects supported by JICA were reviewed to extract lessons on how to strengthen the ownership:

(1) South Sudan: The Project for Management Capacity Enhancement of South Sudan Urban Water Corporation, by Ministry of Water Resources and Irrigation, 2010 - 2013

(2) Egypt: The Project for Improvement of Management Capacity of Operation and Maintenance for Water Supply Facilities in Nile Delta Area, by Holding Company for Water and Wastewater, and three water and sanitation companies in Sharkiya, Gharbia and Minufia governorates, 2011- 2014

(3) Sudan: Human Resources Development for Water Supply, by Public Water Corporation, 2008 - 2015

Analysis and results

The above projects utilized common approaches.

Firstly, setting clear and achievable goals is important. The Egyptian project emphasized the goals that the trainees would become trainers in turn, and scale up the success from model facilities to the whole region. The Sudanese Project identified Morocco as a target country to catch up.

Secondly, achievement of human resources development needed to be visible. All the projects utilized quantitative performance indicators to track the improvement. The project in Egypt showed the effect of reduction of O&M cost and NRW by monetary value.

Thirdly, good performers were honored in the cases of South Sudan and Sudan. The Egyptian project proactively created opportunities for the trainees to heighten their self-esteem by teaching other staff. Opportunities of training abroad effectively motivated the trainees.

Fourthly, all three projects actively involved top management to garner their commitments through constant communication. Providing much-needed equipment was valid to gain those commitments. The Sudanese project facilitated official approval of the national plan for human resources development.

Fifthly, the local situations and needs were well understood and reflected into the contents of training.

Lastly, since the Egyptian project and Sudanese project targeted plural water utilities, facilitating competition among them was effective.

Conclusions and recommendation

Following seven common approaches were identified which were keys to strengthen the sense of ownership, and thereby enhance sustainability of the human resources development projects:

(1) Set and share common goals to be achieved,

(2) Visualize improvement and achievement by measurable indicators,

(3) Meet the needs for esteem and self-actualization to motivate the participants,

(4) Show a commitment by top management,

(5) Adjust programs for human resources development to match local needs, and

(6) Enhance competitive consciousness.

These approaches will be applicable to other human resources development projects as well.

Dual System Based Vocational Education and Training in the Water Sector

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Keywords: Vocational Education, Training, Water Sector, Peru, Dual System

Highlights

To cope with the lack of skilled staff to operate the water facilities an intense vocational education program has been designed and is now in implementation. It´s based on the idea of dual vocational training, which combines training at training centres and on the job training in the Peruvian water companies.

Introduction and objectives

Maintenance, service and operation of facilities and supply networks in the water sector require well qualified technical staff. Large investments into water-related infrastructure also require expanded staff resources and offers additional employment possibilities. Problems as semi-skilled staff as well as low salaries, and demotivation rise up and the handling and operation of modern technical equipment leads to excessive demands. Most personnel resources are needed (nearly 60%) for the technical operation of plants (water supply, waste water cleaning, pressure management).

Methodology approach

The paper will present the experience in the development and implementation of the Peruvian dual vocational training system in the water sector, lessons learnt and first promising results.

Analysis and results

In a more general way but based on these experiences it will try to answer the following questions:

- How can vocational education and training be embedded in a sustainable manner within the sector? Which institutional leverages are suitable and necessary? Who are the main actors, what are the relevant interfaces to the labour market sector, which operational experiences exist?
- How can qualification needs (quantitative and qualitative) in the sector be determined systematically? Which instruments and experiences are available?
- What is the role and relevance of National Qualification Frameworks and how are competences being certified?
- How can the participation of companies in the vocational education and training in the sector be organised? Which preconditions are necessary in the companies, training centres and curricula? How can the dual system approach be introduced in other countries?
- How can vocational education and training in the sector be financed?
- How can the attractiveness and image of vocational professions in the water sector be improved? Which active labour market policy measures can contribute to realise the employment potential in the water sector?

Conclusions and recommendation

The new created Vocational Education and Training (VET) system in the Peruvian water sector is able to meet the increasing demand for qualified staff (at labour and technician levels) in a sustainable manner. It can be observed that the integration of vocational education and training approaches is increasingly being demanded by water sector institutions, water facilities and donors, being reflected as components or fields of the activities in water programmes. The Peruvian approach could be transferred to many countries, but of course, should be modified to the reality of each region and water sector which are lacking of skilled labour in the operation of water facilities.

Impacts of Safe (and unsafe) toilets on Workers' Health

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Co-Authors: Dr. Barbara Janusz-Pawletta, Poland

Keywords: Nigeria, Sanitation, Toilets, Workers, Public health

Highlights

Role of the young generation in finding a sustainable solution for water issues in Central Asia (CA) is important. Next thirty years young people will manage the water resources. Establishing a youth network for water in a region will strengthen motivation of youth to be engaged in water sector.

Introduction and objectives

An idea of establishment of the CAYWPF was presented during the Special Issue Session R3.2AP "Development of cooperation in the Aral Sea basin to mitigate consequences of the environmental catastrophe" of the 7th World Water Forum on April 14, 2015 in Gyeongju, the Republic of Korea. The World Youth Parliament for Water, a youth network acting for water around the world since 2002, has already inspired young people to organize nine national parliaments and five regional parliaments. As engagement of youth in water management is coming on the agenda, it is worth to consider creating a parliament in CA.

Methodology approach

Interview with the representatives of the international organization (UNECE Office in Almaty, UNEP Office in Almaty, UNESCO Claster Buro in Almaty, USAID Office in Kazakhstan, GWP Central Asia, IWMI Central Asia), regional organizations (Scientific Information Center of the Interstate Coordination Water Commission (SIC ICWC)), regional NGO (Regional Environmental Center for Central Asia (CAREC)), governmental organizations («Gidroingeo» Insitute, Institute of Geology and Geophisycs in Uzbekistan) national NGOs, as well as youth of Central Asia, Afghanistan and Mongolia. There has been elaborated questionnaire aiming at improving the Concept note of the CAYWPF.

Analysis and results

The CAREC and the World Bank provided with financial support for the research in the framework of the Call for students on conducting research. In this regard, the organization of the inception meeting, creation of the website, printing the brochure and organization of the social activity in Kazakhstan have been arranged. First, the Concept of the CAYWPF has been elaborated. National Focal Points (NFPs) in seven countries (Afghanistan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Turkmenistan and Uzbekistan) were selected. The inception meeting that took place on September 25 at the World Bank Office in Almaty. IWRM MA students, civil servants from governmental organizations of Central Asia and other partners like UNESCO Almaty Cluster Office, UNECE Office in Almaty, UNEP Regional Office for Europe, and USAID in Kazakhstan supported the idea and provided with their remarks on the Concept of the CAYWPF. Later, together with the republic NGO «Posadi Derevo» and social project «Eto Dvor» the members of the CAYWPF and the MA students of IWRM Program of the Kazakh-German University (KGU) planted the trees in one of the backyards of Almaty. The Concept note for the first regional gathering at the KGU was also prepared.

Conclusions and recommendation

CAYWPF will make valuable contribution to SDGs, in particular Goal 6. Its mission is to mobilize the young people in CA to act for water and thus make contribution to enrich SDGs by 2030 and raise awareness among young people in CA on water issues. The network of young people will act for water in CA at all levels: from local communities where they implement concrete actions to the regional and international levels, where youth will be able to advocate their participation in the water sector. Young scholars will carry out scientific research and work with civil society.

Seminar 4: Ecosystem degradation and livelihoods: moving from vicious to virtuous cycles

Ecosystem degradation and livelihood challenges in India: Problems and prospects

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Keywords: ecosystem degradation, integrated water resources management, sustainable livelihoods, development, India

Highlights

This presentation aims to outline, in the context of India, how poor management of water resources can lead to ecosystem degradation, in turn spiralling poverty and inequity. It also aims to highlight the prospects of how wise integrated water management can bring green solutions, thereby restoring livelihoods, bringing development.

Introduction and objectives

Ecosystem degradation has emerged as a major problem in India, adversely affecting livelihoods of especially the poor and marginalized who were closely dependent on them. Interestingly, the problem is evident in areas where water resources were already limited. The presentation aims to expose the pathways through which poor management of water led to ecosystems degradation, in turn seriously affecting livelihoods in arid/semiarid areas of India. It further aims to share knowledge on how ecosystem restoration was achieved through integrated water resources management (IWRM) at local scale, bringing back prosperity and development in affected communities, thereby suggesting an effective way forward.

Methodology approach

The presentation is based on the findings of an empirical research in arid/semiarid India funded by the Vetenskapsrådet. Data was collected through qualitative research methods at level of local communities in arid/semiarid areas of Rajasthan and Maharashtra.

The study was based on the framework of IWRM, conceptualized as an approach promoting coordinated development and management of water, land, forest and other natural resources, with the aim to maximize equitable social welfare together with ecosystems sustainability. 'Integration' primarily focused on: green and blue waters and the water cycle, different water use sectors, and that of all stakeholders in planning and action.

Analysis and results

From in-depth case studies in the study areas, it emerges that poor management of water as both green and blue water, through groundwater overexploitation, cultivation of water-intensive crops, largescale deforestation and denudation of green cover, and neglect of rainwater harvesting mechanisms/structures, have together acted negatively to degrade local ecosystems. This destroyed local livelihoods but while the rich could engage in alternate gainful employment outside, for the poorer ones, like small/marginal farmers, agricultural laborers, animal herders, migration led them into deeper poverty traps, bringing greater underdevelopment and social inequity.

However, when appropriate correctives were applied through mechanisms like rainwater harvesting, rejuvenated water conservation structures, afforestation, etc. that were based on the principles of IWRM at a 'decentralized' scale involving true 'bottom up' participation of local stakeholders at the micro-watershed level, transformation came about. Highlights were enhancing of blue water storage in ponds and tanks, improvement of green water reserves, rising of groundwater table, in turn leading to more blue water in recharged wells, and restored streams and rivers. This revived agriculture, restored forests and pasturelands,

enhanced crop and animal productivity, thereby preventing migration and fighting poverty. In the end, many such villages could come back to the path of sustainable development.

Conclusions and recommendation

The study shows that ecosystems in arid/semiarid areas are vulnerable to changes in water environment, ignorance of which can have detrimental ecological and human impacts. Also evident is that economic development and prudent water use/management can work together if based upon an integrated approach. The study proposes 'decentralized IWRM' as an effective approach for addressing ecosystems degradation, which can be applied to arid/semiarid areas and also experimented in other vulnerable ecosystems. This is based in participatory micro-watershed-level planning/management with 'bottom-up' approach where green/blue water, other natural resources, water cycle, and different water uses are seen as closely interrelated.

Strengthening Jordan's Groundwater Management: Over-abstraction, Scarcity, Refugees & Water Security

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Keywords: Jordan, groundwater management, scarcity, over-abstraction

Highlights

IRG/Engility worked closely with the Government of Jordan (GOJ) to tackle pervasive overdrafting which threatens long-term water security at a policy, governance, management and community level. Several new tools and resources, a national socio-economic study and legal reforms can now interfere with the existing fundamentals blocking sustainable groundwater use.

Introduction and objectives

The Institutional Support and Strengthening Project (ISSP) worked closely with the GOJ to move towards better groundwater management by delivering new tools and resources to tackle the problem at many of these different levels in order to disrupt some of the existing fundamental dynamics that have been standing in the way of reforms and sustainability.

The objective is to review how IRG's ISSP implemented a number of technical assistance activities while developing new groundwater management systems, tools and studies to significantly strengthen the GOJ's capacity to address groundwater issues at a policy, governance, management and community level.

Methodology approach

The ISSP Team used three methods. It first conducted a national Socio-economic Study of Groundwater Use in Jordan with a focus on options for how to update management and regulation of the sector. Second, the ISSP Team significantly strengthened the wells management cycle including licensing of groundwater wells, meter reading, data collection and groundwater pumping violations management. Lastly, the ISSP Team began the long process of structural legal and regulatory reform, with particular emphasis on compliance and enforcement.

Analysis and results

Over-abstraction of groundwater in Jordan has been perpetuated by socio-economic, political, management, regulatory and legal drivers. The only effective way to materially change groundwater use practices and allocations in Jordan is through a comprehensive, multi-layered approach. The study carried out the first national survey of all agricultural, industrial and tourism/drinking wells in the country. The survey results were then analyzed to create the most comprehensive picture for Jordan's groundwater use, including local, regional and national trends, the productivity of various agricultural uses, the scope and implications of illegal water use, employment and income generation attributable to groundwater, energy use, and the current perceptions of government services. The study allowed the GOJ to update almost all of the technical data for the country's groundwater wells, with significantly more accurate information, particularly for well locations and abstraction levels, contributing directly to better groundwater management. The analysis has enabled the GOJ to determine where abuses were most prevalent, where water was being used most effectively, where new regulations may be needed, and where compliance and enforcement of existing regulations was effective or problematic. The final product of the study was a Management and Policy Implications review that used the study's findings.

Conclusions and recommendation

This work has had a significant impact on Jordan's sector management. The refugee influx overwhelmed already scarce water resources and fragile infrastructure. There is real urgency to effectively manage Jordan's water resources, driven by need for sufficient water supply as well as the reality that a fragile water sector directly undermines social cohesion and economic development. In the face of these pressures, ISSP has delivered updated technical data, extensive and targeted technical analysis, relevant systems and management tools, new processes and an improved legal framework which has enabled Jordan to begin addressing these pervasive and long-standing groundwater overuse issues.

Ecosystem restoration and sustainable agriculture: What's in it for farmers?

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Keywords: Incentives, ecosystem services, livelihoods, adoption barriers, agriculture

Highlights

What do farmers gain from changing their agricultural practices and restoring ecosystems? How can they implement sustainable agriculture and conservation practices when faced with adoption barriers? Case studies demonstrate the use of public and private investment to provide incentives that support farmers in this transition.

Introduction and objectives

Inadequate land and water management can create a vicious cycle of ecosystem degradation; reducing long-term agricultural productivity and increasing reliance on unsustainable and damaging practices. With improved practices, farmers can act as environmental stewards; addressing environmental degradation and supporting the provision of multiple ecosystem services for multiple stakeholders.

Without incentives to overcome technical, cultural or financial barriers to adopt these practices, farmers are, however, limited in their ability to transition to sustainable agriculture and landscape restoration. This seminar illustrates, with case studies, how improved policy alignment and incentive combinations can create packages to support farmers implement this integrated approach.

Methodology approach

For each case study, threats to the ecosystem and the provision of services for multiple users were identified. Best practices to address threats to ecosystem services such as landscape restoration, buffer zones and reduced agro-chemical use, and to improve agricultural productivity were also determined. Institutional mapping was then conducted to analyze existing public programmes and private sector activities within the study area. Incentives provided by these institutions were defined according to a spectrum of incentives , determining also eligibility criteria and stakeholder access. Policy and institutional recommendations were then identified to coordinate the use of incentives in this integrated approach.

Analysis and results

Farmers face barriers to adopt sustainable agricultural activities that support the provision of ecosystem services. The case studies illustrate how different combinations of public-private partnership were used to enable innovative financing for packages of measures that provide incentives for farmers to transition towards a virtuous cycle of ecosystem restoration and sustainable livelihoods.

The Tana Water Fund, Kenya, has been developed with public-private investment to combat threats to water security. The Fund finances incentives for soil and water conservation activities in the upper watershed to improve long-term water supply across the basin. In Brazil, coordinated public-private partnership integrates both regulatory and productive incentives which support farmers' compliance with forest and water-protection laws, and also improve their productivity.

Key to this approach is a supportive enabling environment integrating different short- and long-term incentive mechanisms. This enables co-financing from both private and public users of the ecosystem services, at lower social cost. The use of incentives to govern natural resources in these case studies has

contributed to improved food security, water provision and energy, as well as sustainable livelihoods. The integration of sustainable agriculture development with conservation objectives provided an opportunity for agro-ecosystems to deliver multiple ecosystem services, and support sustainable growth.

Conclusions and recommendation

Farmers need incentives to break the vicious cycle of degraded ecosystems and unsustainable agricultural activities. Coordinated incentives can support their transition to implementing more sustainable and conservation-oriented production. These case studies demonstrate that a better alignment and combination of policies and private investment can provide innovative financing in agricultural and environmental measures. This can create packages of incentives to deliver mutually enforced benefits for farmers, and other sectors of society. If implemented at a sufficiently large scale, this can also provide opportunity to work towards achieving multiple SDG targets simultaneously.

Accounting for Ecosystem services of water interventions – approach, assessments and recommendations

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Keywords: Ecosystem services, water resources, natural capital, valuation

Highlights

Valuing Nature – or Natural Capital– is a growing trend amongst businesses to evaluate the impacts of their activities on the natural environment. Both, positively, as well as negatively, this value creation can then be articulated as part of the business accounting. The Coca-Cola Company is working globally to use Natural Capital evaluations for driving its future strategy and to create shared value on the ground.

For example, the Coca-Cola's global engagement on water conservation and replenishment is not only improving the quality and quantity of water resources but also of the ecosystem services depending on them. Hence, the Company has pioneered a way of using ecosystem services evaluations for a deeper understanding of the full ecosystem impacts of its replenish projects and to help inform future business decisions.

Introduction and objectives

Based on Coca-Cola's experience on water resource restoration projects (replenish projects), the company integrates Natural Capital and Ecosystem services evaluations to enable a high-level valuation of different restoration projects and to achieve maximum ecosystem benefit from water interventions. The objective is to better understand the wider ecosystem benefits of different types of water resource interventions by evaluating eight selected European water projects from three different countries and three general ecosystem types. The work followed the methodology of the The Natural Capital Coalition (NCC), including collection of feedback from relevant stakeholders.

Methodology approach

The first phase involves creation of a practical valuation tool, based on the ecosystem services assessment method. This tool is used for valuation of benefits for specific ecosystem projects. The second phase involves valuation of eight selected European pilot projects with the tool created in phase I, based on geographic regions, ecosystem type and intervention type. Each pilot project is assessed in terms of the state of ecosystem functions (before and after) and calculations of net gain or loss of ecosystem service value. In addition, an assessment for each pilot project is performed, using the draft Natural Capital Protocol.

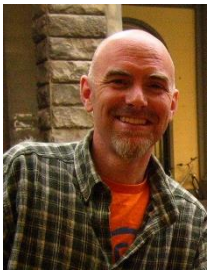
Analysis and results

The net present ecosystem value of each replenish project is determined separately. Then the work assessed each project's impact on ecosystem restoration, based on all four types of services: provisioning, regulating, cultural and supporting. The final outcome shows the overall return on investment of each project. In addition to a scientific review of the currently available methodologies for evaluation and the results for the reviewed projects. A White Paper will summarize these results and seek to draw overall conclusions and recommendations for further uptake and use. Coca-Cola will also work with The Natural Capital Coalition to include additional case studies and approaches in the session to offer a wider band-with of insights to participants.

Conclusions and recommendation

Ecosystem service evaluation throws up a multitude of political, scientific and economic questions that still need to be further discussed in a wider stakeholder consultation. However, the results of this work to date demonstrate that some water replenishment projects deliver much higher value in terms of provided ecosystem services than others. We also start to understand why that is the case and what that means in terms of future trade-offs. This knowledge can be used to drive more impactful future water and ecosystem restoration projects.

Communities as stewards of environment: bringing people into the cycle



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Keywords: ecosystem degradation, community stewards, citizen observatories, earth observation, livelihoods

Highlights

Direct and indirect impacts of ecosystem degradation on livelihoods, health and welfare are driven by poor planning and compounded by limited public participation. Citizen observatories link communities, scientists and decision makers to empower local communities as active stewards of their environment.

Introduction and objectives

Freshwater ecosystems provide economic, social and environmental functions to all levels of society, yet decisions regarding their management are made on limited information and in a non-transparent manner. Empowering individuals to monitor their environment, in a structured and robust manner, provides multiple benefits to private and public decision makers as well as the participants themselves. Citizen observatories provide an active link between citizens, scientists and policy makers. These programmes support transparent and inclusive management and monitoring of the whole environment, moving beyond sector-based and narrow-focused planning approaches.

Methodology approach

Citizen observatories provide fundamental information on ecosystem conditions, local pollution sources and land cover/use, hydrological conditions and water quality. These local scale data combine with earth observation and agency monitoring data through online information systems to provide high-resolution real-time information on ecosystem conditions to agencies, resource users and scientists. These programmes empower communities, strengthen research outputs and improve evidenced-based decision making. The challenges are many; training and engaging communities requires a multifaceted approach, robust data gathering required continuous learning methods and quality control; engagement and stewardship require timely feedback and ongoing activation.

Analysis and results

Citizen observatories and citizen science programmes engage hundreds of thousands of people in every corner of the globe. Results show a range of benefits to both public and private sector entities. We examine the results of several global programmes with regard to their success and challenges in reducing the impacts of ecosystem degradation and the loss of basic environmental services necessary for livelihoods and well-being. We highlight regional and cultural differences in engaging, training and supporting participants in citizen observatories focused on freshwater and sustainable growth. These programmes demonstrate a 400% return on investment (in time dedicated to training and engagement), and a significant increase (90%) in participant's awareness and understanding of local and global freshwater issues. Results from urban agglomerations in Latin America and Asia show major benefits to incorporating local observations with satellite based information systems on catchment and ecosystem conditions. This multi-scale knowledge greatly improves the identification of environmental tipping points and the capacity to predict conditions which lead to the loss of ecosystem services necessary for local communities.

Conclusions and recommendation

Working together with scientists, agencies and private partners, citizen observatories create a critical mass of engaged and empowered community members. Experience shows that local environmental stewards are a first step toward breaking the cycle of ecosystem degradation and loss. For both public and private entities, these programmes provide a needed source of local scale information and a fundamental support for the sustainable and integrated management of freshwater resources; basic requirements to create a virtuous and inclusive cycle.

