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Implications of IWRM in Developing Countries

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ABSTRACT : *The purpose of Integrated Water Resource Management (IWRM) is not to maximize but to optimize water usage amongst the various water demanding sectors. It was an approach first utilized by water resource managers in developed countries to provide a connection between within the hierarchy of certain agencies and across certain agencies. With the hope that a clearly defined function and awareness of activities amongst them would effectively manage water resources. This paper briefly reviews Integrated Water Resource Management and its possible role in the management of water resources in the developing country of Belize. It concludes that given the current fragmentation of the various water responsible entities within the country, IWRM is an approach that can be adapted to remedy this current problem and future problems more specifically the onset of climate change.*

KEYWORDS: *Integrated Water Resource Management, Belize, Implications, Water Policy, Climate Change*

I. INTRODUCTION

Water insecurity is a paramount threat to the future sustainability of global populations (Biggs et al. 2013). It has been reported that water demand already exceeds supply in many parts of the world, and more and more areas are expected to experience this imbalance in the near future (Vairavamoorthy et al. 2008). Currently, some 30 countries are considered to be water stressed, of which 20 are absolutely water scarce (Vairavamoorthy et al. 2008). Predicted that by 2020, the number of countries with water scarcity will likely approach 35 and what is more worrying is that it is the developing countries that face the greatest crisis and it has been estimated that by 2025, one-third of the population of the developing world will face severe water shortages (Seckler et al. 1998). In addition researchers have articulated serious concerns that freshwater especially might become the most limited resource in the future due to significantly constraining relations between water use and the production of food, energy, and other goods and services especially in the developing world (Godfray et al. 2010; Hanasaki et al. 2013; Mulder et al. 2010; Vairavamoorthy et al. 2008).

The past two decades have witnessed increasing global concern with the need for sustainable water and land management in an era of rapid change and persistent water and food insecurity (Pahl-Wostl et al. 2013). This is a valid concern especially since water is known as an irreplaceable and non-substitutable natural resource (Bogardi et al. 2012) and the fact that all societal and economic activities depend on water (Hanasaki et al. 2013). It is easier to accept the view that the failure to harvest this natural capital as the single-most important missed opportunity in economic development(Collier 2010). The aim of this paper is to provide possible implications of IWRM in Belize, through a literature review. The paper is structured as follows: Section 2, a description of the IWRM approach, IWRM for good Water Governance and IWRM in the Caribbean; Section 3, characteristics of the study area; Section 4, a description of Belize's water sector; Section 5, implications of IWRM in Belize; and finally Section 6, the main conclusions of the study.

II. INTEGRATED WATER RESOURCE MANAGEMENT (IWRM)

Water resources planning and management was historically focused on economic performance but there is now a general realization that Integrated Water Resource Management (IWRM) provides a more suitable integrated holistic approach to managing water resources (Geng and Wardlaw 2013). However the definition given by Global Water Partnership (GWP 2000) as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems in its simplicity and entirety still best describes IWRM.

Water Governance and IWRM : According to (Foster et al. 2010) 'water governance' involves the corresponding framework for effective water resources management, including the delivery of all water services in a socially-responsible, environmentally-sustainable and economically-efficient manner — and comprises the processes of defining policy options, of translating them into goals, of providing institutions, procedures, means, monitoring and accounting, of enabling stakeholder participation, and of taking responsibility for outcomes.

Whereby they highlighted key considerations are the relations, linkages and accountabilities of the corresponding public, civil, professional and private stakeholders. This definition embodies what IWRM should or can achieve, therefore in a developmental sense many countries in the Caribbean Region have opted to utilize IWRM as a roadmap to enhance water governance. The region is known to be well endowed with fresh water and as there have existed variations in time and geographical availability within and between countries as well as in availability in ground and surface water.

IWRM in the Region : To mitigate and develop strategies to combat water scarcity as a result of water mismanagement as a way forward countries in the Caribbean region have turn to the Integrated Water Resource Management approach. Some examples of which include the Small Island Developing States (SIDS) of Antigua and Barbuda, Barbados, Trinidad and Tobago, Saint Lucia, Jamaica and Dominica who are using or have used the approach as a road map to improve water resource management, thus promoting efficient, productive and sustainable use of both land and water within the watershed. Some of the challenges that were or will be addressed were, the absence of a national water policy, a lack of cross – sectoral coordination framework for plans and policies, institutional capacity, condition of water service infrastructure and utilization of water resources by all stakeholders. Thereby securing water for people, securing water for food production and protecting all vital ecosystems.

