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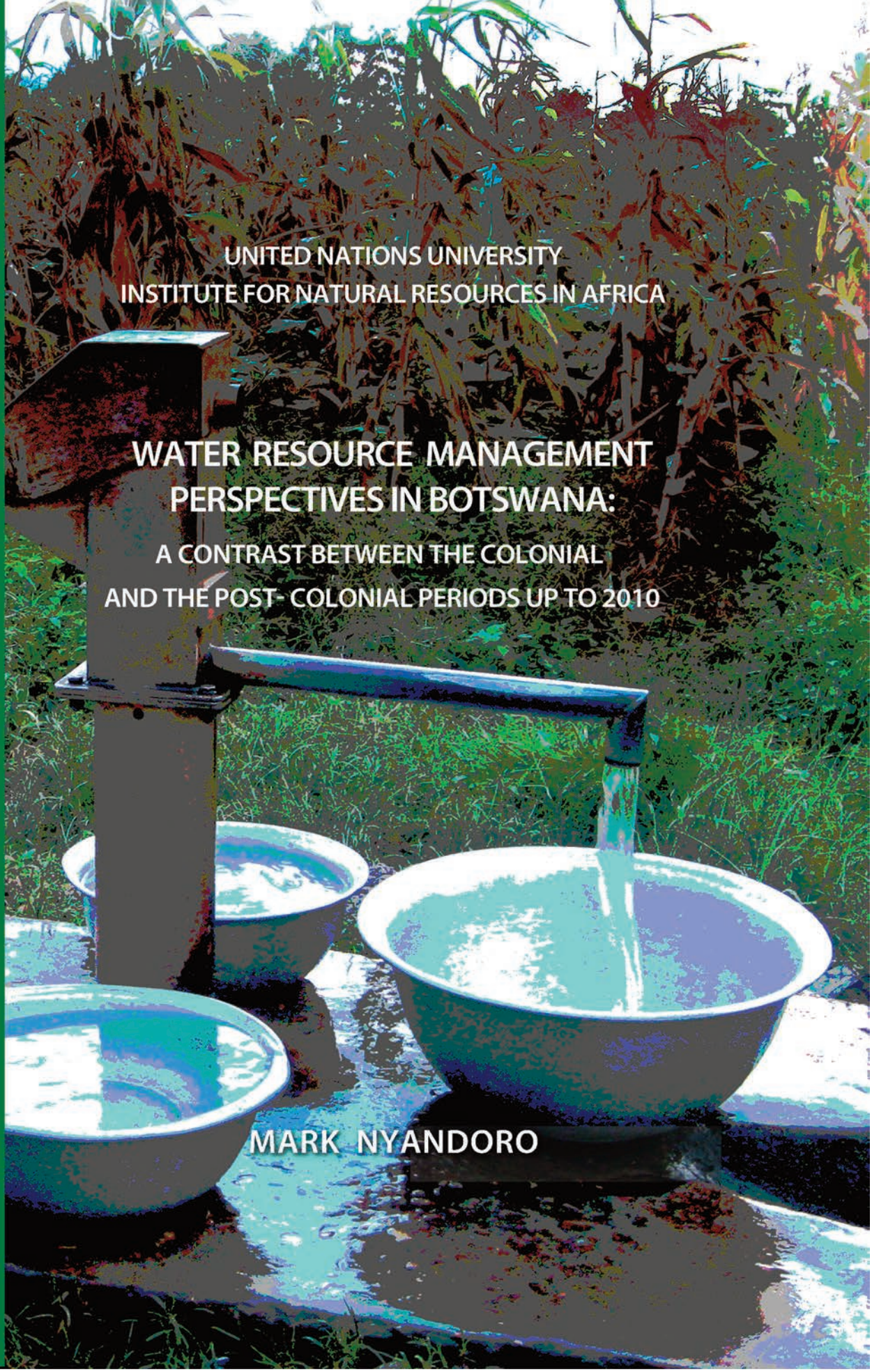

UNITED NATIONS UNIVERSITY
INSTITUTE FOR NATURAL RESOURCES IN AFRICA

# WATER RESOURCE MANAGEMENT PERSPECTIVES IN BOTSWANA:

## A CONTRAST BETWEEN THE COLONIAL AND THE POST- COLONIAL PERIODS UP TO 2010

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***BY***

***MARK NYANDORO***

**UNU-INRA Visiting Scholars Programme**

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## ABSTRACT

Much of the research on water in Botswana places the emphasis on supply and demand and the role of the post-independence state in facilitating infrastructural development under water scarcity conditions. Government experts, the United Nations and major stakeholders have predicted a critical water shortage in the next two decades. Water scarcity is arguably the biggest limiting factor to national development in Botswana. Since the adoption of the Water Act of 1967, a concerted effort has been made to address the imminent water shortage in the new millennium through the work of state agencies. Whilst all water resources, including their control, were vested in the state, legislation in 1967 and subsequent legislative amendments have allowed the state to delegate power over the issuance of water rights to the Department of Water Affairs (DWA) and the Water Apportionment Board. The DWA falls under the ambit of the Ministry of Minerals, Energy and Water Resources (MMEWR), which has the mandate to formulate post-colonial water policy. The MMEWR is assisted in the implementation of policy by the DWA, the Department of Geological Surveys (DGS) and the Water Utilities Corporation (WUC). In comparison, the colonial administration either deliberately ignored, or was reluctant, due to the costs involved, to significantly develop the water sector beyond the precincts of the isolated white enclaves dotted in some parts of the country. In the protectorate era the management of bulk water supply to the relatively sparsely populated African areas was thus provided by "tribal" committees, borehole syndicates and to some extent by the protectorate administration itself. Existing scholarly works seem to gloss over a comparative historical evaluation of water provision and management in Botswana's semi-arid environment in the protectorate (1885-1965) and post-independence eras. Using secondary and primary sources, including oral interviews, this research therefore aims to fill this gap.

**Key words:** *Botswana, protectorate, colonial and post-colonial, water supply, water security, water shortage, legislation, hydrological management, water department.*

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With the assistance of experts, the time at UNU-INRA was used to carry out further research and write the final paper after acquiring more insights on water, which is one of the Institute's major natural resource priority areas. I am, therefore, grateful to the ORD for facilitating funding in the form of a research grant that made this project possible and to the Dean of the Faculty of Humanities at UB for allowing me research leave to work as a Visiting Research Scholar with UNU-INRA.

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I would also like to thank the following for their support and invaluable comments: The Permanent Secretary to the MMEWR (Mr Boikobo K. Paya), the Directors of DWA (Dr Obed T. Obakeng) and WUC, Tracy Molefi (International Waters, MMEWR), Leonard Dikobe (UNDP), Dr Elias T. Ayuk (Director, UNU-INRA), the Librarian (MMEWR), Prof A.M. Kanduza (Head of Department, History), Prof Susan Ringrose (Director, ORI), Timothy Olalekan Williams (Director, Africa, IWMI, Accra, Ghana), Dr Benjamin A. Gyampoh (Personal Assistant to Director, Africa, IWMI, Accra, Ghana), Philip Gyau-Boakye (Acting Director, Water Research Institute/WRI, Accra, Ghana), Dr K. Kankam-Yeboah (Principal Research Scientist, WRI, Accra, Ghana), Ben Y. Ampomah (Executive Secretary, Water Resources Commission/WRC, Accra, Ghana), and Enoch Ofosu (Ministry of Water Resources, Works and Housing, Accra, Ghana), as well as all key interview respondents who are too numerous to mention by name.

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## ACRONYMS

| | |
|---|---|
| **AAC** | African Advisory Council |
| **BDP** | Botswana Democratic Party |
| **CD & WF** | Colonial Development and Welfare Fund |
| **DGS** | Department of Geological Surveys |
| **DWA** | Department of Water Affairs |
| **EAC** | European Advisory Council |
| **GDP** | Gross Domestic Product |
| **IWRM** | Integrated Water Resources Management |
| **MDG** | Millennium Development Goal |
| **MMEWA** | Ministry of Minerals, Energy and Water Affairs |
| **MMEWR** | Ministry of Minerals, Energy and Water Resources |
| **MWRWH** | Ministry of Water Resources, Works and Housing |
| **NAC** | Native Advisory Council |
| **NCSCA** | National Conservation Strategy Coordinating Agency |
| **NGO** | Non-Governmental Organisation |
| **NRZ** | National Railways of Zimbabwe |
| **NSCWP** | North-South Carrier Water Project |
| **NWMP** | National Water Master Plan |
| **ORD** | Office of Research and Development |
| **SADC** | Southern African Development Community |
| **UN** | United Nations |
| **UNDP** | United Nations Development Programme |
| **UNU-INRA** | United Nations University - Institute for Natural Resources in Africa |
| **WDM** | Water Demand Management |
| **WRC** | Water Resources Commission |
| **WUC** | Water Utilities Corporation |

*"The holistic management of freshwater as a finite and vulnerable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy, are of paramount importance for action …"*

*Agenda 21, Chapter 18*[1]

## INTRODUCTION

This paper undertakes a comparative evaluation of water resource management perspectives in Botswana (formerly the Bechuanaland Protectorate) situated in the arid and semi-arid environment of Southern Africa in the colonial and post-colonial periods. It also examines the reform measures that can be implemented to ensure sustainable water resource control.

