ENVIRONMENT AND RESOURCE MANAGEMENT IN GHANA

Edited by
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CHAPTER ONE

Introduction

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KENNETH PEPRAH

"Environment and natural resources management" has become a well-established concept within development theory and policy (Benjaminsen & Lund, 2001) despite the fact that it only gained prominence in academic discourse on development some 34 years ago, following the World Commission on Environment and Development's (WCED, 1987) report on sustainable development. Globally, increasing human population and poverty have drastically accelerated degradation of the environment as well as depletion of natural resources. As a result, most nations have subscribed to new principles for the integrated management of environmental and natural resources (Appiah-Opoku & Hyma, 1999).

Ghana has a long history of attempting to safeguard the environment and managing its natural resources by enacting appropriate environmental protection and natural resource legislations (Tamakloe, 2000; Ekpe, Hinkle, Quigley & Owusu, 2014). Ghana's commitment towards sustainable development has been unwavering since the attainment of political independence in the 1950s. This national commitment has recently been reinforced with the adoption of the Sustainable Development Goals (SDGs) by the government of Ghana in 2015. For a developing nation faced with high poverty levels, slow economic growth, and a rapidly increasing population with high expectations, the development of its plentiful natural resources present an opportunity for rapid socio-economic growth (M'clead, 2013). However, development aspirations have been compromised by the inefficient management of the environment and natural resources.

Environment and natural resource management is based on the idea of utilization of natural resources for the socio-economic development of a nation and the view that "natural resources should be developed rather than exploited" (M'clead, 2013: 6). Exploitation implies wasting resources, while development implies judicious use for long-term benefits. Understanding environment and natural resources management requires an interdisciplinary approach which combines the analysis of a number of interrelated and complex processes — ecological, social and political. In addition to these three realms of environment and natural resources management, and with the main focus on the local level where the day-to-day management takes place, the approach also integrates aspects from the national and global levels (Benjaminsen & Lund, 2001).

Considering that the environment and natural resources represent livelihoods for more than half of the Ghanaian population and contribute more than two-thirds to the national economy, it is argued that the SDGs have been adopted in an environment and natural resource context. Within this context, it is understandable that the national commitment towards realizing the SDGs is reflected in efficient environmental and natural resource management and governance. Unfortunately, not all sectors of the national economy are making an appreciable effort towards the sustainable development vision. Production efforts in the country are frequently reported to be confronted with critical environmental and resource challenges that are impediments to achieving the SDGs. Meanwhile, the SDGs are recognized as possessing transformative power to addressing key environmental and natural resource challenges with about 12 of the 17 dedicated goals centered on environment and natural resources (World Bank, 2017). Sustainable development cannot be achieved without significantly transforming the way the environment and natural resources are managed and governed.

Increasing population pressure on Ghana's environment and its natural resources, as well as lack of strong institutions and incentives for the judicious and sustainable management of these resources have combined to fuel degradation of the natural environment. Environmental degradation imposes one of the highest costs to the

national economy, with an annual estimated total cost of at least GH¢ 2.9 billion since 1988 (Acquah, 1995), corresponding to about US$483 million. The overall annual cost to the country due to the loss of forests through fire, logging, firewood extraction, charcoal production, agricultural encroachment, and fresh water pollution has been approximated at GH¢1.1 billion per year, which is equivalent to about US$183 million (Tamakloe, 2000). These estimates mean that the country's economy bears losses due to degradation of the environment and natural resources that amounts to 4 percent of gross domestic product annually (Acquah, 1995). Moreover, the estimated cost of degradation suggests that even when Ghana's economic growth has been positive as a result of accepted measures of national income, it is almost completely depleted by the degradation of the environment and natural resource base of the country, as well as the consequent destruction of the foundation for sustainable growth and socio-economic development (Ekpe *et al*., 2014).

Paying attention to environment and natural resource management in Ghana is crucial because the challenges of sustainable growth and socio-economic development of the country have been traditionally intertwined with its environment and natural resources. Moreover, current trends of environment and natural resource degradation are unresolvedly linked to current developmental issues for a country which has a high number of its population depending directly and indirectly on the natural environment for their livelihood (Yaro & Hesselberg, 2016). For sustainable growth and socio-economic development, it is critical to examine the environment and its natural resource management as well as the capacities needed to enable their efficient management, while avoiding exploitation.

The aim of this book is to produce a reference material for teaching, learning and management purposes in the area of environment and natural resource management. It provides a variety of conventional and emerging theoretical, empirical and imaginary frameworks to inform understandings and responses to critical environmental and natural resource management and governance issues, such as urbanization, tourism, water resources, solid waste, food security, Geographic Information System (GIS) applications,

environmental policy, externalities and assessment. In doing so, it will provide contexts for a variety of theoretical frameworks, enabling a more meaningful understanding of various environmental and natural resource management and governance issues in Ghana. This book contains twelve chapters with chapter contributions from scholars in the fields of geography, natural resource management, environmental science and GIS.

The chapters adopt comparative literature review and empirical spatial research with the aim of providing a critically informed introduction and overview of key concepts, issues and debates related to environment and natural resource management and governance in Ghana. Though the theoretical and empirical information provided in this book are mostly about Ghana, their pertinence in terms of the processes, structures, necessity, actions, and recommendations for policy are applicable to other countries.

The book provides useful lessons for understanding environment and natural resources management in a developing country. The book is meant for a wider audience in the environment and resource management area, particularly students, teachers, environment and natural resource managers responsible for protecting the environment and developing natural resources. Besides, protection of the environment and sustainable development of natural resources are the responsibility of all, and issues of environment and natural resources affect everyone. Thus, this book is equally of interest to everyone.

Outline of the Book

This book contains twelve peer reviewed chapters. Chapter One is an introduction to the book. It discusses the substance of the book and provides a summary of its contents. It also makes a case for environment and natural resources management for sustainable growth and socio-economic development in Ghana.

In Chapter Two, a conceptual framework for urban environmental management and governance is provided to set an agenda for addressing environmental challenges in urban centers.

Inefficient urban environmental management and governance continue to accelerate the process of environmental degradation and even draw back the little gains made in urban development. The chapter draws on concepts of urban governance to rationalize and explains some underlying conditions, mechanisms and practices to reinforce urban environmental governance for building sustainable cities and towns in Ghana.

Chapter Three continues the analysis of the problems of urban environmental management by presenting the factors inhibiting effective solid waste management for sustainable urbanization. In Ghana, urban solid waste generation has exceeded the management capacity of local authorities. Yet not much attention has been given to the technical issues of solid waste management and their relationship with sustainable urban development. The chapter examines recent trends and future challenges in solid waste management in Ghanaian cities. The author argues that the future of urban solid waste management in Ghana will remain a challenge if action is not taken to discover and apply locally appropriate technologies.

Chapter Four examines environmental targets, environmental externalities and environmental policy instruments in the context of environment and resource management. Among other things, the chapter analyzes environmental target setting and explains that the socially optimum level of pollution is attained when marginal abatement costs are equal to marginal damage costs. The author argues that in trying to achieve the overall goal of environment and resource management, there is the need for environmental objectives and targets to be set, so that by relying on environmental policy instruments, positive or negative externalities will occur.

Chapter Five examines the evolution of environmental policy implementation from environmental science to become a distinct field of study using several disciplines. Since Rachel Carson's 1962 'Silent Spring,' various approaches to global environmental policy formulation and implementation have evolved to address diverse environmental problem. The chapter looks at how society has responded to the various approaches to global environmental policy and contextualizes the discussion in Ghana to identify the set of

approaches that are needed locally to formulate and implement holistic environmental policies. From a Ghanaian perspective, the author recommends that government agencies and departments invest in developing the capacity of their human resource on environmental issues so as to consciously incorporate eco-centric and techno-centric perspectives when formulating environmental policy and plans for implementation.

Chapter Six evaluates the implementation of environmental assessment (EA) decentralization as an environmental planning strategy to identify environmental and socio-economic impacts and at the same time proposing mitigation measures for decision-making purposes. It reveals that the EA decentralization initiative is yielding speedy processing of EA applications, creation of awareness about EA activities at the local level and building capacities of local stakeholders. Even though the author concludes that the EA decentralization programme did not achieve 100% success rate as envisaged in the proposal document, the chapter has the potential to introduce students and teachers to EA decentralization in Ghana, including its benefits and challenges.

Chapter Seven focuses on 'co-management' as a concept for a theorization of the management of small-town water systems. It shows how co-management of small-towns water systems might be conceptualized and what its nuanced specificity might be. In presenting a conceptualization of co-management as a framework, the authors bring the concept into conversation with particular debates around small-towns water systems and argue that co-management provides a useful basis for thinking of the management of small-town water systems as a practice and, that, it is particularly useful for considering the management of small-town water systems as processual and relational.

