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Sustainable integrated water resources management for energy production and food security in Libya

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Abstract

Paper is designed to present an overview of sustainable integrated water resources management at global, regional, national and local level for enhanced energy production and food security in Libya. It demonstrates that how actions, accords, and commitments by institute industry interaction (3Is) initiative with special reference to water resource efficiency for enhanced energy production & food security are being debated by using awareness and preparedness for environmental emergencies at local level (APELL) along with numerous both Libyan and UNEP priority initiatives and programs. Based on case studies to recognize some of the most common problems experienced in Sustainable Integrated Water Resource Management (SWIM) planning for enhanced energy production technologies & food security and developing options for overcoming them a set of recommendations on how to enhance institutional and legal reforms for its implementation at the national/local levels are briefly outlined. Finally it shows that how lessons learnt and best practices technologies especially from UN agencies are assisting to promote water resource efficiency to achieve energy & food security of case study areas in Libya for its wider application in both developed and developing countries.

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1. Introduction

Integrated Water Resources Management (IWRM) is a coordinated, goal-directed process for controlling the development and use of river, lake, ocean, wetland, and other water assets. It involves applying knowledge from various disciplines as well as the insights from diverse stakeholders to devise and implement efficient, equitable and sustainable solutions to water and development problems related to energy production and food security. World over rising interdependence of water, energy, food resources raises security concerns. These resources are tightly interconnected and needed to sustain life on earth. Food production which is the largest user of water globally is responsible for 80–90% of consumptive water use from surface- and ground-water. Water used to generate electricity accounts for about 8% of global water withdrawal. Energy is lifeline for transport and fertilizes crops. Food production and supply chains are responsible for around 30% of total global energy demand. Crops are now being used to produce biofuels. Recent estimates show that by 2050, world population would rise to 9.2 billion resulting in 70% increase in demand for food and a 40% rise in demand for energy. As per another estimate by 2030, the world would confront a water supply shortage of about 40%.

Increasingly resource problems that cross boundaries have scaled up in recent years. Sustainable water resource management for enhanced energy production and food security is a complex business. World Water Council way back in 1996 alerts us that, the wars of the next century will be for water, “unless we change the way we manage water. Indeed water is a key driver of economic and social development. It also has a basic function in maintaining the integrity of the natural environment. Bearing in mind that water is only one of a number of vital natural resources, it is imperative that water issues are not considered in isolation. Both public & private sector managers, have to make difficult decisions on water allocation. It requires apportion diminishing supplies between ever-increasing demands. Drivers such as demographic and climatic changes further increase the stress on water resources. The paper shows that how traditional fragmented approach is no longer viable. It needs a comprehensive and more holistic approach to water management including issue of energy production & food security.

Water security is rightly defined as an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water- related risks to ‘food security’ and people, environments and economies. Tackling water security requires reliable access to sufficient supplies using adequate and affordable water resources management. The present paper highlights that how integrated sustainable water resource management is being tackled based on best practice case study in Libya based on needs assessment that assists in framing the issue infrastructure to store and transport water, treat and reuse waste water information and the robust institutions, able to take and implement decisions. It is based on an open, flexible process, bringing together decision-makers across the various sectors that impact water resources, and bringing all stakeholders to the table to set policy and make sound, balanced decisions in response to specific water challenges faced. It demonstrates that how sound understanding of water security does help to clarify our capacity to predict, plan the institutions best able to help us to achieve them. It further shows that how sustainable regional and national development needs assessment helps in promoting water security that in turn contribute to climate change resilience for economic growth and human security.