For the purposes of this paper, water resource management is defined as an activity that embraces planning, developing, distributing and managing the optimum use of water resources.[2] It should be noted that there is no single "grand theory" that can be used to explain water management, as it is a complex process requiring the collective efforts of state institutions, traditional institutions, civic society, industry and other stakeholders.

The advocacy statement and resolution at the beginning of this paper was a keystone of the United Nations (UN) Report at the 1992 Rio de Janeiro Conference on "Environment and Development". It highlights the importance of water as a lifesaver and the significance of the collective participation of the state and non-state actors in the management of finite freshwater, including groundwater resources. The strategy recommended by the UN at the Rio Summit is not only suitable for the world, but for country-specific cases such as Botswana, where water shortages caused by the vagaries of the weather are more endemic than in many parts of the Southern African Development Community (SADC) Region. Botswana has therefore resorted to sinking wells and drilling boreholes to tap groundwater.

The paper examines water development in the two periods: colonial (1885-1965) and post-colonial (1966-2010), focusing on the similarities and dissimilarities in water management and the efficacy of the institutions responsible for the delivery and management of this critical and vulnerable natural resource, in order to inform water policy and water sector reforms in the new millennium. The two periods are further used to illustrate the historical context within which water management in Botswana evolved.

[1] Report of the United Nations Conference on Environment and Development, Rio de Janeiro, Vol. I, *Resolutions Adopted,* Resolution I, Annex I and II, 3-14 June 1992. See also M. Suzuki, "Water in our future", in H. van Ginkel, B. Barrett, J. Court and J. Velasquez (eds.), *Human Development and the Environment: Challenges for the United Nations in the New Millennium,* UNU Millennium Series, Tokyo: United Nations University Press, 2002, pp. 197-212.

[2] Anon, "Water management", Observator Meteo & Hydro, undated at http://www.observatormeteohydro.com/applicaties.php?id=132, accessed on 2011-08-26.

Water, which is so vital for socio-economic development, was clearly necessary for cattle husbandry and the establishment of central "towns" in pre-colonial Botswana.[3] The chief and his *kgotla* or public assembly exercised central authority over water among other things.[4] The centrality of control over water points characterised the political organisation of pre-colonial Tswana societies.

The need to find new water sources lay behind much of the mobility even of entire chiefdoms, and many of the struggles between chiefdoms focused on water sources. Conflicts over water usually took the form of conflicts over grazing pastures, especially those defined by the presence of water sources. It can be observed that in pre-colonial times, wealthy and powerful Tswana, such as chiefs, established exclusive claims over water sources.[5] These sources were communally or corporately managed through traditional Tswana institutions, which have a long history of centralised and hierarchical authority, and which also guaranteed user rights to water for all recognised members of the community.[6]

Centralised water management was a key feature of the "tribal" committees and the borehole syndicates in the colonial period – a period in Botswana's history marked by the absence of a water department. In the circumstances, water resources were placed under the Department of Works (the Public Works Department). However, in the same period, decentralised control was exercised by the protectorate administration, largely due to the British administration's reliance on the policy of indirect rule (using traditional chiefly structures, local committees and syndicates). This was also because of limited financial resources which did not permit large-scale investment in the social sectors of the economy such as water, energy, health and education. It can be noted that a centralised management strategy characterised the post-independence period, as the major water institutions such as the Department of Water Affairs (DWA) and the Water Utilities Corporation (WUC) were placed under direct state control. The key question the paper seeks to investigate therefore is whether there are any resemblances or differences in water provision and management perspectives in the protectorate and post-colonial eras.

In addition, to achieve sustainable growth for the future, the issue is whether a new policy orientation and direction in Botswana can be charted, given the kind of water sector practices since time immemorial. This is crucial for Botswana, whose demand for water, despite the country's difficult aquatic environment, is increasing rather too rapidly to meet the needs of the people, livestock, wildlife, irrigation, industry, mining and energy generation.

[3] P. Peters, "Struggles over water; struggles over meaning: Cattle, water and the state in Botswana", *Africa*, Vol. 54, No. 3, 1984, p. 31.

[4] *Ibid,* p. 30.

[5] The missionary John Mackenzie cited in M.R. Kinsman, "Notes on the Southern Tswana social formation", unpublished paper presented to the Africa seminar, 24 September, 1980, p. 8.

[6] Peters, "Struggles over water", pp. 31 & 32.

In the process, the factors that distinguish colonial and post-colonial water supply and management strategies in Botswana - the major policy shifts, state involvement and the role of various stakeholders in water development, governance and conservation of a scarce natural resource, which are critical to economic sustainability, will be examined.

The main justifications for this country case study of Botswana are not only aridity, limited water resources and potential sites for water resources development, but the study is also impelled by the desire to understand how different water authorities coped with the difficulties they faced in managing scarce water resources.

This will be done through a historical analysis of different water management systems with clear synergies, and through an examination of how these have influenced water policy in Botswana. Furthermore, important lessons for Africa can be drawn from countries like Botswana that are emerging from a colonial structure with no major investment in water.

Overall, Botswana is a water-stressed country (See Figure 1 at page 4). Shortage of water is due to insufficient rainfall. The country has varying rainfall patterns. It receives rainfall that is below 250 mm per annum in the southwest (comprising the Kalahari Desert or "The Great Thirst-land"[7]) and approximately 600 mm per annum for the northeast.

Climate change is expected to increase rainfall variability. The average daily maximum temperatures in the summer of about $32^0$C and sometimes extremes of almost $42^0$C [8] cause very high evaporation rates that affect surface water reservoirs such as wells, dams and open tanks.

According to the Minister of Minerals, Energy and Water Resources, Ponatshego Kedikilwe, evaporation from dams alone in Botswana is estimated to be 2,000 mm per annum, a very steep figure indeed compared with 1,500 mm per annum for Johannesburg in South Africa and 500 mm per annum for Stockholm in Sweden.[9] This is aggravating the situation in a country with inadequate fresh surface water due to the absence of perennially flowing rivers, except for the international or transboundary waters of the Zambezi, Limpopo and Shashe rivers.

[7] BNARS, BNB 421, Frank Debenham, *Report on the Water Resources of the Bechuanaland Protectorate, Northern Rhodesia, the Nyasaland Protectorate, Tanganyika Territory, Kenya and the Uganda Protectorate, Colonial Office.*

[8] Department of Meteorological Services, "Botswana Climate", Ministry of Environment, Wildlife and Tourism, Republic of Botswana: undated at http://www.mewt.gov.bw/DMS/article.php?id_mnu=91, accessed on 2011-09-10.

[9] P.H.K. Kedikilwe, Minister of Minerals, Energy and Water Resources, "Statement by the Minister of Minerals, Energy and Water Resources, Hon. Dr. Ponatshego H.K. Kedikilwe, MP for Mmadinare, on the occasion of the Groundbreaking Ceremony of the Commissioning of the Commencement of the Construction of the Polometsi/Dikgatlhong Dam and Housing Component, Robelela Village, 1 February, 2008" at http://www.gov.bw/Global/Dikgatlhonggroundbreaking%20010208.pdf, accessed on 2011-08-10. See also the "Third National Water Resources Management Conference", Gaborone: August 2007.

Botswana's aquatic situation is exacerbated not only by low precipitation and excessive evaporation rates, but also by limited groundwater recharge from surface water resources.

On the one hand, erratic precipitation and Botswana's proneness to drought due to the precariousness of rainfall require the adoption of appropriate water management strategies, such as integrated water resources management (IWRM), that can help counteract the damaging effects of desertification. On the other hand, since water is scarce, astute management is required to achieve sustainable development.

**Figure 1: Extent of aridity and poor vegetation cover in Kgalagadi South, Botswana**

***Source: Botswana Government, "Monthly Vegetation conditions," Department of Forestry and Range Resources, Vol. 1, Issue 1, January-April 2008 at http://www.mewt.gov.bw/uploads/files/dfrr%20vegetation_condition.pdf, accessed on 2011-08-18.***

## LITERATURE REVIEW

Water development, supply and management in Botswana have been studied by several contemporary scholars, notably Canesah, Cleophas, Fontein, Stephenson and Toteng.[10] They all argue in favour of improving water supply, management and the development of sustainable hydrological systems. However, they gloss over the history of water and how different management scenarios have emerged since the inception of the protectorate, as they mainly focus on the post-independence era. The history of water is important for an arid country such as Botswana, due to the scarcity of this resource. In the new millennium, there is increasing global awareness that water could become a finite natural resource in spite of it being seemingly plentiful. For Nyandoro and Tempelhoff, water history therefore helps foster historical understanding of the relationship between water and humankind as an important corollary to sustainable development.[11] Water has influenced the development of human communities throughout the world and for Botswana it also contributes enormously to the economic, political, social and environmental development of the country.