Chapter Eight addresses the issue of levies for rural and peri-urban areas by Ghana Water Company Ltd., as an urban utility company and the implications on water access. It shows that the imposition of tariff on water is consistent with the National Water Policy principle on the recognition of the economic value of water. The author recommends that, given the low-income status of rural

and peri-urban communities, the principle of fundamental rights of all people, the principle of subsidiarity, and the principle of solidarity should be adequately integrated into the conditions for urban water extension to rural and peri-urban areas under the utility management model.

Chapter Nine discusses some issues surrounding GIS, a tool for the management of environmental and natural resources. It discusses the historical, conceptual application areas and challenges of teaching, learning and applying GIS. It clarifies some of the issues, which appear very technical to beginners in GIS and also enhance the teaching and application of GIS. The chapter points out some of the basic principles and conceptual issues that are not clearly understood and cautions that GIS is a double-edged sword which, if not properly handled, can be detrimental rather than beneficial to society.

Chapter Ten explores aspects of the legal remits of cadastral surveys that arise as a result of lack of knowledge from clients and practitioners in the land sector. The legal attributes of land are very important in natural resource management. The chapter explains the different plans used and their purposes as well as the legal regime in Ghana needed for a cadastral plan to be properly produced. The chapter also discusses the significance of the law in land surveying and how complementary LI 1444 cured some gaps in Survey Act 127. It contributes to the efficient and legal process of cadastral surveying and the promotion of standards due to this regime.

Chapter Eleven explains the linkages between tourism and environment. It does this by elucidating the relationships between the following concepts: tourism and tourist; origin and destination of tourist; and the negative and positive impacts of tourism on the natural environment. It also explains the models of intervening opportunities. The chapter thus establishes that, conceptually, tourism and environment are inseparable and stresses that it is extremely difficult to do tourism without the natural environment.

Chapter Twelve presents food insecurity experiences among urban folks in Wa. Food insecurity in urban areas has indirect influence on the state of environmental and natural resources. It employs ordinal logistic regression as a vital tool to analyze the

relationships between socio-economic variables and food (in)security to show vulnerabilities. It reveals that there is a high prevalence of food insecurity among the urban population in Wa. It recommends the provision of more agricultural-related skills education and training for the urban youth that would place them on a better position for ensuring food security.

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CHAPTER TWO

Urban Environmental Management and Governance: Towards a Conceptual Framework

ISSAKA KANTON OSUMANU

ABSTRACT

Uncontrolled and unplanned urbanization in Ghana has endangered environmental management with implications for sustainable development of cities and towns. Inefficient urban environmental management and governance continues to accelerate the process of environmental degradation and even draw back the little gains made in urban development. Given the central role of urban centers in national economic and social development, attention needs to be given to sustainable management of urban environments. This chapter presents an overview of the complex issues confronting urban centers in Ghana and proposes a conceptual framework for effective urban environmental governance. Some supporting structures, mechanisms and processes are rationalized and defined to strengthen the process of urban environmental governance as a basis for building sustainable cities and towns. It is contended that efficient urban environmental management and governance at the community level is critical for developing sustainable cities. Productive strategies, such as instituting and enforcing bottom-up decision-making, horizontal and vertical integration of different government agencies involved in urban environmental management, strengthening the adaptive capacity of municipal authorities, and fostering productive dialogue and collaborative work among municipal authorities, have been recommended for confronting the obstacles to urban environmental management and governance.

Keywords: Collaboration, Efficiency, Obstacles, Sustainable Cities, Unplanned Urbanization

Introduction

Globally, urbanization is predicted to increase from 52 percent in 2011 to 67 percent by the year 2050 (United Nations, 2012). Also, the United Nations Population Division has projected that by the year 2030, each of the major regions of the world will hold more urban dwellers than rural inhabitants and fast forward to 2050, two-thirds of developing countries' populations are expected to live in urban centers (Ojo, Tpl & Pojwan, 2017). In particular, rapid urbanization has become a major feature of African countries in the period since 1950. Available estimates from the United Nations Human Settlement Programme (UN-HABITAT) indicate that as at the end of 2010, 414 million Africans lived in cities, and this number is projected to rise to 662 million by 2050 (UN-HABITAT, 2010). The growth of African cities certainly has implications for future economic, social and territorial development (Cohen, 2006). This is because cities perform critical roles as growth poles of national economies, as places of connectivity, creativity and innovation, and as centers of services for their countries. On the reverse side, cities in Africa are also places where problems such as inequalities, deprivation and insecurity are concentrated (Satterthwaite, 2014). These difficulties posed by African cities to their residents, in addition to the failure of city authorities to design effective urban policies, have largely prevented cities from providing the expected economic and social benefits to their residents and hinterlands.

Africa's urbanization has been variously described as unprecedented (Satterthwaite, McGranahan & Tacoli, 2010) and unsustainable (Cobbinah, Erdiaw-Kwasie & Amoateng, 2015) because it is happening in the midst of simultaneously unfolding and highly momentous demographic, economic, technological, environmental, and socio-politico transitions, which are generally negative (UN-HABITAT, 2012). Yet, there is less of a history of urban planning and management efforts towards building sustainable cities. Given the significance of cities in national economic development (Yankson & Bertrand, 2012) and the rapid trends of urbanization in developing countries (UN-HABITAT, 2010), attention needs to be

given to sustainable management of urban environments. Effective urban environmental management and governance at all levels is fundamental for achieving sustainable cities in line with sustainable development goal 11 (SDG 11), and has great potential to drive sustainable development and national economic growth.

Urbanization in Africa is characterized by unplanned spatial patterns, socio-economic deprivation, and unsustainable environmental management (Cobbinah *et al.,* 2015). Particularly, urban environmental issues are multifaceted because they encompass different dimensions of the same object — the environment (Osumanu, 2009). As such, a complete appreciation of the major environmental problems confronting urban centers require a broad approach, which can only be accomplished through a more comprehensive framework that can capture the complexity of the issues that impact the urban environment (de Faria, Bessa & Tonet, 2009).

Frequently, solutions to urban environmental problems have been seen mainly as a matter of appropriate technologies and more actual economic consequences. More recently, however, new discussions have begun to include social dimensions (Bessa, Faria & Abers, 2007). Generally, the traditional approaches to dealing with these problems have failed to consider the intricate relationship between state and society. As environmental management and governance decisions are held as state matters, they are often carried out through the command-and-control regulatory structure and by reinforcing state regulatory capacities (de Faria *et al.,* 2009). Also, the vertical construction and the centralization of power in decision-making processes presented by the traditional-bureaucratic model, do not consider ordinary actors' diverse and concurrent needs, due to the conflicting social and economic interests in the city (Cobbinah *et al.,* 2015). Taking the complex nature of these problems into consideration, conventional assessment and decision-making frameworks do not appear adequate to tackle them. Also, the complexity points to the need for a more efficient and effective management and governance framework.

When social, economic and environmental issues in urban areas are analyzed with all-inclusive frameworks and comparative

approaches, they yield novel understandings for developing environmental knowledge on structural properties and on dynamics of urban sustainability (McPhearson, Haase, Kabisch & Gren, 2016). This chapter is intended to present a conceptual framework for effective urban environmental governance. The chapter contends that efficient urban environmental management and governance at the city level is central for creating sustainable cities. When urban environmental management and governance is ineffective, it can quicken the process of environmental degradation and even set back any previous advances made in urban development.

The chapter draws on concepts of urban governance to rationalize and explain some underlying conditions, mechanisms and practices to reinforce urban environmental governance for building sustainable cities and towns in Ghana. Following this introduction, the chapter deliberates on the multiple issues confronting urban areas in Ghana. The issues are connected to environmental management and governance in terms of processes within a larger framework of sustainable Urbanization. Further, the chapter proceeds to propose a conceptual framework for effective urban environmental governance at the city level. The chapter then concludes by highlighting some measures for achieving effective urban environment governance.

Problems of Urbanization in Ghana and Implications for Environmental Management and Governance

Like many African countries, Ghana's cities and towns have experienced steady growth since the middle of the twentieth century. The percentage of the country's people who live in urban areas (officially classified as settlements with 5,000 or more people) has grown dramatically from 9 percent in 1931 to 31.3 percent in 1984, 43.8 percent in 2000, and 50.9 percent in 2010 (Ghana Statistical Service [GSS], 2012). The annual growth of Ghana's urban population between 1960 and 1970 was 4.7 percent, declining to 3.3 percent from 1970 to 1984, and picking up again between 1984 and 2010 with a 4.6 percent annual growth rate (GSS, 2012). Also, the number of settlements in the country classified as urban has been

on the rise within the same period, from 41 in 1948 to 364 in 2000 and 636 in 2010 (Naab, Dinye & Kasange, 2013). Beyond the general transition of rural areas becoming urban, there has also been an overall expansion of existing cities such that peri-urban communities that served as feed stock to the general urban population have been increasing. These processes of urban change have transitioned Ghana into an emerging urban country where over half of the population are now found in cities and towns.

