Review of rainwater harvesting policies in Ghana: lessons for developing countries

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Abstract: Countries are governed by laws and policies. Policies are designed to create a path meant to direct institutions in the performance of their duties to achieve broader national goals. This paper is aimed at contributing to the body of knowledge in rainwater harvesting and to inform future policies in developing countries. The paper assesses the extent to which the government of Ghana has formulated and implemented policies for rainwater harvesting. It therefore presents policies that have existed from pre to post-independence era on rainwater harvesting in Ghana. The purposive sampling method was employed and selected policy documents were analysed using the content analysis method. A household survey data was also used in this study to complement the findings of the content analysis. The study found that, although an appreciable number of policies have been designed, implementation in all cases has not been desirable. The paper recommends that the rainwater harvesting policy be incorporated into the building code of Ghana in order to help in providing alternative sources of water for use in households.

Keywords: rainwater; harvesting; developing countries; intervention; policies; strategies; environmental policy; decision making; Ghana.

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1 Introduction

> "All peoples, whatever their stage of development and their social and economic conditions have the right to have access to drinking water in quantities and quality equal to their basic needs, and that it is universally recognized that the availability to man of that resource is essential both for life and his full development." [UN (1977) as cited in Gleick (1996) and in Notenboom (2009), p.9].

In many countries today, the quest for socio-economic development faces increasing water challenges. This is aggravated daily by the poor handling of the environment, resulting in climate change and its adverse effects on water and mankind in general. One important development goal of international concern which was meant to be achieved by 2015 yet missed was halving the percentage of people without adequate access to water and basic sanitation. It is estimated that more than 5 million people perish every year from water-related diseases, and over one billion people also suffer because they do not have access to water for their basic needs (Cain, 2005).

> "At the continental level, America has the largest share of the world's total freshwater resources with 45 percent, followed by Asia with 28 percent, Europe with 15.5 percent and Africa with 9 percent. In terms of resources per inhabitant in each continent, America has 24 000 m^3/year, Europe 9 300 m^3/year, Africa 5 000 m^3/year and Asia 3 400.1 m^3/year." [FAO (2003), p.19]

According to the World Health Organisation (WHO, 2000), Africa and Asia are estimated to contain 28% and 63% respectively of the global population not served with improved water supply. The case for Latin America and Caribbean and Europe are also estimated to contain 7% and 2% respectively. This suggests that Africa and Asia have the lowest water supply situation amongst the continents of the world. It is further argued by the United Nations (UN, 2014) that the Sub-Saharan Africa is off track from meeting the Millennium Development Goals (MDGs) on water with just 61% water coverage. With the current pace, it cannot reach the 75% target set for the region. Truly, the target failed, hence Sub-Saharan African still lags behind other developing countries (Amoah, 2017).

Ghana, a developing country in the Sub-Saharan Africa experiences a tropical climate with an average annual rainfall which ranges from 1,100 mm in the northeast to about 2,100 mm in the southwest (Doe, 2007). The country is therefore characterised by great water potential. World Bank (2013) indicates that available fresh water resources in Ghana have decreased from 1,345 m^3 per capita in 2007 to 1,221 m^3 per capita in 2011. According to Falkenmark et al. (1989), a country is water-stressed when its available fresh water resources fall below 1700 m^3 per capita. This indicates that per the water-stress classification as indexed by Falkenmark et al. (1989), Ghana is currently water-stressed. Indeed, this situation was predicted to occur by 2025 but happened earlier

in 2011. Ghana's water challenges urged the Ministry of Water Resources Works and Housing (MWRWH) to develop a National Rainwater Harvesting Strategy with the primary goal of guiding the water sector and water-related actors in the promotion of rainwater harvesting (RWH) as a supplement to water service delivery in both urban and rural areas (MWRWH, 2011). However, implementation of the strategy is yet to materialise and, like most developing countries, remains a challenge.

According to Amoah and Dorm-Adzobu (2013), all freshwater resources (i.e., surface water or ground water) mainly stem from rainwater and can, therefore, be argued as the source of all water sources. They further articulated the view of Mashood et al. (2011) in defining RWH as a means of capturing the rain where it falls or capturing the runoff and taking measures to store that water for domestic use and other purposes. This technology is regarded as the oldest man-made technology that provides potable water for domestic, agricultural and industrial use. This method of providing potable water for several uses is observed as an alternative source of water supply (Amoah and Dorm-Adzobu, 2013; Mashood et al., 2011). Ghana has not fully harnessed the rainwater potential as an alternative source of potable water. This, coupled with choked gutters, have also contributed to the yearly flooding of the capital city claiming lives and properties (Amoah, 2011).

RWH has numerous benefits because it "enables people at household and community levels to be empowered to access alternate water sources and to manage their own water, thereby reducing their reliance and burden on central supply systems. Besides access to safe water, RWH yields numerous benefits: environmental (no negative impact), social (empowers people), economic (relatively low cost), as well as contributing to sustainable development (poverty reduction)." (MWRWH, 2011)

The benefits of rainwater in ensuring water security have become obvious in the face of recent threats of climate change. Many countries of the world, have therefore bought into the idea of using rainwater. In 2001, the International Rainwater Conference in Mannheim (Germany) saw over 400 participants from 68 countries committing to rainwater utilisation, in their countries (Krishna, 2001). In 2002 and 2015, at the World Summits on Sustainable Development, the MDGs and the Sustainable Development Goals (SDGs) were formulated with the objective of reducing poverty. The discussions saw the stakeholders stress on the obvious link between poverty and lack of water. Those who were already involved in RWH activities argued the need for an international platform for rainwater. By this, countries would promote rainwater as a valuable resource, along with its management as an equal part of the already widely accepted Integrated Water Resources Management (IWRM). In this field, pockets of knowledge already exist all over the world – this knowledge needs to be enhanced to become useful to many.