During the colonial period Botswana used to view water merely as a social responsibility. However, although the government still values its social responsibility, the state in the post-colonial era is looking at water differently and as critically important to economic development. For instance, since the 1970s and 1980s, the economic growth of Botswana has been driven by agriculture (livestock rearing and crop cultivation) and mining. The development of these sectors has become more critical because water is scarce in the country, hence the need for optimal water management. Swatuk and Rahm have also analysed post-colonial water institutions and emphasised the importance of harnessing water demand management (WDM) measures to achieve sustainability.[12]

[10] For more details on these scholars' works see C.T. Canesah, "Water resources development and management, a challenging task for Botswana", Water International, Vol. 26, No. 1, 2001; L.C. Cleophas, "Socio-economic factors influencing sustainable water supply in Botswana", Geojournal, 41, No. 1. 1997; J. Fontein, "The Power of Water: Landscape, Water and the State in Southern and Eastern Africa: An Introduction", Journal of Southern African Studies, Vol. 34, No. 4, 2008, pp. 737-756; D. Stephenson, "Water reduction investigations on Debswana's diamond mines", Mining Technology, Vol. 116, No. 4, 2007, pp.196-200; and E.N. Toteng, "Understanding the disjunction between urban planning and water planning management in Botswana", IDPR,Vol 24, No. 3, 2002.

[11] J.W.N. Tempelhoff et al, "Where Has the Water Come From?" Water History, 1, 2009, pp. 1-18 and M. Nyandoro, "Innovation opportunities in irrigation technology for using virtual water in 21st Century South Africa: Reflections from the past to the present", New Contree, 61, May 2011, pp. 201-226.

[12] L.A. Swatuk & D. Rahm, "Integrating policy, disintegrating practice: water resources management in Botswana", Physics and Chemistry of the Earth 29, 2004.

The lessons learnt from the inception of the protectorate in 1885 up to independence are missing. Roe[13] and Peters[14] have made an attempt to reveal the inadequacies of colonial water infrastructure and management systems, which the government has been trying to replace with a more congenial system that is consistent with Botswana's development goals, since independence in 1966.

A unique dimension of this paper is that the author will undertake a historical analysis of colonial and post-colonial benchmarks in the water sector that are both linked and divergent, in order to discern how these issues have collectively affected the formulation of water policy in Botswana. In the pre-independence period, there was no water policy enacted by the protectorate government. The initial effort at water legislation came in the late 1960s with the passage of the Water Act. The current water policy initiated in May 2009 under the new water sector reforms, following the adoption of the National Water Master Plan (NWMP) of the early 1990s, is the only meaningful post-colonial attempt to introduce a clear water policy for the country.

[13] BNARS, BNB 4468, E. Roe, *Development of Livestock, Agriculture and Water Supplies in Botswana before Independence: A Short History and Policy Analysis,* Gaborone: Rural Development Committee Occasional Papers, Cornell University and Ministry of Agriculture, 1980, pp. 1-56.

[14] P. Peters, "Struggles over water; struggles over meaning: Cattle, water and the state in Botswana", *Africa*, Vol. 54, No. 3, 1984, pp. 29-49.

## DWA/WUC: A result of inadequacy of colonial water infrastructure

This paper will, therefore, deconstruct the popular notion that the independence government has failed to improve water delivery and management. It will instead progressively trace how the inherited colonial water infrastructure was grossly inadequate[15] to address the developmental demands of both the 20th and 21st centuries. Development was lagging behind in the colonial period, as in the pre-colonial epoch, because of a poor economy which did not have large mineral deposits, and relied mainly on cattle . As already noted, water management was carried out through decentralised structures such as local committees, borehole syndicates and traditional chiefs – a function that has been centralised since the establishment of the DWA and the WUC - to respond to new water and economic development demands, especially with the discovery of diamonds in the late 1960s.

Prior to the recent water sector reforms, these two parastatal agencies used to perform similar water supply functions. The new reforms are meant to achieve a clear separation of roles and a new policy framework within which these agencies will operate. This will entail the WUC taking over all local water authorities and some of the water supply functions from DWA,[16] in order to enable it to concentrate on its core business of planning, constructing, operating, treating, maintaining and distributing water resources in the areas mandated by the Botswana Government throughout the country.[17] Since its inception in 1970, the WUC's mandate has expanded to supplying all the urban centres and villages in the country as well as wastewater management nationally, as authorised by the Minister for the Ministry of Minerals, Energy and Water Resources (MMEWR),[18] formerly the Ministry of Minerals, Energy and Water Affairs (MMEWA). It is planned that by 2013 the WUC will have taken over all local water authorities, thereby leaving the DWA to perform its core mandate and functions.

[15] The inadequacies of the colonial water infrastructure can be gleaned, among other things, from protectorate annual reports and minutes of the Advisory Council meetings: BNB 25, Bechuanaland Protectorate Colonial Annual Report 1927-28, No. 1424, 1929; BNB 730, Bechuanaland Protectorate Minutes of the Eighteenth Session of the European Advisory Council, 3-6 December 1934; and BNB 33, Bechuanaland Protectorate Colonial Annual Report 1935, No. 1792, 1936.

[16] B. K. Paya, Permanent Secretary of the MMEWR, Personal interview, MMEWR Head Office, 7 February 2012.

[17] WUC, "Water in an Urbanising World", Annual Report, 2010/11, p. 8.

[18] *Ibid.*

Under the ongoing reforms the DWA should operate at a higher level than the WUC. For instance, the DWA should not be involved in water supply, but instead carry out its water resource management mandate under which it will primarily manage policy as well as dam and research development. Water Affairs should also perform a monitoring role and act as an advisor to the Water Resource Council on water rights and other aspects. In addition, it should look after the Okavango, the transboundary waters of the Zambezi, Limpopo and Chobe rivers, as well as groundwater aquifers.[19] This is in line with Botswana's best practice model which seeks to look after all the water resources of the country and prevent pollution, to assure the water supply of future generations.[20] Policy flaws have been detected in new institutions, such as the DWA and the WUC which were given sole water responsibilities in the post-protectorate era, and which have sometimes been treading on each other's toes.

The overlapping of functions between these state agencies therefore necessitated the reform of these parastatal bodies and the implementation of an effective coordinating policy framework in relation to water.

Based on data collected from archival (including oral sources) and secondary literature, the paper examines water resource management perspectives in Botswana, focusing on their comparative implications and challenges for the colonial and post-colonial state.

***A water body***

[19] Paya, Personal interview.

[20] *Ibid.*

## MAJOR COLONIAL BENCHMARKS IN THE WATER SECTOR: THE STATE AND EQUITABLE DISTRIBUTION OF WATER

### *Wells and the pressure to develop / improve water supplies*

The history of water and its management in Botswana since the declaration of the protectorate in 1885 is determined, on the one hand, by the country's arid or semi-arid landscape, and, on the other hand, by conflicting state, civic, or community and private interests. Conflicts over water and well-watered lands were as synonymous with the colonial, as they were with the pre-colonial period. Administrative focus in the 1880s was not on establishing an efficient water provision and management system. The colonial state, with its capital situated outside the country, first at Vryburg, and later Mafikeng (now Mahikeng), was preoccupied with incorporating the protectorate into South Africa. The decade from 1885 to 1895 thus marked a quiescent phase in erecting water resource management infrastructure such as dams and piped water facilities. Wells constituted the main source of water supply, and between 1902 and 1910, newly constructed wells at Serowe cost up to £250 each.[21]

Up to the 1920s, water was provided through wells run by traditional institutions such as "tribal" committees which were allegedly characterised by rudimentary, inefficient and poor management. Communal or corporate management of water wells, as in pre-colonial times, predominated. This was typically a bottom-up management structure. As demands for more and equitable distribution of water were increasing, the Native Advisory Council (NAC), later renamed the African Advisory Council (AAC), was formed in 1920. With its inception, peasant agency increased, and clamours for water and proficient management of this resource by both small and large cattle owners became incessant. For instance, the funds initially set aside by the protectorate administration for the development of water supplies were trivial; as a consequence members of the AAC challenged this from the onset as epitomising the neglect of African development. This explains why the statement by the Ngwaketse representative in 1920 that "our complaint is about water" was endlessly reiterated by AAC members in subsequent years.[22] The minutes of the AAC meetings also reflect the pressure that African representatives were exerting on the protectorate administration and the British government to improve water supplies, especially to cater for livestock.[23]

[21] R. Palmer and N. Parsons (eds.), *The Roots of Rural Poverty in Central and Southern Africa*, London: Heinemann, 1977, p. 130

[22] Peters, "Struggles over water", p. 34.

[23] Ibid.

### *Grants-in-aid and funding bottlenecks*

The lack of adequate funding for water development was bemoaned. Clearly, the grants-in-aid availed by what was called the "Native" or the Colonial Development and Welfare Fund (CD & WF) established in 1919 were derisory, as evidenced by the disbursement in 1927 of a paltry sum of £500 for borehole drilling in the Katleng district.[24] Since this was not enough for the construction of vital groundwater supplies, it prompted the Chief, Isang Pilane, to levy £6.10s per person from his subjects, to drill boreholes.