2. An Appraisal of Existing Situation

Libya has 2000 km coast line. All most all Mangroves have been destroyed. Untreated & Under treated Domestic sewage & industrial effluents being discharged into Sea. Coastal Road is undertaken in violation of Central Reserve Zone (CRZ). Cement Projects do have serious adverse impact. Precautionary Principle requires adoption of Risk based approach asks “how much damage is acceptable or can we get away with?” The system sets numerical limits to allow that much damage to occur, but we end up with more than acceptable damage. Under Precautionary Principle we ask “how little damage is possible?”. Precautionary system urges a “Better Safe Than Sorry” approach decisions. Seas are polluted when relationships between Plankton & Light, Plankton & other Marine Organism and Sea Bed & Surface are damaged. The message is let us not play with Seas & Oceans as “Life on earth is sustained by the existence of Sea, since life began in Sea about 2.5 billion years ago”. Interesting case studies presented in [1, 2] at Al Garabouli, Kasrekhiar and near Tripoli region at Tajoura [2] are designed to promote the adaptation of Mediterranean agricultural systems to climate change through a combination of modern and traditional water

management and conservation techniques [3, 4, 5]. New and indigenous varieties of cereals and legumes resistant to difficult climatic conditions are used. The activities are underway to present the performance of introduced varieties and management practices to farmers, extension agents, researchers and decision makers.

An overview shows that in Libya like many other countries regulatory decisions such as water allocation and pollution licensing are implemented at the scale of the river basin or catchment. This is accompanied by the emergence of institutional arrangements for water resources management that utilizes hydrological boundaries. Most of these institutions are grouped as River Basin Organisations (RBOs). Some are specifically mandated with managing groundwater water aquifers and lakes basins. Libya, Egypt, Chad and Sudan have signed a UN-backed agreement on the shared use of a massive underground aquifer system straddling the four countries known as the Nubian Sandstone Aquifer System. Containing an estimated 150,000 cubic kilometres of fossil water, it covers an area of two million square kilometers. UNDP capacity development programme for sustainable water management has developed a training manual on IWRM for River Basin Organizations that works with networks of local capacity builders around the world to assist water managers with the concept of using an IWRM approach on the ground.

3. Research Problem in Libya:

An appraisal of past and present situation shows that Libyan's structural vulnerabilities, in the absence of a strong adaptive capacity, has produced nurtured vulnerabilities that render its economy susceptible to the impacts of crises. On analyzing how the recent crises are intertwined, it is found that like most North African governments' Libyan responses to the 2007 food crisis were slow, not well targeted towards those most affected by soaring food prices, and included measures that could not be easily terminated once food prices began to ease. Nurtured vulnerabilities - greater sensitivity to fluctuations in international prices, financial transfers and investments - were all reinforced during this period. Despite this, Libyan economy like most other North African economies demonstrated good macroeconomic resilience during the subsequent 2009 global financial crisis. However, the effects of the crisis were detrimental at microeconomic level, particularly for SMEs, informal sector workers and poorer households. Using the fiscal space created prior to the crisis, Libya like most other North African countries were able to implement countercyclical fiscal policies. Yet, these crisis responses deepened the nurtured vulnerabilities, as they were a mere expansion of the measures introduced in response to the world food crisis. Moreover, a sizeable portion of the countries' fiscal stimulus packages was directed towards supporting international trade and export firms, rather than domestic companies or national development. The 2011 Arab Spring forced Libya like other North African governments to become more responsive to the needs of the poor and unemployed, although poorly-targeted public policies continued to benefit mainly the affluent, further reinforcing the growing nurtured vulnerabilities.

4. Research Methodology

Libya based academies, universities, high institutes and Research Centers have launched initiative to reduce, reuse & recycle resources product and services (3Rs) for rebuilding the country to combat climate change impacts [1] induced by 2011 Libyan crisis. The country is engaged in preparing actions, accords, ideas and best practices to mitigate the impact of projected extreme events and weather by considering low carbon, resource efficient measures and enhanced use of renewable to tackle impending climate change [3,4,5,6]. 28 hot spots in Libya are identified to convert them to bright spots. An initiative on water-energy-food nexus is established to focus on the interdependence of the three strategic resources by understanding the challenges and finding opportunities. The nexus objectives are 1) To improve energy, water and food security 2) To address externalities across sectors and decision-making at the nexus & 3) To support transitions towards sustainability.