The rate of urban growth has also been uneven, focusing mainly on Accra-Tema and a few other centers, mainly Kumasi, Tamale and Sekondi-Takoradi, which have annual urban population growth rates of more than 4.5 percent per annum compared to the average national population growth rate of 2.3 percent (GSS, 2013). Consequently, Accra has become a primate city not only because of its population but also in terms of its political, economic and cultural dominance (Yankson & Bertrand, 2012). The increasing rate of urbanization in Ghana has been attributed to a blend of high rates of natural growth of the national population, net increasing rural-urban migration (Songsore, 2003; Osumanu, 2009), and the spatial expansion of major metropolitan areas and some towns outside their formal boundaries (Yankson & Bertrand, 2012). According to Cobbinah *et al.* (2015), these influences are not mutually exclusive but inherently interconnected. Obviously, such rapidly increasing trends in urbanization have adverse implications for the management of both the natural and human-made environments as well as the economic and social well-being of urban dwellers (Cobbinah & Erdiaw-kwasie, 2016; Osumanu, Nyaaba, Tuu & Owusu-Sekyere, 2018).

The current situation of Ghanaian cities and towns is a cause of concern. Large urban centers like Accra-Tema and Kumasi act like 'human magnets,' attracting about 100,000 to 200,000 new inhabitants per year (GSS, 2013). The scale of this urban growth places great pressure on local governance capacity and planning processes. Indeed, demographic studies of Ghanaian cities (e.g., Yeboah, Codjoe & Maingi, 2013; Acheampong, Agyemang & Abdul-Fatawu, 2017) have found that inadequate and overwhelmed local governance capacity has led to increasing urban and peri-urban poverty, with half of the

urban residents living in deplorable conditions. Also, studies have reported a multitude of environmental issues facing the urban poor, from a lack of basic urban services such as access to clean water, solid waste management and sanitation, to exposure to poisonous indoor air pollution (Osumanu, 2007; Yankson & Bertrand, 2012; Cobbinah & Erdiaw-kwasie, 2016).

As is also the case in many African countries, cities and towns in Ghana are experiencing the fall-out of unplanned urbanization. These difficulties include ineffective land use planning and physical development controls, unregulated land demand patterns and unmeasured land distribution structures, lack of established and legitimate arrangements for physical development and problems of land disputes, especially in peri-urban areas (Yankson & Bertrand, 2012; Naab *et al.,* 2013). Urban residents experience directly and indirectly related effects and dangers, such as rise in air pollution and noise from traffic, and removal of urban green and blue spaces, all of which pose substantial threats to the health of urban residents as well as socio-environmental justice (Kabisch & Haase, 2014). The general lack of sanitation, challenges in solid wastes management and increasing incidence of floods, combined with deteriorating water quality, are exerting enormous impacts on the health and well-being of people living in urban centers.

Rapid population growth in cities and towns requires the provision of adequate housing for the increasing number of people. But housing delivery in urban areas of Ghana has generally been challenging. In spite of the progress made in housing provision, especially by the private sector, housing delivery in urban areas has been stalled by inadequate and inefficient implementation of pro-poor housing policies (Osumanu, 2010). Deficient delivery, inadequate access and lack of affordability typify the housing sector in urban Ghana. Consequently, most low-income households live in overcrowded or deteriorating housing units (UN-HABITAT, 2010). These problems have generated pressures on available housing stock and amenities in cities and towns (Osumanu, Kosoe & Dapilah, 2016). Although the number of urban dwellers who have access to safe water supply has improved considerably, especially between 1990

and 2011, there is limited improvement in access to safe sanitation (WHO/UNICEF, 2019). Also, according to GSS (2017), poor sewerage infrastructure in cities and towns serve just 5 percent of the urban households and only 15 percent of the solid wastes generated are properly collected and disposed.

Over the years, transportation problems have existed in major metropolitan areas in Ghana. This is largely due to the prevalence of private modes of transport over public mobility (Osumanu, 2009). For several years, city authorities have focused on road network policies that encourage a mounting motorized vehicular transport system, dependent on a car-centered policy (Jacobi & Peres, 2016), which has caused a decline in efficiency and reliability of public transport provided mainly by privately-owned mini-buses operating as para-transits. This in itself is also the outcome of inappropriate urban development policies which have created a costly and undependable public transport system and led to social exclusion (Osumanu, 2009). Other consequences are increasing emissions of greenhouse gases, slow traffic, and congestion which adversely affect the flow of both people and goods. Also, Jacobi and Peres (2016) have shown that congestion in metropolitan areas affects public transport users most.

The socio-environmental problems in many cities and towns have been attributed to unrestrained growth of population in such areas since the last quarter of the previous century (Osumanu, 2007). Urban areas have experienced horizontal growth and occupied a great part of the peripheral zones, through illegal settlement on vacant lands by low- and middle-income households. A major factor responsible for the hysterical development of informal urban settlements (both in the core and periphery of cities) is the continuous neglect by city authorities over the years to regulate and monitor new developments and to provide adequate urban infrastructure and services (Jacobi & Peres, 2016).

Associated with rapid increase in urban populations is the occurrence of deprivation and inequalities, which manifest in vulnerability and insecurity. Although available evidence suggests that the segment of urban dwellers that live in slums has reduced in recent years, about 30 percent the country's urban residents are

still found in slum settlements (Obeng-Odoom, 2013), which are characterized by awful and unhealthy environments, land disputes and unlawful residential developments. In addition, many of the slum dwellers live in unbuildable places, such as areas prone to flood, which expose them to severe flooding and fire events (Appeaning-Addo, Larbi, Amisigo & Ofori-Danso, 2011).

The problems of urbanization in Ghana have several implications for effective urban environmental governance (Cobbinah & Erdiaw-kwasie, 2016). Uncontrolled and unplanned urban growth has jeopardized environmental management and governance (Osumanu & Akombangre, 2020). The increasing level of metropolitan development in flood-risk zones, coupled with the general absence of appropriate urban infrastructure planning, has exposed many cities to flood and fire events and further threatened the precarious infrastructure of cities and the well-being of residents (Yeboah *et al.,* 2013). Such events have caused severe damage to life and property. Also, the occurrence of urban floods is the result of failures of drainage system design, construction and maintenance. For example, perennial flooding in Accra has been blamed on the overflow of rivers within the inner-city, which is caused by uncontrolled development in riparian communities of such rivers as well as solid waste discharge in river channels and reduction in vegetation cover (Rain, Engstrom, Ludlow & Antos, 2011)

Typically, municipal planners and decision-makers have the responsibility of dealing with urban environmental problems to secure a healthy life for urban dwellers and to ensure sustainable urban communities. A weak urban environmental management and governance structure has been a cause of Ghana's urbanization problems (Yankson & Bertrand, 2012). Due to inadequate local government systems, municipal and metropolitan assemblies have not been able to provide and manage adequate levels of urban services and infrastructure in their areas of jurisdiction. Added to that, national institutions and agencies that are responsible for providing particular services to local governments have not been able to function efficiently. With rapid and unplanned urbanization in Ghanaian cities and towns, there is limited capacity of municipal

authorities to effectively manage urban growth and other emerging global environmental challenges. Authors and researchers such as Cobbannah & Erdiaw-Kwasie (2016) and Osumanu & Akombangre (2020) have raised concerns about effective urban environmental management and governance and the potential of urban areas to provide livable environments for their residents.

Urbanization in Ghana has overwhelmed institutionalized urban planning and management practice. Efforts of urban planners to ensure best use of land resources, and to provide adequate infrastructure have failed due to weak institutional collaboration, low private sector participation, and limited role of urban residents in urban planning and governance (Naab *et al.,* 2013). In this circumstance, effectiveness is lacking in urban environmental management and governance in Ghana.

The evident disconnect between the reality in Ghanaian urban centers and their aspirations of performing their role in national development, including social progress and cultural innovation, can be attributed to a number of governance barriers including:

- Inadequate political and financial decentralization and subsidiarity.
- Overlapping institutional mandates with blurred division of responsibilities among central government and city institutions. Poor horizontal and vertical coordination and harmonization among municipal authorities.
- Absence of political accountability of municipal authorities and continuity due to repeated changes within institutional organograms.
- Prevalence of informal power structures and relations that impede law and policy enforcement.
- Insufficient resources and capacity to adequately plan and administer urban development.
- Need-based policies dwarfed by central government and, sometimes, donor priorities that skew local urban development priority.

But the widespread urban environmental governance challenges

in Ghanaian cities and towns cannot be solely attributed to inaction and/or incapacity of municipal authorities. The situation is more complex and multi-layered than it may seem at first glance. Ghana has exemplary national environmental policies, plans and legislations as well as community-based environmental projects and organizations focused on urban resilience (Yankson & Bertrand, 2012; Naab *et al.,* 2013; Cobbinah & Erdiaw-Kwasie, 2016). In fact, studies (e.g. Boamah, Gyimah & Bediako, 2012; Yeboah *et al.,* 2013) have reported urban officials' frustrations in not being able to successfully address the urban environmental challenges in their areas of jurisdiction. Even where local governments have genuine interests in tackling urban environmental challenges, they rarely have sufficient material and financial resources to achieve results (Setiawati, 2009).