The major trends in water development, including available funding opportunities in the 1920s, have been aptly summarised by Schapera in the following way:

*"At first practically all water development in the Reserves [communal areas] was undertaken and paid for directly by the Tswana themselves. The administration's share was limited almost entirely to sinking wells along a few of the principal routes by which cattle for export were trekked to the railhead. In 1919, however, a special Native Fund was created … [and its] omission of specific reference to the provision of water supplies indicated the relative unimportance in which they were held at the time … Nevertheless, the Native Fund had contributed in a modest way to the most notable effort made by any tribe to improve its water position. In 1927 Isang, while acting chief of the Kgatla, carried out an elaborate programme of boring for water in his reserve. A grant of £500 from the fund proving inadequate, he imposed a levy of £6.10s upon every taxpayer in the tribe. He raised about £4,000 altogether; £1,500 was spent on boring, with a drill and expert labour hired from the Union Government, and the balance paid for installing pumps and reservoirs. Sixteen boreholes in all were sunk, of which seven proved successful: two in Mochudi, and the other five in grazing districts. The sites were selected by Isang himself, and not by expert geologists, which accounts partly for the high proportion of failures."* [25]

Subsequently, no grants-in-aid were allocated between 1935 and 1946 due to the worldwide economic recession, following the Great Depression of 1929, and due to the Second World War (1939-45). In 1956, £140,000 was made available, £750,000 in 1961 and this dramatically rose to £6,000,000 in 1965, before dropping to £3,378,000 in 1966, the year Botswana attained its independence. This is the context within which the borehole syndicates (a group form of private ownership) of the 1920s to the 1930s emerged. Compared to the "tribal" committees, boreholes were seen as constituting more efficient management.

[24] BNARS, BNB 4468, E. Roe, *Development of Livestock, Agriculture and Water Supplies in Botswana before Independence.*

[25] I. Schapera, *Tribal Legislation among the Tswana of the Bechuanaland Protectorate,* London School of Economics, 1943. See also *Native Land Tenure,* pp. 241-242; BNARS File S341/1, Letter from High Commission to Secretary of State, 21 July 1933; Peters, "Struggles over water", p. 35 and BNARS, BNB 4468, E. Roe, *Development of Livestock, Agriculture and Water Supplies in Botswana before Independence,* p. 20.

Although by 1929 most of the water supplies in communal lands were wells, Isang Pilane's communal borehole drilling programme signalled a shift towards increased borehole drilling as exemplified by the Protectorate Annual Report for 1929 which stated: *"…The proposed use of government drills for water-boring throughout the protectorate should in time go far towards enabling the native population to have a reasonable supply of water …"*.[26] Notwithstanding the criticism levelled at the colonial government, the sinking of wells and the drilling of boreholes can particularly be credited to the Bechuanaland Protectorate. However, *"a very serious aspect of these wells is that the underground water level appears to be receding and each year three or four more feet have to be added to the depth of the wells…".*[27] This does not only reveal that the water table was vulnerable to uncontrolled welling and drilling, but it also illustrates inefficient management of water resources and the lack of water conservation awareness in the colonial period. In spite of this, demand for water continued to rise.

***The Pim Commission, state-sponsored borehole drilling and dam construction***

Further demands for improved water supply led to the setting up of the Pim Commission in 1933. The transition to increased provision of government-drilled communal boreholes gained impetus from the recommendations of the Pim Report, which asserted that: "At every stage of our enquiries, whether they related to agriculture, to cattle, or to human health and amenities, we realised that the absolutely essential condition to any progress was the improvement of the existing water supplies and the provision of new water supplies."[28] Thus, colonial welfare and development grants were utilised for the installation of surface water development schemes.

Additionally, irrigation schemes were initiated in the late 1940s with dams of varying sizes as their major sources of water, but still up to 1955 there was no major investment in water infrastructural development and management to meet Botswana's potable, irrigation and industrial needs, as the economy was growing at a slow pace in the years before the discovery of minerals such as diamonds.

[26] *Bechuanaland Protectorate Colonial Annual Report,* 1929, p. 28.

[27] *Ibid.*

[28] *Pim Report,* 1933, p. 110. See also BNA, BNB 4468, E. Roe, *Development of Livestock, Agriculture and Water Supplies in Botswana before Independence:* A Short History and Policy Analysis, Occasional Papers, New York: Rural Development Committee (RDC), Centre for International Studies, Cornell University, 1980, p. 21.

Development was rather stagnant or static. Small, medium and large dam construction projects were only adopted and implemented as a major strategy by 1965, involving communal labour and the Rhodesia Railways (now the National Railways of Zimbabwe, NRZ).[29] For instance, up to 1955, approximately 65 stock watering dams were completed in six eastern communal areas. Between 1955 and 1965 surface water development projects continued with major dam work at Lobatse and Gaborone. By 1965 the Gaborone dam was completed.[30]

**Water for irrigation from a dam**

[29] BNA, BNB 4468, E. Roe, *Development of Livestock, Agriculture and Water Supplies in Botswana before Independence: A Short History and Policy Analysis,* Gaborone: Rural Development Committee Occasional Papers, Cornell University and Ministry of Agriculture, 1980, p. 17.

[30] BNA, BNB 4468, Roe, *Development of Livestock, Agriculture and Water Supplies in Botswana before Independence,* p. 17.

***The "years of progress"***

Apparently, from the mid-1950s to the mid-1960s (dubbed the "years of progress") the construction of groundwater supplies was also vigorously pursued in realisation of the linkages or synergies that existed in the livestock, agricultural and water supply sectors of the protectorate.[31] However, by 1966 there was still no water department, as the protectorate administration was averse to growing the water sector beyond the few white settlements at the time - a trend which persisted throughout the colonial era - and which was only reversed by the advent of a new government in 1966 that was committed to rectifying the water provision and management problems of the past. There were also no major water management instruments in place and no investment in most social sectors; but livestock ranching, dryland, (including irrigation agriculture) and to some extent mining, were beginning to grow beyond colonial levels.

This led to some improvements in water infrastructure to support the industrial growth experienced before the major economic turnaround that came with mining development in the 1980s. Therefore, the pre-independence, and especially the pre-1955 period, has been perceived in some circles as developmentally static, with no major commitment to building water infrastructure. The period after that has, however, been seen as one of substantially greater development activity in the three major sectors of the economy, notably livestock ranching, agriculture (including irrigation farming) and mining. The colonial period was however static for all sectors of the economy, including agriculture, energy, health and education. The level of expenditure on water supply was low, as shown in Figure 2 below. Water demand was not high because of the small population size of about 84,210 in the 1880s and the absence of major industries in the colonial era. Colonial water consumption for surface and underground water supplies from 1935 to 1965 has been quantified in financial terms as shown in Figure 2. It should be noted that water supply and demand statistics from the 1880s are not easy to find.

**Figure 2: Colonial Development Fund/Commonwealth Development and Welfare Act Funding of Surface and Underground Water Supplies in the Bechuanaland Protectorate**

| Year | Underground Water Supplies (£) | Surface Water Supplies (£) | Total |
|---|---|---|---|
| 1935-37 | 25,300 | - | 25,300 |
| 1937-46 | 127,312 | - | 127,312 |
| 1946-55 | 243,127 | 104,930 | 348,057 |
| 1955-60 | 411,628 | 88,396 | 500,024 |
| 1960-65 | 42,650 | - | 42,650 |
| TOTAL | 850,017 | 193,326 | 1,043,343 |

[31] *Ibid,* pp. 20 and 29.

## POST-INDEPENDENCE WATER MANAGEMENT

The post-independence period, however, witnessed more significant expansion, not only of the agricultural sector (which had remained largely stagnant in the preceding 40 years) but also of the water supply and management sectors, starting with the promulgation of the Water Act in 1967 (the first regulation of water use) which became effective in February 1968. From the attainment of independence in 1966 up to 2010, ample evidence exists in the form of five-year national development plans (NDPs) to illustrate the extent of government investment in the water sector. In fact, in the post-independence period, government's emphasis has been on augmenting water supply. Thus, in the wake of water scarcity and the imperative for astute management systems, the Water Act culminated in the formation of state agencies such as DWA (1968), the Water Apportionment Board (1968) and the WUC (1970) with overarching water responsibilities. These bodies have had a relatively turbulent efficacy punctuated by some successes and failures. They have been viewed as more efficient than the "tribal" committees of the protectorate era. Nevertheless, contrary to their colonial counterparts, these parastatal organs resemble a top-down management system which is premised on state centralisation of water control, with little devolution of water powers to the people and district councils.

In line with the government's main focus, especially after 1966, the motive for setting up new post-independence institutions (DWA and WUC) was to boost water supply in the wake of a fast increasing population and the growth of many water-based industrial activities. Figure 4 amply demonstrates population growth starting from two years prior to Botswana's independence and the resultant increase in water demand, as shown in Figure 3 below.

***Water demand (excluding villages not connected)***

**Figure 3: Water demand from 1980-2004 (x$10^6$ $m^3$/Year)[32]**

| 1980 | 1982 | 1984 | 1986 | 1988 | 1990 | 1992 | 1994 | 1996 | 1998 | 2000 | 2002 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Less than 10 | Less than 10 | Less than 10 | 11 | 15 | 20 | 23 | 27 | 32 | 37 | 45 | Over 45 | Over 45 |

Figure 3 shows the evolution of water demand for South East Botswana from 1980 to 2004, which is reflective of the general trend in the country, due to population growth. With increased population as indicated in Figure 4, water demand (excluding villages without water connections) also increased, particularly after 1980, due to more rapid economic growth (compared to the immediate post-independence period) when water supply and demand were still rather low because of the relatively low population.

[32]Adapted from water demand figures, DWA, *Draft South East Botswana Water Development Study,* Sir M. MacDonald & Partners, Cambridge, 1987.

With the turnaround of Botswana's economy water demand, which was less than 10m$^3$/year in the 1980s, escalated to approximately 30m$^3$/year by the mid-1990s and to over 45m$^3$/year by 2004.[33] This phenomenal increase in water demand was largely due to industrial development and the rise in population, as illustrated in Figure 4 below.