To resolve Libyan problem authors have undertaken activities in Developing a Framework for Water Security and Climate Resilience Development using IWRM as a Tool in line with UNFCCC guidelines on Fresh water resources and climate change adaptation. The objective of these activities are to help in Promotion of WACDEP in global climate change processes and the world water week in Stockholm COP 16, Mexico, COP 17, Durban. Libya did celebrate Water, Climate Development Day to help to support African regional process for the World Water Forum. Libya employed Global Water Partnership: (GWP) suggested methodology to target Coordinator for Climate Change and WACDEP that is central to the Targets for WWF[7,8,9,10]. Global Linkages of WACDEP Part of the GWP

Pledge under the UNFCCC's Nairobi Work Program recognized by UNFCCC is adopted as a mechanism for the user Interface Platform of the Global Framework for Climate Services under WMO. Framework for Water Security & Climate Resilient Development is indeed a useful tool to enable implementation of WACDEP, supported by Climate Development Knowledge Network (CDKN). Libya used Technical Background Document Strategic Framework for Water Security and Climate Resilient that provides a Development Capacity Building Plan for the Framework Policy Briefs.

Technical Background Document is prepared to help guide robust decision-making in developing practical low or no-regret adaptation measures. It captures international best practices in defining water security and climate resilient strategies, assessment methods, etc. critique on pros/cons of various methods in existence develops/adapts methods for understanding water futures, climate futures and development futures that provides guidance on dealing with uncertainty, increased climate variability & climate information gaps. It provides knowledge on relevant investments required to enhance water security & climate resilience. It also clarifies links between water securities, IWRM, Climate Change (CC), development Basis for the Strategic Framework on Water Security & Climate Resilient Development [11, 14].

Strategic Framework for Water Security and Climate Resilient Development of Libya is developed to help provide a short, easy to use strategic document. It outlines how to develop 'no/low regrets' investments strategies that focuses on how country can develop 'no/low regrets' investment and financing strategies for water security and climate resilient development. It also incorporates water security and climate resilience into national development plans, macroeconomic frameworks, MTEF, national budgets and overall economy based on the analytical work in the Technical Background document.

Framework Milestones 2011 for World Water Week-Inception meeting of COP 17 was prepared for consultations with CORE TEAM HR Wallingford - lead Oxford University Centre for Environment Oxford Policy Management Institute for Development Studies Associate Partners University of East Anglia Water Security Centre International Office for Water (host of INBO) IWMI-Africa Climate Systems Analysis Group[12,13].

5. Discussion of Results

Based on international best practices& consultation with global, regional, national & local stakeholders, it is found that there is need to promote resilient growth in the Short to Medium Term. This would help:

- To strengthen adaptive capacity needed for Libya to continue to exercise monetary and fiscal restraint; redesign social policies and programs to firmly target vulnerable households; reform education systems and support state institutions to restore trust and inclusiveness;
- To reduce systemic vulnerability needed to diversify trade and financial partners; invest in agriculture and alternative energy; and, support SME development.;
- To expand the drivers and distribution of growth Libya to pursue trade liberalization and privatization while ensuring that measures are in place to lower the risks associated with global integration; remove the legal and regulatory impediments to formal private sector growth, innovation and employment; and, promote sartorial diversification for more broad-based economic growth.

These policies can be financed through the involvement of a wider range of local and international partners as well as innovative funding sources, such as 'Diaspora bonds'

The two themes that are central to the reinforcement of resilience growth in Libya like others in North Africa, include strengthening food security and promoting regional integration.

To improve food security at both national and household levels, the Libyan economy should:

- Improve access to foods through better integration into global food markets and increased credit and financial resources to small and poor farmers;
- Improve agricultural productivity through higher government expenditure on the agricultural sector and related Research and Development activities; and,
- Reform social safety nets, particularly by moving away from regressive universal subsidies on food and fuel towards more targeted subsidies.

To enhance regional integration the country needs to implement following policies:

- Elimination of nontariff measures;

- Improving cross-border trade facilitation and logistics;
- Reducing the cost of infrastructure (notably transportation and ICT);
- Giving a prominent role to the private sector.

These, together with an alignment of policies and procedures related to investment and labour mobility, are meant to significantly improve regional integration and better protect the countries against global economic and financial crises.

Adoption of a resilient growth strategy is critical for turning political transitions in the country into decisive and tangible socio-economic gains.