Ghana adopted RWH strategy in December 2011. However, its implementation is yet to materialise. As in most developing countries, policy documents are swiftly developed but implementation has always been a challenge. One reason for the success in some developed countries in the area of water could be attributed to the fact that policies on RWH have been captured in their building codes, and are being implemented to the core. This has been done to ease the pressure on the pipe system. In contrast, developing countries like Ghana spend substantial proportion of their scarce resources on developing policies, which are not implemented because of weak political will to allocate resources productively.

This study, therefore, attempts to evaluate policy documents on rainwater resources as an alternative source of water supply for water security. Together with other indicators, it helps in assessing water security in Ghana, as well as their chances of meeting the goal of eradicating extreme poverty by 2030. This paper presents a review of the various development policy and strategy documents on rainwater in Ghana from the pre-independence era. Section 2 discusses the scope and methodology applied in the study. The various policies are reviewed in Section 3. Section 4 presents a summary of the assessment of the policies and their impact on the sustainability of water supply. Section 5 presents conclusions and recommendations relevant to advance policy implementation.

2 Scope and methodology

The study covers the review of strategic national policies and strategies that have elements of water and RWH from the 19th century to 2012. The methodology consists of purposefully selecting all policy and strategy documents in Ghana that deal with rainwater or any aspect of it. Thus, all available documents at the Water Research Institute, Water Resources Commission and Ministry of Water Resources Works and Housing on RWH were reviewed. Where documents were unavailable, experts from the organisations provided relevant inputs during round-table briefings. The data collection was undertaken in 2012 during a fieldwork in Ghana by a team from the Technical University of Braunschweig in Germany. Data collected for each period were analysed by evaluating the extent of each policy's implementation in realising the objective of introducing and implementing RWH nationally. The purpose of the data collection was to aid the introduction of a modern rainwater system in the Coastal Savannah region of Ghana. This review draws lessons of experience and makes recommendations to guide future strategies, policies and their implementation.

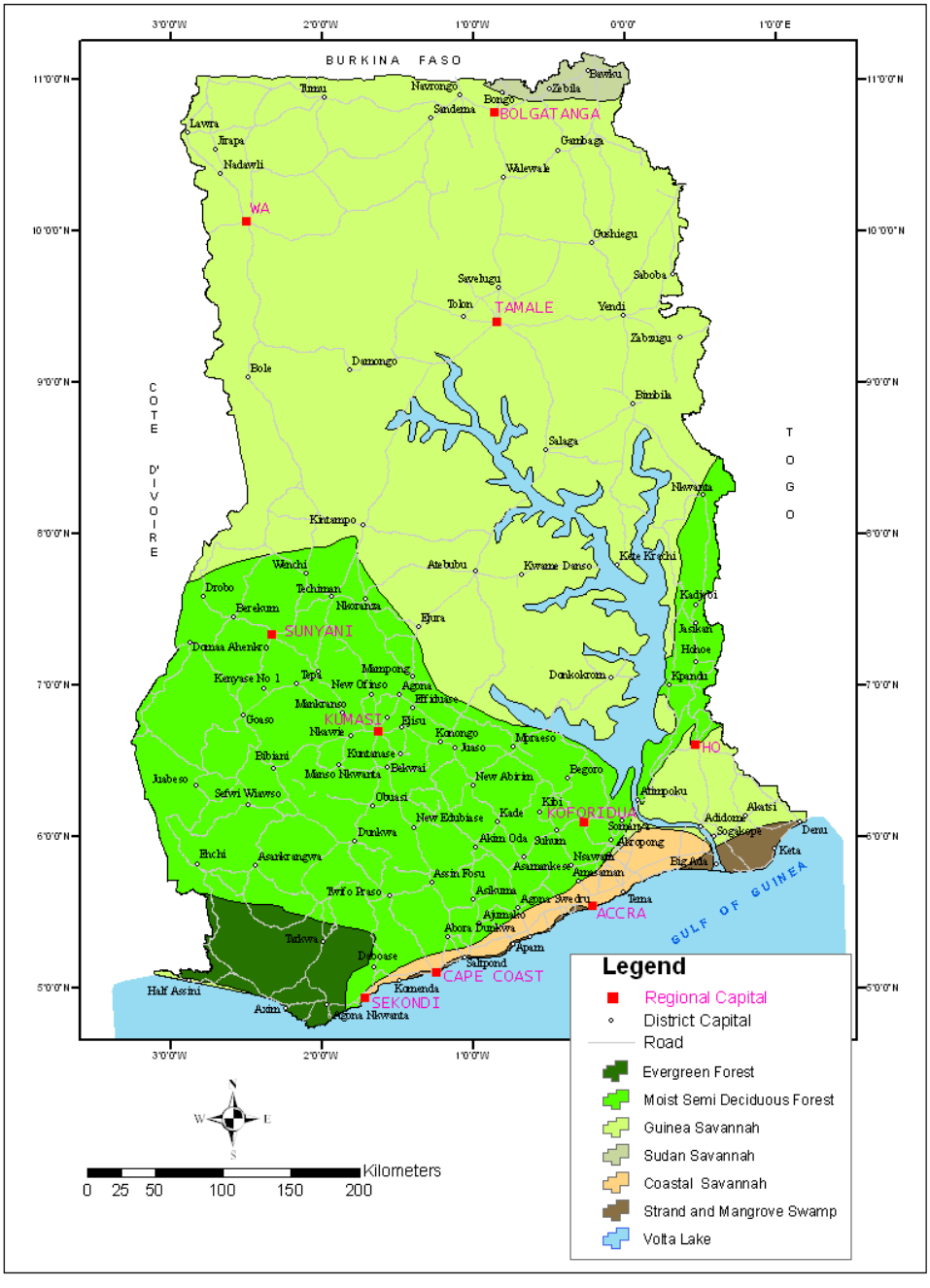
In addition, regarding the household survey, twenty selected communities within the Coastal Savannah Region of the Greater Accra Region of Ghana were randomly selected. The survey process involved the administration of questionnaires to 309 households. Structured questionnaires were used to collect data on the perception of respondents on Ghana's RWH policy. It was further used to analyse respondents' socioeconomic characteristics and their willingness-to-pay behaviour for an improved RWH system or technology.