Characteristics of Study Area

Country Description : Belize is a country which belongs to both the Caribbean and Central America. Its capital bears latitude and longitude of 16º 13´ and 88º 48´. The total area of Belize is 22,966 square kilometers. Belize is divided into four main geographical regions the low lying Maya Mountains in the south, the Northern lowlands, the flat swampy coastal plains and numerous islands of its Coastline. More than 50% of Belize is covered by a tropical rainforest and its most important river stretches from the Guatemala border to the west of the country and empties out in the Caribbean Sea. Belize's highest point is the Victoria Peak which reaches a height of 1,160 m and its lowest point is the Caribbean Sea 0 m.

Climate : According to Köppen climate classification (Rubel and Kottek 2010), Belize only has tropical climate zones. There are two distinct seasons: a rainy season which normally commences around mid May in the south and early June in the north, and last until November; and a dry season which stretches from mid February until May. A cool, wet transition period extends from December until February, during which the region experiences incursions of arctic air masses from the continental USA and Canada, which often results in night time minimum temperatures dropping to about 10˚C or less in the higher terrain of the Mountain Pine Ridge in extreme cold events. Annual average rainfall varies from 1,524 mm in the north to 4,064 mm in the south. Seasonal differences in rainfall are greatest in the northern and central regions of the country where, between January and April, fewer than 100 mm of rain fall per month is not unusual. The dry season is shorter in the south, normally lasting from March to mid-May.

Water Resources : Belize has an abundant supply of both surface and groundwater, yet currently the total water resources cannot be assessed because of data availability especially with respect to groundwater. The surface water resources are known to be available over the entire country of Belize with the exception of the Vaca Plateau, where the water bodies seep into the porous limestone. (Buckalew et al. 1995) stated that surface water resources in Belize are abundant; these resources include 16 major rivers draining from the Maya mountains to the coast of Belize. The most recent data on renewable internal freshwater resources is an estimated value of 16.0 billion cubic meters, estimation which was conducted by the World Bank in 2009. With a total annual withdrawal of 95 million cubic meters a year, domestic usage being between 240 and 280 liters per day in urban areas and roughly 160 liters per day in rural areas. Source of which is provided by both surface and groundwater. Although groundwater supplies all or part of the needs of the urban and more so the rural population, the various institutions responsible strata identification, well drilling, installation of irrigation and aquifer assessment do not conduct or do not properly document these task. Consequently this is the reason why knowledge of groundwater resources is limited.

III. BELIZE WATER SECTOR ASSESSMENT

Existing Functions and Responsible Entities : In his assessment (Williams 2013), the institutions with water resource responsibilities were presented Fig 1 and by reviewing the organizational framework of each he was able to categorize four overall functions. These functions as seen below were: a) Water Supply and Sewage Service, b) Water Protection and Conservation, c) Water Abstractions and d) Water Safety. The responsibilities of the respective entities are, excepted where stipulated in legislation, not clearly defined nor coordinated and there are extensive overlaps, and in some cases, gaps and duplications exist(Williams 2013). Several studies

have claimed that an overlap often result in poor management and development of resources(Chase 2008; Godfray et al. 2010; Hanasaki et al. 2013; Mukheibir 2010; Pahl-Wostl et al. 2013). To overcome such a challenge within the sector a water policy was developed.