**Figure 4: Evolution of Urban Population (1964 -1991)[34]**

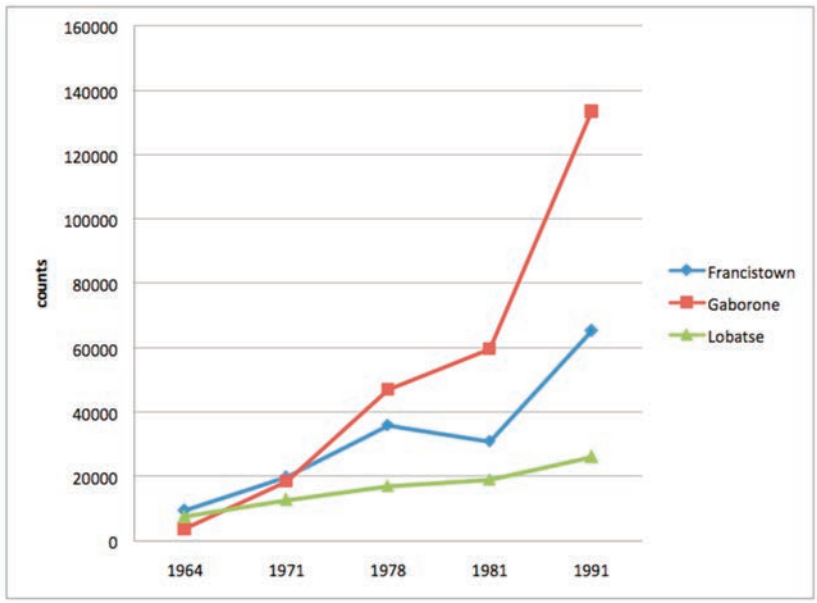


Figure 4 illustrates that the population of Botswana's major urban areas was growing at a rate that dictated the need for more water provision, as shown in Figure 3. For instance, the population of Lobatse which was 7,613 in 1964 rose to 26,052 in 1991. In the same period, the population of Francistown increased from 9,521 to 65,244 and that of Gaborone, the capital, from a meagre 3,855 to a phenomenal 133,468 and to 191,776 by 2010.

Between 1964 and 1991, 34 per cent of Botswana's population relied on boreholes and wells. By 2010, demand for water increased as groundwater was catering for 60 per cent of the national water supply. The Government is trying to increase piped water infrastructure too. Demand for water in Gaborone alone rose from 6.37 ($10^6$ m$^3$/year) in 1986 to 21.34 ($10^6$ m$^3$/year) in 2001.[35]

[33] *Ibid.*

[34] Adapted from the urban population figures for Lobatse, Francistown and Gaborone in T. Tlou and A. Campbell, *History of Botswana,* Gaborone: Macmillan, 1997, p. 372.

[35] DWA, *Draft South East Botswana Water Development Study,* Sir M. MacDonald & Partners, Cambridge, 1987, p. 57.

Clearly, the economy is growing, as evidenced by the fact that in 1966 the country's Gross Domestic Product (GDP) was *P37 million (*pula); by 1979 it was P650 million; in 1993 it reached over P7 billion and in 2010 it was estimated to be US$15,246 billion. However, the stress on water resources due to competing claims and a difficult geophysical environment is a paramount challenge to sustained development in Botswana. It can be noted that Botswana is not only trying to develop its economy, but is also grappling with developing an appropriate and clear water management strategy. Attempts to achieve these dual objectives are under way as evidenced by the work being carried out by the major water state agencies, i.e. the DWA and the WUC. As part of its main priorities, the independence government is striving to rectify the water delivery inefficiencies of the colonial period, albeit through a reliance on groundwater resources.

**Competing interests and the reliance on groundwater aquifers over surface sources**

Fresh surface water is inadequate, due to the lack of reliable riverine systems. Therefore, the majority or about 80 per cent of the human and livestock population thrives on groundwater that exists deep in the beds of sand rivers. Groundwater, like any other source of water, requires impeccable management. Independence and the discovery of major diamond deposits by De Beers at Orapa in 1967,[36] in particular, generated enormous economic growth and development, but mining has been competing for water with livestock (the traditional economic backbone of Botswana), irrigation, and potable water supply sectors, and with other emerging industries. At independence (1966) Botswana's population was 500,000. By 2010 it was over 2,000,000 and the national herd was over 3,000,000, up from 700,000 in 1940.[37] Nevertheless, the buoyant phase brought about by the mining and beef industries was challenged by the enormous stress imposed on water resources by the demands of a growing economy.

The construction of dams, coupled with a resort to transboundary waters has been embraced, but this was not the government's primary focus; this is due to the limited prospects of achieving water security because of high evaporation rates and the restrictions imposed by international water agreements. In these circumstances, water resource management is not only a UN priority, but also a key element for socio-economic and sustainable water governance and development in Botswana, which is what is currently driving state policy. As already noted, most post-colonial government work has been on expanding water supply. There is considerable government investment in technical capacity and human capital in a continuous effort to optimally exploit both surface and groundwater resources, as evidenced by the completion of Phase I and Phase II of the North-South Carrier Water Project (NSCWP), at a cost of US$1.5 billion and US$2.5 billion respectively.[38]

[36] T. Tlou & A. Campbell, *History of Botswana,* Gaborone: Macmillan, 1997, p. 279.

[37] BNARS, BNB 4468, E. Roe, *Development of Livestock, Agriculture and Water Supplies in Botswana before Independence,* 21.

[38] Swatuk and Rahm, "Integrating policy, disintegrating practice".

This hydro-project involved the construction of dams and pipelines to convey water to villages and urban centres. In addition, supply is complicated by systemic water losses through old pipes. For example, the average total water loss through leakage per year for 450 villages is estimated to be 3.5mm$^3$ of water which is equivalent to P10,500,000.[39] Clearly, the country cannot afford these inefficiencies[40] in the distribution of a scarce commodity envisaged by the UN to be under threat of depletion by 2025. Water management is thus critical.

Environmental history, the role of state and non-state actors, human and financial capital are cardinal factors in understanding Botswana's water resource management system in both the colonial and post-colonial periods. Among the country's growing population of approximately 2 million in 2010 (up from an estimated 1.67 million in 2004), there are many potable water consumers, large and small scale livestock farmers, old and emerging mining and industrial enterprises – all requiring water. The demand for water was dictated by the insatiable needs of these various sectors, including tourism and wildlife water requirements. Consumptive use of water by people includes water for drinking, sanitation and hygiene. Consumption of surface and groundwater for 1990 was 41.9 mm$^3$ per annum and 75.7mm$^3$ per annum respectively.[41]

Water consumption is projected to reach 186.2mm$^3$ per annum and 140.3 mm$^3$ per annum for the same categories of water by 2020.[42] The rate of urban water consumption in comparison was higher than the rate in the rural areas of the country,[43] but for both areas water is fundamental to sustainable development. An increase in population also directly entailed a proportionate, if not an incomparable escalation in the demand for water, which invited two specific government water-sector responses. Firstly, in the five-year development planning period from 1992 to 1997, population growth trends compelled the government of Botswana, as required by the UN, to primarily focus on meeting the basic needs of the people through the provision of safe, reliable and affordable water supplies. Secondly, the state aimed to meet the water requirements of industrial, mining, agricultural (irrigation), commercial and institutional users in order to achieve the stated objectives of rapid economic growth and sustainable development.[44] For Botswana, it is government or official policy to achieve sustainable and equitable water distribution.[45]

[39] *Ibid.*

[40] For an alternative view on water utilities efficiencies or inefficiencies in East Africa see D. Mbuvi and A. Tarsim, "Managerial ownership and urban water utilities efficiency in Uganda", UNU-Merit Working Papers, UNU and MGSoG, July 2011, pp. 1-29.

[41] *Botswana National Water Master Plan Study, Final Report,* Vol. 5 – Hydrogeology, Ministry of Mineral Resources and Water Affairs and Department of Water Affairs, Government of Botswana, March 1991.

[42] *Ibid.*

[43] *National Water Master Plan (NWMP),* Gaborone: Government Printers, 1992.

[44] *National Development Plan 8 (NDP 8),* Gaborone: Government Printers, s. p, p. 280. See also Swatuk & Rahm, "Integrating policy, disintegrating practice".

[45] *NDP 8,* p. 281.

Notwithstanding the scarcity factor, in line with the UN's water governance principles, Botswana is making enormous efforts to cater for all actual and latent water users in both urban and rural settlements. To keep pace with aggregate demand in the latter, more than 60 supplementary boreholes are drilled every year.[46] In order to meet major urban, village and subsidiary water supplies the government is complemented by the local district councils. According to the Government of Botswana National Development Plan, in 1998 there were 460 rural village water supply schemes that were being operated and maintained by the various district councils situated throughout the country.[47]

Irrigation or agriculture is a primary consumer of water. Whilst an estimated 20,000 ha of land is available for irrigation in the country,[48] in 1998 only 1,380 ha was under irrigation, mostly in the Tuli Block freehold area of the northeast. Smallholder farmers also irrigate their crops using water from small dams. It is government policy to assist in the construction of small dams and in well and borehole construction as well as rehabilitation. Recently, the government allowed famers in Mahalapye to drill on-field boreholes to water their crops and livestock.[49]

In the light of water scarcity, therefore, the government is aggressively pursuing multiple alternative and innovative technologies such as rainwater harvesting, storm water capture and diversion, solar-power desalination plants and wastewater recycling to improve water use efficiency.[50]

Mineral and energy production requires substantial amounts of water. President Ian Khama acknowledges the legacy of an inadequate water infrastructure inherited from the colonial government when he argues that there are state-initiated projects, such as water and electricity,[51] which will not be allowed to suffer, as they are key or central to the development of the country.