2.1 Study area

The Republic of Ghana is a country located in the western part of Africa, along the Gulf of Guinea. It covers an area of 238,537 sq. km (equivalent to 92,100 sq. miles). The population of Ghana is over 25 million. Politically, it has consolidated democratic rule and it is described by experts as having made giant strides in democratic rule especially after their 2012 and 2016 elections respectively. Economically, until most recently, it was regarded as one of the best-performing economies in Africa. Ghana is divided into ten administrative regions with six ecological zones (see Figure 1). It is characterised by a dynamic rainfall pattern. The lowest annual rainfall range is between 700–800 mm while the highest is 2100–2200 mm (see Figure 2). Thus, Ghana's main rainfall varies from about 2,150 mm in the southwest coastal region to about 850 mm on the east coastal

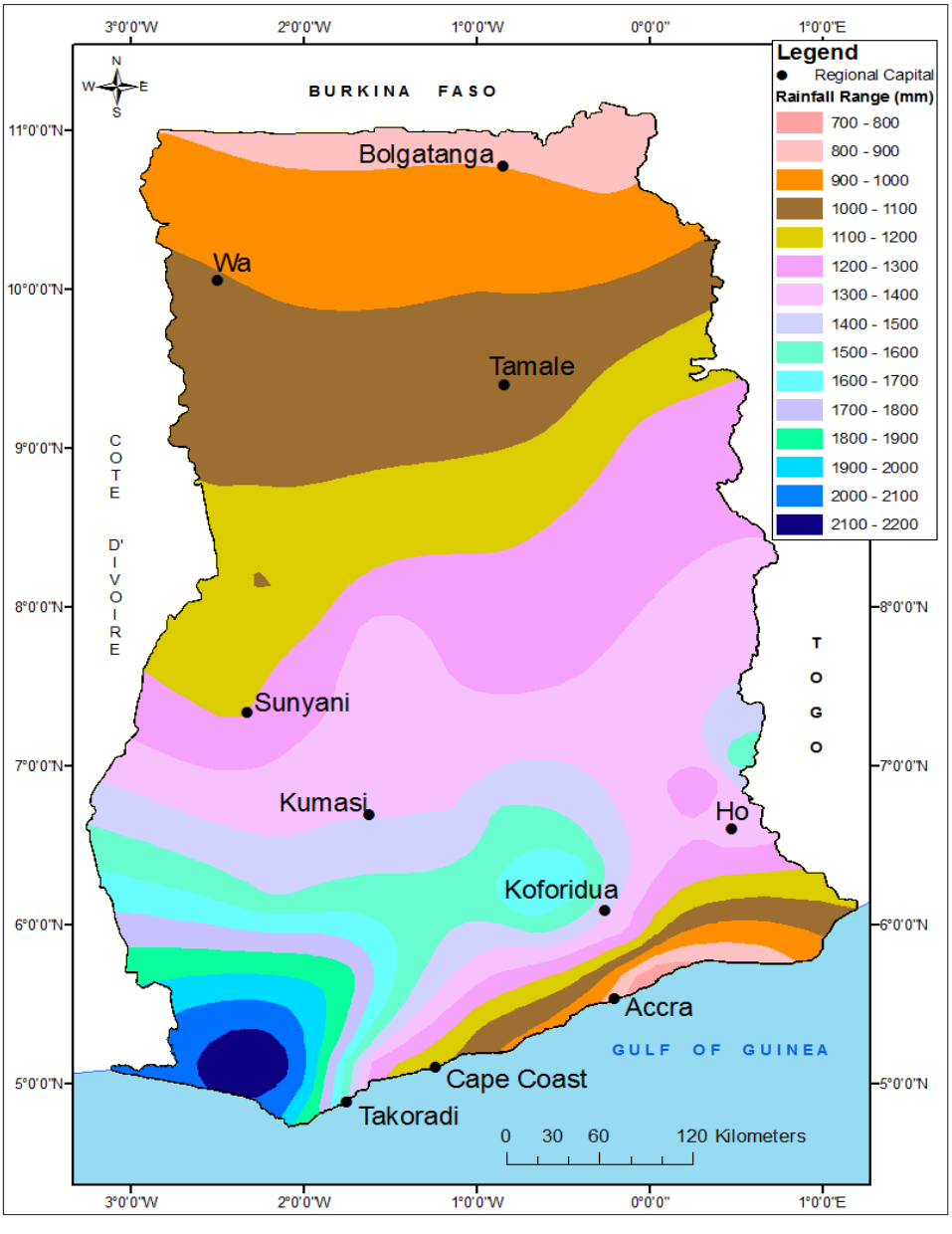
region and 1,000 mm in the regions of the north. The climatic condition is tropical with temperatures generally between 200C–300C. It is endowed with a broad range of natural resources which include but not limited to oil, gold, diamond, and timber.