Groundwater sustainability: Narrowing the gap between science, policy and society

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Keywords: Groundwater management, transdisciplinary approach, social-groundwater model, local scale, Yucatan, Mexico

Highlights

Groundwater problems occur in different ways and depending on the aquifer. To assess them, global and regional models exist. Some models overestimate data, therefore uncertainties arise and results can be poor at local scales. Models are important, but how can scientists meaningfully contribute to groundwater sustainability without considering local involvement?

Introduction and objectives

Groundwater is a key, socially important, common-pool vulnerable resource. Because it is out of view, its monitoring on both, global and local scales is challenging. Modeling tools have been developed towards solutions to groundwater environmental problems. Although models are accessible, drawbacks are: they are not always locally affordable; data is not always reliable; and stakeholders are not included. Global assessments are important, but problems might be exacerbated if we do not examine groundwater from another perspective considering that its related problems are largely local. The aim is to develop a transdisciplinary socio-groundwater model as a toolbox for better resource management.

Methodology approach

We applied five different, interrelated, methodologies: 1) material flow analysis: to quantify groundwater flows associated with present-day economic sectors; 2) structural mental model approach: to analyze stakeholders' risk perception regarding groundwater pollution, by eliciting mental models; 3) underwater exploration: to obtain insights about current and real status of local wells and sinkholes; 4) community-based conservation: to integrate local values, beliefs and perceptions into groundwater conservation; 5) environmental activism: to directly involve stakeholders in local well clean-ups, and community events. These methods were developed in a transdisciplinary process with stakeholders spanning sectors including: NGO's, local communities and policy makers.

Analysis and results

We analyzed, in a unique way, groundwater in Yucatan, Mexico, a place where no other sources of freshwater exist. Applying system analysis and bringing local and scientific knowledge we adapted our framework. Data was obtained from different sources: literature, national and local statistics, stakeholder's workshops, expert opinions, expert consultation, local interviews, and estimations. Investigation of flows by applying groundwater flow analysis helped us to develop the first water balance and to reveal wastewater emissions to the aquifer. Mental models of local members and experts were obtained and we found discrepancies regarding risk perceptions. Speleological records obtained during underwater explorations evidenced current hotspots of pollution due to bad waste disposal local practices. Interviews revealed a profound sense of loss of local and traditional knowledge, and strong desire to learn about groundwater, to restore cultural practices and to revitalize local values. Through sinkholes clean-ups locals were aware of groundwater sensitivity, hazardous materials associated with human activities (i.e. agriculture) and this provided us with insights of local pollution sources. Direct involvement with policy makers, experts and locals was key to guide

and validate the project stages in an iterative process, and simultaneously narrowed the gap between science, policymaking and society towards groundwater sustainability.

Conclusions and recommendation

Technical solutions to groundwater problems are of importance; however, local stakeholder involvement is crucial. We agree with the relevance of models, but we offer a much more comprehensive view and approach of local groundwater problems since we involved stakeholders during the research process. This is a reliable and versatile methodology to meaningfully contribute with groundwater sustainability. It can be adapted to specific social, economic, political and environmental setting of different regions.

A real transformation is required in how we value, manage and characterize groundwater systems since only hydrological models and single-disciplines approaches seemed to have failed.

Ecosystem Degradation Cycle in the Himalayan Foothills of Jammu, India

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Keywords: ecosystem degradation cycle, Himalayan foothills, Water scarcity, Soil erosion, water conservation

Highlights

Wide-scale ecosystem degradation has been observed in the foothill Himalayas of Jammu. Poor crop productivity due to water scarcity and land degradation is the root-cause of poverty. Poverty and poor livelihood opportunities in turn makes it difficult for farming families to invest in arresting degradation and creating water infrastructure.

Introduction and objectives

Foothill Himalayas is a fragile ecosystem and face large scale degradation. Part of them falls under the Jammu division of India. A variety of environmental, social and economic factors contribute to the ecosystem degradation constituting a vicious cycle. Water scarcity is responsible for poor crop productivity, and hence poverty. Both poverty and ecosystem degradation are interlinked as the population is dependent on land. Degrading land yields poor returns which translates into inability of the communities to invest in water harvesting and ecosystem conservation. The objective was to relate these factors and address water and poverty issues.

Methodology approach

An attempt was made to identify and relate the factors involved in ecosystem degradation in the foothill Himalayas of Jammu and Kashmir, India. Both natural (rainfall events, erosion, deforestation, soil and parent material etc.) and anthropogenic factors (moisture stress, marginal holdings, lack of technical knowledge, population pressure etc.) were identified and related with each other to create a cycle of events promoting ecosystem degradation and its influence on livelihoods and poverty in the foothills. Studies were conducted to assess the viability of cheap in situ moisture conservation practices that can be promoted and employed to break this cycle.

Analysis and results

Although the total annual rainfall seems to be sufficient, nearly 80% of it falls in July and August resulting in water scarcity for most part of the year. The rains received are of high intensity resulting in wide scale soil erosion, washing away most of the top fertile soil. Poor moisture retention and degraded soil results in poor crop productivity and scarce natural vegetation. Increasing population has also put pressure on land with reduced land holdings resulting in illegal deforestation. Marginal land holdings result in difficulty in adoption of soil and water conservation practices. Moreover poor returns from agriculture means, investing in land and water remains the least of farmer's priorities. Only 43 per cent of the farmers here are aware about the severity of the problems related to runoff and soil loss. All the above factors lead to continuous land degradation, thereby reducing the productivity of theses lands, which in turn affects the economic condition of the farmers. Cheap technologies for water conservation like mulching and organic manuring can enhance

moisture storage and were found to increase crop yields from 30 to 50%. These can very well help in penetrating into the viscous cycle of degradation and poverty.

Conclusions and recommendation

All the above factors lead to continuous ecosystem degradation, thereby reducing the productivity of these lands, which in turn affects the economic condition of the farmers luring them to other sources of employment and the cycle continues. The challenge lies in protecting the limited land and scarce water resource from further degradation, improving productivity of land and eroding poverty in Jammu region of the state. Targeting socio-economic factors of degradation through dissemination of technical know-how and introduction of cheap alternatives of water conservation can turn this vicious cycle into a virtuous cycle.

Social-ecological deltas and green infrastructure: lessons from the Paraná and Dutch delta


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Keywords: Deltas, social-ecological systems, open systems, delta design, eco-engineering

Highlights

This contribution approaches deltas, hybrid landscapes connecting urban areas to the watery marine environment, as social-ecological systems. A theoretical systems approach to managing delta development and delta water resources is translated into practical hydroecological delta interventions. Our insights contribute to physically shaping sustainable delta futures in terms of environment and delta societies livelihoods.

Introduction and objectives

Living in deltas comes with opportunities and threats. To improve delta societies' livelihoods, hydraulic infrastructure is put in place to capitalize on delta opportunities (e.g. irrigation) to try to minimize delta risks (e.g. extreme flooding). This type of infrastructure is often associated with a simplified, closed systems approach that aims at controlling the state of the water. This in turn often yields short term societal gains, but at the expense of long term environmental delta dynamics. Therefore, we argue that in complex delta systems, interventions cannot be monofunctional or rigid, and should create additional benefits to society in both short and long terms. Our contribution outlines a co-evolutionary systems approach to deltas, followed by practical design options for hydroecological measures.

Methodology approach

Recently it has been argued that deltas are taking shape in a co-evolutionary fashion as opposed to closed delta system conceptualizations. Our contribution departs from a co-evolutionary or open systems approach to deltas. The approach centres around acknowledging interaction between environmental, social and technological systems on different scales of a delta. We use two studies (one systems-theoretical applied on deltas, and another one on practical delta design options) to elaborate on this approach. Interventions are summarized under the header 'green infrastructure'. The proposed hydroecological interventions are contributing to the system's sustainability, instead of compromising it.

Analysis and results

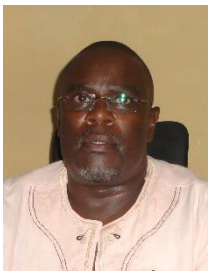
The socio-environmental impacts of rigid hydraulic engineering only surface when assessed over longer time scales. Soil subsidence due to prevented flooding and subsequent sedimentation intake in former floodplains is becoming an issue in subsiding world deltas. Together with rising sea levels, this threatens the livelihoods of millions of delta inhabitants. In several world deltas, including the Dutch delta, water and flood dynamics are (temporarily) restored at places where hydraulic infrastructure was originally put in place to prevents such dynamics. Interventions such as dams or embankments can be redesigned to not only prevent large scale flooding, but also to facilitate minor floods and sedimentation. This increases land height, which may enable delta societies to 'grow' horizontally and vertically with sea level rise. Open system design creates awareness among delta inhabitants and acknowledges the complexity of systemic interventions in deltas, in

attempts to improve delta communities' livelihoods. In the Paraná delta, Argentina, private urban developments are currently functioning as closed systems that impair the delta's water regulating functions. We will present design examples of green infrastructure of how to redevelop a currently urbanizing island in the delta into an open system. The intervention should be adapted to each place and its context.

Conclusions and recommendation

- To a rigid paradigm of controlling water in deltas, a 'softer' or 'open' form should be added, in which the mutual influence of specific delta subsystems such as the social, ecological and technological is acknowledged;
- The role of water as a carrier of long term delta dynamics and potential 'means' to sustainable delta futures should be reemphasized;
- There is a number of landscape design options available that can translate this line of thinking into practice. Green infrastructure could contribute to an open system design, exemplified with two examples proposed in the case of the Paraná delta.

Aquaponics a Sustainable Poverty Reduction and Water-saving Enterprise in Uganda



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Keywords: Aquaponics, Sustainable, Enterprise, Water-saving, Poverty

Highlights

Integrating aquaculture and hydroponics (Aquaponics) farming among urban, peri-urban and rural poor households/farmers to provide an alternative source of income and food stuffs that are usually scarce and unaffordable for majority of the households in Uganda. The Aquaponics units are based on a closed-loop water recycling system.

Introduction and objectives

Fish stocks are declining in natural open water bodies due to over fishing and are scarce on the local market due to exports. In addition, traditionally used horticultural food stuffs that are a critical source of nutrients in diets such as tomatoes, onions, etc are also scarce and unaffordable by majority poor due to low production and increasing demand. By introducing Aquaponics, households are given an opportunity to rear and grow own fish and horticultural products; use water more efficiently; earn an extra income and contribute to the overall availability of such food stocks on the market.

Methodology approach

Through demonstrations established at 8 selected sites in the country, communities are sensitized and trained on how Aquaponics work with a view of encouraging adoption of the innovation. The Aquaponic units are connected/ assisted with low cost gadgets to measure water-use efficiency; pH changes; and weight of produce; and households are trained and assisted in gathering, recording and keeping data on the performance of the units with a view of assessing the units' economic viability and effectiveness in reducing household poverty and nutrient deficiencies. Routine monitoring and evaluation of the Aquaponic enterprises is conducted by the Water Governance Institute team.

Analysis and results

One cubic meter of Aquaponics space has been found in a pilot project to produce up to 100 (0.5 kg) fish; 30 kg of horticultural crop; earn on average US$550; and save 24,624 litres of water through water recycling in 6 to 8 months. An Aquaponics unit of this size would cost at most US$350 to establish. From the data, it is clear that the investment cost per cubic meter Aquaponics unit would be recovered in one farming cycle.

WGI decided to up-scale the pilot with a view of commercializing the innovation in 4 project districts in Uganda. The districts were selected on the basis of their poverty and income disparity index levels; their access to fish and horticultural products; and the fish eating culture of residents.

Two demonstration sites were established in each district and the following preliminary data is emerging.

The demonstrations have revealed there are an increasing number of households (on average 2 per district per year) adopting the innovation. Fish yields are averaging 80-100 per cubic meter in non-automated units and 120-150 in automated units. Varying and inconclusive horticultural produce data has been obtained in the initial phases. More reliable data is expected within the next 6 months.

Conclusions and recommendation

Aquaponics farming is a viable enterprise for urban, peri-urban and rural communities. It will go a long way to reduce poverty levels and mitigate nutrient deficiencies that are common among poor household in such locations.

The closed-loop water recycling character of the Aquaponics unit uses water efficiently and saves water for other production purposes, thus ensuring sustainable water-use and spurring economic growth.

Ecosystem services supplied by water in Argentina: Socio-assesment and Law

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Keywords: Ecosystem services, Water, Latin America, Socio-assesment

Highlights

At present, Argentina does not have an environmental services protection law and judicial cases are limited, so researchers should devote more time to be able to design an adequate and effective new regulation.
Our aim is to supply general guideliness to be taken by political policies and/or future regulations.

Introduction and objectives

The purpose of this paper is to make an analysis of the main regulations and case law, regarding ecosystem services protection supplied by water in Argentina, in order to find strengths and weakness in connection with social assesment inclusion.
Then we will be able to design a "Learned Lessons Index", where legal and social variables will be treated at the same level in order to combine and integrate them with the environmental ones.
The spatial scope chosen was from 2002 until present, when main national environmental laws were enacted as a consequence of the Constitutional amendment of Argentina in 1994.

Methodology approach

Exploratory phase:
We will compile regulations and case law about environmental services, and we will follow the direct documental observation method to access to information.
Descriptive phase:
The information taken before will be categorized and make a description of "cases", where the hard core will be the ecosystem services protection supplied by water.
Analytical phase:
The documental analysis implemented before will have the aim to ascertain principles and legal frameworks, in order to find strengths and weakness in connection with social value judgements, which should be applied to legal and case law protection of ecosystem services supplied by water.

Analysis and results

From our legal study, we can state that ecosystem services have not been regulated, with the exception of national native forests law (N° 26.331, 2007), and of some scattered provincial regulation. Its main purpose is to restore, protect, use and manage in a sustainable way "environmental services" supplied by forests. This regulation states that water resources are in connection with all the forest ecosystem and should be protected as a whole.
Our appreciation is that this law fixed a payment system where social assesment was and currently is not taken into account. Our concern is that some research data are showing that social motivations (such as social pressure), is taken as equally important as the economics ones, by the communities which live near and enjoy different environmental services.
Then, water national law (N° 25.688, 2002) did not include the legal protection of ecosystem services, so this was not incorporated by judicial case law.

The only argentine case law which included environmental services protection is named as "Dino Salas againt the Province of Salta", where an indigenous community filed a law suit requesting to stop deforestation, and the Supreme Court of Justice recognized this environmental and human right.

Conclusions and recommendation

One of the difficulties of the lack of regulations is that economic assessment should be performed in a subjective way, and sometimes it cannot be estimated in a fair way.

Discourse-based assessment method may provide useful information helping to identify the social groups which are affected by ecosystem services supply, and by resulting changes in their social welfare.

The majority of argentine environmental laws have an unisystemic approach, so that is one of the reasons which explains the existance of several cases of enviromental judicial citizen´s activisms, due to the law´s enforcement limitations in our country.

Perspectives from Europe: Ecosystem Services valuation for innovation promotion

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Keywords: Water Innovation, Ecosystem Services, SMEs, decision-making, sustainability

Highlights

The DESSIN project aims at fostering ecosystem-enabling innovation in the European water sector and worldwide. SMEs as the drivers of ecosystem-relevant water management and technology solutions need support in making ESS recognized by the market. To this end, DESSIN develops an ESS valuation methodology and provides support services to SMEs.

Introduction and objectives

Small and medium-sized enterprises (SMEs) play a key role in driving innovation in the water sector, including ESS-relevant technologies. To be competitive, the full range of benefits they create needs to be included into water management decisions at all levels. Additionally, SMEs need support in outlining the advantages of their products for the common good. The European research project DESSIN seeks to overcome this predicament through a methodology to better valuate, and thus promote, ESS provided by water innovations. adelphi, as one project partner, investigates market barriers that constrain innovation activity and provides support for SMEs to realize market opportunities.

Methodology approach

The study gives an overview of barriers and drivers concerning the uptake of ESS-relevant water innovation from a European perspective. It first states the difficulties that ESS-relevant solutions face in a highly competitive market where price and service provision matters often more than sustainability principles. It then provides brief case examples for specific technologies and water challenges and discusses the approach taken by the DESSIN project. The study then outlines the experiences made in developing and promoting the valuation approach with the SMEs and makes recommendations regarding the validation and promotion of ESS-relevant technologies.

Analysis and results

Multiple barriers hamper new innovation crucial to improve the environmental impact of the water sector and create sustainable jobs. Most challenges are rooted in a lack of understanding by decision-makers for the external costs of products and services in the long term. By various means, DESSIN aspires to tackle this and improve the decision situation for ecosystem-relevant water technologies. This includes a valuation methodology, and the creation of demonstration sites as well as intensifying collaboration, and hence synergies, among public and private stakeholders. The most important intervention by DESSIN is to improve the capacity of the technology developers to promote the advantages their products provide in terms of ESS. Co-designed with and designated for SMEs, there are numerous services and tools available at the current stage of the project. The results from the project are of relevance globally – judging from DESSIN's experience in working with the technology developing SMEs, it is clear that their capacity to promote the key advantages of ESS-relevant solutions needs to be strengthened.

Conclusions and recommendation

Initiated by the EU's need for new and sustainable innovation in the water sector, DESSIN brings attention to solutions embracing an ecosystem-enabling approach. It specifically analyses the role SMEs play in the change needed toward longer-term oriented decision-making and builds support systems that aid their companies. The tools and services provided to SMEs improve their route-to-market activities and hopefully inspire further research-and-development efforts. The gained understanding on water-related market mechanisms, especially concerning the barriers and drivers, highlights the need for governments to take action in building business environments conducive to water innovation with a triple bottom line.

Phototctalytic Degradation of Phenol in Industrial Wastewater using Modified TiO_2 in Visible Light

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Keywords: wastewater treatment , organic contaminant removal, advance oxidation process, photo catalysts, power saving

Highlights

- Investigate effective operating parameters on photocatalytic processModifying visible light activating TiO_2 Nano particles.
- Modifying TiO_2 Nanoparticles to work under visible light
- Comparison between efficiency of degradation under UV and visible irradiation at similar operating condition

Introduction and objectives

Contaminated water has important effect on human health and has been a major concern in recent decades. In particular, there have been increasing concerns over the contamination of drinking water supplies with trace levels of organic pollutants like phenolic compounds.

Heterogeneous Photocatalytic oxidation using TiO_2 nanoparticles has introduced as an alternative technique for water treatment processes to degrade/decompose of organic compounds.

The present research study on effective parameters of degradation efficiency for organic contaminant which have investigated recent years, and describes which one is more efficient and practical for industrial level.

Methodology approach

- Review recent investigation about effect of mentioned parameters on efficiency of photocatalytic degradation
- Select phenol as organic contaminant and use TiO_2 doped with Ag under visible and UV light. In many chemical industries, phenol and phenolic compounds are widely used and have become common pollutants in wastewater bodies. TiO_2 is the most common photocatalyst (due to its optical and electronic properties, low cost, chemical stability and non-toxicity) and proven to be efficient for degradation of phenol. Moreover, TiO_2 is known to be an excellent photocatalyst for complete mineralization of phenol in water. Electron–hole recombination leading to lower rate of photocatalysis is a disadvantage of TiO_2.

Analysis and results

A new class of activated silver doped TiO_2 was found to enhance photocatalytic oxidation of phenol under UV and visible light illumination. The light response range and photo-efficiency of TiO_2 is limited because of its wide band gap. It has been reported that TiO_2 doped with metals extends the absorption wavelengths from UV to visible region that enhances visible light photocatalytic activity.

Pollution degradation under visible light has been studied for 5 mg/lit phenol concentration in the presence of 1.5 g/L catalyst. The results showed maximum degradation efficiency of the process after 240 minutes for mentioned phenol concentration as 82.6%. At the same condition under UV irradiation we get maximum 72.8% degradation efficiency. It shows effect of catalyst modification for using under visible light irradiation and it can lead to save energy in this case. Photoreactor volume used in this research was 0.7 lit, pH=6.8 and T=25°C.

Conclusions and recommendation

Characterization of synthesized Ag-TiO_2 has been analyzed by XRD, SEM and DRS analysis and success of the synthesize has been proven.

Degradation efficiency of two different photocatalytic processes have been measured at similar operation conditions and competence of silver doped TiO_2 has been proven.

As efficiency of this process with mentioned operating parameter is high and due to its advantages, it is recommended for future work to design photoreactor with higher volume and suggest a practical way to separate nanoparticle photocatalysis after each cycle of process. This approach could overcome problems to use this process in industrial scale water treatment.

Data Drought: An Assessment of Global Water Monitoring Systems

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Keywords: Monitoring, Data, Water, SDGs, Technology

Highlights

Water monitoring systems are fundamental to solving today's most important global water challenges but have been in decline since 1980, resulting in gaps in monitoring water for livelihoods and ecosystems. New technologies and approaches can provide a cost-effective path towards revitalizing the world's water monitoring system, delivering significant global benefits.

Introduction and objectives

The mismatch between the need for and supply of data on water resources is more notable than ever. On the supply side, recent years have seen a decline in the coverage of water monitoring systems. This deterioration in water monitoring comes at the same time that increased volatility in global climate patterns and rising demand for fresh water has resulted in a greater than ever need for accurate and timely water data. This report investigates the current state of the water monitoring system, quantifies key gaps, and introduces a cost-effective approach and set of key recommendations to close these gaps.

Methodology approach

This research uses both qualitative assessment and quantitative data analysis to document current data resources, determine need and categorize value. To assess the gap, global aggregated data sets that collect location for active in-situ sensors and stations is compared to the minimum station density based on best practices from organizations such as the World Meteorological Organization's (WMO). For quantifying the benefits, anecdotal evidence of benefits from increased data is combined with bottom-up estimates on the financial, environmental, and social benefits from increased data. All quantitative estimates are complimented with a review of existing literature and a selection of case studies.

Analysis and results

Water data is the foundation of many critical environmental, economic and social decisions, including many of the objectives set forth by the range of Sustainable Development Goals (SDGs). Yet the global water monitoring system has been in decline since 1980 and today there are numerous global gaps in station coverage; streamflow monitoring has declined nearly 40% from its peak number of stations, and precipitation stations have declined by over 30%. Across all components of the water monitoring system, developing countries – particularly Asia, Africa, and South America – are the areas with the greatest monitoring and reporting gaps.