From 1990 to 2010 most of the water used in the country was consumed by the mining and energy sectors. The environmental consequences of the water used and recycled for mining purposes are countless.

[46] L. Carlsson & J. Ntsatsi, "Village water supply in Botswana: assessment of recommended yield for production boreholes in a semi-arid environment", *Journal of African Earth Sciences,* 30(3), 2000, pp. 475-487.

[47] *National Development Plan 8 (NDP 8),* Gaborone: Government Printers, s. p, p. 280.

[48] *National Water Master Plan (NWMP)*, Gaborone: Government Printers, 1992.

[49] I. Mazonde, Director ORD, Personal Interview, ORD, University of Botswana, 6 September 2011.

[50] *National Development Plan 8 (NDP 8)*, Gaborone: Government Printers, s. p, pp. 293-294.

[51] President Ian Khama, BTV News, 20:00hrs Bulletin, Thursday, 19 May 2011.

Available groundwater has been depleted through pollution of aquifers by improperly discharged wastewater from major mining operations at Orapa, Jwaneng and Selebi-Phikwe and the coal-driven power station at Moropule. Such water, as seen in a study on South Africa by Nyandoro is unsuitable for the irrigation of edible crops or fruits.[52]

It can be noted that water that is perennially available to Botswana is transboundary in nature and therefore its utilisation is limited by a gamut of international regulations and laws that have been instituted to control competing national demands of this critical resource.[53]

For Swatuk, off-takes made by one state inevitably affect neighbouring states.[54] For instance, Botswana's NSCWP is an intra-basin water transfer scheme that reticulates water through a series of dams and pipelines from the Shashe River in the northeast to all major villages and towns along the eastern corridor. As an upstream riparian, off-take in Botswana reduces water available to other states such as Zimbabwe, South Africa and Mozambique in the Limpopo River Basin.

In contrast, Botswana is a downstream riparian in the Okavango River Basin. The Okavango River, whose source is in Angola, flows through Namibia before emptying into the Okavango Delta.[55] Invariably, international law permits Angola and Namibia reasonable use of this water,[56] and it is a question of time before plans for development in the middle Okavango start to benefit Botswana too.[57] Taken in conjunction with other water supply challenges, this calls for careful water policy formulation.

[52] For a study of irrigation water and the deleterious consequences of mining pollution in Botswana's neighbour, South Africa, see M. Nyandoro, "Innovation opportunities in irrigation technology for using virtual water in 21st Century South Africa: Reflections from the past to the present", *New Contree,* 61, May 2011, pp. 201-226.

[53] For Savenije and van der Zaag, all perennial surface water resources in Botswana are shared international watercourses. See H.H.G. Savenije & P. van der Zaag, "Conceptual framework for the management of shared river basins with special reference to SADC and EU", *Water Policy,* 2, 2000, pp. 9-45.

[54] L.A. Swatuk, "The new water architecture in Southern Africa: Reflections on current trends in the light of Rio+10", *International Affairs,* 78(3), 2002, pp. 507-530; L.A. Swatuk, "State interests and multilateral cooperation: Thinking strategically about achieving 'wise use' of the Okavango Delta system", *Physics and Chemistry of the Earth,* 28, 2003, pp. 897-906.

[55] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[56] A.R. Turton, P. Ashton & E. Cloete (eds.), "Transboundary rivers, sovereignty and development: Hydropolitical drivers in the Okavango River basin", African Water Issues Research Unit and Green Cross International, Pretoria & Geneva: 2003.

[57] Swatuk & Rahm, "Integrating policy, disintegrating practice".

## WATER POLICY: FORMULATION AND DEVELOPMENT

### *Lack of water development policy in the colonial era*

There was no serious attempt in the protectorate era to formulate a water policy. British colonial policy was that colonies existed for the benefit of the British economy and that colonies should pay for their own development and administration.[58] From 1885 the British government's activities were limited to the maintenance of law and order as well as the eradication of cattle diseases such as foot-and-mouth. Throughout the colonial period, except for the last few years before independence, almost nothing was spent on the development of health, welfare and educational infrastructure. These were left entirely to the traditional leadership such as the *dikgosi* and the *merafe*.[59] It is disconcerting to note that there was no arm of the colonial administration that was responsible for water development. This was confirmed by a member of the European Advisory Council (EAC), Glover, who in 1947 during a meeting of the Council moved a motion advocating the reorganisation of the Public Works Department and the financing of a Water Division *"to enable water development and water maintenance … [and to increase] watering facilities [for cattle]".*[60] In his view, the matter was extremely urgent and demanded a definite policy, *"for water is life."*[61] He went on to state that:

*"the new feature that makes a definite policy necessary and urgent is the fact that from now on [1947 onwards], this protectorate must stand on its own feet financially and we can no longer afford to rely on the remittance-man complex which left undone what could not be paid for by grants-in-aid or CD Funds".*[62]

Post-colonial government evolution of water policy was predicated on events during the protectorate days and minutes of the AAC meetings. The Tswana representatives constantly brought up the urgent need for water.[63] Government policy which ultimately resulted in major programmes of borehole drilling throughout the country and which essentially set significant trends for the post-colonial government involved the colonial "state" and the Tswana elite. The means of financing, the areas selected, the type of management organisation, were the outcome of interaction between the protectorate administration, in the person of its resident commissioner and the Colonial Office in London, and between the Tswana chiefly elite and the rest of the Batswana.[64] This is the context within which a water development policy evolved in Botswana in the post-colonial period.

[58] Tlou and Campbell, *History of Botswana,* p. 265.

[59] *Ibid.*

[60] *Ibid,* p. 130.

[61] *Ibid.*

[62] *Ibid*.

[63] Peters, "Struggles over water", p. 34.

[64] *Ibid*, 35.

***Post-independence water policy: controlling demand to increase supply***

The post-Protectorate era ushered in a new national development-oriented planning system in Botswana in the form of NDPs. Given the many years of lack of real focus on water development, the independence government was keen to address inherited water sector problems. Water was central to the plans aimed at achieving the industrial transformation of Botswana which was lagging behind that of regional neighbours such as South Africa and Zimbabwe, both of which had inherited sound water infrastructure at independence. In a semi-arid country where drought is a permanent climatic feature, water scarcity is the biggest limitation to sustainable development.[65] This handicap has been confirmed by the Botswana Millennium Development Goal (MDG) Report of 2004 which also identifies water shortage as a chief constraint to development, given the rapid increase in domestic and industrial demand for water.[66] For this reason, securing adequate supply is the central feature of evolving water policy in the post-independence era. Since the adoption of the Water Act of 1967 a concerted effort has been made to address the imminent water shortage in the 21st century. The Act enabled the state to wield enormous power over the issuance of water rights through the Department of Water Affairs and the Water Apportionment Board.[67] As already indicated the Ministry of Minerals, Energy and Water Resources formulates water policy and is assisted in the implementation of government policy by the DWA, the Department of Geological Surveys (DGS) and the Water Utilities Corporation (WUC).

The WUC is a parastatal institution that is responsible for the supply of water to six urban/mining centres and other designated areas, with the exception of the Orapa mine.[68] The DWA, with the aid of the Department of Geological Surveys (DGS) is responsible for groundwater investigations, protection and monitoring of water resources. It is also responsible for the protection of surface water, administering water legislation and the provision of water supply to all villages or rural communities.[69] The Government of Botswana feels duty-bound to supply water to all urban and rural settlements, hence controlling demand is perceived by policy makers as an important way of increasing supply. Possible Water Demand Management (WDM) measures being considered in Botswana consist of rainwater collection, storm water run-off diversion and collection, re-use especially for irrigation of fodder, progressive pricing policy, water-efficient appliances in households, industries and agriculture, development of non-water-borne sanitation systems (eco-sanitation), and consumer education.

[65] P. Smit, *Botswana: Resources and Development,* Pretoria: Africa Institute of South Africa, AISA, 1970.

[66] *Botswana Millennium Development Goal Report*, 2004.

[67] M. Goldblatt, J. Ndamba, B. van der Merwe, F. Gomes, B. Haasbroek & J. Arntzen, *Water Demand Management: Towards Developing Effective Strategies for Southern Africa,* Gland: IUCN, 1999, p. 101.

[68] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[69] *Ibid.*

Under the current water sector reforms the functions of DWA and WUC are being clearly streamlined under the National Water Master Plans (NWMPs) and the five-year development plans (NDPs) to avoid duplication of roles and promote the evolving water management strategy or policy.

The operation and maintenance of village water schemes is performed by the District Councils on behalf of the Ministry of Local Government, Lands and Housing.[70]

Overall, the WUC supplies 21.5 per cent of the population, including the urban populace, with water (a mandate which has been expanded recently to include formerly municipal council areas).[71] DWA provides for 22.5 per cent of the population living in the 17 major villages of the country.