The current urbanization challenges in Ghana require urban administrators to redirect policies/regulations to ensure adequate livable environments for urban residents (Osumanu, 2009), and introduce programmes and projects to recover degraded areas through alterations in land use and occupancy (Boamah *et al.,* 2012). Environmental governance of urban areas is crucial to the realization of sustainable urbanization. Environmental governance unlocks the path to rethinking new management strategies, which involve a variety of managers, bodies, interrelationships and interests (Jacobi & Peres, 2016). Different stakeholders tend to express particular kinds of activities, which emanate from available needs and the accompanying options of negotiation, articulating the concern of collectives and making sure that the mutual benefit prevails (Jacobi & Peres, 2016). Therefore, the concept of environmental governance can be an effective tool to tackle the 'unsustainable' processes of urban development in Ghana, typified by a model of horizontal expansion (or sprawl) and occupation of intra-urban spaces (Osumanu *et al.,* 2018).

In view of the growing environmental problems in Ghanaian cities and towns, and the absence of an efficient urban planning and strategy that would provide practical and collaborative environmental management, urban environmental governance should be considered when discussing matters of urban sustainability. The construction of

urban sustainability is contingent on the interconnections between social justice, human well-being, ecological stability and urban growth (Jacobi & Peres, 2016). A coordinated and collaborative effort by municipal authorities, civil society organizations (CSOs), the private sector, and local communities to tackle the persistent urbanization challenges, and replace this with effective urban environmental governance structures, especially at the municipal level, can stem the tide of this urban deterioration and catalyze transformative growth.

Towards a Conceptual Framework for Urban Environmental Governance

Kooiman (1993:2) defines governance as "activities of social, political, and administrative actors that can be seen as purposeful efforts to guide, steer, control, or manage societies." Similarly, Halfani, McCarney and Rodriquez (1995) describe governance in terms of a three-dimensional relationship between civil society and the state; rulers and the ruled; and the government and the governed. Graham, Amos and Plumptre (2003:2) also see governance as "the interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have their say." The governance concept offers a means of regulating the dynamics of a society. Governance has special applicability to urbanization because of its emphasis on social, economic, cultural and environmental consequences. Within the context of urban areas, governance is linked to the overall process necessary for individuals, businesses and institutions to strategize and manage towns and cities for economic, social and cultural well-being of residents (Jiboye, 2011). As such, urban governance has a developmental role, i.e., altering systems by generating novel principles, which inspire stakeholders in the urbanization process to find new values, new goals and rallies public-private-community partnerships to contribute to their realization (Obeng-Odoom, 2013).

According to Cooper and Hall (2008), environmental governance is closely related to the concept of government in its ability, as a form of political entity, to exercise power. However,

the concept of environmental governance is much broader than government because it can occur at different levels (local, regional, national or international) and may include government agencies, private businesses, non-governmental (non-profit) organizations, local communities and even volunteer groups where communal interests are recognized and concerted actions are required (Cooper & Hall, 2008). Environmental governance provides an opportunity for decisions on environmental issues to be made and to determine those involved in the decision-making process. The concept is particularly significant for cities and towns in developing countries where local governments typically lack relevant management capabilities (Dahles & Bras, 1999).

The Environmental problems facing Ghanaian cities and towns are the result of the absence of effective regulatory and institutional frameworks that enable environmental policies to be enforced. Urban environmental governance can act like a filter between the pressures and their environmental outcomes, to stem the decline in urban environments (Jacobi & Peres, 2016). The concept of urban environmental governance has been a subject of discussion by international organizations and of agreements communicated in the declarations and principles reached by the United Nations and in numerous reports of the United Nations Development Programme (UNDP). As a result, the issue of urban environmental governance has become central to finding solutions to urban sustainability and is expected to make the difference between environmental improvement and damage. Improvement in processes that permit critical environmental policies can achieve better outcomes, with fewer environmental effects and equitable distribution of costs and benefits, even if by developing a park or building a road (UNDP/UNEP/WB/WRI, 2005). By introducing the concept of good urban environmental governance, UNDP and UN-HABITAT's (2000) Global Campaign on Good Urban Governance initiative espoused the following principles: participation; rule of law; transparency; responsiveness; consensus; equity; effectiveness and efficiency; accountability; strategic vision; subsidiarity; and security.

According to Cameron and Quinn (2005), collaborative actions

can be problematic because tensions may arise due to the different interests that are advanced by the various stakeholders. Provan and Kenis (2007) have identified three likely sources of tension in collaborative actions: (i) between efficiency and inclusiveness, i.e., a tension emanating from the need for managerial efficiency in environmental governance and the necessity for stakeholder participation, through inclusive decision-making; (ii) between internal and external legitimacy, or the tension that arises when building external legitimacy involves activities and actions that are valuable to the general collaboration, but not to some individual stakeholders or the internal requirements of the collaboration itself; and (iii) between flexibility and stability, which is the tension that arises when a collaboration desires to balance short-term objectives with long-term foci. These tensions can affect power relations in the decision-making process, and aggravate any differences between the expressed values of environmental governance and its processes.

The urban environmental governance system involves multiple stakeholders, including government agencies, private business entities, local residents, non-governmental and/or non-profit organizations. The proposed conceptual framework (Fig. 2.1) applies Beaumont and Dredge's (2010) seven parameters of governance effectiveness. These are facilitators (the people or institution in charge, which in this case are the city authorities); the governance community (type of communities where the environmental problem is located and operated); location of the environmental problem (physical areas relevant to the governance operations); the focus of governance activity (aims and orientation); resourcing (sources of funding, knowledge and skills); the background of the governance facilitator (the nature of the persons or institution in charge); and roles and responsibilities (the main functions of the governance structure). Also, the framework considers any potential tensions within the governance system, which are likely to vary in light of the multiplicity of prospective approaches and orientations (Provan & Kenis, 2007).

As shown in the proposed conceptual framework, an urban environmental governance system is seen as a collaborative

organization which brings a group of stakeholders together in search of shared goals of effectively managing the urban environment, while considering social and economic outcomes. Some distinctive characteristics of the framework include parameters of effectiveness, potential tensions, and stakeholder interests and perceptions because these may be valuable for determining environmental governance outcomes.

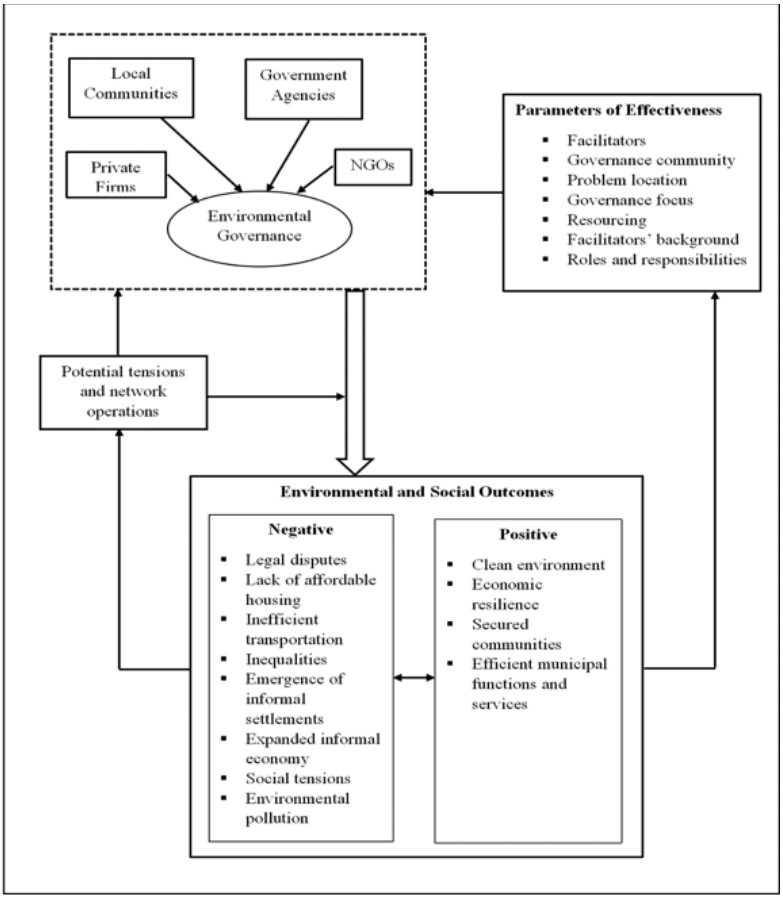

Fig. 2.1: A Conceptual Framework for Urban Environmental Governance

The framework consists of five fundamental elements, which are:

- Environmental governance characteristics.
- Potential tensions that may arise from the interests of different stakeholders.
- Parameters for measuring environmental governance effectiveness.
- Stakeholder interests and perceptions of the environmental governance system, how it operates, its effectiveness, and the environmental outcomes.
- The impacts of environmental governance on environmental and social processes.