The good news is that closing this gap and developing a global water monitoring system that is efficiently managed is now more cost-effective and scalable than ever given developments in in-situ monitoring, remote monitoring, and systems for data analysis. When billions of dollars and billions of lives are at stake – as is the case with the global dialogues around climate change and sustainable access to water resources for both livelihoods and ecosystems – every marginal increase in accuracy in water data can deliver significant impact.

Conclusions and recommendation

This research identifies many barriers to overcome in closing the global water monitoring gap. First, a multi-sector coalition for driving the needed change must be established. Second, there needs to be a comprehensive framework and set of tools at the basin-level to quantify the gaps and efficiently close the gap. These two actions will provide the platform for assessing the gap and closing it. Once established, focusing effort on streamflow monitoring and developing countries is expected to yield the greatest impact. In addition, we recommend developing partnerships to explore this macro-level analysis at a more granular level.

Impact of Wetland Conservation on the Livelihoods: A Case Study

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Keywords: Wetland, ecosystem benefits, economic valuation, livelihoods, collection action

Highlights

Oussudu wetland in Puducherry, India, generated multiple ecosystem benefits utilised by various stakeholders. After 2008, conservation efforts by the governments resulted in impacting different stakeholders in different ways. What is the economic impact of conservation on the livelihoods? What shall we do for achieving win-win outcome by alternative institutional arrangements?

Introduction and objectives

Oussudu wetland, an interstate wetland governed by Tamil Nadu and Puducherry governments, was providing wet-land based and dry-land based ecosystem benefits to people. After 2004,due to land-use changes in the region and conservation efforts by the governments, certain changes were brought in the ecosystem benefits. The governments declared the wetland as bird sanctuary and restricted the people's access to ecosystem benefits. What is the impact of conservation efforts on the livelihoods of the people? Who gained and who lost? An economic valuation study was conducted to investigate the above and the paper discusses the study results.

Methodology approach

The study results come from an inter-disciplinary approach combining inputs mainly from hydrology, ecology and economics to assess the change in the ecosystem services and their impact on the livelihoods under different regimes. The economics approach utilises an approach, namely, 'before' and 'after' conservation efforts. Apart from utilising existing secondary data on land-use changes, rainfall, water levels, etc, we conducted extensive primary survey among various stakeholders in the region in order to assess the livelihoods impact of conservation efforts. Estimation of the economic values of the ecosystem services was carried out by using various economic valuation techniques.

Analysis and results

After conservation efforts, many ecosystem benefits (such as, fish, fodder, plants,etc) enjoyed by the local people have been restricted and a new set of ecosystem benefits (such as, recreational benefits) have been created. So, the stakeholders of the ecosystem benefits at present are entirely different from that of before conservation. Moreover, the nature and size of the ecosystem benefits enjoyed are very limited now. An economic valuation exercise over the current ecosystem benefits suggests that in 2015, the recreational benefits enjoyed by all the visitors is estimated to be Rs. 5.72 millions (US$ 95,333). Agricultural benefits amount to Rs.11.5 millions (US$ 191,667) per year. The estimated value of groundwater used for irrigation is ` Rs. 269,652 (US$ 4450) per year. The economic value of biodiversity conservation is estimated to be Rs 2.44 millions (US$ 40,000) per year. The total economic value of ecosystem services with management is Rs. 19.67 millions (US$ 327,834) per year and the net present value of the benefits is Rs.82.89 millions (US$ 1.4m). The results suggest that expected value of ecosystem benefits would go up significantly in case the local people are also involved in the conservation effort and through initiating a benefit sharing arrangement.

Conclusions and recommendation

Enhance awareness and cooperation among stakeholders and incentive-based institutional arrangements for managing wetland. Ensure cooperation among industries and government in order to treat effluents. Control pollution from industrial units to improve water quality. Regulate access to ecosystem benefits such as fishing, collection of medicinal plants, bathing, etc. Since tourists are willing to pay for improved facilities, increase the entrance fee to cover management costs. Monitor solid waste dumping and groundwater exploitation by commercial establishments. Ensure farmers adopt practices that minimise non-point source pollution from agriculture. Share revenue from ecotourism and water supply with local administration and households through benefit sharing.

Seminar 5: Water for sustainable and inclusive cities - how to induce change?

Urban Drainage in Barcelona: from hazard to resource?

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Keywords: urban drainage, resource, hazard, Barcelona

Highlights

Stormwater needs to be considered as a resource rather than as a hazard.

Stormwater can create flows amenable to various non-drinkable uses easing the pressures on urban water supply.

In Barcelona, progress is being made towards the consideration of stormwater as a resource but many obstacles (physical, institutional) remain.

Introduction and objectives

Approaches to urban drainage are changing the view of water flows in cities from one that emphasizes the hazardous nature of these flows to one that sees the potential of stormwater and rainwater for enhancing the local water resource base.

Our objective in this paper is to trace the historical trajectory of urban drainage management for the city of Barcelona from the 19th century to the present highlighting the main changes and related challenges in approach, from the "tout a l'égout" philosophy of the 19th century to the sustainable urban drainage systems of the early 21st century.

Methodology approach

Research for this paper has been based on literature reviews (on urbanization, water , and urban drainage); archival work; review of relevant technical plans and documents as well as selected interviews with staff managers of the Barcelona City Council, especially those responsible for stormwater management.

Analysis and results

We have identified three main historical periods which we review and analyze in detail, particularly regarding their successes and failures. First we focus on the so-called "Garcia Faria Plan" of the late 19th century which, for mainly sanitary purposes, followed the approach (then dominant in Europe) of "tout a l'égout"; that is the need to move away from urban areas as rapidly as possible stormwater and wastewater flows. This approach lasted for much of the 20th century until and because of the increasing problems of existing drainage systems to absorb stormwater, the city undertook the construction of a system of large underground stormwater reservoirs. Due to pollution, however, these flows could not be reused and were slowly released to wastewater plants and then to the sea. Finally since the early 2000, urban drainage is increasingly adopting the view of reusing stormwater flows as seen in a variety of new urban projects. However, the transition towards sustainable urban drainage systems may be hampered by the physical layout of the city (Barcelona is very dense) and also by conflicting opinions by urban experts regarding the feasibility of these new approaches.

Conclusions and recommendation

In Barcelona the change towards sustainable urban drainage systems is timely and relevant for at least two reasons both with connections to climate change: first the need to generate new and alternative water resources at the local scale given the projected declines in precipitation and water supply for the coming decades. Second, the need to manage adequately excess flows derived from more frequent flood events. But this may need some institutionalk flexibility and especially the full implementation of water policies based on the "fit for purpose" concept.

Recalibrating the Los Angeles River: Design as Advocacy for Change

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Keywords: Rivers, Green Infrastructure, Landscape Architecture, Urban Design

Highlights

Designers have been a critical force catalyzing the recalibration of the L.A. River into a new and improved green spine for Los Angeles. This presentation highlights the efforts of landscape architects and urban designers to inspire the public and advocate for transformative change in recalibrating the Los Angeles River.

Introduction and objectives

Most recognized as an engineered flood control channel, the Los Angeles River and its extensive network of concrete canals, tunnels, and buried conduits encased by industrial lands and rail corridors, has severed communities socially, economically, and environmentally. Civic leaders joined forces in 2007 to fund the visionary Los Angeles River Revitalization Master Plan (LARRMP) originally led by a team of landscape architects including Mia Lehrer + Associates (MLA). This spurred a long and inclusive process of transforming the flood control channel into a source of socio-economic revitalization and a crucial step in re-greening the sprawling city.

Methodology approach

The revitalization of the L.A. River has been a collaborative effort, however, building towards this comprehensive green infrastructure network has been dependent on effective and innovative landscape architecture and urban design strategies including community-driven design and an ecological planning approach that embraces multi-beneficial thinking. Uniquely positioned as part of the original LARRMP team, MLA employs this approach while advocating for a continuous river greenway and adjacent community opportunity areas. Through transforming complex planning efforts into legible design perspectives, MLA has envisioned several projects from parks with flood capacity to green neighborhood networks that inspire and motivate stakeholders and public officials.

Analysis and results

Since the inception of the LARRMP, important strides have been made in the creation of this new green corridor. The efforts of MLA alongside those of non-profits, consultants, organizations, municipalities and community groups have resulted in several planned and/or realized projects turning community-driven design ideas into green infrastructures that assure multi-modal connectivity; provide habitat, recreation, flood control, and stormwater treatment. These endeavors have both spurred changes in policy and captured the imagination of the public. Most notable include the EPA declaring the entire concrete-lined Los Angeles River channel as "traditional navigable waters" in 2010. This designation was crucial to applying Clean Water Act protections throughout its 834-square-mile urban watershed triggering new policy and opening the door for new projects once considered risky that are now not only feasible but desirable to meet the new stormwater quality objectives. In 2015, with the help of visualization provided by the local design community, the Army Corps of Engineers recommended 'Alternative 20,' a $1-billion plan to restore an 11-mile stretch of the river that passes through downtown. This has increased the support and attention of local, state, and federal government will likely continue with revised County-led Lower Los Angeles River Master Plan.

Conclusions and recommendation

The transformation of the L.A. River reflects the broader change in thinking about infrastructure. A new, layered, multi-beneficial planning approach supported by the power design has to communicate vision through a combination of advocacy, community engagement, and projects has awakened a new perspective to this once forgotten corridor. People no longer see the L.A. River as merely a flood control channel, they now embrace it as a living, evolving, community-beneficial system just as so many like-minded communities around the world are coming to understand their own rivers.

Sludge Management: Changing the Face of Sanitation Across the Globe


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Keywords: Sustainability, sanitation, sludge management

Highlights

Creating appropriate transport and treatment mechanisms for pit waste is the focus of FSM work and critical to the success of developing improved approaches. Water For People work shows the right balance is needed between business capacity, finance, technology and demand, otherwise progress will either fail or be unsustainable.

Introduction and objectives

Since 2011, Water For People has facilitated the creation of pit emptying businesses in the unplanned areas of three African cities. The basic model is where entrepreneurs purchase rudimentary emptying equipment, finds customers and employs an operator to empty the pits. The entrepreneur hires a vehicle to transport full barrels of sludge to the treatment plant. Whilst this model is robust and profitable, it has weaknesses including poor value for money offered to customers. In addition, crowding-in is not occurring and the scaling process is too slow to have the desired impact on public health.

Methodology approach

Water For People recognized that existing business models are not the cleanest, most efficient, or most profitable way of emptying pits. Attempts were made to change the emptying technology to make the process cleaner, better finance, and to change the business model to enable growth, but all have floundered. This session will focus on examples of our on-going work in Kigali, Kampala and Blantyre and give clear illustrations of the main constraints within the system. It will outline the results of the density testing over 100 pits and lead to a re-evaluation of the whole emptying process.

Analysis and results

The difficulties of achieving the desired city-wide scale for pit emptying services is hampered by tight margins, the disgusting nature of the business, the inefficiencies of pits in absorbing water, a customer base who is prominently poor, an unwillingness of banks to finance sanitation business and lack of entrepreneurship and acumen within the typical private sector operator. These constraints are all interlinked and compounded by the fact that the vast majority of the contents they remove is water, which is very expensive to both transport and treat. A better approach is possible and we need to shift our technology research efforts away from trying to design better and cleaner emptying equipment and focus instead on improving the performance of the humble pit latrine so that it only produces dense thick sludge and only requires emptying once every 15 years. The work in Kampala shows that dense sludge can be profitably converted in briquettes and lead to a simplified decentralized approach to waste treatment. This would represent better value for money for the consumer, greater efficiencies along the whole length of the sanitation value chain, and less likelihood of indiscriminate dumping.

Conclusions and recommendation

The key to scaling improved pit emptying services in African slums is to develop business models based around cleaner emptying processes, encouraging higher caliber of entrepreneurs and finances in the sector. These would need to be complimented by technologies which improved the efficiency of the pit latrine in dealing with the large quantities of water used to flush the toilet, small decentralized waste processing plants and facilitating businesses which converted sludge into valuable fuel briquettes. A six prong approach is needed and not a silver bullet, single shot, quick fix, technology based solution.

Bengaluru- reusing waste-water as a resource

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Keywords: Waste-water, groundwater, reuse, aquifers, wetlands, bio-diversity, circular flows

Highlights

Faced with a limited availability of fresh water the city of Bengaluru is using treated waste-water after polishing in constructed wetlands to fill its lakes and recharge groundwater. In the process urban bio-diversity is enhanced,lakes saved and groundwater aquifers recharged. Replicability is now on.

Introduction and objectives

The city of Bengaluru in India gets its water from a river a 100 km. away and 300 mts. below the city making it a very expensive water with high embodied energy. There is a limit to water drawal too. Hence it is now looking at reusing waste-water and harvesting rainwater where its urban lakes can play a major role. In one experiment at a 50 hectare lake at Jakkur a 10 mld waste-water treatment plant and a constructed wetland help keep the lake full and groundwater aquifers recharged for supplemental water to the city.

Methodology approach

Using the Integrated Urban Water Management approach and adopting a decentralized waste-water management strategy the city has rehabilitated a 50 hectare lake. The conventional Upflow Anaerobic Wastewater Treatment Plant was located upstream of the lake. Incorporating and further polishing the wastewater in a constructed wetland meant the lake was always full and stocked with fishes. Bird bio-diversity increased and the aquifers recharged to the tune of 8 million litres every day. This decentralized approach is now being tested in 4 other lakes in the city.

Analysis and results

The waste-water consistently met norms set by the State Pollution Control Board for release of treated waste-water to urban water bodies. BOD was less than 20 mg/l. The wetland was found to reduce Nitrates by about 47% and Phosphates by 80%. The sludge in the wastewater treatment plant was found usable for agriculture by the University of Agricultural Sciences.

A water balance test suggested that about 8 million litres of water being recharged. A water quality test from an open well showed that the water met potable water quality except for biological parameters. Overflow from the lake was measured at about 1.5 million litres per day feeding a downstream lake. The city produces around 1100 million litres of waste-water and a method has been established to put it good reuse using ecological systems of wetlands and lake restoration.

Bird biodiversity rose in the wetlands and grey pelicans now roost in the lake throughout the year.

Conclusions and recommendation

Using an Integrated urban water management approach and by recycling waste-water using both a conventional and ecological approach it is possible to protect and enhance water bodies in the city and keep them full. By recharging the aquifers they provide valuable supplemental water at very low embodied energy and price. Fisheries and sale of sludge can pay for the waste-water treatment plant. If groundwater is appropriately valorized and priced financial sustainability can be achieved for the entire system. The Jakkur lake ecosystem demonstrates a model ready for replication in urban areas of India.

Building social entrepreneurship to face water challenges in Mexico City

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Keywords: Social incubators, innovation, co-creation, inclusiveness, Mexico

Highlights

The technological, methodological and social innovations are the keys in the development of solutions that can be used to fix the water issues in Mexico. Being involved in the challenges and getting trainings, coaching, open innovation processes, gives big and small actors another perspective than traditional solutions.

Introduction and objectives

Mexico City is faced with tremendous water challenges: only 7% of the wastewater is treated, water supply suffers of 40% leakage and 10 million Mexicans don't have access to safe water. Moreover groundwater is decreasing year after year, water is highly polluted and floods are regularly devastating parts of the city.
In reaction to this water crisis, Veolia is proposing a new approach based on open innovation and social businesses. The objectives of the project are to:

- Build local solutions to Mexico City's water issues
- Push local innovation to create social impact by fostering co-creation with local actors

Methodology approach

In 2015, "SenseCube Agua Urbana" was created. It is a social incubator of water-linked projects in Mexico City. Adding values from SenseCube know-how in entrepreneurship and water expertise and means from Veolia and Sacmex in a common support and coaching system to create social innovation and impact.

- Support or creation of social companies (financial, skill-based sponsorship…)
- Build a strong network among social actors (sourcing start-ups, create links…)
- Awareness on social innovation among Veolia and SACMEX to better co-create efficient solutions

Analysis and results

Potential social and environmental impacts of start-ups are evaluated along 3 criteria:

- Job creation;
- development of access to water;
- health and hygiene benefits for the staff and served populations.

These criteria are used from initial selection through the follow-up of the start-ups. The project is unrolled, with 2 calls for proposals, for which almost 100 start-ups applied. 11 were selected in the program to propose innovative solutions to Mexico water issues. A six-month incubation period began in July 2015, featuring mentors from different sectors of the economy to support the entrepreneurs with their strategy, commercial development, communication and financing needs (200 hours workshop and mentorship, 48 hours coaching and leadership sessions, 80 hours weekly follow-up).
Typical projects are:

- Gota de Esperanza: procuding up to 5,000 litres of water per day from the air.
- Tubepol: Technology for pipes and leaks without digging.
- ResilienteMX: Digital platform to prevent flooding.
- Conciencia Hídrica: real-time hotel water-metering and awareness raising among guests.

Conclusions and recommendation

In case of water challenges in Mexico City, none of the concerned actors has the solution by itself. Innovation and social performance will come from partnerships linking entrepreneurial spirit of social start-ups, means and resources of big corporates and legal support from Mexico City's institutions.

At this stage, some key points can pointed out.

- Full involvement of each actor is necessary, to give rise to co creation.
- Technology can only be a part of the solution.
- Local solutions can only become global answers if they are replicated on a large scale with help of big corporations

Urban sustainability: learning from failure. Magdalena River Case, Mexico City.

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Keywords: Green Infrastructure (GI), Soft System Methodology (SSM), project failure, sustainability and river restoration.

Highlights

Sustainability should be a priority in urban areas, but some sustainable projects fail because numerous factors that affect the implementation were not contemplated during the design phase. This research aims to study a failure case to understand the restrictions towards the implementation of sustainable projects and better water management.

Introduction and objectives

The Magdalena River is the only river that meanders in a natural form in Mexico City. However, its ecosystem services are neglected as the river is effectively an open sewage. In 2006, a group of experts in water and sustainable matters created an Integrated Master Plan to restore the river. Nevertheless, when the construction began a series of problems started to limit the completion of the project and the possibility of the river's rehabilitation. This research studies this project's failure to understand the barriers implementing sustainability in Mexico City.

Methodology approach

Soft System Methodology (SSM) is used in this research as it helps to understand the problem from the viewpoint of the people involved and it is highly effective when the problem itself is undefined. SSM proposes seven steps to identify the problem in the real world and the possible solutions in conceptual models or system worlds. Finally, SSM compares both the real world and conceptual models and proposes actions to change the system. In that manner, this research proposes a series of recommendations to be considered in future projects in order to overcome successfully the implementation phase.

Analysis and results

The Magdalena River flows through several political divisions and diverse areas involving several actors, from the federal government to several municipalities, while passing through historic boroughs and informal settlements. The Magdalena River project's case scenario is mapped in a "rich picture" developed from interviews, newspaper articles and papers. The rich picture shows that the implementation phase is limited by a poor planning and series of factors that are difficult to map, as the informal relationships between the actors. Then, "root definitions" of the problem were constructed to define the actors and how they are related to the river's project. Secondly, a broader set of interviews with experts and stakeholders in water and sustainable projects helped to create "Conceptual Models", as they introduced the limitations that this kind of project faces and the possible solutions they think are necessary to accomplish sustainability in relation with water management in Mexico City. The problem´s "rich picture" and the "conceptual models" were compared to find desirable and feasible changes in the system that lead to action.

Conclusions and recommendation

The poor public participation and the lack of institutional adaptability to change their ”business as usual” way of proceeding were the main restrictions towards the Magdalena River’s restoration. Public participation was highly limited as the election cycle in Mexico restricts project continuity, which also compromises the quality of the project itself. It is recommended to incorporate flexibility which can be achieved by creating a macro project that can be constructed in several, small and independent parts or sub-projects.

Resource recovery and reuse as an incentive for a more viable sanitation service chain

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Keywords: Resource recovery and reuse, institutional processes, business models, partnerships, developing countries, benefit sharing

Highlights

The paper shows options of how resource recovery and reuse (RRR) can be an incentive for sanitation service delivery, by cutting costs or using generated revenues from reuse to fill financial gaps across the service chain to complement other supporting mechanisms for making waste/water management more attractive.

Introduction and objectives

Recovering nutrients, water and energy from domestic waste streams, including wastewater and fecal sludge, is only slowly gaining momentum in low-income countries. Resource recovery and reuse (RRR) offers value beyond 'environmental benefits' through cost recovery. An expected game changer in sanitation service provision are business models where benefits accrued via RRR can support upstream sanitation services despite the multitude of private and public stakeholders from waste collection to treatment. The presentation evaluates institutional options and common bottlenecks for increasing the viability of the sanitation and waste management service chains via resource recovery and reuse.

Methodology approach

The conceptual framework for the study of about 70 empirical cases was based on a business modeling framework and the analyses of stakeholders, the institutional and regulatory environment. The analysis was conducted in-depth in four developing-country cities (Kampala, Bangalore, Hanoi and Lima). Key analytical tools used were: a) a 'triangle analysis' – to evaluate the legal-political system (i.e. the existence, content and structure of policies and regulations and the effects on the RRR sector); b) a 'power and interest analysis' – to map out and evaluate the roles, relationship dynamics of key stakeholders, and c) a business model analysis.

Analysis and results

Key results from the study showed that:

1. Sustainable sanitation through resource recovery and reuse can be achieved with integrated business models that go beyond standard sanitation services and transform waste into valuable resources such as biofuels and fertilizer while also improving water management. New models for benefit sharing are required between the private and public sectors.
2. Clear social and economic benefits to key stakeholders will drive the formation and sustainability of strategic partnerships, which influence business viability in the RRR sector. However, benefits generated through RRR should ideally support the upstream sanitation chain.
3. It is important to note that where multiple governmental institutions are responsible for designing policies and implementing interventions, unclear and complex coordination issues make it difficult to capture economic value and plug it back into the value chains, posing challenges for both pure public sector models and public-private partnerships.

4. Legislation is largely supportive of reuse, provided certain quality standards are adhered to and although structures for implementation and enforcement are still relatively weak they do exist and can being strengthened.
5. There are different options to increase the overall viability for sanitation service chains.