While district councils are theoretically responsible for supplying water to 22 per cent of the population living in rural villages, the DWA, in practice, constructs most of these supplies through its in-house facility. Although most of these are private sources, the DWA is often called upon to assist with the rehabilitation and maintenance of small dams, boreholes and wells to ensure water security. In the process, to achieve this noble goal, the DWA and WUCs' functions are constantly overlapping. Attempts are being made to transfer or decentralise water powers to rural water users and others. However, devolution of responsibility to district council water departments is proceeding slowly. [72]

The government continues to exercise control through the Water Act. The Act also allows for existing water rights to be suspended in the event of a water shortage due to drought or in circumstances where water is required for public purposes.[73] As a management surveillance mechanism, the Act has set borehole abstraction limits of 22.75$m^3$ per day for mining, industry and forestry. In addition, it provides penalties for pollution (including a clause that permits the disposal of waste water with minimal pollutants) as well as penalties for altering and interfering with water flow.[74]

The costs of delivering water in urban areas are mainly borne by the government which finances the water requirements of the largest users such as public institutions like schools and hospitals.[75]

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[70] *National Development Plan 8 (NDP 8)*, Gaborone: Government Printers, s. p, pp. 279-880.

[71] Anonymous respondent, Personal Interview, MMEWR, Gaborone, 7 September 2011.

[72] *National Development Plan 8 (NDP 8),* Gaborone: Government Printers, s. p, pp. 284.

[73] M. Goldblatt, J. Ndamba, B. van der Merwe, F. Gomes, B. Haasbroek & J. Arntzen, *Water Demand Management: Towards Developing Effective Strategies for Southern Africa,* Gland: IUCN, 1999, p. 101.

[74] *Ibid.*

[75] Swatuk & Rahm, "Integrating policy, disintegrating practice".

Although the WUC has set up a tariff or price structure, it can be noted that most consumers pay a nominal fee of approximately less than P50 per month, thereby making it cumbersome for government to recoup running and operational costs. In both the cities and major villages consumers pay a connection fee for private water, which comes in the form of either an on-property-standpipe or in-house facility.[76] No fee is levied for drawing water from a communal standpipe. Thus, the costs for the provision of water by District Councils (DCs) to such rural users are assumed by these councils, and by extension by the government, as part of the subsidisation element. In light of this, the government has designed a deliberate policy aimed at recovering the "full recurrent costs of all the major village water supply schemes",[77] but defaulting on water bill payments by some citizens remains a problem. Others are engaged in a phenomenon known in Ethiopia and Tanzania as "spaghettiisation" and "structural leakage"[78] of water, usually carried out during difficult times (as also happened in Zimbabwe at the height of that country's economic and political crisis) to avoid paying water bills. "Spaghettiisation" is not only economically costly, but also hydraulically inefficient.

At the same time, the demand for private connections is increasing. By 1999, approximately 83 per cent of Batswana households had access to piped water, in contrast to 77 per cent in 1991, and 56 per cent in 1981.[79] In 2010, about 89.3 per cent had piped water.[80] Every water user, including cattle ranchers, has to pay to cover the costs of water pumping and maintenance.[81] It is important to have low cost alternative technologies so that water can be delivered at an affordable cost, to prevent people from defaulting on their water bills or water use payments.

Botswana's contemporary water policy is premised on the National Water Master Plan of 1991. The plan focused on supply-side interventions, in response to increasing demand. The NWMP projected major increases in water demand between 1990 and 2020 (that is, urban areas by a factor of five, mining, rural consumption and energy by a factor of three, and irrigation was expected to double).[82]

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[76] *Ibid.*

[77] *National Development Plan 8 (NDP 8),* Gaborone: Government Printers, s. P, pp. 286.

[78] M. Kjellén, "Structural Leakage in Dar es Salaam: The Investment Deficit in Water Distribution", in Uppsala, "Meeting global challenges in research cooperation", Proceedings of a Confrence and Workshop in Uppsala, Thematic Session 5, 27-29 May, 2008, pp. 304-311.

[79] M. Goldblatt, J. Ndamba, B. van der Merwe, F. Gomes, B. Haasbroek & J. Arntzen, *Water Demand Management: Towards Developing Effective Strategies for Southern Africa,* Gland: IUCN, 1999, p. 101; C. Lado, "Socio-economic factors influencing sustainable water supply in Botswana", *GeoJournal,* 41(1), 1997, pp. 43-53.

[80] Anon, "Percentage of households with access to piped water", at http://indicators.hst.org.za/healthstats/174/data/int, 1996-2010, accessed on 2011-09-14.

[81] J.R. Atlhopheng, "Water resources in Botswana", J.R. Atlhopheng & O. Totolo (eds.), *Environmental Issues in Botswana,* Gaborone: Lightbooks, 1998.

[82] Atlhopheng, "Water resources in Botswana".

Increasingly, therefore, water demand management (WDM) - defined at the 1991 Dublin Conference as *"actions which promote more desirable levels and patterns of water use"* - was becoming essential in everyday planning in Botswana.[83] This view has also been confirmed by Leonard Dikobe of the UNDP whose organisation is placing a lot of emphasis on Integrated Water Resources Management (IWRM).[84]

Clearly, augmenting supply comprises one of the enduring objectives of the government of Botswana. As already noted, the government has invested extensively in technical capacity and human capital in a continuous effort to optimally exploit both surface and groundwater resources, but more needs to be done. Though on a significantly smaller scale, the DWA continues to assist in the development of rural water supply and water-borne sanitation systems. The department is also involved in the construction of water systems for delivery to major villages. Its work in this area includes investigation of possible dam sites and exploitable groundwater resources. Having assumed responsibility for managing and controlling the NSCWP and all its assets, the WUC assumed responsibility for bulk potable water supplies to major villages along the NSCWP and in the greater Gaborone metropolitan area.[85] It could find itself swamped in the end.

To further enhance existing water supply in an arid terrain, the government of Botswana is exploring ways of harnessing new technological innovations such as wastewater recycling and reuse. Research into the feasibility of wastewater use in agriculture and into the social acceptability and desirability of using wastewater, if treated to potable standards, is being undertaken in the country.

However, as proved in another study on South Africa carried out by Nyandoro, using wastewater for agriculture or irrigation farming is not only an environmental bane and detrimental to the production of crops suitable for human consumption,[86] but also the costs of recycling the water (just like the costs of desalination as in the case of South Africa) are prohibitive, in a country that is confronted with other developmental challenges.

A shift in government policy which has seen an end to "special water tariff rates" has encouraged the mines at Orapa and Selebi-Phikwe to install their own recycling and other water-saving technologies. The government is also actively supporting portable desalinisation plants in remote locations and appropriate technology such as rainwater harvesting, storm water diversion and impoundment in order to increase water supply.[87]

[83] H.H.G. Savenije cited in Swatuk & Rahm, "Integrating policy, disintegrating practice".

[84] Leonard Dikobe, UNDP, Personal Interview, UNDP, Gaborone, Botswana, 8 September 2011.

[85] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[86] M. Nyandoro, "Innovation opportunities in irrigation technology for using virtual water in 21st Century South Africa: Reflections from the past to the present", *New Contree,* 61, May 2011, pp. 201-226.

[87] M. Goldblatt, J. Ndamba, B. van der Merwe, F. Gomes, B. Haasbroek & J. Arntzen, Water Demand Management: Towards Developing Effective Strategies for Southern Africa, Gland: IUCN, 1999, pp. 102-104; National Development Plan 8 (NDP 8), Gaborone: Government Printers, s. p.

Water quality is often compromised by pollution. Pollution in Botswana is rather minimal compared to a bigger regional industrial country such as South Africa, but water quality is affected by salinity, high fluoride levels and nitrate pollution. In spite of the fact that legislation exists to control pollution levels (through the polluter-pays principle), the government is often reluctant to penalise key employers in the country,[88] and also the cost of policing is very high.

Despite a relatively effective supply strategy, the government of Botswana does not have a comprehensive demand policy. Water demand figures for the colonial period are either scanty or non-existent; but in the post-colonial period, controlling demand and improving current use practices and forms of delivery are perceived by policy makers as important ways of increasing supply. There are a number of possible WDM measures being considered in Botswana. These consist of the alternative technological innovations referred to earlier in the paper. However, there is no concerted effort on the part of the government to implement these measures, save during severe drought periods.

Despite government's stated policy in favour of full cost recovery in the water sector, for political reasons the ruling party, the Botswana Democratic Party (BDP) sometimes avoids controlling demand through punitive measures.[89] While government can reprimand on occasion, it apparently prefers a patrimonial approach to "public goods,"[90] a major limitation in policy discourse, as this results in water prices that remain far below operating and maintenance costs.

[88] M. Goldblatt, J. Ndamba, B. van der Merwe, F. Gomes, B. Haasbroek & J. Arntzen, *Water Demand Management: Towards Developing Effective Strategies for Southern Africa,* Gland: IUCN, 1999, pp. 102-104.

[89] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[90] *Ibid*.