Figure 1 Ecological zones of Ghana (see online version for colours)



Source: Dorm-Adzobu (2012)

Figure 2 Rainfall ranges in Ghana (see online version for colours)



Source: Dorm-Adzobu (2012)

3 Brief historical background

This section presents background on general water supply and focuses particularly on rain water in three different periods namely pre-independence/colonial, independence and post-independence eras.

3.1.1 Pre-independence or colonial period

The system of formalising Ghana's urban water supply can be linked to the colonial era. In the 19th century, after the institution of formal colonial government; pumps, artificial reservoirs, and piped water supply systems were introduced in the Gold Coast. Formal water systems were not introduced primarily for the local Ghanaian communities but for the industrial enclaves, cities, and settlements. Other forms of water sources such as rivers, lakes, streams, and rainwater were used without proper treatment. Eventually, Ghanaians were exposed to boiling rainwater after harvesting before use. This to a large extent was meant to reduce water-borne diseases associated with untreated water.

According to the MWRWH (2011), RWH was also used by the British, especially, in many missionary and government residences. They had RWH facilities incorporated in the designs of their buildings. In 1948, the Department of Rural Water Development was established to engage in the development and management of rural water supply through the drilling of bore holes and construction of wells for rural communities (MWRWH, 2009). However, the Department's activities did not primarily include RWH. More so, the subsequent lack of maintenance culture on the part of indigenous people of Ghana affected the harvesting techniques introduced by the British during the colonial era.

3.1.2 Independence and immediate post independence

Ghana gained independence from the British in 1957. A year after, a Water Supply Division, with headquarters in Kumasi was set up under the Ministry of Works and Housing. The Water Supply Division was charged with responsibilities for both urban and rural water supplies.

During the dry season of 1959, there was severe water shortage in the country. Following this crisis, an agreement was signed between the Government of Ghana (GoG) and the WHO for a study to be conducted into the water sector development. The study focused not only on technical engineering but also on the establishment of a national water and sewerage authority and methods of financing. Furthermore, the study recommended the preparation of a 'Master Plan' for water supply and sewerage services in Accra-Tema covering a 20-year period (1960–1980). In line with the recommendations of the WHO, the Ghana Water and Sewerage Corporation (GWSC), was established in 1965 under an Act of Parliament (Act 310) as a legal public utility entity. Between 1957 and 1958, there were 35 pipe-borne water supply systems in the country. This number rose to 69 in 1961 and then to 194 in 1979. By this date, there were 2,500 hand-pumped borehole systems in the country and by 1984, additional 3,000 boreholes had been drilled and fitted with hand pumps. However, by the late 1980s and early 1990s, 33% of the water supply systems had deteriorated greatly or completely broken down due to inadequate funding to carry out maintenance. Incidentally, the 'Master Plan' made no concrete provision for RWH to be adopted.

3.1.3 Economic recovery and structural adjustment eras (1983–1990)

The water supply systems which were not properly managed saw some deterioration in the 70's. During the era of the economic recovery program (ERP) beginning 1983, efforts were made to prevent the deterioration in Ghana's water supply systems. However, the attempts were not sustainable to permanently recover water supply systems in the

country. A World Bank report in 1998 states that: "The water supply systems in Ghana deteriorated rapidly during the economic crises of the 1970s and early 1980s when government's ability to adequately operate and maintain essential services was severely constrained." (MWRWH, 2009).

A structural adjustment program (SAP) was implemented in Ghana between 1984 and 1990. The water supply sector was not a priority sector, albeit, statistics indicate that the national average for water supply coverage stood at 36% in 1990. In recognition of the deteriorating quality of water, the government passed in 1996 a water resources Act which set up the institutional and regulatory framework for water management [International Monetary Fund (IMF, 2000)]. Recent statistics indicate that the national average for water supply coverage which stood at 36% in 1990 improved to 68% by 2002 (AFDB, 2005).

Clearly, the ERP and SAP did not contribute significantly towards the development of the water sector in Ghana as it did for other sectors. This, therefore, affected the possibility of focusing on rainwater as the economic and structural policies in the water sector management had other targets rather than rainwater supply systems.

3.1.4 Water regulatory and management institutions in Ghana

Over the years, lack of accurate data and information has hampered effective policy and decision-making in the area of water and sanitation. The development of accurate statistics on water and sanitation has been a challenge in the country. This challenge has been attributed to lack of standard/uniform definitions and indicators when dealing with water and sanitation programs (MWRWH, 2009).

The water sector restructuring project (WSRP) launched in 1987, was as a result of the five-year rehabilitation and development plan prepared for the sector. Multilateral and bilateral donors contributed $140 million to support the implementation of the WSRP. The reforms were aimed at reducing water loss by introducing rationalisation through reduction of the workforce, hiring of professionals and training of the remaining staff. A strong focus in the WSRP was also to improve management and increase efficiency through an organisational change in the water sector. Accordingly, a number of organisational reforms within the Ghanaian water sector were initiated in the early 1990s. As a first step, responsibilities for sanitation and small towns' water supply were decentralised from GWSC to the district assemblies in 1993 (GWCL, 2012). The reforms could have helped in providing district specific statistics to enhance the promotion of RWH. However, there has not been any evidence regarding the reforms promoting RWH.