Conclusions and recommendation

Smart policies, effective institutions, and strategic partnerships are needed to catalyze the public and private benefits of RRR initiatives. Innovative and strategic partnerships have an important emerging role in transforming waste into business opportunities because of the potential cost leverage for sanitation services; but clear benefit-sharing mechanisms will drive the sustainability of the partnerships.

Catalouging Possibility: Implementation of Sustainable Urban Stormwater Projects in Stockholm

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Keywords: Urban, Stormwater, Sustainability, Implementation, Knowledge management

Highlights

Projects and initiatives rarely do well in isolation, they need interest, awareness and investment to grow. Cataloguing sustainable urban stormwater projects in Stockholm has facilitated an exchange of knowledge between agencies, assessed implementation challenges and analyzed project outcomes, allowing stakeholders to make more informed stormwater management decisions.

Introduction and objectives

World populations are urbanizing and building larger, denser, impervious cities that are increasingly disconnected from natural water cycles. Modern cities now generate large volumes of stormwater, which often overwhelm existing infrastructure causing: flooding, pollution of surrounding waterways, increased sewage treatment costs and groundwater deficits.

Developing and implementing a diverse portfolio of best management practices for stormwater capture, cleaning and reuse is imperative to the growth, maintenance and viability of urban ecosystems. The core objective of the UrbanRain: Stockholm catalog is to improve information accessibility and facilitate the inclusion of sustainable stormwater infrastructure in development projects.

Methodology approach

Compilation of the UrbanRain: Stockholm catalog began through an extensive investigation into proposed and pre-existing projects in Stockholm. Once a project was identified all publically available data on the project was collected and a standardized questionnaire was given to the responsible party (if identifiable). Collected responses were then catalogued and assessed to identify trends and implementation challenges, while received data was compiled and analyzed in conjunction with literature values and management priority maps of key drainage and risk factors to compare technologies' placement and performances.

Analysis and results

Data collection for the Stockholm stormwater catalog highlighted the need for a common resource, as it was difficult to track the implementation of initiatives through the many agencies that were often jointly responsible for projects. This lack of clearly designated responsibility resulted in cases where initiatives had been abandoned, either in the planning stages or after implementation. Despite these obstacles many of the contacted stakeholders positively regarded sustainable stormwater infrastructure and reported a keen interest in having a compiled database of projects as a resource.

The current version of the UrbanRain: Stockholm catalog is a web-based, open-access database that is designed as a decision making and planning tool. The interface allows projects to be searched by a variety of criteria to reflect the needs of the survey respondents. Further, the database allows sustainable stormwater solutions, often implemented in isolation, to be viewed as part of a larger water management network. A critical perspective for future optimization of sustainable stormwater infrastructure. Information about new or overlooked projects may be submitted through a form, so the database continues to stay updated with

minimal investment of resources. All research findings and data analysis results are publically available on the website.

Conclusions and recommendation

Sustainable stormwater management is an interdisciplinary and multiscale issue that involves a wide variety of stakeholders who possess varying degrees of subject literacy. An open-access resource that provides clear information and reliable data improves the appeal and accessibility of these technologies, crucial factors to their implementation.

Developed in collaboration with the UrbanRain project and Tyréns, UrbanRain: Stockholm serves as a starting point for developing a network of catalogs to encourage open dialog and adoption of sustainable stormwater technologies. Future improvements could include interactive features where individuals can report local areas that frequently flood or request reuse diversion for community farms/gardens.

Initiatives for sustainable groundwater management by public water utility.

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Keywords: private water tankers, groundwater, reuse.

Highlights

This study probes into how informal water supply industry private tankers mine the groundwater and supplies to end users in the peri urban areas; how public water utility provider has addressed this unsustainable practice and what other best practices can be introduced to reduce groundwater exploitation and equitable distribution.

Introduction and objectives

Bangalore's peri-urban areas are witnessing proliferating business of private tankers who source water from bore wells without a check on quality, and charge exorbitant prices during summers. Quality concerns and public discontentment forced water board authorities to sell Cauvery River water to users at a nominal fee. This was a welcome move but not sustainable and equitable. Hence, the objectives are:to demonstrate the extent to which private water tankers are capitalizing on limited piped water supply; what is the success rate of measures taken by the public water utility provider to tackle the issue and policy prescriptions.

Methodology approach

Survey and discussions with Tanker owners were conducted to understand the dynamics of supply vs demand in terms of Areas of operations, Delivery schedule and delays, Demand assessment by different types of end users (largely domestic and construction) and seasonal variation. The dynamics of private tanker economics and the profit margins they are earning was compared with the Bangalore Water Supply and Sewerage Board tanker supplies. Feedback on quality, quantity and pricing were taken from the end users of both public and private suppliers has aided in recommending certain policy prescriptions and strong regulatory framework.

Analysis and results

There are various dimensions of anonymity observed while estimating the number of private tankers getting into the business as there is no formal registration or licensing in place to trade the right quality and quantity of water. There are about 15,000 private tankers operating in the city since five years.This study was for tanker operators in a ward spanning an area of 24.5 sq km.There are around 85 tankers involved in trade making on an average 35 trips per tanker per day, one lakh tanker trips per month. Prices vary season wise. Traders disclosed assured profits of approx. 1$ (US) for every trip. Number of trips made per month approximately is 350 to 500 per month in summer seasons. To ensure their profit range the tankers confine sale of water to 1-10 kilometers only with most being 3-5 kms. Some well owners sold upto 60 tankers per day during peak seasons. The BWSSB introduced GPS enables 30 tankers since 2014 with a capacity of 6,000 litres, available on call 24/7. Drivers worked in three shifts and were tracked by engineers at the call centre. Drivers tally cash receipts with entries in the log book made before dispatch.

Conclusions and recommendation

This initiative by board has ensured welfare of the people by providing clean, safe water and curbed the unsustainable groundwater abstraction, but is limited to certain parts of the city. The board is unable to take action against the tanker mafia in peri urban areas as there are technical impediments like overseeing the expansion of piped water network. Way forward to scale up this service, study recommended selling treated water for non potable purposes. BWSSB has 14 sewage treatment plants which are recovering treated water of good quality fit for secondary non potable usages and are selling to industries.

Managing Extremes: Sustainable Planning for Water Resources in San Diego

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Keywords: Extremes, El Niño, Urban Planning, Sustainable Cities, Collaborative Policy-Making

Highlights

To enhance sustainable water resource management practices in San Diego, California, the research investigates: locations for flood water retention measures and improving institutional arrangements for implementation of these measures. This research is conducted within the Spatial Planning Faculty at Technical University Dortmund in cooperation with the San Diego Planning Department.

Introduction and objectives

San Diego is currently facing one of the worst ongoing periods of drought in the history of California and is simultaneously threatened by flood caused by the largest El Niño event on record. Flooding causes not only physical damages to buildings and infrastructure but also creates environmental hazards like urban runoff pollution from heavy rainfalls. In consideration of this and current deficits in water storage and recycling, the project's aim is to promote a more sustainable water supply by implementing different measures. This objective is to be met through both a technological and an institutional approach.

Methodology approach

To meet our research goals one main method is the Best Management Practice (BMP) locator, an GIS data based method to analyze water streams. It is used to work out which places are best for water storage to improve conditions during flood events. Additionally, a policy analysis is elaborated to figure out the best constellation between relevant stakeholders and actors to implement the measures for an overall more sustainable water supply during both weather extremes. An excursion to San Diego to transpose the theoretical work into practice via interviews and local site visits is currently underway.

Analysis and results

A policy and actor analysis offers insights into present institutional arrangements, particularly who works together in creating planning policies and actions. This analysis, considers these arrangements and identifies points for greater collaboration between actors involved in water management. The analysis, furthermore, considers the priorities of the city and neighborhood levels, and integrates these preferences into the final suggested measures. This is important in achieving a broad participation and engagement with a wide range of stakeholders, a crucial aspect of trying to realize possible measures in a changing environment (e.g. increasing urbanization, water consumption, water variability).

The results of the BMP locator offers locations for preventative measures in case of extreme storm events. Special emphasis is put on low impact development (LID) approaches. LID relieves the water supply and wastewater disposal system during these events and helps prevent runoff pollution along the Pacific Coast, a crucial issue for the San Diego area. Furthermore, the research examines how these approaches can help to store water for times of drought. These findings will then contribute to a measure catalogue with

recommendations for the case study areas, East Village and Mission Valley, two of San Diego's most prone to flooding and highly developed neighborhoods.

Conclusions and recommendation

In addition to the measure catalogue, another contribution the research will produce is a general policy advisory statement for the City of San Diego Planning Department. This advice should not only be applicable to San Diego, but potentially transferable to other problematic and water-stressed regions with similar weather conditions. The measure catalogue as well as these general recommendations are elaborated in complement to already existing plans and programs.

At this stage, the research is still in progress, but will be completed by July 2016.

Sustainable wastewater reuse strategy implemented in Sri Lanka

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Keywords: Environment, Income, Satisfactory, Service, Pollution

Highlights

Optimum use of wastewater in vegetation in a well-planned drainage system with regular purification to enhance the good health, affordable economy and reduce environmental pollution.It is one of the most outstanding ways to save water to build a prosperous country.

Introduction and objectives

Water-related problems are being increasingly recognized as one of the most immediate and serious environmental threats to mankind.The latest Global Environment Outlook of the United Nations Environmental program (UNEP) reports that about one third of the world's population currently lives in countries suffering from moderate-to-high water stress, where water consumption is more than 10% of renewable freshwater resources. Application of treated wastewater could be an alternative solution for reducing pipe born consumption in agricultural lands.The key objective of this study to identify the practical difficulties in reusing treated domestic wastewater for home gardening.

Methodology approach

A four story building with 12 apartments in the Badulla district in Sri Lanka was selected to study practical difficulties in reusing wastewater. The water consumption was recorded and the waste-water production was calculated before collecting to a plastic shell tank. A filtration system was introduced with screening as pre-treatment. The above cleared water was used for the domestic agricultural purpose basically for production of vegetables and flowers .

Analysis and results

It was found that the wastewater collection could be estimated at 45% of the total water used and 60% of the wastewater was reused in agricultural field. Therefore a 20% of drinking water for daily consumption of relevant consumer was saved which will finally contribute to expanding service coverage with more new connections.

Because of partially treated wastewater introduced to the agriculture with high nutrients such as N and P, the food production was increased. Father the environmental protection was ensured as it could minimize the surface water pollution. An additional cost of Rs. 3500/= per month could be saved based on the calculation done using the current tariff.

Successful wastewater reuse projects have to be designed to reflect the specific local conditions, such as water demand, urban growth, climatic condition, socioeconomic characteristics and preference, as well as institutional and policy frameworks.

Conclusions and recommendation

For a positive wastewater reuse on a sustainable basis some key factors are identified. Proper planning of wastewater reuse is important with reference to specific needs and conditions. This could be facilitated by incorporating wastewater reuse for water management. This planning needs to be taken for all issues, including public health, stakeholders, and the viability of operation and maintenance. Economic and financial requirements are needed to be studied in depth, as less viable schemes for wastewater reuse will create a social burden and are short-lived. Local capacities, including human resources and legal framework are very important in achieving sustainable targets.

Water Security in changing paradigm through institutional & participatory mechanisms

Author: Mr. Amit Kumar, Environment Watch India, Director-Programmes & Research, India

Keywords: Institutional, Participatory, Sustainability, Equitable, Decentralized

Highlights

The risks of our paradigm of unsustainable development have exacerbated with changing climate conditions and all of these risks are interconnected; a holistic view and approach is key to mitigating them.Recent extreme events show the unpredictability and intensity of these risks and we can only check them by sustainable development

Introduction and objectives

In a changing climate scenario we are not only recognizing but experiencing the impacts of rapid and often unplanned urbanization that's leading to profound social instability, risks to critical infrastructure, rising water crises and the potential for epidemics. The quality of infrastructure that has come up on a large scale in cities is not environmentally sustainable and the real challenge is how to replace it in a phase manner and to enforce new development project sustainably. The purpose of paper is the need to address these risks effectively and to assess the system of governance in place.

Methodology approach

Consultations with various stakeholders involved in the planning and management of urban development in context of recent extreme effect of flooding of Chennai City. ULBs or urban local bodies were studied, to gain an understanding of the quality and efficiency of urban management mechanisms and to further propose interventions to enhance the performance of the ULBs. Vulnerability impact analysis using urban profiling, Identification of current and future climate stressors, Understanding risks and Vulnerabilities, Identification of strategies to reduce vulnerability and manage risks and develop resilience, Finance provisions, participatory processes to governance processes, regulations and institutional mechanism.

Analysis and results

The severe flooding in Chennai caused by torrential rains brought to a halt schools, colleges, IT companies, factories, and commercial establishments in India's fourth-largest city. This happened in Chennai as construction blocked storm water channels and reduced the capacity of reservoirs designed to soak up unseasonal rains. As cities grow, with a nod and a wink, unauthorized construction along these channels and lakes chokes water flow. According to a study by Indian Institute of Science, Bangalore, the concrete structures have increased nearly 13 times in Chennai and flood plains and open areas have been reduced by a fourth. The disaster in Chennai has lessons that underline the imperatives of conserving lakes and the drainage system that links them to minimize urban flooding. State Government is planning to construct barricades along the dry beds of river to check Illegal sand mining. Govt. of India has allotted budget for development of 100 smart cities and has also decided to open 14 new flood forecasting and warning centres in state of Tamilnadu. Participatory processes should involve flood victims in hazard mapping. Our urbanization policy, plans and practices in changing climate should be equitable,sustainable, participatory,decentralized,democratic and with a transparent approach to water management.

Conclusions and recommendation

Government, civil society and the private sector should have well defined roles in any urbanization policy or model and a system should be in place to ensure sustainable metropolitan growth. We urgently need to set up legal and institutional mechanisms to ensure bottom up, participatory, accountable governance for rivers, for pollution control, river action plans, for groundwater, for environment management, irrigation systems, lakes, rivers, wetlands, embankments, canals, pipelines, and other related water infrastructure. Such project/river specific committees should be statutory bodies with powers to make necessary mandatory orders with respect to the functioning of the projects. (We need to explore more models like the new approach of Underground Taming of Floods for irrigation (UTFI) is being field tested in Uttar Pradesh by International Water Management Institute in which excess surface waters from channels of flood-prone rivers during the rainy season when there is high risk of flood is transferred to a modified village pond. It involves the process of trapping and storing seasonal floodwater and using this water for irrigation during the dry season production)

Citizen's platform - sustainable water solution tool in urban centres

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Keywords: Citizen's Platform, Good Governance, Water

Highlights

Basti Vikas Manch, voluntary citizen's platform presents a critical dimension to achieve basic rights to water services across 86 slums in Hyderabad City. The value to manage 'people first' through conflict and cooperation has developed innovative model of sustenance for the poor to demand for equitable water resource management.

Introduction and objectives

In South Asia, cities are challenged by ever-growing demand for water infrastructure facilities to ensure equity in delivery of citizen's right. The water supply for slums faces chronic shortages in investment and operation and maintenance, leading to problems of inadequate coverage, intermittent supply, in-equitable water access, deteriorating infrastructure, and environmental un-sustainability of water (Wagle et al., 2011). The Basti Vikas Manch (BVM), a non-affiliated citywide platform for Citizens in Hyderabad (India) brings in greater transparency and public participation. The paper discusses on such platforms for inclusive governance on sustainability of urban water infrastructure and coverage in South Asian urban slums.

Methodology approach

The purpose of this paper goes beyond supply and demand management approach. It draws on the continuous process of conflict and cooperation about citizen's rights and services provided by urban development bodies. A combination of governance framework literature with collectivization, a social tool to exert pressure tactics for action is analyzed for sustainable change. Based on this empirical data a number of characteristics are identified as barriers in implementation and interaction; creating change for social solutions provided by BVMs that focus on managing people, change in perspectives and attitudes on good governance by all stakeholders.

Analysis and results

In Hyderabad city, the economic costs of water services are not taken into account. When there are water supplies, standpipes are widely dispersed and provided in intermittent service. For hours women and female children end up queuing to fill their water containers. These queues often led to squabbles with those lowest social strata, where even within slums complex social hierarchies exist. A platform to raise citizen's concern, BVM initiated a collectivization process where slum dwellers raised their voices about their plight. The BVMs operate across 86 slums with a value of equity and inclusion in service delivery. Community issues are democratically identified pertaining to women, youth and children. Community volunteers as BVMs are capacitated to generate awareness, conduct rallies and lobby with government departments to avail citizen's rights to water and WASH related services. Several successes to regularize the water supply and O&M of water infrastructures by the community, but to overcome challenges for social solutions remain within the realms of ruling parties for political resonance of services that largely get defined by constituencies. Such characteristics capture the ability and capacity of local government and the BVMs to renegotiate for inclusive water supply services among slums and the urban elites.

Conclusions and recommendation

Local governments in South Asian cities need more legal, institutional and financial space for inclusion of services to those marginalized that form majority of urban population. Citizen's participation through endogenous process can support attitudinal change among various stakeholders to account for new form of development and making them happen by availing the methods and technologies on water management. This requires continuous engagement and commitment of these stakeholders not in managing water but managing people's conflict and cooperation in effective service delivery. Citizen's platform can be one of the solutions for smart cities provided it is democratic, inclusive, adaptive and apolitical.

Informal vendors in the supply of water in urban Ethiopia

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Keywords: Water, vendors, illicit, indispensable, access

Highlights

This research shows that informal vendors have become a fundamental water supply modality in Ethiopia's urban areas, despite their illegal status and perceived alternative role. It also challenges the idea of water access as a dualistic concept, highlighting how it is far more fluid in low-income communities in reality.

Introduction and objectives

Water point non-functionality has blighted the drive towards universal access to potable water to date, while a disregard of this very same issue has seen a simultaneous overestimation of global access rates. In the inaugural year of the SDGs, this PhD research (in partnership with WaterAid) localises the narrative to advocate change based on community-level challenges. Ascertaining the true value of informal vendors to consumers is implicit in this, as is how these unregulated actors could be incorporated into existing urban water governance arrangements if deemed significant. This will then instigate spin-off debates regarding the concepts of access and affordability.

Methodology approach

The study employed a predominantly qualitative and ethnographic approach to navigate the everyday politics of local water dynamics. The nature of the research, i.e. the need to understand household resilience both within a context of extensive water informalisation and against the wider enabling environment, necessitated an in-depth approach. Fieldwork at the community level consisted of focus groups, household financial diaries, water point functionality mapping exercises, and semi-structured interviews. Participant observation and semi-structured interviews were conducted with informal vendors themselves, while semi-structured interviews were also held with various stakeholders at multiple levels to fulfil this holistic approach.

Analysis and results

The analysis is still ongoing, but the main findings that have emerged to date are as follows:

- The overwhelming majority of community residents interviewed within a low-income region of Addis Ababa purchase water from informal vendors on a weekly basis.
- Although the service they provide is indeed expensive, informal vendors oversee an efficient operation selling potable water.
- The service they provide is not only appreciated by their customers but is also depended upon in the absence of consistent access to a formal supply.
- Informal water vendors also consistently operate in central, wealthier areas of Addis Ababa where the formal water network is comparatively more developed.
- Access to water is a far more fluid concept than global figures suggest. Households oversee intricate and flexible domestic water strategies, whereby multiple sources are employed in conjunction with consumption priorities based on marginal cost decisions.

- Water affordability is an immaterial concept in its present form. Water is the foremost priority for many households and is therefore a resource they are willing to pay for. The issue of unaffordability becomes relevant only in relation to the significant one-off costs associated with connecting households to the formal piped network.

Conclusions and recommendation

Informal water vendors are not just important in Ethiopia's low-income communities, but they appear to be engrained within wider urban society. The water injustice is indeed felt more acutely in poorer regions. However, the urban water demand-supply imbalance is such that these unregulated services are being employed irrespective of socio-economic circumstance in order to supplement the deficiencies or outages of the formal water network. The efficient distribution operation informal vendors collectively oversee to ensure those either temporarily or foreseeably unserved have access to water therefore needs to be recognised and harnessed rather than denounced.

Developing a city-scale partnership for water stewardship in Lahore

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Co-Authors: Dr. Conor Linstead, Freshwater Specialist, WWF

Keywords: water stewardship, collective action, business water risk, small and medium enterprises (SMEs)

Highlights

This paper demonstrates a strong business case for implementing improved water management practices in the industrial sector in Lahore.

A partnership mechanism has been initiated in Lahore for business, government and civil society stakeholders to collectively identify shared water risks, and develop actions plans and projects to address those risks.

Introduction and objectives

Pakistan is a water stressed country and, in addition to impacts on communities and ecosystems, water scarcity has serious implications for the sustainability of the industrial sector, in both direct operations and supply chains. The key objectives of the Water Stewardship Pakistan (WSP) project were: to promote improved water management in key industrial sectors in Lahore and surrounding districts; and to establish a water stewardship platform at a city level in Lahore to facilitate business participation in water resource management. The key aim of this water stewardship platform is to work toward sustainable water management for businesses, communities and ecosystems.

Methodology approach

We gathered a range of evidence to develop a common understanding amongst stakeholders of the water context of Lahore, the risks faced by businesses, communities and ecosystems from the deteriorating condition of the water resources, and the dependency of business on water in their supply chains. Through individual business water audits we demonstrated the potential water use reduction, effluent quality improvement and cost saving to business of improved practices. We established a multi-stakeholder water platform in Lahore. The key objectives of this platform are to agree on the shared water risks, and develop shared action plans to address these risks.

Analysis and results

Water audits and bespoke plans for improving water management practices were implemented for 35 businesses. These businesses invested Rs 120 million ($1.1m USD) in one-off costs to implement recommended measures. As a result of this investment the businesses saved Rs 178 million ($170m USD) per year, which will continue to be saved annually. This cost saving comes as a result of the reduced need to pump, heat and cool water, and a reduction in the use of process chemicals. The total water saving achieved was 4.6 Mm^3/yr (10% of the total water consumption of the 35 businesses). Power consumption was reduced by 6.6 MW, and 1088 tonnes less process chemicals were used, which would otherwise have been discharged in effluent. The payback period for the investments to achieve these reductions is typically around 9 months. These improved practices have been further disseminated to 280 businesses through training workshops. We estimate that if the whole industrial sector of city adopted better practices it would reduce the current groundwater deficit of Lahore by approximately 15%.