Since urban environmental governance generally involves many participants, the goals, efforts, and outcomes of the process should consider the various interests for acceptability to be achieved. Considering such interests and ensuring effective coordination will aid in achieving inclusivity (Provan & Kenis, 2007). This is essential since stakeholders may have conflicting interests and agendas, or may even be competitors within the urban space. Within this framework, the attainment of effective collaborative urban environmental governance cannot solely depend on managing the physical (natural and built) environment, but it will also depend on participants' interactions and their views on the ways the environmental governance system operates, of its effectiveness, and of its social and environmental outcomes.

Conclusion

Urbanization in Ghana has constrained the efficient functioning of urban centers in the country and undermined the extent to which cities and towns can perform their role in national development, including social and economic progress as well as cultural innovation. This chapter has discussed several of the key challenges and threats inherent in Ghana's urbanization process and their implications for urban environmental management and governance. These include uncontrolled population growth, inefficient land development control, deficient housing, inadequate access to water supply and

sanitation, development of informal settlements including slums (especially in ecologically sensitive areas), increasing urban poverty and insecurity. In the midst of these difficulties, Ghana's urban centers have been struggling to get onto the path of sustainable development. The chapter has identified the importance of environmental governance as a tool for addressing some challenges of urbanization towards achieving urban sustainability. A conceptual framework for urban environmental governance has been proposed, which has identified relevant stakeholders and five key elements for analyzing urban environmental governance. These are: their characteristics, potential tensions, parameters for measuring effectiveness, impacts on the environmental outcomes, and stakeholder perceptions.

While there is no magic silver bullet for instituting effective urban environmental governance, some propositions for facilitating transformative change are:

- Empowering and supporting municipal administrators to institute and enforce bottom-up decision-making and accountability aimed at the sustainability and livability of cities and towns.
- Enabling horizontal and vertical integration of different government agencies working at the city- and town-level through the empowering of knowledge-sharing initiatives and structures.
- Strengthening the adaptive capacity of municipal authorities by involving long-term and integrated policies and plans and adequate monitoring and evaluation systems.
- Catalyzing productive dialogue and collaborative work among municipal authorities, NGOs, the private sector and local communities' need to operate as a partnership of equals.

Productive strategies such as those above could be instrumental in tackling the barriers to urban environmental management and governance in Ghana, and possibly provide wider lessons for other African urban contexts.

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CHAPTER THREE

Urbanization and Sustainable Solid Waste Management in Ghanaian Cities

ENOCH AKWASI KOSOE

ABSTRACT

Increasing population and rapid urbanization pose challenges to solid waste management for urban areas. In Ghana, urban solid waste generated exceeds the capacity of local authorities to manage. Yet not much attention has been given to the technical issues of solid waste management and its relationship with sustainable urban development. Thus, local authorities' capacities to respond to new ways of managing urban solid waste in ways that will ensure sustainable development may be in want, even though consensus on the broader objective of achieving sustainable urban solid waste management has been reached. Using a desk study to review relevant empirical literature, this chapter discusses urban solid waste management in Ghana and analyses the factors inhibiting effective sustainable solid waste management for urban development. The chapter concludes that the future of urban solid waste management in Ghana will remain a challenge without efforts to discover and apply appropriate local technologies.

Keywords: Urbanization, Solid waste, Solid waste management, Sustainability

Introduction

Urban solid waste constitutes a rising problem for environmental management in the Global South (Kosoe, Diawuo & Osumanu, 2019; Zohoori & Ghani, 2017). Studies (e.g. Kabera, Wilson & Nishimwe, 2019; Kubanza & Simatele, 2016; Myers, 2017) have indicated that with increasing population and urbanization, solid waste management has become a major challenge for cities in the Global South. The main aims of solid waste management are to address the human

health, environmental, aesthetic, land-use, resource and economic concerns associated with the illegal and improper disposal of solid waste (Henry, Yongsheng & John, 2006; Nemerow, 2009; Wilson, 2007). Yet, urban residents and households in the developing states suffer most from the enormous inadequacies and deficiencies in solid waste management (Gutberlet, Kain, Nyakinya, Oloko, Zapata, & Zapata Campos, 2016; Zohoori & Ghani, 2017). This is as a result of increasing waste generation, inadequate budgetary allocation to waste management, waste managers and local authorities' lack of understanding of the varied factors that impact the different activities in solid waste management, and uncoordinated handling of the entire management of the functioning of waste systems (Guerrero, Maas, & Hogland 2013; Zohoori & Ghani, 2017).

Globally, there is a steady increase in the amount of solid waste generated. In 2006, for instance, the total amount of Municipal Solid Waste (MSW) generated globally amounted to 2.02 billion tons, representing a 7% average annual increase since 2003 (UN-HABITAT, 2010). Current estimates suggest that about 4 billion tons of MSW are generated annually worldwide (Kaza, Yao, Bhada-Tata, & Van Woerden 2018). According to the United Nations Environment Programme [UNEP] (2018), 125 million tons per annum of solid waste was generated in Africa in 2012, of which 65% (i.e. 81 million tonnes) was from Sub-Saharan Africa (Scarlat *et al.,* 2015). The Sub-Saharan Africa (SSA) region generated 174 million tons of waste or 0.46 kg per person each day in 2016. Although this figure is the lowest globally, it is expected to triple by 2050 (World Bank [WB], 2018).

In Ghana, understanding the effect of the interface between urbanization and solid waste management remains one of the most pressing challenges. Too often, the impacts of inadequate waste management are intensified by poor urban management in allowing poor households and neighbourhoods to be without the provision of adequate facilities. Many urbanized households, especially the poor ones, are found in inaccessible and marginal neighbourhoods (Porter, Binns, Elliott & Smith, 2008). City-wide collection services are a rarity, and where they exist they are often restricted to the wealthier neighbourhoods. In many cities, private solid waste removal services

do exist and are provided by both companies and groups of people traditionally associated with such activities (Osumanu, 2008). However, the fees required for such services confine them to those households that can afford them. In poor neighbourhoods, solid waste is simply dumped in open spaces, from where it is occasionally removed and usually taken to uncontrolled dumping sites in the outskirts of the city. Ironically, it is the poor who usually recycle solid waste, using, saving and selling empty bottles, cans and/or paper (Porter *et al.*, 2008). Sometimes, individuals and families even live on resources from city dump sites where they work to earn their livelihood.

The foregoing discussion demonstrates a strong relationship between urban population growth and solid waste generation, collection, and disposal, and their role in sustainable urbanization, even though they are addressed separately at policy and programme levels such as Metropolitan, Municipal and District Assemblies (MMDAs) as well as in development plans and environmental sanitation policies. Delivering the visions of the sustainable development goals (SDGs), namely: 3 — good health and well-being; 6 — clean water and sanitation; 11 — sustainable cities and communities; and 12 —responsible consumption and production, especially in urban areas is inherently linked to taking a holistic view of urban solid waste management and adaptation to unplanned urbanization. Therefore, this chapter discusses sustainable solid waste management practices in Ghanaian urban areas. Recognizing the inability of city authorities to tackle waste management problems effectively (Guerrero *et al.,* 2013; Kosoe *et al.,* 2019), the author focuses on highlighting the factors inhibiting effective management of solid waste in urban Ghana and calls for alternative management approaches, including private sector participation.

The study is a comparative case study, with the data being primarily document/literature analysis. According to Neuman (2011), document analysis helps to compare cases easily and is less expensive and unobtrusive. Review of literature was based on different disciplines, including waste management, solid waste management, sustainable solid waste management, especially in

Ghana, sustainable development goals, sustainable development goals and solid waste management, urban development, urban planning. Computerized searches were conducted using online databases subscribed to by the University for Development Studies. Criteria used in determining data inclusion and exclusion in the study are articles with focus on (a) urbanization (b) solid waste (c) solid waste management (d) sustainability (e) sustainable solid waste management (f) solid waste management in Ghana. The selected literature gives a reflective understanding about urbanization and sustainable solid waste management in Ghana. The articles selected for review in this paper are from journals published between 1993 and 2019. Papers considered relevant for the review were those that relate to solid waste management in Ghanaian cities and urbanization which explicitly refer to the attainment of sustainable development. The chapter consists of four sections with the introduction being the first. Section two looks at the state of solid waste management in Ghanaian cities dealing with solid waste generation, collection and disposal. Section three explores solid waste management and sustainable urbanization. The conclusion to the chapter is presented in section four.