The Water Resources Commission (WRC) was established in 1996 to be responsible for the overall regulation and management of water resources. In 1997, the Public Utilities Regulatory Commission (PURC) came into being with the mandate of setting tariffs and quality standards for the operation of public utilities. With the passage of Act 564 of 1998, the Community Water and Sanitation Agency (CWSA) was established to be responsible for management of rural water supply systems, hygiene education and provision of sanitary facilities. After the establishment of CWSA, 120 water supply systems serving small towns and rural communities were transferred to the district assemblies and communities to manage under the community ownership and management scheme (GWCL, 2012). The improved water supply systems by the CSWA focused on the piping scheme, borehole fitted with pump, hand dug well fitted with pump, and protected spring [Ghana Integrity Initiative (GII, 2011)]. RWH was not

observed as part of the central improved water supply systems. Therefore, the central ones overshadowed the role of RWH.

Finally, pursuant to the statutory corporations (conversion to companies) Act 461 of 1993 as amended by LI 1648, on 1st July 1999, GWSC was converted into a state-owned limited liability company known as Ghana Water Company Limited, with the responsibility for urban water supply only. A Water Directorate was also created within the MWRWH in 2004 to oversee sector policy formulation and review, monitoring and evaluation of the activities of the agencies, and coordination of the activities of donors. The Environmental Health and Sanitation Department of the Ministry of Local Government and Rural Department was also upgraded into a Directorate in 2008. These organisations were put in place to streamline the activities in the water sector which included alternative sources of water supply such as RWH.

3.2 Review of national policies

This section provides Ghana's national and water-specific policies with emphasis on rainwater management.

3.2.1 General policy documents for Ghana from 2003–2013

The economic growth rate recorded by Ghana in recent years from 7.3% in 2008 to 13.4% in 2011 has essentially been promoted by several policies introduced by the government. Among them are the Growth and Poverty Reduction Strategy (GPRS I, 2003–2006 and GPRS II, 2006–2009), and Ghana Shared Growth and Development Agenda (GSGDA, 2010–2013) which is informed by the country's commitments to MDGs, New Partnership for African Development (NEPAD) and above all by the underlying obligations set out in the 1992 Constitution of the Republic of Ghana.

The Growth and Poverty Reduction Strategy (GPRS II) for the period 2006–2009 follows the initial Ghana Poverty and Reduction Strategy (GPRS I) launched in 2003. The provision of water was highlighted in both GPRS I and GPRS II. In GPRS I (Section 6, Subsection 6.2.1.1), it made provision for small dugouts, bore holes, tube wells, and other simple water harvesting structures especially in the three northern regions and the Afram Plains be provided. Apart from the fact that this provision was not detailed enough to cover the entire country, there was no provision or roadmap for its implementation hence it saw no significant impact. In addition, nothing was said about RWH and its incorporation into the nation's building code. As a result of the loopholes in the policy document on water and rainwater, a strategic environmental assessment (SEA) conducted on the GPRS I showed that water is a cross-cutting thematic issue and should be addressed properly because it is highly relevant to promoting livelihood, health and vulnerability issues in Ghana (MWRWH, 2007; NDPC, 2004).

Chapter four, Section 4.6 of GPRS II made provision for accelerating the provision of safe water in rural and urban areas. In the case of rural areas it stated: "…..improve community owned and managed water supply systems; provide in the building code an enactment requiring all building plans to include RWH facilities, provide check-dams (dugout) to harvest rainwater for agricultural purposes, strengthen human resource capacity in water and to disseminate information on safe water." In the case of urban areas, it stated: "…. provide, in the building code, an enactment requiring all building plans to include rain harvesting facilities." This provision on rainwater has not

materialised because the provision has not been captured in the building code. Ghana's building code was completed over a decade ago; however, it has not been implemented due to technical, financial and political reasons.

3.2.2 National water policy on RWH

The provisions of the GPRS II to a certain extent influenced the formulation of the National Water Policy (NWP) in 2007. The policy provided the path to harnessing rainwater potential. It required that government should enact appropriate legislation to be implemented through authorities such as the Metropolitan, Municipal and District Assemblies. It also provides incentives towards making RWH a viable option to supplement household and institutional water requirements (MWRWH, 2007).

Although the building code has not been revised, the NWP made provision for RWH to be incorporated in the building code. This served as the basis for drafting a National Rainwater Harvesting Strategy. Although not much has been achieved from the NWP in terms of improving water supply in Ghana, there are current calls for a review of the policy document (Clottey, 2013). This is because the Water Directorate of the Ministry of Water Resources Works and Housing believes its contents are fairly outmoded six years after the policy document was launched by the government.

3.2.3 Water supply and rainwater policy from 2010–2013

The Ghana Shared Growth and Development Agenda (GSGDA, chapter two, Section 2.6) states:

> "priority policy interventions to be implemented are aimed at achieving the following key objectives: ensuring efficient management of water resources; accelerating the provision of safe and affordable water; ensuring the implementation of health education programmes as a component of all water and sanitation programmes; improving sector coordination through a sector-wide approach to water and environmental sanitation delivery; and improving sector institutional capacity…." (NDPC, 2010)

Ghana's rainwater strategy also made provisions for key strategic interventions to be implemented to achieve the policy objectives. These include: enhancing trans-boundary water resources cooperation and management; development and implementation of legislative instruments for efficient water resources management; development of mechanisms and measures to support, encourage and promote RWH; improving data collection and management for water resources assessment and decision making; supporting for the provision of safe water in rural and urban areas with investments for the construction of new facilities as well as the rehabilitation and expansion of existing water facilities; strengthening public-private and NGO partnerships in water provision as well as improvement of community-owned and managed water supply systems;…(NDPC, 2010). The GSGDA facilitated the drafting of the National Rainwater Harvesting Strategy which was completed in 2011 as an adaptation measure to the water crises in Ghana. The overall goal of the strategy document was to institutionalise and facilitate the implementation of modern RWH techniques in Ghana.