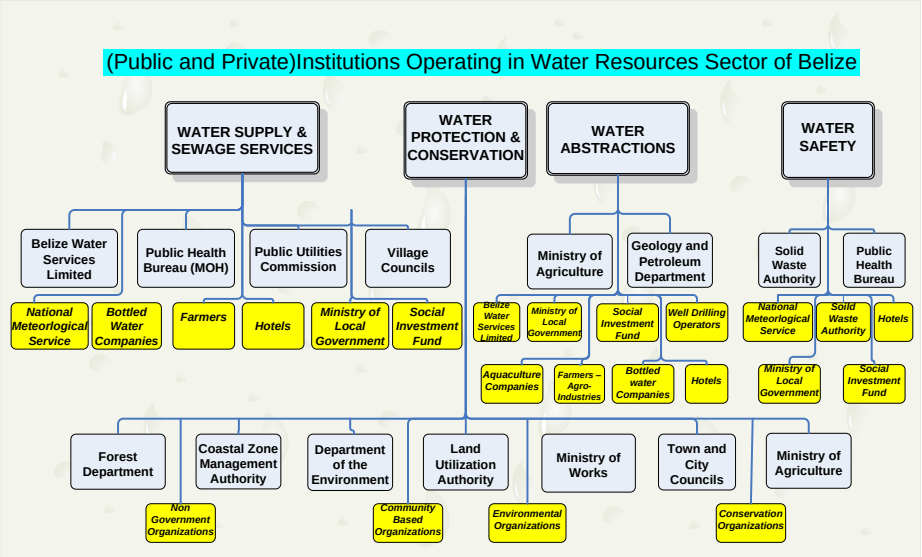

Figure 1. Organogram of institutions operating In Belize's Water Resources Sector(Williams 2013)

Structuring of Belize's Water Policy : The water policy was structured based on several fundamental principles Fig 2 found in the survey they conducted. Their results reiterated that water is a finite and vulnerable resource, essential to sustain life, the environment, the economy and national development. As a national resource, it belongs to the people of Belize, ownership which is indefinite. Water is vested in the state that is the guardian and guarantor of water rights. In addition the state governs, manages and promotes rational use of water resources for the benefit of Belizean public continuously. Furthermore access to safe and affordable water is a fundamental right of all Belizeans which is vital since there is a directly correlated with the levels of health and poverty. Also it was mentioned that water has an economic value and the "user pays" principle is integral in ensuring the sustainability of this resource. Feedback from an environmental perspective also mentioned, global climate change, climate variability and land use and how it would impact water availability and usage. Especially with respect to watersheds and all its functional units, that is crucial in achieving an integrated and holistic approach to water resource management.

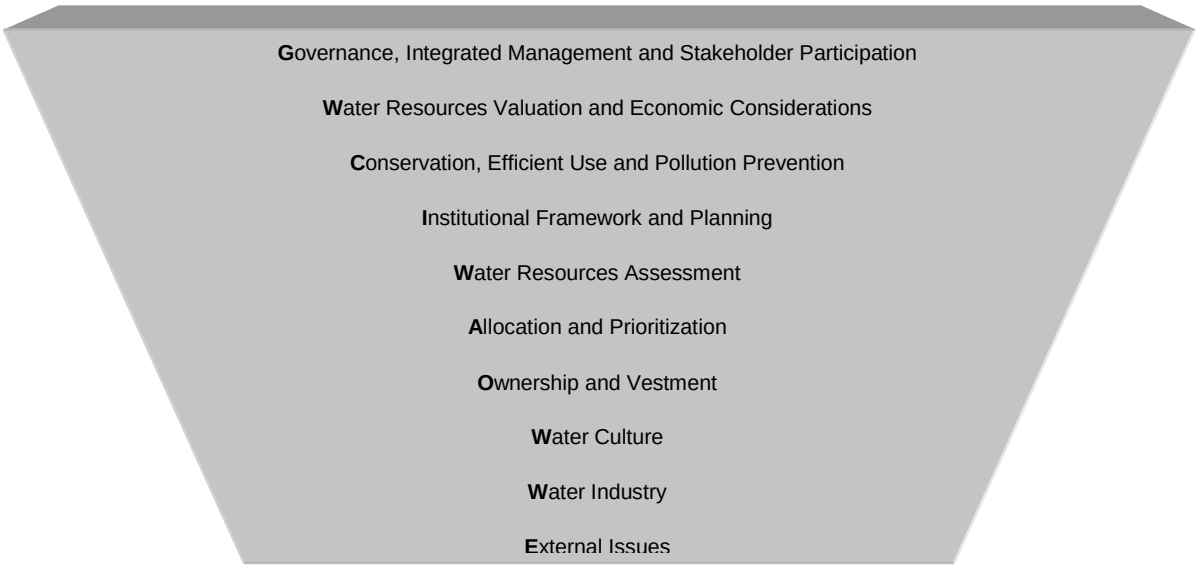

Figure 2. The ten thematic areas identified as the main components of the proposed water policy