State of Solid Waste Management in some Ghanaian Cities

Urban solid waste constitutes a major problem for environmental management in developing countries (Azevedo, Scavarda, & Caiado, 2019; Kosoe *et al.,* 2019; Marshall & Farahbaksh, 2013). The rapid rate of uncontrolled and unplanned urbanization in Ghana has triggered processes of environmental degradation. One of the most pressing concerns is the problem of urban solid waste. Over the years, Ghana has had difficulties in urban solid waste management with regard to infrastructural and technical inefficiencies. A visit to any urban area in Ghana reveals heaps of uncontrolled garbage; roadsides littered with refuse; streams and drainage channels blocked with solid waste; and management of poor disposal sites, which constitute health hazards to fringing communities (Environmental Protection Agency [EPA] Ghana, 2016). Solid waste management in Ghana is a complex

issue that has been a major feature on the priority list of successive governments, local authorities, and international donors in recent years. As a result, government has over the years put in place national policies and regulatory frameworks. Some of these policies and regulatory frameworks include:

- National Environmental Policy, 1991.
- Environmental Sanitation Policy, 2010.
- Local Government Act, 2016 (Act 936).
- Environmental Protection Agency Act, 1994 (Act 490).
- Environmental Assessment Regulations, 1999 (LI 1652).
- National Building Regulation, 1996 (LI 1630).
- Water Resources Commission Act, 1996 (Act 522).

In addition to the policies and regulatory frameworks, the Ministry of Local Government and Rural Development, Ministry of Environment, Science, Technology and Innovation, and the Ministry of Health have prepared guidelines and standards for solid waste management. These include:

- Health Care Waste Management Policy for Ghana, 2020 (which replaced Guidelines for the Management of Health Care and Veterinary Waste in Ghana, 2002).
- Manual for the Preparation of District Waste Management Plans in Ghana, 2002.
- Landfill Guidelines, 2002.
- National Environmental Quality Guidelines, 1998. This is now divided into (a) Ghana Standard for Environmental and Health Promotion Requirements for Effluent Discharge (1212, 2019); (b) Ghana standard for Environmental and Health Promotion Requirements for Ambient Air Quality and Point Source households households/Stack Emissions (GS 1236, 2019; (c) Standard for Environmental and Health Promotion Requirements for Noise Control (GS 1222, 2018); and (d) Standard for Environmental and Health Promotion Requirements for Motor Vehicle Emission (GS 1219, 2018).

The other relevant legal provisions to guide the MMDAs in their solid waste management efforts are the:

- Procurement Act and Assembly Tender Board regulation.
- By-laws of the MMDAs.
- Land Use and Spatial Planning Act, 2016 (No. 925 of 2016).
- Town and Country Planning Ordinances, 1944 (Cap 84).
- Vaccination Ordinance Cap 76; Food and Drugs Law 305b, 1992; and Mortuaries.
- Funeral Facilities Act, 1998 (Act 563).

All these legal frameworks have provisions for sanitation and solid waste management. Therefore, these policies and legal frameworks require the efforts of the relevant public sector institutions to implement and enforce them for effective solid waste management. Also, the policies and regulatory frameworks place enormous responsibilities on MMDAs. However, the MMDAs generally find it difficult to perform these tasks due to their limited human, financial and logistical resources. The problem of solid waste in urban areas of Ghana is a direct result of a rapidly growing urban population, the changing patterns of production and consumption, the inherently more urbanized lifestyle and the consequent industrialization (EPA-Ghana, 2002). According to Oduro-Kwarteng (2011), the solid waste management problems come about as a result of the gaps in effort to implement policies and legal provisions.

Solid waste management in urban areas of Ghana focuses mainly on collection and final disposal. After Ghana's independence in 1957, incinerators were introduced in the major cities to process and manage solid waste, but due to the lack of technical expertise and financial challenges, the technology failed (Cobbinah, Addaney & Agyeman, 2017). City authorities therefore became responsible for providing sanitation services to residents, especially the Accra City Council (ACC) (Acquah as cited in Owusu-Sekyere, Bagah, & Quansah, 2015). The Council, according to Owusu-Sekyere *et al.* (2015), was able to manage refuse and sanitation with the assistance of a few community sanitary inspectors, and also with the commencement of systematic waste collection and disposal services in 1925. Public dustbins emptied by two pushcarts and later replaced with large carts drawn by mules were introduced. With the enactment of the Local Government Act of 2016 (Act 936) which

repealed Act 462 (1993) which replaced the PNDC Law 207 of 1988 (Oduro-Kwarteng, 2011), city authorities as legal entities have powers conferred on them by the Local Government Act 2016 (Act 936) to promulgate by-laws to govern and regulate solid waste management, sanitation, cleansing and abatement of nuisance in the city. Waste Management Departments (WMDs) are therefore responsible for waste collection and transport operations, management of disposal (landfill) sites, and repair and maintenance of waste management vehicles and equipment.

Due to the huge cost of local government and inefficiency of the public sector in the provision of solid waste management services, there has been a policy shift in solid waste management towards private sector-led involvement since the 1990s. With privatization, the companies were given a particular zone to manage. The total cost is not pushed to the beneficiaries, but the government rather subsidizes the cost and allows the beneficiaries to pay some percentage of the total cost. The consumers pay between 10% and 20% of the total cost (Owusu-Sekyere *et al.,* 2015).

Solid Waste Generation

Ghana generates 0.51kg/capita/day, which is higher than the regional average of 0.46kg/capita/day (World Bank, 2018). From 2005 to 2015, the volume of municipal solid waste generated daily in Accra increased from 1500 to 2800 tonnes (EPA-Ghana, 2014). Ghana's five largest cities (Accra, Kumasi, Sekondi-Takoradi, Tamale, and Tema), based on the 2009 estimated population, accounted for about 19% of the total population, and their residents generate an estimated 3,200 tonnes of solid waste per day. Also, there are about 105 other urban localities, comprising about 34% of the total population and generate in excess of 5000 tonnes of solid waste each day (Ministry of Local Government and Rural Development [MLGRD], 2010).

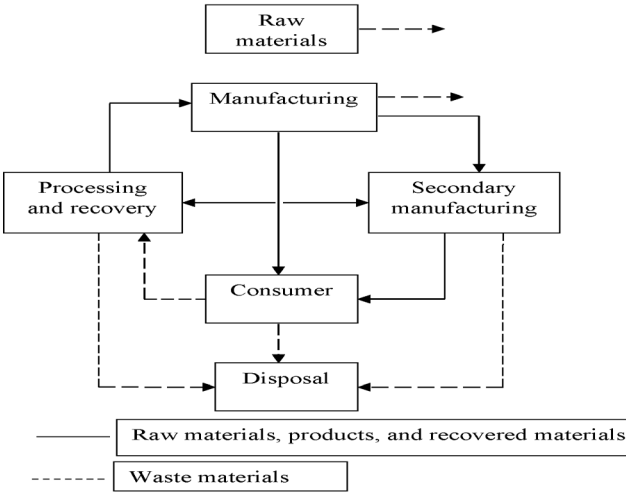
The solid waste composition nationwide is made up of waste from organic sources, paper, and plastic materials. Wastes from metropolitan areas and municipalities are dominated by organic materials compared with waste from the relatively smaller districts, which are dominated by plastics (Miezah, Obiri-danso, Kádár, Fei-

Baffoe & Mensah, 2015). In general, organic materials currently constitute over 60% of the average solid waste generated in Ghana. Likewise, northern Ghana generates more plastic waste than organic waste, compared with southern Ghana. Analysis of waste stream in Ghana indicates that, the bulk of solid waste generated in Ghana has consistently been organic. The composition ratio of the various components of waste streams has, however, changed over the years. Waste generation in Ghana currently ranges between 0.2 and 0.8 kg/person/day (Miezah *et al.,* 2015). This translates into an estimated volume of 13,500 tonnes of solid waste produced daily nationwide, based on an estimated 2015 population of 27 million (Ghana Statistical Service [GSS], 2012). Per capita waste generation has evidently increased over the last decade, with average per capita generation per day in Accra, for instance, increasing from 0.4kg/person/day in 2005 to 0.7kg/person/day in 2015 (Miezah *et al.,* 2015).

Fig. 3.1 illustrates material flow and solid waste generation in society. According to Tchobanoglous, Theisen, and Vigil (1993), solid waste generation in a society starts with the waste generated from the mining of raw material. Thereafter, solid waste is generated at every step in the process as raw materials are converted to goods and services for consumption. It is apparent that one of the best ways to reduce the amount of solid waste to be disposed is to reduce the consumption of raw materials and increase the rate of recovery as well as re-use of waste materials. Although the concept is simple, effecting this change in a modern technological society has proved extremely difficult (Tchobanoglous *et al.,* 1993). The quantities and characteristics of waste generated in any urban areas are functions of the lifestyle and living standards of the urban residents and the type of the urban natural resources (Chandrappa & Das, 2012). Excessive quantities of waste are generated from a society from inefficient production processes, and low durability of goods/services as well as unsustainable consumption of resources (Nicholas, 2003).