3.3 Brief review of policies, practices, strategies and legal framework in other countries

Many countries in the world have national water laws and policies. However, not all countries of the world have policies and byelaws regulating their rainwater supply system. Most countries have come to appreciate the importance of having RWH laws in building codes. This is more common among the European countries.

RWH systems are not a new concept in the UK. Traditionally, people have collected and stored rainwater for household use. Until mains supply became the norm, rainwater was used for laundry, washing up and other cleaning operations. However, modern RWH systems have been described as relatively new to the UK (EA, 2010). According to Hassell (2005, p.4), "There is little legislation in the UK specifically relating to rainwater harvesting systems." Although not much has been done, Hassell argues that the UK government sees RWH as an answer to solving water challenges experienced in the south and east of the UK. As of 2005, there were calls by the water supply companies and the UK Rainwater Harvesting Association (UKRHA) to legislate for rainwater to be nationally acknowledged and properly introduced. RWH in the UK since 2002 (Ward, 2008) shows turnover doubled every year for the last 3 years and stood at £1,000,000 (US$1.8 million) a year (Hassell, 2005). He indicated further that, this growth was expected to continue at least for three years. In addition, the socio-economic benefits induced government's further support for the commercialisation of modern RWH in the UK.

According to the European Rainwater Catchment Systems Association [ERCSA, n.d], the Federal Administrative Court in Germany in 2010 further sanctioned among other things the use of rainwater for laundry in Germany. Germany by its geographical location is a water-rich country yet it is the renowned leader in this rainwater technology. Thirty-five percent of new buildings built in Germany are equipped with rainwater collection systems. The German RWH industry is worth 340 million Euros and creates a large number of jobs. The legal and administrative framework on rainwater is determined on a national level and the federal government provides support up to the municipal level (Moench et al., 2011). RWH is fairly advanced in Germany, with the rules for such systems incorporated into national building codes specifically Deutsches Institute for Normung e.V., Berlin (DIN) 1989.

The national legislation in Belgium requires all new construction to have RWH systems for the purposes of flushing toilets and external water uses. The purpose of this legislation is twofold: to reduce demand for treated water and the expansion of the water supply infrastructure and to collect and use rainwater instead of surcharging storm water management systems [CWWA (2002) cited in TRCA (2010)].

In Australia, Governments in states such as Victoria, South Australia, Sydney (New South Wales), Gold Coast and Queensland have taken active steps to ensure that newly constructed houses are designed and built with the latest rainwater efficient designs and products. This initiative is law driven and not just a political promise. In the case of Queensland State, apart from the Building Regulation (2006) that provides a rainwater tank as a requirement under which harvested rainwater must be stored and a rebate up to $1,500 is made available for the purchase and installation of home rainwater storages (Graffam et al., 2010).

In the USA, States of Arizona, Texas and New Mexico, specifically the City of Austin and San Antonio, Albuquerque and Bernalillo County per their laws have

residents install the RWH system. Ohio is believed to have the most extensive rules on RWH. The Government of Arizona State announced a one-time tax credit of 25% of the cost of water conservation system (the maximum limit is $1,000) for its residents which includes rainwater. Even the builders are eligible to get the tax credit of up to $200 per residence unit constructed with a water conservation system. Any citizen in this state who has purchased a water harvesting system on or after January 1st, 2008, can apply for the Arizona tax credit (Texas Water Development Board, 2005).

In India, the government upon realising the importance of rainwater issued a Gazette Notification of providing RWH in the building bye-laws 1983. This was done through the Ministry of Urban Development and Poverty Alleviation to ensure that buildings in Delhi provide for RWH (Government of India, 2002). Although efforts have been made towards institutionalising RWH in the country, there is no national law as such for RWH. There is, however, a National Water Policy which is regarded as a cogent and comprehensive document and can form the basis to be converted into a law. Under India's constitutional set up, water is a state subject. States like Himachal Pradesh, Ahmedabad, Bangalore, Port Blair, Chennai, Kerala, and New Delhi have made it mandatory in their building codes. Institutions of local self-government have been established and steps are being taken to improve the existing law and to empower local institutions. In this regard, necessary efforts are made to ensure that these institutions and local communities work together for the maintenance, use and survival of traditional and modern water harvesting systems. There is, therefore, a clear need to evolve a decentralised legal regime which empowers people and make them real managers of resources. It can be argued that in order for a developing country like India to harness the importance of traditional and modern RWH systems for both rural and urban areas, it is imperative a national law which includes a mix of incentives and penalties be enacted and enforced.

According to the International Rainwater Harvesting Alliance (IRHA, 2013), generally, Africa is not water scarce due to adequate rainfall contribution vis a vis the needs of her population. In Africa, rainwater collection is becoming more widespread with projects currently in countries such as Kenya, Botswana, Togo, Mali, Malawi, South Africa, Namibia, Zimbabwe, Mozambique, Ghana, Sierra Leone, and Tanzania [Global Development Research Center (GDRC) (UNEP, 2002)]. It has also been observed that many planners and estate developers do not compulsorily include this in their designs. IRHA (2013), therefore, argues that enforceable legislative instruments and better management of rainwater systems are lacking in Africa. It further suggests that, the solution lies in implementable standardise modern technologies and practices which should be included in building codes. The political will to implement the recommendation to the core is also critical in Africa. Kenya leading the way, has since the late 1970s emerged with many projects each with their own designs and implementation strategies (UNEP, 2002). Kenya's achievement in almost a decade now is attributed to legislative measures backed by political will. In 2006, the Kenyan Government initiated a move to making it mandatory for all new buildings to have RWH system. It is also important to mention their long-term national plan (vision 2030) which strongly promotes RWH. This is followed by a charge to the Cabinet Secretary responsible for water affairs to ensure the development and implementation of a national RWH and water resources management policy and strategy which shall be effected through appropriate legislations. Based on this policy a new Water Act 2014 shall be developed and enacted by Parliament (Ministry of Water and Irrigation-Kenya, 2012).