A water stewardship platform for Lahore has been established with representation from multi-national companies, SMEs and their representative organisations, water management institutions, and civil society groups.

Conclusions and recommendation

We have demonstrated that the businesses and communities of Lahore face significant and increasing water risks if current levels of water consumption continue and water quality issues are not addressed. While there is a compelling financial case for individual businesses to reduce water consumption and pollution load, even if better water management practices were adopted across the whole industrial sector the savings would not be sufficient in themselves to address business water risks. To fully address water risks a water stewardship approach at the city-scale will be needed and this project has initiated a platform in Lahore to facilitate this.

A 'sponge' city called Kajiado in Kenya

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Mr. Robert Meerman, RAIN/Aidenvironment, Netherlands

Keywords: Water provision, Retention, Recharge, Reuse, Sponge City

Highlights

The Sponge City approach derives from urban planning in China and the US and is now for the first time deployed in an African development context. It reverses the trend of depleting ground water levels around Kajiado Town resulting from an increased demand and decreased recharge capacity.

Introduction and objectives

Kajiado is one of many growing towns (20% increase in 6 years, KCIDP 2014) in the arid lands of Kenya. Due to increasing demand of water, groundwater resources are overexploited. Increased hard surfaces such as roofs, roads sewage drains and reduction of vegetation around the town negatively impact groundwater recharge potential as storm water drains quickly without giving it time to infiltrate into the soil. This increased demand for water combined with the decreased recharge potential has lead to a drop in groundwater levels, which has left a number of boreholes in Kajiado dry and others diminishing in yield.

Methodology approach

The intervention started with site selection and data collection, consisting of a geohydrological assessment of the urban area, current water supply (boreholes), sub-catchment and recharge areas, using existing data and a field/satellite based research (remote sensing, geophysical exploration, geochemistry and isotope studies). This was followed by a survey of planned urban development and further deliberation with the county governments to recognize high potential recharge and infrastructure development. At selected high potential sites, different methods of recharge are developed, combined with reuse and storm water management.

Analysis and results

The site selection and data collection will result in high potential sites for artificial recharge and reuse (locally of through the town's boreholes) of the urban groundwater. At selected high potential sites, different methods of recharge are developed. These include household level interventions like soakpits and tanks, road interventions like soak pits, diversion of trenches to recharge zones, Irish bridges as recharge dams, and wastelands and gullies interventions like gully plugging, recharge parks for storm water storage, weirs in seasonal drainage channels, and artificial wetlands. The results are offered to the county government and relevant line ministries for their uptake and follow up. At least 5 different technologies are piloted in the field. Many other towns in (semi) arid areas in Kenya suffer from similar water shortage problems as Kajiado, for instance Wajir, Isiolo, Kitui and Narok. The generated pilot scheme and proof of concept serve as a scalable template for different county governments. Sponge City solutions can be tailor made to cover geohydrological and organizational issues particularly tapping into the growing mandate of the county governments under the recent devolution.

Conclusions and recommendation

The above described recharge and infrastructure development interventions break the vicious circle of increasing water demand and decreasing recharge potential . Rather than seeing urban infrastructure as a problem the approach augments this infrastructure to become a catchment for water harvesting. Increased recharge capacity will turn the environment into a sponge, that is able to absorb the rain water and as a result recharge the ground water level. In this way, the Sponge City will create a virtuous cycle of increased ground water levels that can meet the growing water demands in the city.

Case Study: Conservation of Pipe Borne Water through Inclusive Approach

Author: Mr. Somasundaram G.G Rajkumar, National Water Supply & Drainage Board, Deputy General Manager, Sri Lanka

Keywords: Innovation, Inclusive approach, Sustainability

Highlights

Colombo City's underserved settlement depended on free water outlets for water supply, system pressure was low that resulted in collecting water in underground sumps. The system pressure was improved through inclusive approach by the provision of individual connections or metering the free water outlets. Water bill collection is over 86%.

Introduction and objectives

Pipe borne water supply to the Colombo city was provided well over 100 years, installation of water meters were done since 1980's. Those who proved ownership of their properties had the opportunity to have metered private water supply and pay for the same. Those who obtained water from public water outlets were around 300,000 and they had free water supply. The income level of those depending on public water outlets was high, being urban residents. They also need to be inclusive in the provision of metered water supply with better service level.

Methodology and approach

People living in Under Served Settlements (USS) were educated on the value of water, they were convinced that payment has to be made in proportion to their consumption, changed there thinking and brought about identifying a representative who would be responsible for settlement of water bills. The society members agreed for the installation of water meters, receive monthly bills and to maintain the water outlets. The introduction of this innovative approach for the conservation of treated water in USS had to be sustained, regular interventions with the society was required for the continuous settlement of monthly water bills.

Analysis and results

The provision of metered water supply with bill payment in proportion to water consumption resulted in the reduction of water being wasted from the free water outlets. Further reduction occurred after receiving bills, where the consumption reduced over a period of time. By the conservation of water the system pressure improved and water available throughout the day. The pressure reading taken across the city showed the minimum pressure was around 2m, indicating that at any given time the user could obtain water conveniently from a garden tap. When pressure is high overhead storage could be used to serve upper floors. To cover the entire city free water outlets 1,735 societies were formed. Since the users of the free water outlet were identified the number of users reduced, the in quality of living and hygienic conditions improved. The success of the innovative initiative through inclusive approach is reflected from their monthly payment being made by over 86% of the societies.

Conclusion and Recommendation

In this case study, the success of an innovative inclusive approach on city USS is presented. Water Loss from the free water outlets was curtailed through the adaptation of inclusive approach. This resulted in system pressure improvement significantly and the service level improved. The people were dignified; they contributed towards reduction of water losses. They enjoyed the benefit of receiving improved water supply and improvement in quality of life. Their measure of acceptance is shown through regular monthly settlement of water bills, which is over 86% indicating that the methodology adopted is acceptable and that it is sustainable. This approach could be replicated successfully because it is a win -win situation.

Seminar 6: Water Stewardship: A Driver for Business Growth

Sustainable water management at SANOFI: an integrated action approach

Author: Mr. Thomas Senac, sanofi, France

Co-Authors: Mr. Romain Journel, sanofi, France

Keywords: management, scarcity, sustainability, business, life-cycle

Highlights

Sanofi is committed to handle water-related concerns along its entire value-chain. Thus we develop actions both in relation to products and their life cycle, and in relation to involved facilities, for which we address scarcity issues for water-withdrawal and qualitative aspects for effluent discharge.

Introduction and objectives

Today, a leading industrial company must demonstrate being responsible for several topics, including Environment… This is specifically important for all stakeholders, especially for investors for whom business continuity and company's image at local and global levels are major issues. For a pharmaceutical company, among environmental concerns, water-related aspects are very specific and potentially crucial due to the type of processes (fine organic chemistry, biological productions) and of products (pharmaceuticals), their usage and fate. As a responsible and growing company, SANOFI is committed to handle the full scope of water-related issues as a key driver of our revised Company-wide environmental strategy.

Methodology approach

We consider both 1) our facilities for water in-take and scarcity concerns and for discharge and impacts, including micro-pollutant concerns, and 2) our product specificities, in relation to usage and life-cycle.

We determine and prioritize our different actions globally and at site level by combining several aspects: classification of processes, products, facility locations. For this, we rely together on internal and external expertizes covering wide ranges of domains : ecotoxicology, hydrogeology, waste water treatment, R&D…. This leads to prioritization of our action plans at dedicated facilities and at company level, and to partnerships in programs with other companies and academics.

Analysis and results

Water in-take: We defined 3 types of facility locations with potential concern for water scarcity: those with acknowledge potential for water-scarcity (representing today 20% of sanofi's water in-take), those to be confirmed (7%) and others using more than 1 Mm^3/y (24%) ; the other are with weak or no concern. Dedicated actions and follow-up are defined.

Facility discharge: we have prioritized evaluation and action-plan in relation to production facilities and to substances. Apart from mass-balance and analytical approaches, we also develop new biomonitoring tools to assess the impact on water-bodies. Together with water companies and academics, we have also been testing several micro-pollutants effluent treatment techniques. This helps us define strategies and set-up action plans.

Product impacts: we assess our products' environmental impacts by carrying out environmental risk assessments not only for each new molecules and also for less recent ones. We also contribute to scientific research on this topic through scientific partnerships with academics.

Life-cycle: we work on production environmental impacts (solvent use, waste management), on packaging, transport. At patient level, we encourage and support the proper use of medicines and contribute voluntary in several countries to take-back programs for collection and safe disposal of unused medicines.

Conclusions and recommendation

Through its pro-active global water approach, Sanofi is committed to be a leading company addressing water as a concern in the frame of its sustainability program. We have identified areas of concerns along the entire life-cycle of our products for different water-related aspects and have set up dedicated actions on mid / long term. We also plan to broaden our action through addressing the issue down our supply-chain for relevant procurement categories.

This rather comprehensive and practical approach can easily be replicated in similar industrial cases as a 'fuel for business growth' around water issues at company (or sector) level.

Water Stewardship as a Critical Growth Factor

Author: Mr. Stephen Harper, Intel Corporation, Global Director, Environment, Energy and Sustainability Policy, United States

Keywords: Stewardship, technology, footprint, community

Highlights

Water is a critical input in producing of semiconductors. Semiconductors in turn can play a role in improving the stewardship of water. This presentation will focus on both ends of water stewardship -- reducing our own water footprint and maximizing our water handprint -- helping others via technology.

Introduction and objectives

Water is a double-edged sword for Intel. We use significant amounts of water, operating in a few very arid regions. Conserving that water is critical for us and our communities. Some of that water needs to be ultra-pure, so there is a water quality dimension. On the other hand, information technology can play a critical role in improving the efficiency of water use. Hence, Intel has both defensive and offensive interests in water stewardship. this presentation will introduce both dimensions and show how they interplay as a critical driver for growth.

Methodology approach

Presenter will lay out past history of water stewardship at Intel and how our approach has changed as water has become an even more critical resource for our growth.

Analysis and results

Presentation will concisely summarize Intel's lessons learned in a way that will provide actionable guidance to other companies in a similar situation.
Concrete examples of how information technology can advance water stewardship will be offered.

Conclusions and recommendation

Water is critical input resource for semiconductor manufacturing.
Information technology can be a critical resource for water stewardship.
These two aspects of water stewardship can be meshed as part of an intelligent corporate growth strategy.

Shared source water protection for mutual growth

Author: Mr. Gregory Koch, The Coca-Cola Company, Senior Director, Global Water Stewardship, United States

Keywords: vulnerability, shared data, common goals

Highlights

Coca-Cola discusses their water resource sustainability program as the foundation of their water stewardship strategy across some 1,000 global manufacturing locations. A non-export, local bottling and distribution business model leads Coca-Cola to assess multiple water sources and engage governments and communities for shared action, and mutual growth.

Introduction and objectives

Given their dependence on local water sources for both product manufacturing and their marketplace's prosperity, Coca-Cola's source protection program requires evaluation and action on shared, raw water sources, regardless of their own use. This session will highlight the genesis and evolution of the program, governance processes, typical and atypical findings and actions with the objective of demonstrating how the program protects manufacturing capacity and ability to grow their business sustainably.

Methodology approach

A summary of a plant-based, quantitative risk assessment will be described along with the resultant risk mitigation strategy. Key programs, partners, goals and progress will be presented. Importantly, plant-level capacity building and governance programs that enable execution will be detailed. Source vulnerability assessments requirements and source water protection plans will be outlined along with examples of how resultant, collective action mitigated vulnerabilities and enabled continue growth.

Analysis and results

Three example manufacturing sites will be presented inclusive of the local source water hydrology/hydrogeology, identified vulnerabilities to water quantity and/or quality water, resultant actions by the company and collectively with others within the watershed, and outcomes. These studies will demonstrate the viability of this shared source water protection approach for collective action and business sustainability by presentation of impacts to the company's physical, legal and social licences to water in each of the three locations.

Conclusions and recommendation

Shared source water protection among industry, governments and communities can provide the basis for mutual growth within defined sustainability limits of available water resources. Key principles for program success include establishing a common fact base, a rights-based approach to water use and access, and shared responsibility and accountability for action. Recommendations for program improvement will be presented including expanded capacity building and proactive stakeholder identidfication, engagement and follow up.

Water for Sustainable Development and Business Growth

Author: Ms. Ezgi Barcenas, United States

Keywords: water stewardship, collaboration, collective action, business growth, sustainability

Highlights

As the world's largest brewer, we face many risks around the world including climate change, water scarcity and limited natural resources. Our scale, reach and experience put us in a unique position to affect real change to help conserve water and restore shared watersheds while fueling business growth.

Introduction and objectives

More than just the critical ingredient in our products, water is a precious resource for the communities where we operate, some of which face drought, infrastructure issues and other water-related challenges. Our water strategy is focused on operational risk and relies on collective action. From barley fields, to breweries, to restaurants, to communities, we plan to illustrate how we use our scale and expertise to proactively collaborate with others across our value chain through sustainable business operations, community programs, capacity building initiatives, responsible investment, public policy engagement, brand cause initiatives and product innovation to fuel business growth and sustainable development.

Methodology approach

Our water strategy can be summarized in two simple words: collective action. We are in a unique position to unite many different parties — employees, consumers, partners and suppliers, public officials, NGOs, academics and others — to affect real change at both the local and global levels. 90% of our water use comes from growing barley and other agricultural ingredients. Much of the remainder is used in the brewing process. Considering the role water plays throughout our operations and our supply chain, our comprehensive strategy is to conserve, reuse and restore this resource everywhere we can while influencing governance.

Analysis and results

Although watershed restoration and conservation efforts can be very long-term and the results may not be immediately visible, we recognize water as a strategic issue that is material to business growth. Our water stewardship efforts are not just a CSR initiative – sustainability is very well-integrated throughout the company, and colleagues in Corporate Affairs, Supply, Operations, Procurement and Marketing teams around the world are demonstrating leadership by shifting norms, farming practices and water consumption habits while influencing governance through collaborative watershed projects, public policy discussions, and consumer-facing awareness campaigns.

Successfully managing our environmental impacts and water risk is a complex undertaking which is why we are partnering with organizations such as WWF, TNC and Water.org to become better water stewards, protect watersheds and provide access to water. Three of our eight global environmental goals we made public commitments on are focused on water. We are no longer only focusing on our impact, but also those impacted; not only working on efficiency of resources but also allocation of resources. Working outside our walls with other water users, public officials and NGOs is allowing us to be part of long-term solutions to our shared risks.

Conclusions and recommendation

Water crisis is a growing concern, and businesses, governments, NGOs, and communities need to tackle it together to design innovative solutions, improve infrastructure and influence governance. Water stewardship is key to business growth and long-term sustainability of operations and supply chains. AB InBev would like to illustrate specific case studies from countries like Mexico, Brazil and China that help advance water stewardship, improve water access and management and cultivate agricultural development and innovation.

Unlocking The Economic Power of Water through Policy and Regulation

Author: Mr. Jon Freedman, Global Partnerships & Government Affairs Leader, GE Power, Water & Process Technologies, United States

Keywords: Reuse, Sustainable, Regulation, Policy, Water Reuse

Highlights

1) Municipalities and governments need to reuse more water to ensure demand equals supply.
2) By understanding the various policy options and concrete examples of how these policies are being applied worldwide, attendees can shape a perspective on how to customize a strategy to their situation.

Introduction and objectives

With the global growth of both populations and economies, the demand for water is approaching unsustainable levels. By 2050 the world will demand 55 percent more water and 70 percent more energy. Municipalities and governments need to reuse more water to ensure demand equals supply. The goal of this presentation is to inform attendees of the various policy options for water recycling and reuse, inspiring them to action. By presenting a number of policy options and concrete examples of how these policies are being applied worldwide, attendees can shape a perspective on how to customize a strategy to their situation.

Methodology approach

Drawing on his paper "Addressing Water Scarcity through Recycling and Reuse," Jon Freedman, Global Government Affairs Leader, GE Water and Process Technologies, will explore readily accessible information on policy options for governments. In his keynote, Freedman will highlight four major water reuse policy options for governments to consider as they look for ways to expand water recycling and reuse: education and outreach, removing barriers, incentives, and mandates and regulations.

Analysis and results

The presentation is designed to help attendees (including communities, governmental authorities and businesses) think through their options for increasing recycling and reuse of water that are being implemented around the world. Freedman will offer a spectrum of policy tools ranging from less intensive mechanisms, such as making information available, to more proactive regulatory approaches that require water reuse. Recognizing that each community has different water, economic, social and other needs, Freedman intends to spark discussion among attendees about what set of policies might be most effective in any particular situation or for any particular group of users.

Conclusions and recommendation

As a growing number of communities around the world encounter acute water scarcity issues, many are turning to water recycling and reuse as solutions. By understanding the major types of policies for encouraging water recycling and reuse described in this presentation— education, barrier removal, incentives, and mandates — attendees will be better prepared to plan for and address their unique water resource needs.

Private actors in transboundary basins

Author: Dr. Nicole Kranz, Deutsche Gesellschaft für Internationale Zusammenarbeit, South Africa

Keywords: Private sector, transboundary water management, water stewardship

Highlights

Role of private sector in regional and transboundary water management settings.
Role of water stewardship in promoting responsible water management across and beyond regional boundaries.
National and transboundary guidance on good corporate practices.

Introduction and objectives

Water not only constitutes the lifeblood for ecosystems and societies, but is also a fundamental commodity in the processes and supply chains of many businesses across the world. Rapid population growth, urbanisation, increasing consumption and climate change impacts lead to a mounting pressure on water resources resulting in water-related risks for all users, including businesses and civil society.
As a response to perceived and real water risks, water-stewardship approaches are emerging with business involvement in various countries around the world. This paper seeks to investigate the role of water stewardship approaches in transboundary river systems and respective implications.

Methodology approach

The paper makes uses of case studies investigation of selected transboundary river basins, where private businesses/companies are playing a decisive direct or indirect role in determining management practices in the respective catchment. Through this case study analysis the paper identifies some key modes and types of interaction and influencing between water stewardship approaches and transboundary water governance. It furthermore seeks to derive key principles and loci for business' role in transboundary water management. In addition to aiding the better understanding of business motivations in shared basins, the paper also seeks to provide for a set of policy recommendations.

Analysis and results

Transboundary water governance is often perceived as the influencing sphere of governments, international relations, as well as regional policy-making. Often overlooked is the role of non-state actors in transboundary water management, including private, for profit actors, such as businesses. While such actors do not feature in official treaties or agreement and are often not granted similar observer status such as NGOs, they do however play a role in determining transboundary water policy in quite a few catchments. Starting with the typical scenario of the industrial site as pollution source, which is not only threatening domestic water quality, but also for those riparian states downstream; the paper investigates also more indirect forms of influence including large agricultural operations relying on transboundary water resources, industries requesting preferential access to water resources in order to assure water security in water stressed environments. Finally, one can identify private sector roles and influence at a very localized level, which do however reflect back to the transboundary level through various mechanisms. The paper investigates not only the role of private actors, but also respective responses from government as well as other key actors in the transboundary sphere.

Conclusions and recommendation

Are policies of international river basin commissions sufficient for accommodating the seemingly strong role of private actors; are they sufficiently equipped to use potential benefits arising from private sector interaction adequately. While this is an emerging field in research as well as in practice one can draw on a range of examples from Europe, Asia and Africa demonstrating the close linkage between assuring a river's services for ensuring industrial operations across border, while at the same time catering to ecosystems' needs. Accounting for private sector interests complicates matters, is however increasingly necessary to grasp the breadth of pressures faced by sustainable water management at the transboundary level.

Scaling action and fuelling growth through corporate supply chains

Author: Ms. Morgan Gillespy, CDP, Sr Program Manager, Water, United Kingdom

Keywords: Water, Resilience, Supply chain, Risk management, Growth opportunities

Highlights

The supply chain often accounts for a substantial portion of a company's water use, impact and risk exposure. Increasingly, it is also a source of opportunity. Using transparency to scale water stewardship amongst suppliers enables companies to understand indirect water impacts, incentivising action to reduce these impacts and enhancing resilience.

Introduction and objectives

CDP's supply chain program, representing 75 corporations with US$2 trillion in annual procurement spend, enables supplier reporting on climate and water risks and opportunities.

These companies use the data collected to identify opportunities for improvement within their supply chains including opportunities for collaborative action with suppliers on targeted water projects. These projects help to fuel business growth for both customer and supplier, delivering as they do, enhanced capacity, cost reductions and increased business resilience.

This presentation will identify the key actions companies can take to identify, evaluate and implement collaborative water projects, fuelling business growth.

Methodology approach

In 2015, requests for information were distributed to 7,879 suppliers. A total of 4,005 suppliers responded, providing 3,932 total climate change responses and 826 water responses.

One question suppliers are requested to answer is to communicate proposals for the collaborative development of water-related projects.

Suppliers identified 280 unique water projects, focused on training, education, infrastructure investment or the development of new products and/or services.

This presentation presents analysis of these collaborative projects and is supported by two case studies highlighting how companies can work collaboratively with suppliers to identify and realise growth opportunities through improved and integrated water management.

Analysis and results

34% of responding suppliers provided proposals to 19 major corporate customers. Of those

- 22% focused on education;
- 18% required investment in infrastructure;
- 12% identified opportunities through the development of new products and/or services; and
- 12% focused on training.

Benefits and outcomes identified as a result of implementing these projects include water efficiency gains, cost savings reduced water consumption and a reduction of the water intensity of certain products.

The presentation will include two case studies from members of CDP's supply chain program (anticipated to be Unilever and Colgate Palmolive), detailing the process each company went through to identify, evaluate and implement proposals from suppliers.