Solid Waste Collection

In Ghana, urban solid waste generation exceeds collection capacity. As of 2004, the average municipal solid waste collection covered about 68% of solid waste generated in the big cities of Ghana.



Source: Tchobanoglous, Kreith and Williams (2002)

Fig. 3.1: Flow of Materials and Waste in Industrial Society

On the average, however, by 2010, the solid waste collection coverage in all cities reached 80% of total waste generated (Oteng-Ababio, 2010). The municipal waste management systems of the five largest cities in Ghana (Accra, Kumasi, Sekondi-Takoradi, Tamale, and Tema) were only able to take care of about 75% of solid waste generated daily (MLGRD, 2010). Urban solid waste collection within the Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana is contracted to private service providers to enhance efficiency and improve quality service delivery (Oduro-Kwarteng, 2011). Solid waste collection is generally serviced under the House-to-House (HtH) or Door-to-Door (DtD), and/or Communal Container Collection (CCC) systems. From the baseline environmental sanitation data gathered in 2007/2008 by the MMDAs, close to 76% of households in Ghana relied on improper solid waste collection and disposal methods, with only less than 5% relying on house-to-house solid waste collection (MLGRD, 2010). Also, the proportion

of households having access to door-to-door collection services increased from less than 5% as indicated in the 2007/2008 MMDA baseline sanitation study (MLGRD, 2010), to more than 14% (GSS, 2014). The percentage of households depending on communal containers and open-dumping, has, on the contrary, decreased from 76% to 61% over the same period (EPA-Ghana, 2016). The Accra, Kumasi, and Tema Metropolitan areas achieved increased collection percentages of between 14% and 30% from 2004 to 2006. The percentage of solid waste collection in the Sekondi-Takoradi and Tamale Metropolitan areas, however, declined (from 72%-55% and 57%-40%, respectively) due to limited private sector participation during the period (Oduro-Kwarteng & van Dijk, 2013).

The dumping of solid waste into communal containers (mostly placed near public toilet facilities) remains the commonest waste collection points for domestic solid waste in most low-income households. The CCC mode is of two forms: the pay-as-you-dump, which is common in the low income, high density populated communities; and the free dumping mode, which has been fashioned for public places such as markets, educational institutions and public hospitals, among others. With the pay-as-you-dump, households discharge their waste into Skips at transfer stations or designated locations where collection vehicles pick them. According to the AMA, this practice is common within the Accra Metropolitan Assembly (AMA). This policy became necessary due to the high indebtedness by the government to private solid waste management companies that were contracted to manage solid waste in the metropolis (Owusu-Sekyere *et al.,* 2015). The communal containers are provided by both the Municipal Assembly and Zoomlion Ghana Limited (a private waste management company). Collection of these communal containers (especially the free dumping) is irregular, which leaves the urban space filled with heaps of uncollected solid waste, especially in the ill-served low-income suburbs, which creates unpleasant scenes with bad smell.

The house-to-house (HtH) collection, on the other hand, is commonly practised in higher income and some middle-income communities as well as some public institutions. Under the HtH

system, each houseowner and/or landlord, office building, business, and street-vending kiosk is required to register with a contractor and pay a fee, which is tiered according to income status. High class residential areas that utilize HtH services provided by private companies pay a monthly fee between Fifteen Ghana Cedis (US$2.6) and 25 Ghana Cedis (US$4.3) (Amoah & Kosoe, 2014; Owusu-Sekyere *et al.,* 2015). A major challenge with the HtH collection is the ill-timed collection of the waste containers whenever they are full. This hampers efficient service provision which acts as a major impediment for many households to patronize this service despite its benefit. Another observed challenge is excessive fees consumers pay that are not commensurate with the services they receive.

Disposal of Solid Waste

The main disposal methods for urban solid waste are open dumping and sanitary landfill. Open dumping grounds generate foul odour and habitats for vectors and rodents (Chandrappa & Das, 2012). Environmental issues have now become a matter of public concern and awareness is growing, resulting in pressure on the MMDAs to change this behaviour (Oteng-Ababio, 2013). Over 29% of households dispose their solid waste indiscriminately, and at inappropriate locations such as drains, open parks, and into streams in Ghana (EPAGhana, 2016). In many cases, uncontrolled burning of waste precede or follow dumping activity.

In Ghana, landfilling is the predominant mode of solid waste management (Oduro-Appiah, Donkor, & Ampim-Darko, 2013; Oteng-Ababio, 2014). Landfills can be categorized according to open dumps, controlled dumps or sanitary landfills (or secured landfill or engineered landfill) (Chandrappa & Das, 2012; Tchobanoglous et al., 1993). The Landfill Guideline (2002) recognizes and accepts four different types of landfills — sanitary landfill, high-density aerobic landfill, mechanically improved dumping and manually improved dumping. When improperly managed, landfills can generate some gases (e.g. methane, carbon dioxide, nitrous oxide), which can potentially contribute to climate change. The use of landfill sites

in Ghana is largely due to the availability of land in the peri-urban fringes of towns (Kansanga, Ahmed, Kuusaana, Oteng-Ababio & Luginaah, 2020).

Fig. 3.2 illustrates a typical schematic diagram of landfill. An engineered landfill or sanitary landfill facility is an integrated waste management disposal system. Disposal in an engineered waste landfill facility is the final stage in the waste management process, providing long-term confinement of waste materials. An appropriate treatment may be needed to process the waste for final disposal. Some of the processing may include minimizing or eliminating hazardous properties, stabilizing the waste, and/or reducing its volume (Chandrappa & Das, 2012).

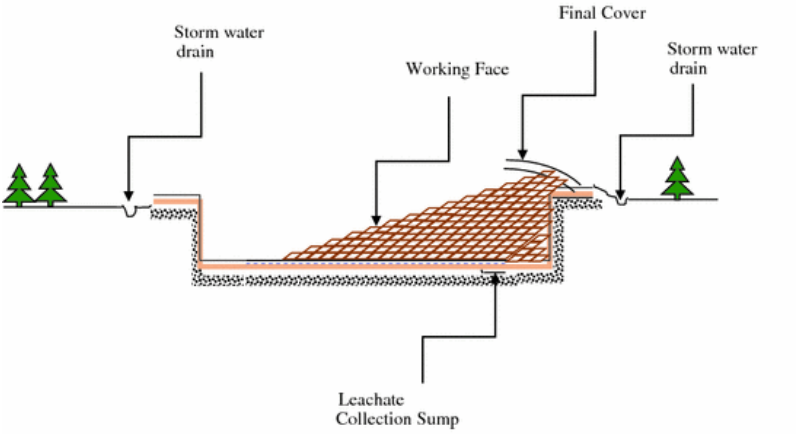


Fig. 3.2: A Typical Schematic Diagram of a Landfill.

Also, landfilling is generally seen as a cost-effective and simple means of disposing solid waste in urban areas (Henry *et al.,* 2006; Oteng-Ababio, Arguello, & Gabbay, 2013). This is because landfill sites in Ghana are usually acquired by the government through compulsory acquisition procedures as enshrined in the State Lands Act, 1962 (Act 125) and in line with Article 20 of the Republican Constitution of Ghana (1992). Again, Metropolitan, Municipal and District Assemblies can acquire customary lands for landfilling from

local communities through private treaties (Kansanga *et al.,* 2020). However, Owusu, Oteng-Ababio and Afutu-Kotey (2012) argued that the cost-effectiveness tag on landfills mostly draws from their operations below acceptable environmental standards and poor maintenance culture. In spite of the extensive dependence on landfills for solid waste management in urban areas in Ghana, their operation tends to ignite land use conflicts at different scales, especially at the community level (Kansanga *et al.,* 2020), often referred to as NIMBY (Not In My Back Yard). In their study on the operation practices of landfills in Ghana, Kusi, Nyarko, Boamah and Nyamekye (2017) also found that landfill sites were very close to residences and water bodies, and therefore posed great health dangers to residents.

Solid Waste Management and Sustainable Urbanization

Cities are the motors of economic activities. The dynamic economy leads to the increase of goods flow and, thus, to the generation of waste (Chwesiuk, Kijewska & Iwan, 2010; Mesjasz-Lech, 2014). Urbanization and economic development have brought significant alterations to the urban landscape (Chen & Wang, 2013). The urban area is an ecosystem which has been touched by the biggest environmental changes caused by human activities. It is densely populated and has an expanded structure and infrastructure (Zhenming & Bin, 2013).