This achievement is very significant considering the fact that about ten years ago, a study revealed in ten Sub-Saharan African countries that, water legislation on RWH was completely absent (IRHA, 2013). Specifically, in Ghana, work on incorporating the rainwater strategy into the building code started about a decade ago. Unfortunately, changing trends in government, prices, design and national planning preferences, stakeholders input, among others have so far kept the document in policy rooms without seeing the light of day. Unfortunately, unlike the developed countries, most of the developing countries have not successfully captured and implemented these policies and strategies in their building codes or regulations. This has therefore made water security through alternative sources like the rainwater a doubtful option. However, workable laws and policies which when implemented to the core will certainly yield fruitful results.

In all, except for a few African countries, Africa as a whole is still lagging behind regarding harnessing the full benefits of RWH for water sustainability due to lack of policy implementation and political will.

4 Assessment of policies and strategies in Ghana

The urge to formulate a policy on RWH in Ghana was facilitated by the establishment of a Water Directorate in 2004 by the MWRWH. It could be inferred that the establishment of the Directorate was also born out of a general policy enshrined in the GPRS I, which was launched in 2003. Following agitation by institutions such as the Ghana Science Association, the Ministry of Water Resource, Works and Housing put together a draft report in 2011 to institutionalise RWH in Ghana, following the examples of other African countries like Tanzania, Kenya, and Burkina Faso. The key provisions as are:

- GPRS II (rural) "provide check-dams (dug out) to harvest rainwater for agricultural purposes, strengthen human resource capacity in water and to disseminate information on safe water"– (Urban) "…. provide, in the building code, an enactment requiring all building plans to include rain harvesting facilities" (NDPC, 2005)
- GSGDA (rural and urban) "develop mechanisms and measures to support, encourage and promote rainwater harvesting". (NDPC, 2010)

Since the completion of the final report of Ghana's National Rainwater Harvesting Strategy in 2011, little has been done about the implementation except a call for a review of the National Water Policy. This is a common practice in Ghana and other African where policies are formulated and beautifully printed but little action is taken to operationalise the policies. Developing countries like Ghana have not been strategic enough in formalising rainwater as an alternative source of water for water security. The way forward is government support for existing policies should be backed by legislation as in the case of some developed countries.

4.1 Survey analysis of rainwater harvesting policy (RWHP)

This section presents an analysis of the survey data on RWH. Here, we describe the household characteristics which include socioeconomic characteristics, knowledge of RWHP and households' interest in harvesting rainwater for domestic use.

Table 1 Household characteristics

Characteristics	*Gender dummy*		*Martial status (dummy)*		*Literacy status (dummy)*		*Knowledge of RWHP (dummy)*	
	Male	*Female*	*Married*	*unmarried*	*Literate*	*illiterate*	*yes*	*no*
Frequency	201	107	207	101	228	80	14	294
Percent (%)	65	35	67	33	74	26	5	95
Characteristics	*Monthly income (Gh¢)*		*Willingness-to-pay (WTP, Gh¢)*				*Household size*	
Mean (SE)	200.23 (14.96)		0.025 (2.74)				4.2 (0.67)	
Standard dev.	262.51		48.04				2.81	

Source: Authors' construct[1]

4.1.1 Household characteristics and RWHP

From Table 1, the gender distribution of respondents sampled who were mainly household heads indicates that about 65% were males with about 35% females. This is not different from the national characteristics where household heads constitute about 65% of the population (See GSS, 2012). Also, about 67% were married as against 33% unmarried. A total of 74% were literate household heads and could speak and write the official language of Ghana (English) while 26% were illiterates. The average household size of 4.2 was also approximately consistent with the national average of 4.4. The average income confirms that majority of people in Ghana are within lower income brackets due to the fact that the economy is predominantly agrarian and petty trading. With the goal of assessing households' awareness, perception and/or views about RWHP, these descriptive statistics provide evidence that the right category of people consistent with the national data were sampled for the survey.

By way of evaluating households' awareness of RWHP in Ghana, we found that about 95% of households in the study area were unaware of the existence of RWHP in Ghana while about 5% demonstrated their awareness of this policy. This suggests that majority of the people in Ghana are ignorant of the RWHP. This mainly could be attributed to the low publicisation of this policy.

In addition, the study sought to find out whether the percentage of respondents who were aware of the RWHP would be prepared to pay to harvest water from an improved rainwater harvesting technology (IRWHT). The results are presented in Table 2.

Table 2 Household knowledge of rainwater policy and WTP cross-tabulation

Options	*Willingness-to-pay (WTP, *Gh¢)*					
	0.00	*0.001-0.030*	*0.031-0.060*	*0.061-0.090*	*0.090+*	*Total*
	Count	*Count*	*Count*	*Count*	*Count*	*Count/%*
Knowledge of RWHP						
No	57	193	27	4	13	294 (80.6%)
Yes	1	10	2	0	1	14 (95%)
Total	*58*	*203*	*29*	*4*	*14*	*308*

Note: *Ghana cedis (1Gh¢ = 0.319 US$ as at 15 October 2014).