Sharing this learning aims to highlight how other companies, regardless of sector, can begin to leverage integrated water management throughout their supply chains; insights as to how best to work with procurement teams who might not be incentivised to change current practice based on environmental criteria; and tips on how to make the business case for implementation. By focusing on opportunities within the supply chain, both customer, supplier and ultimately the catchments they operate in and buy from see benefits of increased capacity for growth.

Conclusions and recommendation

Through the integration of water related data into procurement policies, processes and procedures companies are able to better identify opportunities (efficiencies, cost savings, brand value) and implement steps to realise them. Further, by collaborating with suppliers, customers are able to better fuel growth not only within their own business but for their suppliers business as well. Importantly however, integrating environmental data into procurement decisions also enables companies to take more meaningful and impactful approaches to eliminating water impacts. The scaling up of this practice should be seen as a critical next step to realising a water secure future.

Identifying Water Stewardship Actions to Improve Business Water Security

Author: Dr. Ashok Chapagain, Water Footprint Network, Water Footprint Network, Science Director, Netherlands

Co-Authors: Dr. Ertug Ercin, Netherlands
Ms. Alexandra Freitas, Netherlands
Ms. Ruth Mathews, Netherlands

Keywords: Water security, Water risk mapping, Risk Assessment Framework, Tools, Water Footprint

Highlights

Targeted action on water stewardship can be identified through assessing water related risk in the context of local and basin characteristics. The assessment framework can be applied to SMEs, supply chains and global portfolios. Business water security can be achieved by tailoring actions that manage risk through stewarding water resources

Introduction and objectives

Secure water supplies, predictable regulations and equitable allocation are crucial for business sustainability. The Global Risk Report 2016 from the World Economic Forum shows water as one of the top risks to economic growth sitting squarely with climate change, mass migration and terrorism. A suite of online tools and approaches have emerged recently helping companies understand their water related risks. These tools have however some limitations and do not provide guidance on the specific actions that should be taken by businesses. The application of a scientifically based, tailored assessment framework increases business understanding of the water stewardship actions needed.

Methodology approach

Business water security was examined by assessing risk drivers such as water quantity and quality at the point of water use and at basin level, the environmental regulatory framework and protected areas and using these to characterize water risk. Business locations were than classified related to risk levels and water stewardship opportunities. Together these results were used to recommend stewardship actions and changes to policies and procedures. The approach was tested and refined by applying the risk assessment framework for SMEs, an investor, and in a global portfolio, and presented how companies and investors could benefit from the approach.

Analysis and results

The Risk Assessment Framework (RAF) has been valuable in raising awareness in companies and investors of the role of water in building sustainable business activities. By combining water quantity and quality, regulatory conditions and protected areas, the RAF provides a comprehensive view of local and basin conditions within which they operate. The RAF handled over 6000 individual locations, both existing and in the pipeline for investment and resulted in prioritization of locations for and selection of water stewardship action based on risk classifications. Exposure levels, i.e., the degree of water dependence of the business activities, were taken into account in the prioritization. The results can directly benefit a facility through improved practices and increased water security without hampering growth. When used by investors, the RAF can indicate client improvement programmes and can become part of the analysis for new client acquisition. Combined with financial risk assessment and social impact analysis, this provides a comprehensive basis for investments. Use of water footprint indicators aligns the RAF with further study into business improvements that can reduce water dependence and contribute to sustainable water conditions. A Water Footprint Assessment will provide detailed information that will allow companies to manage their water risk.

Conclusions and recommendation

The RAF builds on previous risk assessment approaches and extends them to address level of exposure based on water dependence and to provide guidance on the specific water stewardship actions that should be taken to improve business resilience. The RAF was tested in three different business contexts: local operations, a bank's investment portfolio and a global portfolio of business locations. The RAF was applicable to each situation and provided pertinent information for businesses and investors. The outcome of the assessment supports businesses in their water stewardship journey and investors in reducing their water footprint while increasing their social impact.

Circular economy as a growth booster

Author: Johann Clere, Open Innovation Director, Veolia Research and Innovation, France

Co-Authors: Mr. Laurent Auguste
Mr. Carlo Germano, France

Keywords: recycling, circular, growth, business, authority

Highlights

Industrial development clashes with the boundaries of the planet: the environment is already severely damaged, in turn threatening businesses. Time has come for looking at environmental processes not as a source of administrative burden, but as an asset for a more sustainable growth.

Introduction and objectives

Natural resources –including the biodiversity- are becoming increasingly scarce and polluted, while our needs are growing in an ever more densely populated and urbanized world facing climate change issues. Business have to rethink their relationship with resources and surroundings, to come up with new growth models that are more resource-efficient and more sustainable. The circular economy approach means that industry gradually build into their offerings smaller footprint products and services, which entails a growing space for partnerships and co-construction, with other businesses and with communities.

Methodology approach

Businesses have to comply with a growing body of environmental and social laws. In reaction, forward-looking industries not only want to keep pace with these constraints, but turn towards partnerships to help developing and implementing alternative and proactive environmental protection approaches as part of their long term strategies.

The methodology developed by Veolia with its client businesses taps into the metabolism analogies, whereby water, energy and material flows are jointly scrutinized by recycling experts, at sites and global level, to list and prioritizes actions which correspond to the greatest business resilience, tapping into technological advances, as well as logistic approaches.

Analysis and results

Industries on all continents are now using this approach to streamline water, energy and material recovery into their sites:

- The Bakkavor Group in Tilmanstone (UK) has also decoupled its water consumption and discharge from its production, which is achieved through water recycling;
- Nestlé – Mexico, Lagos de Moreno is the first zero water dairy factory in the World;
- Antero Resources, a producer of oil & natural gas in the Marcellus and Utica Shale plays, has selected Veolia to design, build and operate a treatment complex in Appalachia, to treat and recycle 9,500 m^3 a day of flowback and produced water;
- The world largest Gas-to-Liquid complex in Qatar meets its zero liquid discharge target ;
- Danone – with a global partnership with Veolia – is aiming at better reaching its ambitious 2020 environmental and social objectives by better integrating its whole value chain in a circular economy loop.

These approaches nurture a culture of global alliances built on a genuinely collaborative approach in which complementary skills contributed by each partner are harnessed to create shared value, by securing access to water resources, and managing environmental footprints.

Conclusions and recommendation

The circular economy creates value for businesses and the wider society: it is a hedge against upstream risks including water and raw material availability and price volatility, and contributes to environmental protection, thus aligning with customers' expectations and the long term strategies of businesses. The time of partnerships has come, with the common goal of creating and sharing value, rather than competing and creating value independently.

Seminar 7: Financing water infrastructure for sustainable growth

Bridging the Gap

Author: Dr. Alex Money, University of Oxford, United Kingdom

Keywords: Mutuality, sharing economy, green bonds

Highlights

An innovative model to lever private sector capital into financing sustainable water infrastructure. The approach aligns the interests of company shareholders with managers of water utilities.

Introduction and objectives

Returns on water infrastructure are often low due to state-controlled tariffs; while the cost of capital is high due to perceived sovereign risk. Low returns and high costs help explain why the current provision of infrastructure investment in most developing countries is woefully inadequate.

I propose a new model of business mutuality, to lever more private sector investment into infrastructure. By accessing the large pools of global savings via the balance sheets of multinational companies, the deficit gap can be bridged. The model is based on a core principle of the sharing economy, where collective capability meets collective need.

Methodology approach

Research is based on interviews with CEOs at food and beverage multinational companies; with Chief Investment Officers at fund management firms in the UK, USA, South Africa and Australia; with senior bankers including the CFO of the World Bank; government representatives including UK Treasury; insurance company representatives; non-governmental bodies (e.g. Nature Conservancy); corporate sustainability specialists; and various academics.

Analysis and results

This is a conceptual paper.

The capital of Pangia, an imaginary African country is growing rapidly and needs a $100m water treatment plant. The return on capital is 6%, reflecting state-controlled utility tariffs. Meanwhile the cost of capital is 10%, reflecting sovereign risk. On this basis, the plant doesn't get built.

Meanwhile two large multinationals operating in Pangia, are reviewing their long-term organic growth targets. They agree the plant is necessary not just for their operations, but also to ensure that their customers continue to thrive. Their CEO's agree to each raise $50m through a green bond issue, with a yield of 2%. This is then repackaged into a $100m loan to Pangia's water utility, with a yield of 4%.

From the utility's perspective, the treatment plant is now a viable investment. The multinationals have effectively arbitraged credit risk to help improve water security in Pangia's capital, which is good for their consumers, good for their shareholders, and good for the economy. This has not been at the cost of profits: in fact, the action is earnings accretive. This model of mutuality connects capability with demand, and offers a fresh, unexplored perspective on the future of the sharing economy.

Conclusions and recommendation

This idea presents a novel approach to combining aspects of credit arbitrage (a well-understood investment strategy) with green bonds (a nascent but fast-growing asset class).

This approach carries execution and governance risks. Access to relatively cheap capital is a necessary but insufficient criterion.

My research suggests that the model has the greatest traction where companies providing the investment capital have a close interest – beyond the merely financial – in the project, for example because the infrastructure is material to their own in-country operations. Multinational companies operating in the consumer staples sector are more obvious candidates.

Global municipal water market renews pursuit of water public-private partnerships

Author: Mr. Keith Hays, Bluefield Research, Vice President, Spain

Co-Authors: Phuong Pham, Senior Analyst, Bluefield Research
Lucie Baudoin, Analyst, Bluefield Research

Keywords: water treatment, wastewater, desalination, PPP, concession

Highlights

The most recent, complete global study of water PPPs capturing global trends and providing in-depth analysis on a country, project, and company level. The analysis includes legal frameworks and project pipelines as well as company strategies to provide a complete view of the industry.

Introduction and objectives

The global market for municipal water public-private partnerships (PPP) is set for a resurgence between 2016 and 2020, with nearly $60 billion of investment planned. This build-out stems from 577 project contracts signed between 2010 and 2015, while another 130 are under construction in 2016. A slew of policy initiatives is stimulating demand for private investment in water infrastructure.

Objectives of the study and conference presentation:

- Provide a global perspective on the size/location/value of global water PPP market.
- Understand the drivers and inhibitors of PPP markets, national and municipal.
- Gain valuable insights on successes/failures from a project/country perspective.

Methodology approach

Bluefield analyzes the ownership positions, geographies, and plants of the largest PPP project participants by equity ownership of capacity, including semi-public utility entities, independent water producers, vertically-integrated EPC firms, Japanese trading houses, and infrastructure investors. The study includes tracking and analysis of over 1,800 PPP projects in 44 countries, including top-down regional trends and bottom up company profiles.

Analysis and results

In diverse urban environments, largely in developing countries, the PPP model has gained renewed attention after a decline in project flow in the run-up to 2010.

Although barriers remain in terms of contract risk allocation, cost recovery through water tariffs, and tender design, global best practices are gaining traction as flagship projects near construction, such as Egypt's Abu Rawash wastewater treatment plant, Philippines' Bulacan Bulk Water Supply tender, Ghana's Teshie-Nungua desalination plant, and Mexico's Atotonilco wastewater PPP.

A common convergence of macroeconomic and environmental factors has encouraged governments to pursue PPPs as of late instead of turnkey procurement through engineering, procurement, and construction (EPC) firms. Dramatic falls in oil and commodities prices, combined with unsustainably low water tariffs, groundwater overdraft, and untreated wastewater discharge have prompted governments to make good on initiatives for private participation with bankable projects.

China has broken out as the largest country for water sector PPPs over the last five years, accounting for two-thirds of the global water PPP market with 278 million m^3/day of capacity installed. Latin American and other Asian countries follow China as the most active water PPP markets which are also more open to foreign participation.

Conclusions and recommendation

- PPPs are a key tool for driving infrastructure build-out, but are not one-size-fits all and often require sector reform.
- There is a resurgence in government interest to do PPPs in water based on SGDs, infrastructure needs, that is evident in our data of project deals and policy announcements.
- Private sector players recognize more private participation is not always the answer - and that participation needs to be better deployed considering a spectrum of project types and options.
- In the near term, a shakeup in PPP activity is expected as China, Brazil give way to new markets.

Case study: Lessons from the post-build era of Australia's desalination program

Author: Mr. Dawid Bosman, Trans-Caledon Tunnel Authority (TCTA), Senior Manager: Advisory Services, South Africa

Keywords: Australia, desalination, investment, finance, value

Highlights

The Australian response to the Millennium Drought is still unfolding. The divergent strategies chosen by the five state governments after the drought, in dealing with the climate-resilient water resources they had acquired, provide insight into the paradigms that may influence future water investment decisions in the adaptation to climate change.

Introduction and objectives

The Australian response to the drought of 1997-2009 was, inter alia, to spend $12 billion on six large desalination plants, through which five cities were effectively drought-proofed. In the aftermath, divergent choices were made on how the new infrastructure should be managed. In the West, full-capacity operation was sustained; towards the East, the choices varied from "hot stand-by" to long-term mothballing.

The rationale underpinning these decisions are noteworthy, and leads to an intriguing question: Does assured water have the potential to unlock greater efficiencies within the water-power-climate nexus, when regarded within a systemic framework of hydro-power and flood mitigation assets?

Methodology approach

The paper will be a synthesis in a case study format, based on insights gleaned from a visit of the facilities, and supplemented by desk research. The conclusions will be drawn from the interpretation of the information, against the background of current trends and prevailing economic conditions. Throughout the analysis, a systemic approach will be favoured, to illustrate the causal links that exist, and give rise to discernable trends.

Analysis and results

The Australian case is a useful template for unfolding the value proposition of sea water desalination. Some view it as merely a temporary plan, in the event of a drought. But recent analysis suggests that it serves a higher purpose, by enabling a more cost-effective and integrated system of water supply, renewable power generation and urban flood risk protection, as well as enhancing the attractiveness to private investors.

The investment options emerge when the value of assured water becomes apparent. The existing model, suggesting that the value of water increases with scarcity, becomes less useful when scarcity can be addressed at will. With the scalability and climate independence of desalination, the value of water becomes a factor of its quality, abundance and reliability. It is this three-fold assurance that changes, fundamentally, the role of water within the nexus, and is attractive to private investment. Assured water allows the operating rules with a system comprising desalination, hydro-power and a dam (for water supply and flood protection) to be optimised for cost, supply assurance and flood protection. This reduces the inherent water risk of business enterprise in the supply area, and enhances the potential of water assets to attract private finance.

Conclusions and recommendation

Desalination allows the value of water to be framed in terms of quality, abundance and reliability, in short: Assured water. Within the water-energy-climate nexus, assured water can enable better asset utilisation, and allow more cost-effective climate adaptation options, when an optimised, systemic approach is used. Secondary benefits include a more stable investment environment.

This proposes a new framework within which the desalination investment decision should be evaluated, and dispels the flawed notion that assured water could be compared directly with water from an uncertain source. This offers an essential insight for political and institutional leadership.

Performance-based finance for drinking water security in Africa

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Co-Authors: Ms. Susie Goodall, United Kingdom
Ms. Johanna Koehler, United Kingdom

Keywords: Africa, Finance, Maintenance, Rural Water Supply, Water Security

Highlights

A Water Services Maintenance Fund offers a novel financial model to improve drinking water security for Africa's rural population. A maintenance service provider with a monitoring system demonstrates that scale pools risk and improves maintenance performance. Rural water users pre-pay based on results increasing government, donor and private sector support.

Introduction and objectives

Maintaining water infrastructure investments in rural Africa will deliver political, economic and social returns to government and water users by improving water security for the poor. Allocating financial risks fairly and effectively can be advanced where risks are pooled at scale. We explore the political, legal and financial case for a new Water Services Maintenance Fund. Kenya's new County Governments offer institutional coordination to advance performance-based models which link payments with results. Empirical data from a new Maintenance Service Provider with a novel monitoring system informs the financial architecture of the fund and finance flows from government, donor and communities.

Methodology approach

A risk-based framework informs a structured programme of social, legal, financial and political analysis. Socio-economic surveys in two Counties provide data on household welfare, water payment preferences and voluntary recruitment to performance-based maintenance company established in 2014. Company performance in repairing water infrastructure is validated by a novel and automated monitoring system. A water audit captures the existing but fragmented management of infrastructure and associated variation in performance and accountability. High level meetings with national and county government identify potential responses to coordinate maintenance through a maintenance fund. The legal scope of the fund is specified and funding models developed.

Analysis and results

Results identify significant gains from maintaining water infrastructure at scale. Maintenance service providers dramatically reduce downtime of broken infrastructure by an order of magnitude (> 1 month to < 2 days). Community payments are contingent on proven improvements in service delivery. The water audit indicates uneven investment in infrastructure and under-investment in institutions. For example, community-based management allocates operational and financial risks to those least able to cope.

A performance-based model which links matching funds to user commitments is gaining traction with donor and private sector interests. County Governments are actively seeking new models given their new responsibility to deliver sustainable services with financial resources to support a fund. National level analysis of Water Ministers' divergent plans for rural water sustainability suggests appetite for new models but divergent approaches. The launch of a water services maintenance fund offers a novel model to guide the development and delivery of drinking water security to Kenya's rural poor. A novel monitoring system of water user demand and service level performance is critical to establish accountability in the funding model.

Conclusions and recommendation

Until effective financial models can blend government, donor and user payments, drinking water security will neither be achieved nor maintained. Sustainable financial models for delivering drinking water security in rural Africa are a major policy gap to meet the SDG. With four out of five people without improved water access living in rural Africa the scale and magnitude of the challenge is unprecedented. The legacy of uneven investments in infrastructure and under-investing in institutions is being revealed by new monitoring systems to promote accountability and evidence-based investments. Monitoring underpins performance-based finance and is central to making sustainable finance work.

Seminar 8: Good water governance for inclusive growth and poverty reduction

Maximizing economic & social welfare through localised water resources management

Author: Ms. Kettie Alinafe Harawa, Environmental Scientist, Country Director, Water For People Malawi

Co-Authors: Prof. R.M Kalin, United Kingdom, Strathclyde University, Scotland

Keywords: Sustainability, Permaculture, Financing, Community, Management

Highlights

Since 2012, Water For People has partnered with Strathclyde University to implement an Integrated Water Resources Management (IWRM) approach in the Traditional Authority Chapananga in Chikwawa-Malawi. The goal was to maximize economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems.

Introduction and objectives

The 2015 WHO/UNICEF JMP report indicates that 147 countries have met the MDG drinking water target, including Malawi. However, in Malawi, 25% of the improved water points are reported not to be functional (2014 Joint Sector Performance Report) at any given point. This is a great challenge to the achievement of SDG 6. The key causes of non-functionality are due to poor management of the water point, specifically the governance structure and the financing mechanism for maintenance, repairs and replacement. IWRM approach was implemented to address these challenges while promoting protection of the water, land and related resources.

Methodology approach

IWRM activities implemented in 18 villages of Chapananga included:

(1) Community management – training to instill community confidence and competence to create financial and social value around the water supply system beyond merely providing clean water, especially in women.

(2) Permaculture - Development of gardens to use excess borehole water and local resources to grow crops, which generates income.

(3) Water Point Banking – Establishment of tariff structure to recover full costs and be converted to savings, which can be loaned out at an agreed interest rate to the users, further building financial capital for pump management.

Analysis and results

As a result of the intervention, the 18 villages where the activities were focused established water point committees with 60% women representation, not just in numbers but also key decision making positions. Each community designed their tariff structure based on full cost recovery with support from government workers. The communities then developed a finance management model which included permaculture gardens and the Water Point Banking in a transparent manner. The use of wasted water from the water point for growing crops (like coco-yam, rice, vegetables) not only provided the communities with extra nutritious food and generated income for water point operation and maintenance but also helped to prevent the malaria transmitting parasite, mosquitoes from bleeding in the water ponds. Similarly, the Water Point Banking provided the communities a readily available capital for the water users to borrow as startup capital for small business. As such the Water Point Banking also acts as an incentive for communities to continue contributing as they see an immediate benefit to access loans. Through these initiatives, tariff collection is

less problematic; mostly all water users do pay tariffs. The successes of the model are visible and other communities have already started copying.

Conclusions and recommendation

This paper therefore aims at sharing some of the incentives for adopting and scaling IWRM approaches for sustainability of water points. When communities are actively engaged, there is transparency and accountability and where they see immediate social and economic benefits in investing in water, they will adopt the approaches. Thereby making the water resources sustainable and in turn improving the wellbeing of women, men and children.

Church CBO models sustains bore holes from Rushere Town Board

Author: Ms. Maxensia Kiiza, Living water International Uganda, H&S Coordinator, Uganda

Keywords: Sustainability, operation and maintenance, church

Highlights

I work as H&S Coordinator with Living water International Uganda an organization which runs an integrated WASH program in the South-Western part of Uganda in Kiruhura district. The program highlights the sustainability of water points, sensitization of water users on WASH and proclamation of the gospel of Christ.

Introduction and objectives

As a social and divine institution, the church has proved the most reliable in community transformation. World over, It has existed for more than 2000 years with a steady membership and philosophy. In Uganda, the church has the highest influencing power of individuals with majority of Christians subscribing to the moral teachings and advice from their local church.Upon this background, LWIU (Living water international Uganda) worked with Rushere community church to mobilize communities around Rushere Town Board to form 4 water user committees responsible for the general management and sustainability of the 4 bore holes drilled by LWIU.

Methodology approach

Kiruhura district is water stressed due to long droughts. Survey showed that no natural spring existed in the entire district hence Deep Wells became the effective technology. After construction of four water points, Rushere community church (RCC) was empowered to mobilize communities around four boreholes to select water user committees (WUC) members based on consensus and gender inclusion. RCC CBO is a big umbrella where the four WUCs subscribe to the monthly water user fee collections and functionality results.Capacity of WUC members was built in regards to financial management and O&M of the wells. Routine meetings held on a monthly basis.