Challenges to Water Resource Management : The challenges to water resource management in Belize encompass three main issues which are physical, institutional and policy. Some more specific issues include water availability which is exhibited in the dry season and in the rural parts of the country. Water quality where there are, poor raw and treated water in some areas. A main contributor to the country's economy is also an issue because agricultural intensification results extensive land clearance and also the intense use of agrochemicals which have impacts on both the quality and quantity of water. Deforestation due to extensive land clearance for various purposes for example agriculture as well as rural and urban development impacts water availability (Meerman et al. 2010). With deforestation the following as well occur soil erosion, land degradation, sedimentation which all have an impact on water quality(Fiore 2002). In her research it was also mentioned that the uncontrolled rural development reduced the vegetative cover which also led to land degradation contributing to reduced water availability and poor quality. Also there exist inadequate water supply infrastructure especially in the rural communities which result in effective abstraction, treatment and distribution of water. Studies (Gladden and Wang 2011; Williams 2009) have shown inadequate/unavailable data for flood forecasting, drought monitoring, groundwater assessment, water quality assessments and with insufficient current and historic precipitation, stream flow, runoff, water demand and supply data. The impact of climate change on water resources in Belize is more so vague thus making it difficult to predict. Therefore it is of vital importance that an IWRM strategy is not only established but enforced to attain an efficient and sustainable management of the national water resources.

IV. IMPLICATIONS OF PROPERLY ESTABLISHED IWRM

The implications can be linked to the three strategic objectives of the IWRM process. These objectives are efficiency (maximizing the economic and social welfare of water), equity (allocation of cost and benefits to promote sustainable social development and environmental sustainability. This would be achieved by the framework which defines clearly the role of all stakeholders across the respective sectors. Resulting in less repetitiveness in activities since jurisdiction would no longer be fuzzy. Also it would allow for capacity building and institutional by determining where room for improvement is needed.As a management tool IWRM would allow for both groundwater and surface water resources assessment which to the best knowledge of the author has not been undertaken within the last three decades. These assessments would assist agencies like the Belize Water and Sewage Limited (BWSL) refine the water allocation mechanism and serve as risk assessment and management tool in the public sector and agricultural sector by more efficiently monitoring and providing real time data for droughts and flooding as an example. The most consequential role of IWRM as an instrument is information management and exchange. A role that is essential presently as in the case of the agricultural sector to determine the most suitable cropping cycle and in the future when determining the impact of climate change on the productive sectors. IWRM would be able to assist in the formulation of strategies which would mitigate the effects of the extreme climate variability whilst still maintaining good governance, resource protection, appropriate land use and most importantly efficient water use. Since to be prepared for climate change require the technologies and policies work n sync towards anticipation(Bormann et al. 2012), mitigation(Agyenim and Gupta 2012; Cook and Bakker 2012; Dukhovny et al. 2013), and decision adaptation(Geng and Wardlaw 2013; Mitchell 2006; Rubel and Kottek 2010) for its possible impacts.

V. CONCLUSIONS

This paper has attempted to highlight the importance of IWRM in the Caribbean Region focusing on the on Belize a developing country which is located in both Central America and the Caribbean. The study gave an insight to the countries general description before giving an assessment of Belize's water sector, how it is currently structured and the approach taken when the countries first water policy was being drafted. Finally challenges to the country's water management practices were mentioned and a way in which IWRM could be considered a reliable option if properly established. If improvements are not made to water governance through the suggested approach of Integrated Water Resource Management securing water for food, for Belizeans and the ecosystem they depend upon will not be achieved although the country has an abundant source of freshwater. This review also acknowledges that the development and implementation of adaptation strategies to climate change will rely on management instrument of information management and exchange to formulate the previously stated strategies. An instrument which is most effective when applied in unison with the other instruments provided by the IWRM approach.

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