Source: Authors' construct

From Table 2, we have found that the percentage of respondents who were aware of the RWHP showed a relatively higher WTP to harvest water from IRWHT. Thus, 92% out of a total number of 14 (100%) 'Yes' respondents indicated their WTP from one pesewa to about ninety pesewas. In contrast, approximately 81% were ignorant ('No' respondents) about RWHP albeit they expressed their WTP. This provides a strong evidence of WTP for IRWHT in Ghana and perhaps other developing countries with similar characteristics.

In sum, the survey has shown that majority of respondents are not aware of the RWHP in Ghana. Nevertheless, they have preference for RWH as an alternative source of domestic water supply.

4.2 Assessment questions and issues

1 Is the rainwater policy still needed in Ghana? – Both general and specific policy documents on RWH are now very relevant and critical to water security in meeting the SDG 6.

2 The purpose and goal of the policy – The purpose of the RWHP has not been fully met. Nevertheless, some of the general policy documents influenced the drafting of the current specific strategy on RWH for water security.

3 Are changes required to improve the effectiveness or clarity of the policy document? – First, the roadmap for implementation must be clear enough to facilitate enforcement. Second, the beneficiaries should be sensitised on the benefits of RWH else their difficulty in understanding the policy will hamper its implementation.

4 Is the rainwater policy document being complied with? – Although some pilot projects have been undertaken especially by the Water Research Institute, communication of their findings and its impact on users is yet to be fully felt.

5 Is the policy document up-to-date and consistent with Research Institution's (e.g., University's) strategic plan? – The policy document on RWH is not out-of-date, despite the fact that the National Water Policy is due for review. Albeit, some studies have started in some Universities, national institutions and Non-Governmental Organisations (NGOs), it is woefully inadequate. Research on RWH should be incorporated in engineering university's strategic plans so that more research is encouraged in this area.

6 Are RWH benefits economic inclusive? – The construction of RWH systems requires the production of water tanks, gutters, pumps, and filters, etc. This employment prospect can be undertaken locally using local materials and labour. The IRWHA and the American Rainwater Catchment Systems Association (ARCSA) have demonstrated their readiness to organise relevant capacity building to provide technical skills needed by local people and companies (IRHA, 2013). This will create job opportunities for those who will produce the gutters, filters, install and maintain the system.

7 Is the RWH technology eco-friendly? – The introduction of this 'green technology', particularly in large buildings such as factories and governmental institutions, can reduce both running costs (e.g., water fees) and carbon emissions (from the treatment, distribution, etc., of water). If used on a large-scale, this will certainly help towards 'greening' the economy and contributing to the global fight against carbon emissions.

5 Summary and conclusions

Ghana did not have any policy on the water sector until the 1990s after the establishment of WRC. After the inauguration of the commission, several policy documents have been drafted and adopted yet little has come out as a result of implementation lapses. The National Water Policy (MWRWH, 2007) has made little impact on improving the overall

water supply in Ghana. Rainwater supply policy implementation has not made much impact in Ghana. From the field survey, this is attributed to the fact that majority of Ghanaians are not aware of the existence of the RWHP.

This survey has found that the political will to implement rainwater harvesting policies for urban and rural water security is very weak. This has left activities in policy documents unimplemented until they become outmoded. Also, the overreliance on donors for funding has crippled the implementation of most projects. This is clearly obvious in instances where delays in donor funding has affected the execution of projects.

The study has found that countries that have legislation supporting their modern RWH have been successful in implementing the system and harnessing the socio-economic benefits associated with RWH. By these benefits of RWH, not only are developing countries like Ghana going to bridge the water shortage gap in the wake of climate change, they will also generate some money to support the formal water sector as well as creating jobs to reduce the high rate of unemployment.

5.1 Policy recommendations

This section presents measures that need to be undertaken for sustainable management of rainwater in Ghana and other developing countries:

1 Policies, strategies and practices should where necessary be transformed into laws. This will have a mix of incentives and penalties enacted to be enforced without compromise.

2 In addition, education to reorient people on the benefits of RWH should complement the formulation and implementation of appropriate legislation. This will also allay any possible fears that could be entertained due to the unfamiliarity of the general public with unconventional modern RWH systems, capital outlay required, uncertainty regarding system design approaches and health and safety fears.

3 Strong political will in enforcing policies, laws and strategies is very important. Enforcement should be made a national issue rather than contingent on the government in power. RWH systems and conservation of water should be proclaimed as matters of national importance by Governments. By this, whichever government in power will enforce it without recourse to critics and deviants.

4 Provision of RWH should become an essential town planning requirement and be a pre-requisite for sanction of new development. Town and estate developers should not be permitted to build if the right designs and compliance are not adhered to. Thus, provision of RWH structures in all building plans should be made mandatory before applications are accepted.

5 Technical regulations should be in place to ensure that a certain distance of the pipes is maintained so that rainwater harvested is not contaminated by septic tanks, especially in the rural areas.

6 Creation of a national rainwater-harvesting fund. This will help provide subsidies for the poor who are willing to have the system but cannot afford it. Again, it can help provide soft loans to entrepreneurs who would be willing to enter into the venture but cannot afford the initial capital.

7 Strengthening of Institutions. State institutions that will be responsible for providing education and enforcing the laws should be strengthened to carry out their mandate effectively.

8 Granting rebate on property tax assessment and other fiscal incentives for effective use of RWH system. In the short-term, houses with the RWH system should be given some rebate to attract other estate owners.

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Notes

1 Data collected by EXCEED Research Team under the Technical University of Braunschweig, Germany in 2012.