Such a growth strategy will help pave the way for a more stable and equitable growth trajectory, which addresses the reclamations at the very heart of the Arab Spring.

6. Concluding Remarks

Paper presents challenges and opportunities of current global scramble for scarce resources – water, energy and food. It highlights, appraisal of global, regional, national and local issues related to water resources management to demonstrate that how actions, accords, and commitments by 3Is initiative with special reference to water resource efficiency are being debated by using awareness and preparedness for environmental emergencies at local level (APELL) along with numerous both Libyan and UNEP priority initiatives and programs. Libya need to find ways of building resilience against crises that could threaten economic and social stability. Country should focus on inclusive development in order to tackle the long-standing socio-economic problems that have destabilized the country in recent years.

The paper introduces a new and innovative resilience framework to gauge the impact of the recent crises (e.g. food crisis, financial crisis, Euro-debt crisis, Arab Spring) and to critically assess government interventions aimed at minimizing their effects and identifying options for policy makers.

The proposed crisis resilience framework considers crisis vulnerability as a product of ‘structural’ or ‘nurtured’ factors, and argues that a country’s ability to cope during crises is largely determined by its ‘adaptive capacity’ - that is its access to and control of resources to deal with shocks or stresses.

Country’s structural vulnerabilities can, in the absence of a strong adaptive capacity, produce nurtured vulnerabilities that would render economy susceptible to the impacts of crises. Based on case studies to recognize some of the most common problems experienced in IWRM planning and developing options for overcoming them a set of recommendations on how to enhance institutional and legal reforms for its implementation at the national/local levels are briefly outlined.

Finally it shows that how lessons learnt and best practices especially from UN agencies are assisting to promote integrated water resource management and sustainable consumption and production of water in Libya for its wider application in both developed and developing countries.

References

- [1] Almabruk A. Reflections on climate variability within selected monthly mean time series in Libya and neighboring countries, *Geographia Polonica*; 1995, 65: 51-62.
- [2] Bindra SP et al. Water Energy & Food Nexus, Proc. Conference Jan, 2012, Amritsar, India, 2012
- [3] Bindra SP. Libyan Rapid Response Task Force for Food Security 2012, Libya Academy, Tripoli, 2012
- [4] Bindra SP et al, 2008, National Adaptation Planning for vulnerability to climate change, IEF First Conference on climate change, Libya
- [5] Bindra SP. First Libyan National 350 program to Combat Climate Change, Oct, 2011, Libya Academy, Tripoli, 2011
- [6] Bindra SP, et al. Rio + 20 Libyan National Report, May, 2012 UNCSO Website Newyork, USA, 2012
- [7] GWP/INBO (2009), Handbook for IWRM in Basins, Global Water Partnership (GWP),UN-Water, 2007
- [8] GWP (2009), Triggering change in water policies, GWP website www.gwp.org/.../Policies/Preparation-of-a-national-water-resources-polic...
- [9] GWP (2004): Catalyzing Change: Handbook for developing IWRM and water efficiency strategies, www.gwp.org
- [10] GWP (2004): IWRM and Water Efficiency Plans by 2005: Why, What and How, www.gwp.org
- [11] UN. An overview report that introduces the process of Integrated Water Resources Management (IWRM) United Nations Economic and Social Commission for Western Asia (UNESCWA) 2004. www.un.org/

- [12] UN. 2008, 'Status Report on Integrated Water Resources Management and Water Efficiency Plans' at the sixteenth session of the Commission on Sustainable Development, UN-Water May 2008. www.un.org/
- [13] UN. 2009, 'Guidelines for IWRM Coordination', UNESCO-International Hydrological Program (IHP), World Water Assessment Program (WWAP), Network of Asian River Basin Organizations (NARBO) in 2009. ww.un.org/waterforlifedecade/pdf/_iwrn_eng.
- [14] UN. 2007, 'Guidelines for IWRM Implementation', United Nations Economic and Social Commission for Western Asia (UNESCWA) 2007. www.un.org/waterforlifedecade/pdf/iwrn_eng.