## WATER RESOURCES: CHALLENGES TO SUSTAINABLE MANAGEMENT

The main challenges to the sustainable management of diminishing water resources in Botswana are multiple and complex. For both the colonial and post-independence periods these can be understood in the context, inter alia, of the slow pace of development in the former, and a relatively increased tempo in the latter. For both periods, institutional limitations, institutional overlap, inadequate funding, human resource capacity and cultural impediments exist.[91] It can be conceded that following many years of colonial domination and lack of real development in the water sector, among others, the enormous stress on development in the post-independence era has invariably reduced the environment to secondary importance. The emphasis placed on water and infrastructural development in order to boost the economy through agriculture, mining and massive construction projects has had deleterious consequences on groundwater aquifers. In a bid to achieve an accelerated rate of growth and development, very little heed is therefore being paid to the conservation of the environment.

As demonstrated at the beginning of the paper, colonial Botswana lacked water institutions. The early management structures such as the "tribal" committees and the borehole syndicates had many limitations. After independence, Botswana continues to suffer from some institutional overlap in implementing water policy. The problem of overlapping jurisdictions among water agencies prevents smooth and rational policy implementation at all levels of government. For instance, the WUC has authority only in cities, the DWA only has control of state lands, and communal lands are controlled by the District Councils.[92] For Swatuk, this represents a "fractured structure". [93] Other government ministries such as Agriculture, Minerals, Lands, Wildlife and Tourism also compete for water. From a conservationist and environmental point of view, a principal problem is that the Department of Lands has authority to allocate and manage land but generally does so without consideration of water, sanitation, agriculture or waste management. For example, land might be allocated for industrial use without full consideration of the pollution effects on water resources. [94] Groundwater, while logically associated with land, is separated from land for government purposes.[95] To add to the complexity, each district manages its own multi-faceted system of inter-governmental affairs to ensure that water is provided within the district.[96]

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[91] *Ibid.*

[92] *Ibid.*

[93] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[94] *Ibid.*

[95] N. Monagen, Director, Department of Lands, Personal Interview, Department of Lands, Gaborone, 25 April 2002 cited in Swatuk & Rahm, "Integrating policy, disintegrating practice".

[96] G. Gabaake, Director, Department of Water Affairs, and Commission Member, Okavango River Basin Commission, Personal Interview, Department of Water Affairs, Gaborone, 18 April & 10 -11 September 2002.

New occupants of land increase water use as they often drill additional boreholes leading to a drop in the water table. To address this problem, the National Conservation Strategy Coordinating Agency (NCSCA) was formed as an umbrella organisation to unify water policy across ministries. The NCSCA, however, is not powerful enough to fulfill this mission. The water needs of livestock, wildlife, mines and agriculture are often in conflict.[97]

In all this, it must be noted that the less powerful lobby groups such as tourism, local environmental and international environmental non-governmental organisations (NGOs) sometimes find it difficult to push a purely environmental agenda against industrial, ranching and mining interests. While government continues to state that it will "streamline" and "coordinate" decision making among all those active in the exploitation of water resources,[98] coordination is still limited.

Cultural interpretations exacerbate the situation, as they fly in the face of technically proven evidence that shows that if water is not properly managed it will soon run out.[99] Some cultural interpretations about water are grossly misleading. For instance, there is no general belief in Botswana that water will run out. Such cultural impediments militate against the cultivation of a national consciousness drive that makes people aware that water scarcity is a reality, more so as the country's population is growing and rapidly urbanising along the eastern transportation corridor or the "rain belt".[100]

It is also important to bring the Khoisan (Basarwa) and other "minority" groups into the mainstream economy to avoid some of these cultural interpretations and, sometimes, the conflicts that frequently ensue between the state and these communities. One example of conflict and outrage over water between the government and the San is the case in 2005 which was brought before the High Court of Botswana for arbitration when this community was allegedly denied access to water in the arid lands of the Kalahari where they rely on underground aquifer resources for water supply.

[97] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[98] *National Development Plan 8 (NDP 8)*, Gaborone: Government Printers, s. p.

[99] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[100] *Ibid.*

The refusal to grant them permission to this water is believed to have led to the death from dehydration of Xoroxloo Duxee, a member of the San community. The case before the High Court requires the government to devise ways of amicably solving the dispute to avoid incidents similar to the the death of Duxee after he was allegedly denied the right to access an existing water borehole on drought-stricken lands or to drill a new one in the Central Kalahari Game Reserve.[101]

Overall, drought which is prevalent in Botswana has negative consequences not only for people, but also for the livestock industry. As drought impacts livestock most seriously, and as the majority of cattle holdings are concentrated among the rural elites, "solutions" are to be found in more boreholes, not fewer livestock, and intensified water conservation campaigns.

Another challenge is that sustainable water policy is hindered by inadequate scientific data and ineffective monitoring, or limited human resource capacity. The expertise needed for government decision-making is lacking. Policies that help monitor water use and the purpose for use do not exist. Most of Botswana's water policy is supply oriented.[102] One problem hindering the implementation of demand-side policy measures is that there is currently no accurate measure of demand. There is also no accurate measurement to determine water use or need within segments of the population.

Last but not least, a clear and effective pricing policy should be implemented. However, the water pricing policy should take into account affordability or the ability and willingness of the people to pay and decide how to deal with these problems to avoid citizen agitation. Overall, it should be noted that non-implementation and partial-implementation of the laws are major barriers to sustainable water policy.[103] It is therefore important for policy to be proactive and not reactive.

[101] Anon, "Outrage as Botswana Bushmen denied access to water", 21 July 2010, at http://www.survivalinternational.org/news/6257, accessed on 2011-08-26.

[102] Swatuk & Rahm, "Integrating policy, disintegrating practice".

[103] *Ibid*

## CONCLUSION

From the foregoing, it is clear that in the colonial period there were elements of both centralisation and decentralisation, while the post-colonial period was characterised by state centralisation in the manner water was supplied and managed, with minimum devolution of water powers. On the whole, water supply and management have faced several challenges in these two periods.

There is a need for sustainable water resources management in Botswana, one of the driest countries in Sub-Saharan Africa. Botswana needs to embrace Integrated Water Resources Management (IWRM) to sustain mining, cropping, livestock ranching, tourism, industrial and domestic needs. Currently, the government is aggressively pursuing multiple alternative and innovative technologies in order to increase water supply and to improve water use efficiency.

Furthermore, this paper demonstrates that development in Botswana is inhibited not only by water scarcity, but also by inept management of a finite resource and the lack of coordination between water institutions at the policy level, including lack of collective participation between state and non-state actors.

The limitations of the colonial water infrastructure are clear, but parastatal bodies such as the DWA and the WUC need to be reformed and strengthened to enhance their efficacy. There should be a clear separation of powers between the two, and greater financial investment to enhance their operations. In the main, the paper reveals more changes than continuity between the way in which water is being managed in the post-colonial period and the way it used to be managed in the protectorate era, although similarities exist in some management aspects.

***Major results and findings of the research***

1. There is lack of coordination between institutions at the policy level.
2. Protectorate water policies were forged out of differences in opinion and interests between London (the Colonial Office) and South Africa (the Office of the High Commissioner), among the colonial officials themselves and from a competitive interaction with the Tswana elite.
3. Water demand was not high in the protectorate era because the population size was small.
4. The colonial period cannot be wholly blamed for the failure to significantly develop water supply because the resources were simply not there or they did not permit such investment in the social sectors of the economy.

5. Water management is a complex process requiring the collective effort of state institutions, traditional institutions, civic society, industry and other stakeholders. There is no simple solution to the problems Botswana is facing in the delivery and management of water; interactive approaches are needed for success.

6. Planning, together with appropriate funding and inter-sectoral collaboration are needed in Botswana's water sector.

7. The growth of the livestock, industrial, mining and domestic sectors has led to the dramatic rise of water resources use and demand in this primarily arid/semi-arid country.

8. For many years until the current reforms, Botswana had no clear water policy.

## RECOMMENDATIONS

1. The challenges facing the post-colonial state reveal a need to improve on the weak managerial aspects of the colonial period, the consolidation of the strong management strategies of the present, as well as a rethink of water management (based on historical experience) to implement newer and more sustainable water management methods.

2. The existing alternative technologies to improve water use efficiency should be more intensively pursued and more technologies that are commensurate with an arid terrain could also be tried, especially based on other countries' experiences, for example the use of tanks in Burkina Faso. There is definitely untapped potential in Botswana's water sector.

3. To improve current technology and to implement newer technologies, the injection of substantial amounts of funds by the government in the water sector is imperative.

4. Water institutions such as the DWA and the WUC should have a national outlook and they need to be fully resourced. They do not need to be replaced, but they should clearly be strengthened.

5. There is no Water Resources Commission to coordinate all water bodies and to act as an overall body responsible for water resources management, as in Ghana. Therefore, such a body should be put in place.

6. The government of Botswana should also design a national water policy, as in the case in Ghana[104] and other countries, to provide a framework for the sustainable development of the country's water resources.

[104] For details see Government of Ghana, *National Water Policy,* Accra: Ministry of Water Resources, Works and Housing, June 2007, pp. 1-70.

## APPENDIX

**Figure 5: Geographic location of Botswana**


***Botswana: Southern Africa***

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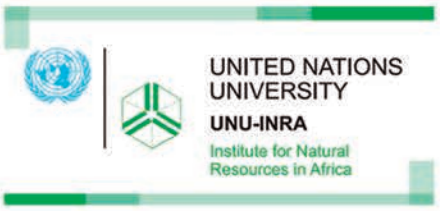


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