Analysis and results

The church being a highly respected entity in Kiruhura motivated water users to easily contribute the operation and maintenance fee for the sustainability of the wells.The church representation on every WUC promoted transparency and accountability. The payment of ten percent of the monthly fee collection to the borehole care takers motivated them to take good care of the sources to reduce water contamination.The issue of climate change has been dealt with through encouraging communities to plant trees near bore holes to provide shade to water users and as a way of encouraging the rain formation cycle.

Results

The model increased functionality of water points due to the availability of operation and maintenance fees. Capacity has been built for the committee members in relation to management of O&M fees and record keeping. RCC was registered as a community based organization with the district authority which gave it freedom to operate as a legal entity. Safe water coverage increased from 30-35% and health of the people improved. Accessibility of water increased since the water points were equally distributed with water users taking less than 30 minutes to fetch water to and back home. The account balance stands at the rate of 13779.5 USD

Conclusions and recommendation

The church plays a bigger role in impacting lives and is a strongly respected entity that is listened to by the community. Being at the fore front of announcing the message of water point sustainability made it easier for communities to pay operation and maintenance fees without hesitation hence sustaining water points,increasing accessibility and improved health.

Church unites a big number of people in the society and takes the highest vote in influencing people. Therefore it should be empowered to pilot models which encourage community participation. I recommend up scaling the model to other parts of the country.

Water governance under resource extractivism - the case of Mongolia

Author: Dr. Ines Dombrowsky, Deutsches Institut für Entwicklungspolitik (DIE), Head of Department, Germany

Co-Authors: Dr. Jean Carlo Rodriguez de Francisco, Germany

Keywords: water governance, resource extractivism, inclusive and sustainable growth, River Basin Organizations, institutional change

Highlights

A rare case of a long-term analysis of institutional change presenting the case of Mongolia's water sector analyzing to what extent water governance reforms have been able to make the country's resource-based growth path more sustainable.

Introduction and objectives

In recent years, resource-rich countries, such as Mongolia, have experienced massive investments in the exploitation of extractive resources. Besides boosting economic growth, extractivism may have drastic negative effects on the environment including the quantity and quality of water, and in consequence on people. In this case, water resources are used for economic growth, but making the growth path socially inclusive and environmentally sustainable poses a particular challenge. This raises the question what options the water and environment sectors have to engage powerful actors, such as the mining sector, towards a development path in line with the 2030 Agenda.

Methodology approach

Using the case of Mongolia, this paper analyzes institutional change in the water and environment sector in face of the country's resource extractivism during the last 15 years. A particular focus is put on legal reforms and the attempt to install River Basin Organizations which have been promoted as platforms to manage competing claims on water resources. The analysis is based on extensive document analyses and longer-term observation of institutional change with repeated rounds of interviews with key stakeholders in Mongolia's water sector in the period of 2009 to 2016.

Analysis and results

The paper shows that massive investments in mining have partly contributed to two-digit growth rates, but are already and will impact water resources and people drastically. These impacts have promoted several reforms in Mongolia's water and environment sectors, including water law reforms in 2004 and 2012, a law banning mining in riparian zones in 2009 and EIA reforms in 2012. A National Water Commission was set up in 2000, a Water Authority in 2005 but dismantled again in 2012, River Basin Councils (RBCs) have been established since 2009 and River Basin Administrations (RBAs) since 2013. Moreover, the Ministry of Environment was declared one of four strategic ministries in 2012. Still, at national level water administrators find themselves in a difficult position between promoting the country's economic growth through water diversions for mining and protecting the resource. At the basin level, the establishment of RBAs has potential, but still RBAs lack resources and partly mandates to balance competing claims and to perform monitoring and enforcement tasks. RBCs have as multi-stakeholder fora have been dismantled again or are inactive. Water tariff and further environmental reforms in parliament stall due to resistance by powerful actors. The country ranks high on TI's corruption index.

Conclusions and recommendation

On the one hand, institutional change in Mongolia's water sector has been stunningly fast, and a number of significant measures have been taken which at least on paper have the potential to make Mongolia's resource-based growth path more sustainable. On the other hand, institutional change is partly too fast in order to establish new routines and implementing the respective legal provisions remains a considerable challenge in view of powerful actors. It will be of interest whether the 2030 Agenda will have an impact on the country's discourse on its future development path.

Reliable and sustainable rural water supply governance through meaningful consultation

Author: Mr. Ajay Kashi, private consultant, India

Keywords: Corruption, Rural Water, empanelment, implementation

Highlights

The study has put-forth findings based on direct involvement of a private design firm in preparation of project reports for rural water supply schemes initiated by the Rural Development Panchayat Raj Department (RDPR). The study highlights current governance mechanism issues leading to scheme failure and loss of capital investment.

Introduction and objectives

Approximately $2.5 billion annually is being spent on providing potable water to rural habitations in India, which does not necessarily translate into reliable, sustainable and affordable water supply services. Continuing poor governance mechanisms including political influence, incompetent consultant empanelment, outdated charge rates, technical scrutiny inefficiencies, monitory favours are formidable constraints leading to scheme failures. Only 14 of 320 schemes initiated by RDPR were successfully implemented in 2014. Objective is to develop a framework capturing current governance mechanisms followed by an entity of RDPR, which are negatively impacting implementation of water schemes in rural parts of Karnataka.

Methodology approach

Two major rural water supply schemes which the consultant was contracted by PRED to provide DBOT services failed to proceed to implementation stage. This motivated the consultant to conduct a workshop including all concerned stakeholders and rural water users to understand the underlying causes deeply impacting scheme failures.

Combination of qualitative research methods including focus group discussions and interviews, and perception-based quantitative survey targeting domestic rural water users were applied. A general overview of how corruption affects rural water sector was discussed at different levels of this study. Key findings were validated and captured.

Analysis and results

Focus group discussions and interviews were carried out with stake holders including, PRED and KRWSSA officials, empaneled consultants and rural water users. Political pressure, evaluation criteria for design consultants' selection, project implementation criteria, lackadaisical approach of government officials, monitory benefits, fee component for empaneled consultants, political influence and willingness to pay were some of the key parameters discussed.

Out of 32 participants from PRED and KRWSSA as part of focus group discussions, 72% of them attributed political pressure as the key aspect in determining the success rate of scheme implementation. An overwhelming 84% of empaneled consultants who attended the workshop suggested that a combination of fee component and bribes are the main contributors for several potentially competitive consultants from being discouraged to bid for empanelment, which directly influences scheme design quality, ultimately leading to scheme failures. As far as the general perception of rural water users were concerned, 86% hinted

at regional political influence as the major contributor to schemes not being implemented although majority (approx. 92%) of the water users expressed their willingness to pay for domestic water usage if such schemes were implemented.

Conclusions and recommendation

Analysis implied that political pressure and corruption imposed by regional political parties directly upon PRED officials for vested interests to secure monitory benefits from consultants in order to approve design reports for facilitating scheme implementation, as a major contributor for scheme failures.

Understanding of incentive structures and civil service reform initiatives including consultant fee component revision must be applied to rural water sector institutions for improvising governance. Probability of detection or penalty must be increased by clarifying procedures and streamlining operational roles, increasing accountability and transparency through consumer participation, promoting transparency in interactions between government entities and private sectors, etc.

Best practices in municipal governance of water services, Lessons from Medellin, Colombia

Author: Ms. Corina Kwami, University College London, United Kingdom

Keywords: governance, shareholdeship, municipal, water services, participation, decision-making

Highlights

This paper highlights best practices in the governance of water services demonstrated by Empresas Publicas de Medellin (EPM), the Colombian multi-utility company associated with the resilience of city of Medellin after decades of violent` instability. This study aims to identify best practices EPM has uses to strengthen the governance including its relationship between the city, its main shareholder who receives 30% of all profits of the company and different community organisations.

Introduction and objectives

As cities in the global south face increasing demand for water services due to population growth, rapid urbanisation, the effects of climate change and changing consumption patterns, there is a need for understanding how to sustainably manage demand. Efforts to manage demand from EPM, Medellin's multi-utility company, suggest that sustainably managing demand of water in this city may be associated with the relationship between the city and the company. This relationship is characterised as a shareholdership, where the city owns shares in the company. The objective of this study is to identify best practices specific to this relationship.

Methodology approach

Semi-structured interviews with stakeholders such as lead experts from EPM were conducted to identify activities and practices including but not limited to pricing, research and development and infrastructure planning undertaken by the city with EPM to manage demand. The aim of the interviews was to identify activities and practices that helped the city and company implement and take action towards its targets for equitable pricing, water quality and access to services in the city. Interviews were supported with quantitative evidence for current and past trends in pricing, quality and access and future projections.

Analysis and results

Interview results were analysed using textual analysis. The guide and approach used for this analysis was developed by the future cities' team at University College of London Liveable Cities group. Word frequency analysis was used to identify principles explicitly or implicitly mentioned which was then used in the coding of the data. Textual analysis was used to explore evidence of activities between the city and company in planning and regulatory activities. These are discussed and analysed to identify best practices. Best practices included strategies for assigning responsibility and programs such as agua prepago, a pre-paid water program – a joint city and company plan to expand access to the water network were analysed. To ensure comparability of interviews, the top 20 frequently used words were listed and grouped according to the issue it was most associated with (pricing, water quality, access etc.). Words found across all groups included "future," "participation," "shareholder," "profit." Words specific to the groups included: "equity", "community" and "fair" for pricing; "investment," "partnership" and "trust" for water quality; and for "future," "community" and "fair" for access. While there were limitations voiced for these best practices, the results suggest that best practices were "future oriented" and required strong buy-in from the city and

EPM. Greater inclusion of community groups was consistently highlighted in the critique of these activities identified as best practices.

Conclusions and recommendation

Best practices in governance such can strengthen efforts to manage demand for a sustainable city, yet they are complex and require a wide breadth of perspectives from all stakeholders involved. EPM offers insight into managing demand through best practices in governance at the municipal level. A shareholdership of utilities is one of the several ways a city can envision the delivery of safe, quality drinking water in the future. While it is not the solution for every city, the findings from this study suggest practices to manage demand and recommend a "future oriented" approach in programs for a strong yet adaptive relationship between stakeholders and shareholders. This can provide public and private systems with the tools to manage demand through governance.

Ramping-up access in Niger: reform, pro-poor policies, and performance

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Co-Authors: Mr. Remi Bourgarel, Niger
Ms. Martine Vullierme, France

Keywords: Access, pro-poor, performance, reform, capacity

Highlights

The water reform in Niger was designed to meet the country's commitment to develop access to drinking water through social private connections and public standpipes. The leadership of the national authorities, the strong support of the World Bank to the water reform, and investments, proved essential.

Introduction and objectives

Niger, one of the world's poorest countries, pledged to meet the MDGs, with a National Strategy on Poverty Reduction. For acces to water, the goal was to increase the coverage from less than 31% in 2001 to 75% of the urban population, through private connections or public standpipes.

The implementation of an ambitious institutional reform of the sector in 2001 associated with a strong social policy including relevant tariffs, employment of young people, training and skills development, CSR policy, allowed big progresses in the field of water access development: infrastructures, private social connections, public fountains, and water quality improvement.

Methodology approach

To ramp-up access to potable water, the Niger government decided to implement a social policy to provide access to the poorest, to reduce non-revenue water through active leakage control, whilst improving the produced water quality and becoming a reference in customer management.

The Government reformed its water sector with the establishment of a State-owned asset company, tendering out the operation to a private company in charge of coverage expansion and day to day operations, in the frame of a lease contract including an incentive and penalty mechanism. This operating company is co-owned by 49% local stakeholders and government.

Analysis and results

The Water reform was introduced and the distinction between the organizing authority and the operator fully operational after the signature of the 10 years contract in 2001.

More than 60,000 private social connections were constructed, providing overall access to 2,250,000 inhabitants, compared to 800,000 before tendering out the operations. The staff productivity increased from 8.6 staff per connection at the beginning to 3.6 after ten years, thanks to a massive capacity building program. Water is now provided on a continuous basis in most urban centers and areas of Niamey, with 98% compliance with microbiological standards; Non-revenue water fell from 22% down to 17% and the bill collection ratio increased from 91 to 97%. The operator is hence able to recover its O&M costs, partially service the sector's debt and contribute to CAPEX – no longer relying on government subsidies.

For the social connections, pro-poor tariffs were decided by the Authorities. The operator developed a methodology using field surveys to determine the technical feasibility of connections, to provide information to target groups about the application for social connections, and follow-up with the new customers. For standpipes, target neighborhoods were selected according to poverty of inhabitants, network and standpipe density.

Conclusions and recommendation

Developing access needs coordination in:

- Governance, with leadership, long term vision and clear and distinct roles;
- Finance, using donor and institutional lenders money and sustainable cost-recovery from tariffs;
- And Proactive, Innovative and Performance-based management.
- The choices made by the Niger government proved effective:
- Sharing of investments between local authorities / Central Government / local State + IFIs,
- Tariffs are bound to the capacity of the end user to pay, which was essential for the success of the water reform,
- The remuneration of the private operator is disconnected from tariff, and incentivized through KPIs.

Establishing responsible water resource authorities in South Africa

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Co-Authors: Prof Loretta Feris, University of Cape Town

Keywords: Decentralisation, Catchment Management Agencies, governance, Delegation

Highlights

This study develops a set of indicators that examines the conditions that should be in place before a Catchment Management Agency can take on certain water resource functions. The research provides insight into how indicators can be used to measure the performance of river basin organizations

Introduction and objectives

Catchment Management Agencies (CMAs) in South Africa were designed to achieve more efficient, accountable and participatory water resource management at the local level. However, as with many other examples of decentralization, the challenges associated with shifting powers and functions to a lower form of government were underestimated and the process has taken longer than anticipated. The objective of this research is to determine the legal and operational requirements that should be in place before a CMA can take on the full range of decentralized powers, duties and functions, prescribed under the National Water Act (NWA).

Methodology approach

The project involved a legal review, including an assessment of the inherent risks for both the CMA and the regulator, including concerns related to feasibility (financial and technical) and desirability (legally and operationally). Before functions are assigned or delegated, due consideration must be given to the capacity of the CMA. This involved reviewing a range of other indicators used to assess the capacity of basin organizations and then adapting these to suit the South African context. The indicators were developed through workshop and stakeholder engagement with the Department of water and Sanitation and the established CMAs.

Analysis and results

The research reviewed different indicators used to assess river basin performance. The Network of Asian River Basin Organizations (NARBO) benchmarking process was identified as a suitable indicator set that could be adapted to the South African context. NARBO was established in 2003 and supports the expansion of RBO and IWRM principles in the Asian region. The NARBO benchmarking process used a set of 14 performance indicators, developed through stakeholder participation from peers. The NARBO benchmarking is based on the Balanced Scorecard (BSC), developed by Kaplan and Norton in 1992. The BSC is one of the most widely used scorecards for organizational performance and was introduced as an alternative measure for private sector organizations to look at performance, beyond the normal financial indicators. The NARBO indicators are broadly categorized around four areas: Learning and Growth, Internal Processes, Financial and Stakeholders.

Through a workshop process with existing CMAs in South Africa, the NARBO indicators were adapted to the South African Context. Sixteen indicators were developed across nine areas with some of the indicators applicable to the organization as whole, while others applicable to the key components of the NWA: sustainability of water resources, equitable access and efficient water use.

Conclusions and recommendation

In order to effectively delegate powers to lower forms of governance, clearly defined criteria are required. Delegation can therefore happen against a set of mutually-agreed and measurable criteria. This assists the Minister in deciding when it is desirable to assign powers. This research outlines a framework to support this delegation process, built around 16 indicators that align with the principles of the National Water Act and support key functional areas for all organization: Learning and Growth, Internal Processes, Financial and Stakeholders. The approach can be used and adapted to other contexts to support the establishment of river basin organizations.

Dynamics of change: network characteristics that improve service authority performance

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Keywords: Service delivery, institutional development, stakeholder networks, rural water supply

Highlights

This research includes case studies from Ghana, Malawi, India, Tajikistan, and Bolivia to identify aspects of stakeholder networks that help water service authorities to improve performance. It offers methods for conducting this analysis, and compares common patterns found across these cases.

Introduction and objectives

Improved institutional performance will be essential for achieving the SDGs. Because many stakeholders interact with service authorities in rural water supply, influences supporting institutional development span beyond any one organization or project. Understanding the full breadth of stakeholders interacting with institutions and their effects can provide important insights into how institutional development happens beyond the scope of a single project. This research seeks to understand the cumulative effect of these interactions, and identify dynamics that help service delivery authorities improve performance over time. It is investigating how change happens, rather than preferring specific service delivery models over others.

Methodology approach

This research studies cases of success where improved performance of a service authority has been documented. Such cases were identified and studied in Ghana, Malawi, India, Tajikistan, and Bolivia.
Egocentric network mapping is used to develop network models for analysis. Stakeholders are asked to identify who they interact with and how according to a framework including connections of information, resources, skill transfer, and power. Subsequent interviews follow up with other stakeholders identified to eventually produce a whole network model. Participants are also asked for their view on network dynamics that help improve the performance of service authorities over time. These multiple perspectives, combined with network data, can be used to identify dynamics that are both perceived as important and observed as present in the stakeholder networks.

Analysis and results

This presentation is proposed with two intended benefits for participants. Firstly, the research methods can help stakeholders identify and interpret interactions in their sectors to understand forces supporting institutional development. Secondly, preliminary findings on positive network dynamics may help stakeholders to better support institutional development in their own contexts. Preliminary findings from fieldwork in Ghana and Malawi have identified four dynamics supporting institutional development:

- Service authorities receive multiple types of strong support from upper levels of sector hierarchy;
- Some stakeholders help to facilitate information flows around formal lines of authority, and simultaneously build capacity at different levels of sector hierarchy;
- Some stakeholders primarily provide capacity support and dialogue to complement roles that others play as authorities or funders; and
- Local service authorities act as local hubs to facilitate information flow

These four dynamics are perceived by stakeholders to support improved performance of service authorities in Ghana and Malawi, and additional dynamics are expected to emerge from case studies in the other countries. The final case study is expected to conclude in July, and findings will be available during World Water Week.

Conclusions and recommendation

Many factors influence the development of institutions, and stakeholders can more effectively complement each others' roles when their interactions can be understood. This research provides both methodological tools for understanding interactions, and identifies dynamics that support institutions to develop. Stakeholders can apply these findings to intentionally create environments that help service authorities to improve performance.

MSP/Social Learning Approach to Complexity of Basin Governance: Rufiji, Tanzania

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Keywords: Rufiji Basin, Complexity of catchment governance, SWAUM, Multi-stakeholders and Social learning

Highlights

Recognition of water governance complexities at the basin level with realization that existing approaches don't take account of non-linear parameters (conflict and disagreement, knowledge gaps and uncertainties); WWF piloted Sustainable Water Access, Use and Management (SWAUM) programme, tailed to address complexities through a multi-stakeholder partnership and social learning approach. This approach places 'integration' at the heart of water resources governance and management.

Introduction and objectives

Tanzania is endowed with numerous and diverse water resources, managed on hydrological units known as Basins. The Great Ruaha Catchment in Rufiji Basin is under high stress, mainly by poor water governance, uncoordinated sectorial planning and elevated upstream water demands; mainly for larger scale rice schemes. Downstream tourist destination of Ruaha National Park, ecological wetlands for fishing, livelihoods of 4-million people and 45% national hydropower generated from Mtera dam are negatively affected. This paper present WWF new programme approach to complexity of basin water governance in Tanzania. The Sustainable Water Access, Use and Management (SWAUM) programme tailed to address basin water governance complexities through a multi-stakeholder partnership and social learning approach, which places 'integration' at the heart of water resources governance and management. SWAUM has engaged poor and disadvantaged groups to play an active role in securing their water resource needs for growth and poverty reduction at local and national level.

Methodology approach

Multi-stakeholder partnership and social learning approach used to place 'integration' at the heart of water resources governance and management. SWAUM established dialogues and created an opportunity for representatives of all stakeholders (poorer women, 'tail-enders', pastoralists, disadvantaged group and youth), to come together; hence actively engaged in water and land resource management of the Great Ruaha Catchment for inclusive growth and poverty reduction, in accordance with the principles of the National Water Policy and the Water Resources Management Act. Collaborative initiatives (CIs) used to engage all players in the planning, implementation and management of felt challenges to natural resources conservation. CIs aim to bring actions learning and through solving a specific problem (land use, water source conservation, water quality, cattle troughs, hydrological data collection, water allocation, etc)

Analysis and results

SWAUM Programme mechanisms for supporting improvements basin water governance and people's livelihoods and wellbeing (which together with security and basic needs also includes realization of self-esteem, respect and 'empowerment') include the collaborative initiatives (CIs), central components of the social learning methodology through which stakeholders work and learn together, together with the broader participatory processes (i.e. the multi-stakeholder workshops), which are specifically designed and facilitated

to build the esteem of groups of local women and men. Improving the real lives of ultimate beneficiaries, at the same time as enhancing the natural resource base and better land management.

Conclusions and recommendation

On 5th – 6th May 2016, WWF and the Tanzanian government will jointly host a regional Symposium titled 'Making Catchment Governance Work for All" to influence key decision-makers, policies, plans and process determining water governance at catchment, regional and national levels – and to optimize SWAUM's impact within and beyond the 5-years. We believe that the Symposium will further consolidate and institutionalize a collective and unified water governance regimen in Tanzania for inclusive growth and poverty reduction.

Water Stewardship: Enabling conditions for improved water governance in Europe

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Keywords: Governance, Business, Water Stewardship, WFD

Highlights

We discuss our ambition for private sector Water Stewardship as a tool to improve water governance, specifically:

- The drivers and enabling conditions for facilitating private sector Water Stewardship.
- Two years into our three year WaterLIFE project, we will demonstrate how we have evidenced our assumptions.

Introduction and objectives

Implementation of the EU Water Framework Directive (WFD) requires governments to take a holistic and inclusive approach to water management. If implemented correctly, the WFD will ensure the way water is managed is sustainable and resilient to climate change and other threats. However, to date, implementation has been poor.

The WaterLIFE project aims to accelerate delivery of the WFD and achieve Good Ecological Status throughout Europe by taking collaborative action with communities, government and businesses.

We are evidencing the conditions needed to facilitate institutional frameworks that enable increased private sector and civil society participation in water governance.

Methodology approach

We bring together government, civil society and the private sector from the catchment to the EU level to implement WFD through improved institutional mechanisms. We:

- Work with civil society partners The Rivers Trust, Westcountry Rivers Trust and others, in five catchments in England and Wales.
- Work with private sector partners Coca-Cola and others through our catchment framework and business engagement activities.
- Work across the EU through our WWF and WaterLIFE networks to test the applicability of our learning within other European contexts.
- Demonstrate impact: environmental; capacity; behaviour change and policy change.

Analysis and results

We wanted to test the hypothesis that private sector Water Stewardship is a tool to improve governance of water resources in Europe. We have identified the following drivers for Water Stewardship: operational, reputational and regulatory risk, and political and cultural opportunity. We have increased our understanding of how far the approach can take us towards WFD implementation within these different scenarios across Europe.

These tools, events and measures are designed to facilitate improved governance mechanisms:

1. A Water Summit attended by government, civil society and 50 businesses
2. Business engagement materials: updated WWF Water Risk Filter; Water Stewardship report, WFD implementation booklet; film.

3. Toolkit to help civil society and businesses work together
4. Implementation of two UK Water Stewardship catchments to demonstrate how businesses can mitigate risk as part of a multi-sector approach.
5. Issue-focused workshops bringing government, businesses and civil society together.

These sit alongside research to better understand behaviour change and motivation for engaging in Water Stewardship.

We seek feedback on: the applicability of our findings within their contexts; whether they would adopt any of our approaches (and what further tools would be needed); whether they have advice about other governance factors we should consider.

Conclusions and recommendation

We are two years into our three year project. Our conclusions to date indicate that under certain scenarios facilitating the alignment of the private sector and civil society within government water management process is beneficial to all stakeholders and the environment.

We would like to promote our toolkit for private stakeholders and encourage feedback from the audience about our findings, particularly around private sector engagement with civil society and towards their ambition to influence governance within their geographical context with regards to culture, politics or other factors we have not yet considered.

Progressive tariff: A way to promote equity and inclusive growth

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Keywords: Pro-poor, progressive, equity, sustainbility

Highlights

In saline affected Paikgacha poor needed to travel long to collect water or pay exorbitant price to buy privately. WaterAid Bangladesh piloted water supply with progressive tariff that served 1,097 families; while tariff collection is 99.57%. This has demonstrated water governance for sustainable service with full-cost recovery while addressing equity.

Introduction and objectives

WaterAid Bangladesh piloted an innovative pro-poor model of water supply and local governance in a coastal town that brought residents safe, affordable water through a progressive tariff system ensuring financial sustainability; while addressing equity and poverty. The tariff structure was determined based on extensive consultations with the residents, ensuring all social and income groups well-represented. The objective is to share the model and our experiences including challenges with WASH sector actors, development practitioners, academia and researchers;so that the approach can be adopted elsewhere to solve water crisis in similar context while promoting good water governance and inclusive growth.

Methodology approach

The research has followed a city wide approach. The analysis has been carried out based on data collection from the municipality authority and project progress report in 2015. The town dwellers (households) are classified into three economic groups: well-off, poor and hardcore poor; while the consumers portfolio are divided into three brand categories such as household, institutions and commercial. The work process such as setting tariff structure, approval for connection and metering, tariff collection has been studied. Financial analysis on operational cost and income has been carried out to figure out sustainability status.

Analysis and results

Paikgacha is a small town in coastal zone in southwestern Bangladesh. Town dwellers were suffering from acute scarcity of safe drinking water. Of the 4,200 families in Paikgacha, 51% are poor or hard-core poor. They needed to travel long distances to collect water from ponds, or pay exorbitant price of BDT 700 per 1,000 liters of water from private vendors. Culturally, the burden of water collection mainly borne by women and adolescent girls. WaterAid started working with the municipality to establish a pipe water system to address this acute water crisis, and rolled out a pro-poor and progressive water tariff system that would make the water affordable to everyone, even the poorest ensuring sustainability. This tariff system charges differential rates based on ability to pay. For example poor families pay BDT 50 for 1,000 liters of water, while non-poor and institutions pay BDT 80, and commercial users pay BDT 120 for same amount. The tariff rises progressively with increasing consumption, but poor families pay the same flat rate of BDT 50 in consideration of affordability. Additionally, low income households can apply collectively for a community water point with reduced connection fees. Households under community water point share monthly bill equally.

Conclusions and recommendation

The southwestern coastal zone in Bangladesh is suffering severe water shortages due to saline intrusion and contamination in groundwater. The coastal towns are increasingly exposed to climate risks; where safe drinking water is the lifeline for survival and growth - especially for the poor. Due to lack of pro-poor water supply, private vendors are taking over water-supply markets with monopoly and selling drinking water at extremely high price. Equitable growth is not possible without ensuring a sustainable pro-poor water supply. The seminar is thus about sharing a practical experience on progressive tariff to address water crisis.

Towards implementing the (Water) SDGs through multi-stakeholder platforms

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Keywords: collaborative, multi-stakeholder, water, stewardship, governance

Highlights

The paper showcases the value of multi-stakeholder platforms in driving the SDG agenda towards a sustainable water future. Platforms such as the SWPN SA have been able to achieve ±48 million m³/a water savings through improving agricultural water efficiency, a sector accounting for ±60% of the total country's water demand.

Introduction and objectives

The introduction of the new water-related SDGs in October 2015 has raised questions as to their implementation and achievement. Experience with attaining the MDGs has shown that conventional governance approaches have only inadequately addressed this challenge. Regionally adapted modes of implementation need to be developed in order to cater for the needs and capabilities of different stakeholders.

This paper discusses how multi-stakeholder platforms operating under the banner of water stewardship and combining the strengths of the private and public sectors and civil society show a commendable way forward in seeking to attain water focused SDG's.

Methodology approach

The paper makes use of in-depth case studies and practical examples for SDG implementation from a national multi-sector platform on water management and stewardship in South Africa, the Strategic Water Partners Network South Africa, outcomes from a regional learning forum collating best practices in this regard, held in Johannesburg in October 2015, as well as other regional initiatives and approaches supported by the IWaSP programme under GIZ.

The paper thus lays an important foundation for effectively connecting water stewardship to SDG implementation and operationalizing this innovative concept in the context of unpacking the SDGs. The results (intermediary results) will be placed in the context of SDG implementation and assessed as to their usefulness in this regard.

Analysis and results

The paper interrogates the critical questions of where to from here? How can the attainment of SDG goals in the projected timeframe be achieved? Not only do the SDGs call for reaching multiple goals, for example in the water, but also in the agriculture, energy, human development sectors which are all inextricably linked to water management.

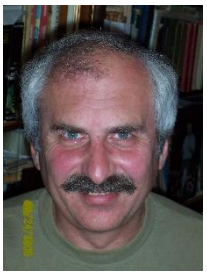
It is proposed that emerging approaches developed in the (Southern) African context under the label of water stewardship might be instructive for showcasing new modes for SDG implementation. Evidence is collected from the activities of three implementation areas in the Strategic Water Partners Networks, focusing on agricultural supply chains, effluent management and water efficiency. Work undertaken under the agriculture group of the SWPN for example, shows projected savings of 48 million m³/annum through improvements in agricultural water use efficiency, born of a collaboratively funded initiative based on the

principles of water stewardship. The paper also present the results of the SWPN partnership with the South African Department of the Water and Sanitation to develop the No Drop system targeting municipal water loss reduction from 32%, to 18% by 2025, saving over 630 million m³ (over R2,5 billion) annually.

Conclusions and recommendation

The route to a sustainable water future will require considerable innovation. It is clear that singular institutions ensconced in silos cannot solve the plethora of challenges related to access and sustainability of water resources. Regional approaches to water management have thus to a large extent embraced the integrated water stewardship model which focuses on utilizing stakeholder diversity as a tool for holistic and effective water management. Greater facilitation of constructive discourse is however required to ensure that the water stewardship paradigm is not utilized as a platform to negate internal institutional and organizational obligations to comply with existing legislation.

Formalization and role of public participation in transboundary waters management



Author: Dr. Ilya Trombitsky, Eco-TIRAS International Association of River Keepers, Moldova

Keywords: public participation, management, trans-boundary waters

Highlights

Good water governance could be reached only in case of involvement of all stakeholders, including public, to decision making process. Public could do steps of self-organization to simplify the process and rise its impact on decision making. This work demonstrates approaches to strengthen public impact on governmental decision making.

Introduction and objectives

The IRBM is a novel for EECCA countries, so the active public involvement could enforce the reformation of water policies in the region. In a short period it is necessary to change the centralized attitude of water departments to involvement of numerous stakeholders, including public, to shaping of water policies. So the public could familiarize other stakeholders with IRBM concept, including on trans-boundary level, promote modern water policies on local level for water bodies and tributaries. In case of Dniester River the public plays also a role in involvement of secessionist Transdniestria region in water cooperation and confidence building.

Methodology approach

In 1999-2012 NGO community of Moldova and Ukraine united forces on issue on establishment of integrated transboundary Dniester River management. It is included support of development and promotion of the modern river basin treaty, the change of governments' attitude towards the river management, inter-sector cooperation and strong public involvement. The transboundary NGOs association Eco-TIRAS was established and adopted own river basin strategy with basic actions: involvement of NGOs in the Dniester River basin actions planning and management; strengthening of NGO river community as a tool to promote IRBM in both countries by coordinated actions; international promotion of Dniester River.

Analysis and results

It was realized that systemic public participation organized and coordinated among both riparian countries NGO communities on the river basin level could substantially improve the river basin policies on transnational level, by adoption of the river basin treaty and avoiding of non-sustainable investments dangerous for the river, including those in hydro-energetic infrastructure. The long-term insistence to transfer the water agencies under the Ministry of Environment permitted to realize this reform in both countries. Currently the signing of the association agreements with the EU also helps in promotion of IRBM and WFD implementation despite of serious reluctance of national bureaucracies. Another lesson is that close cooperation with OSCE and UNECE helps in impact on national water policies. Also, deep involvement of NGOs could help in development of political documents like the Climate Change Adaptation Strategy and the river basin management plans. But the adequate access of public to information which remains a weak area in both riparian countries is a key issue for public to formulate the right position. Political instability and corruption, as well as a weak prioritization of environmental policies are also substantial obstacles in promotion of IRBM.

Conclusions and recommendation

At present the Dniester River basin is the leading experimental site to develop and evaluate the public participation impact on trans-boundary river basins. The specific approach – the establishment of joint registered trans-boundary association of NGOs from both riparian countries has demonstrated its efficiency. The current cooperation between NGOs of Moldova and Ukraine is deep and sustainable which permits to monitor planning investments and prevent environmentally unfriendly actions. The accumulated unique experience of Moldova and Ukraine in realization of the joint public efforts should be taken into consideration as the model on how public could develop efforts on trans-boundary level.

Engaging The Public in Public - Private collaborative partnerships

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Co-Authors: Dr. Nicolas Kosoy, Canada

Keywords: SDG, multitiered collaborative partnerships, governance

Highlights

Compared to the Millennium Development Goals capacity development is an explicit and integral component of the Sustainable Development Goals. Capacity development is now an essential operational path for development at the country level and not only as strategy development goals; representing a paradigmatic shift for inclusive growth and poverty reduction.

Introduction and objectives

Globally approximately 14% of the human population lack access to safe drinking water and 36 % people lack access to improved sanitation services. Many water operators in developing countries lack the capacities to address problems associated with poor governance, weak operational and financial management skills. Our research aims to provide an exploratory analysis on the role of collaborative partnerships known as the Water Operators' Partnership developed by the United Nations to increase access to water and sanitation services in developing countries. Water Operators' Partnerships are not for profit public – public, public – private, private – private partnerships.

Methodology approach

Through the exploration of the case study method, this research highlights the need for decision makers to characterize water resources in terms of plural values operating within Water Operators' Partnership framework. This research used observations, interviews and participation in job shadowing sessions completed in the field as part of Belize Water Service – Contra Costa Water District Water Operators' Partnership documenting process. Archival documents were also collected from various stakeholders. Contextual factors such as political, socio-economic and environmental defining how water operators' function, were also examined through an extensive literature review.

Analysis and results

The current Water Operators' Partnerships does not apply a polycentric approach to governance in addressing the capacity development of water operators. The reliance on market mechanisms and technological solutions for addressing water allocation issues results in a technocentric value system for resolving water distributive issues. A technocentric value system masks the power asymmetries that arise from advancing market and objective solutions over socially deliberated paths of development. Introducing polycentric governance in the development of collaborative partnerships such as Water Operators' Partnerships will enhance the chance of increasing access to improved water and sanitation services for rural and poorer segments of the population. A multitiered Water Operators' Partnerships framework is proposed in this research, identifying the need to consider several levels of intervention while recognizing their interdependence to ensure a sustainable and equitable delivery of water and sanitation services in both the urban and rural sectors in developing countries. The multitiered Water Operators' Partnership recognizes that capacity development is the acquisition of knowledge and skills, which builds on and harnesses rather than replacing endogenous capacity to address local concerns. A multitiered Water Operators' Partnerships

provides for the inclusion of groups traditionally left out of the decision-making process in water distributive issues.

Conclusions and recommendation

This research concludes the existing Water Operators' Partnership governance is not sufficient to facilitate achieving long-term social transformation objectives of the Sustainable Development Goals. The process to develop the capacity for improved resilience of socio-ecological systems through the use of a multitiered Water Operators' Partnerships requires a balance between prioritizing the needs of local communities with the biophysical realities of finite water resources at the national and global scales. Within this context, capacity development allows those responsible for water and sanitation services to identify their needs, and design and implement the best suitable WSS strategies within a given local context.

Determinants of performance of water providers in rural Central America

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Keywords: Human consumption, water community providers, volumetric pricing, adaptation to climate change, performance

Highlights

We identified low-regret policies that seek to increase drought preparedness and satisfy the longstanding development needs of rural areas in Guatemala, Nicaragua and Costa Rica.

Community water providers should consider instituting volumetric pricing and shore up the financial health of their organizations through improvements in cost recovery practices.

Introduction and objectives

As a result of the acceleration of climate change and variability, drought events are expected to be more intense and prolonged in Central America (CA). Community-based drinking water organizations (CWO) are the most important providers of water in poor rural areas of CA. However, little is known about their adaptive capacity to these climatic events and the main drivers affecting their performance. We use primary data collected from CWO located in poor regions of Guatemala, Nicaragua and Costa Rica to asssess these factors and discuss policy options to increase their performance in water provision.

Methodology approach

We carried out statistical analysis of survey-based and GIS data, collected from 160 water community organizations and 7,000 households located in the driest regions of Guatemala, Nicaragua and Costa Rica. We also obtained data on the governance structures of CWO (e.g. rules, financial characteristics, human capital of the water board, relationship with external actors, performance indicators), water use at the household level and biophysical variables (e.g. land uses, temperature, precipitation).

Analysis and results

Controlling water demand is critical for preparedness against droughts. In this regard, one of the most important strategies a CWO can take is adopting volumetric pricing. Nevertheless, the incentives and obstacles that limit this critical change should be carefully addressed in order to scale up results.

Promoting the financial health of CWO through improved cost-recovery practices is another important low-regret solution for building drought preparedness. However, adaptation to drier conditions in the future will need substantial modifications in the water infrastructure, which requires large amounts of capital. Most sampled CWO are not capable of financing these investments with their current savings levels. Still, policies supporting CWO should minimize the tendency of perpetuating their dependency on governmental funds or external donors, as it undermines local incentives to pay for maintenance, replacement and expansion of water infrastructure.

Dialogues among policy makers across different levels of decision making processes should raise awareness about the transversal impact of climate change in different sectors of the economy. They should also consider stepping out of the "water box" when designing adaptation policies.

Conclusions and recommendation

The vulnerabilities of CWO are intrinsically associated to structural problems, affecting the capacity to deliver reliable water services in poor rural areas. Under these conditions, the implementation of low-regret adaptation measures could be an effective strategy to respond simultaneously to generic threats to water provision and to the longstanding development needs.

Identifying governance practices or institutional conditions for successful management of local water systems is a critical pillar for proposing solutions based on relevant empirical evidence. The generality of these solutions has the attractiveness that they can be implemented in a wide array of contexts, irrespective of the climate change predictions.

Identification of underreported high-risk WASH practices using a mobile platform

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Keywords: Water, sanitation, underreporting, mobile, open defecation, unimproved water

Highlights

SDG/MDG targets assume a single main source for drinking water and sanitation. Many households use multiple drinking water or sanitation options, leading to underreporting of high-risk practices.
Using a mobile platform, we document underreported high-risk WASH practices across eight countries. Ambitious SDG targets need to incorporate comprehensive metrics shown here.

Introduction and objectives

Improvements in the quality of drinking water and sanitation (WASH) facilities as part of the erstwhile Millennium Development Goals (MDGs) were tracked through indicators that failed to capture high-risk practices undertaken on a regular basis. Using a mobile platform in conjunction with local partners, we implemented representative randomized household surveys in eight countries in Asia and Africa to quantify the presence and magnitude of such underreporting. Much of the questionnaire was modeled after the widely-used Demographic and Health Surveys (DHS) to ensure benchmarking. Additional questions were meant to identify regular use of high-risk practices.

Methodology approach

Household surveys (n = 245,054) were conducted in nine regions across eight countries in Asia and Africa, as part of the Performance Monitoring and Accountability 2020 (PMA2020) project. Female resident enumerators (REs) used mobile phones with a customized open-source application to conduct household interviews. In addition to identifying the main water and sanitation facilities, interviewees identified all household water and sanitation options regularly used for at least one season of the year. Unimproved water consumption and open defecation were targeted as high-risk practices. We defined underreporting as the difference between the regular and main use of high-risk practices.

Analysis and results

PMA2020 estimates of high-risk practices as the main option matched DHS estimates within the 95 percent confidence interval. However, estimates of these practices as a regular option was far higher than the DHS estimates. Across the nine regions, underreporting of unimproved water ranged from 0.5% in DR Congo (Kinshasa only) to 13.9% in Nigeria (Lagos state) with a median of 5.5% in Uganda. Underreporting of open defecation ranged from 2.7% in DR Congo (Kinshasa only) to 11.5% in Indonesia, with a median of 9.9% in Ghana. In terms of population, there is an underreported population of 25 million regularly consuming unimproved water and 50 million regularly practicing open defecation. We examined results in Ethiopia in detail as a case study and identified disparity across urban and rural locations – underreporting of high-risk practices was more prevalent in urban areas. A socio-demographic analysis identified wealth, location, access to multiple sources, and certain characteristics of the household head as drivers of high-risk practices. We also identified the use of multiple options for meeting WASH needs.

Conclusions and recommendation

The PMA2020 mobile surveys offer a cost-effective and innovative platform to rapidly monitor critical WASH metrics. The Sustainable Development Goals (SDGs) set ambitious targets, which must be monitored rapidly. Many SDG goals rely on metrics used in MDG implementation. That framework considers just one main drinking water or sanitation option, but in fact households regularly employ many options. Our analysis demonstrates widespread underreporting of high-risk WASH practices under the MDG paradigm, which necessarily leads to inflated reports of progress. Policies based on the old paradigm, therefore, fail to consider the range of challenges and solutions to meeting WASH needs.

Designing water sector governance to meet SDGs, Burkina Faso case

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Keywords: Governance, Burkina Faso, WASH, technical assistance, SDGs

Highlights

Burkina is one of the first countries having already in January 2016, a governance framework to meet SDGs. COWI and IRC have been delivering technical support to the government for designing this framework. This paper aims at sharing key lessons learned and recommendations for an effective process in similar countries.

Introduction and objectives

Water governance includes two main areas: 1) the governance of water resources based on IWRM tools, and 2) the governance of WASH services focusing on the specific policies, institutional arrangement, etc. for the delivery of WASH services as public goods. COWI and IRC have been providing technical support the government from 2014 to 2015 for designing building blocks for water governance in order to meet SDGs. The objective of this paper is to share the knowledge and lessons learned from this experience so that it helps similar governments to get prepared for the implementation of SDGs.

Methodology approach

It's important to notice that the whole process led by the government has not been fully designed and structured from the beginning. SDGs have introduced new paradigms that needed a thorough revision of the water governance. Thus, the main challenge has been the positioning of sector governance as a corner stone for the national water policy with a specific implementing programme to strengthen the whole set of four sector SDGs related programmes. While having been a poorly coordinated process, the systematic documentation and analysis generated some meaningful lessons relevant for global sharing.

Analysis and results

The technical assistance has been provided through assignments contracted by the ministry in charge of water and sanitation. Main outputs are one national water policy and 4 national programmes operationalizing the policy to meet water-related SDGs. Programmes covered the management of water resources, the development of drinking water services, the development of sanitation and hygiene services, the governance of WASH services (crosscutting conditions for effectiveness and sustainability). The whole process took 24 months, each output was separately contracted. About 450 days of consultants was invested. Operationalizing SDGs required new competences (unusual in the sector). In addition to engineers, public finances specialists was mobilized to address financing issues and develop models; public policy specialists was mobilized to integrate water policy and programmes with other national development and growth policies; human rights specialists was mobilized to identify gaps and new angles for public actions. The process yielded a good set of individual outputs but the consistency of the package is yet to be improved. The main cause is the lack of coordination by the government. For example, the water resource management programme was designed first and then followed the national water policy that went in parallel with the 3 other programmes.

Conclusions and recommendation

After the adoption of MDGs, Burkina spent 5 years, as most of African countries, to set-up the required sector programmes. Thus being almost ready by January 2016 to start implementing SDGs, from a 2 years anticipating process, makes Burkina an interesting case to learn from. Kicking-off SDGs at country level requires an effective country-led process to avoid continuation of governance models used for MDGs that will not be adapted to address SDGs related challenges. The process also requires clarity in targets, mobilization of relevant expertise (for governance solutions) and strong coordination to deliver a consistent set of well integrated programmes.