Since the adoption of the Sustainable Development Goals (SDGs), environmental sustainability has been on the radar of international and academic communities. The reason is that sustainable environment has implications for agricultural productivity, peaceful society, water security, energy security and human health (Oteng-Ababio, Owusu-Sekyere & Amoah, 2017). A significant factor that accounts for environmental deterioration is urban pressure. With majority of the world's population living in urban areas, urban waste has increased (World Bank, 2018). The increased urban waste in various compositions follows the population pressure, municipal expansion, economic development, improvement of people's living (Li, 2007) and the changing lifestyle of urban populations (Gutberlet, 2017). From all indications,

the urban growth process is not going to cease anytime soon. It is therefore imperative that society finds a way to maximize the associated benefits while managing the environmental deterioration effect through the implementation of sustainable solid waste policies (Alhassan, Kwakwa, & Owusu-Sekyere, 2018).

The sustainability of a city can be understood as "a practice that uses resources efficiently and improves the quality of life in an excellent environment within the constraints of our earth" (Shen, Peng, Zhang & Wu, 2012). Haas and Troglio distinguish between three aspects of the sustainable development of cities: environmental, social and economic (Haas & Troglio, 2013). Goal 12 of the SDGs is the sustainable consumption understood as consumption that simultaneously optimizes the environmental, social, and economic consequences of acquisition, use and disposition in order to meet the needs of both current and future generations (Phipps *et al.,* 2013). It is significant due to the depletion of resources caused by the excessive consumption in cities as the quantity of urban solid waste reflects the level of goods and services going to waste (Mesjasz-Lech, 2014).

The problem of solid waste management is a function of rapid urbanization, changing production and consumption patterns, and more urbanized lifestyles and emerging industrialization. These problems include: poor planning for solid waste management programmes; inadequate equipment and operational funds to support solid waste management activities; inadequate sites and facilities for solid waste management operations; inadequate skills and capacity of solid waste management staff; and negative attitudes of the general public towards the environment in general (Oteng-Ababio, 2013). A sustainable solid waste management system encompasses a system that is environmentally, financially (economic), and socially appropriate and acceptable (Oduro-Kwarteng, 2011) and meets the criteria of sustainable development that meet the needs of the present generation without compromising the ability of future generations to meet their needs (World Commission on Environment and Development [WCED], 1987). Therefore, sustainable solid waste management must be: economically affordable, socially acceptable, and environmentally friendly (McDougall, White, Franke & Hindle,

2001). These interrelated aspects (environmental, financial/economic and social) of sustainability, when met, ensure that solid waste does not cause environmental pollution and public health hazards (Baud, Post & Furedy, 2004; Baud & Post, 2003). In the past, the economic cost of a solid waste management system was the major controlling factor in the decision-making process (McDougall *et al.,* 2001). Financial sustainability ensures that there is a more sustainable cost recovery approach than reliance on government subsidy financing. Full or partial cost recovery through user charges based on ability-to-pay reduces the financial burden on the government (Oduro-Kwarteng, 2011).

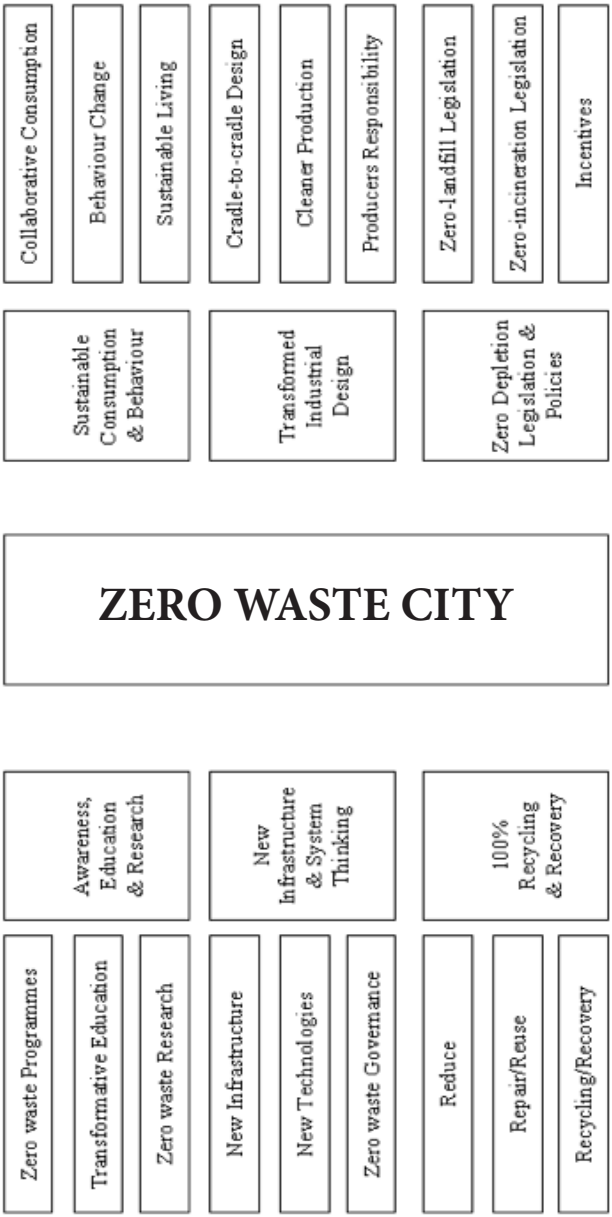
More recently, however, environmental considerations have played an important role in this process. Environmental concerns over the management and disposal of waste can be divided into two major areas: conservation of resources and pollution of the environment (McDougall *et al.,* 2001). Environmental sustainability requires that solid waste collection and disposal, which imposes a great burden on the environment and resources, be transformed into a closed-cycle system (closing the loop), restoring various natural cycles, thus preventing the loss of raw materials, energy, and nutrients. This means that waste reduction and minimization are an integral part of solid waste collection through source separation and separate collection. Social sustainability of solid waste collection concerns providing services to all strata of society, regardless of income. Formal solid waste collection and necessary institutional arrangements ensure total service coverage where everybody is served (Oduro-Kwarteng, 2011).

The implementation of appropriate urban solid waste management, leading to the minimization of solid waste plays an important role in urban sustainable development (Mesjasz-Lech, 2014). This has led to what is currently advocated as the concept of "integrated waste management system" (Lindell, 2012). Integrated solid waste management is generally seen as the most widely accepted and practised concept for solid waste management (Zia & Devadas, 2008). In the Global South, many cities use integrated solid waste management (ISWM) as the principal strategy for urban solid

waste management (ElSaid & Aghezzaf, 2017; Rigamonti, Sterpi & Grosso, 2016). However, different regions have different conditions that require them to determine the best integrated solid waste management approach to reflect their peculiar situations. Integrated solid waste management has been described as the integration of sustainable management options: waste minimization, recycling, composting and other recovery options (McDougall *et al.,* 2001; Topic & Biedermann, 2015).

According to Tchobanoglous *et al.* (1993), it entails the selection and application of suitable techniques, technologies and management programme to achieve specific goals and objectives, including environmental and health regulations, economic reliability and social acceptability. It takes into account local conditions and the selection of proper mix of alternatives and technologies to meet changing local challenges without compromising legislative demands. The decision-making process and the eventual mix for integrated solid waste management process is informed by environmental, economic, social and institutional considerations and the trade-off thereafter can take place at different levels (Lardinios & Van de Klundert 1997; Oteng-Ababio, 2010). It takes a holistic approach that should be applied to all functional activities to be undertaken. It includes several principles that can be incorporated into the design and creation of products and processes and in managing the wastes created during these processes (Goel, 2017). Adipah and Kwame (2019) consider integration in the management of solid waste as a way of considering technical, semi-technical and non-technical aspects in waste management. This opinion seems to have seen waste management as a technological process where new knowledge is very relevant in the management process. One other form of integration in waste management is consideration of the private sector, the public sector and communities to develop local solutions to waste challenges (Lindell, 2012; Kosoe *et al.,* 2019).

The objectives that integrated solid waste management seek to address include minimizing public health and environmental impacts by using appropriate collection, transport, storage and disposal technologies and practices; reducing resource consumption



Source: Zaman and Lehmann (2013).

Fig. 3.3: Drivers for transforming current cities into Zero Waste cities

based on the four Rs of: reduce, reuse, recycle and recover; adopt waste-to-energy technologies; minimize greenhouse gas emissions; and minimizing use of landfills and conserve land (Goel, 2017). The need for reducing waste resulted in an innovative 'zero waste' city concept (Mesjase-Lech, 2014). Zero-waste aims at eliminating rather than managing waste and adopts a system approach that aims at no waste and encourages waste diversion through recycling and resource recovery (Oteng-Ababio, 2010). The proper realization of all rules governing the urban solid waste management can break ground for zero waste cities. Fig. 3.3 presents the key principles of the zero-waste city (Mesjase-Lech, 2014).The key factors for the implementation of zero-waste cities are short and long-term strategies. The long-term strategies include awareness and education, behaviour change and systems thinking. The short-term strategies, on the other hand, include innovative industrial designs, legislation and 100% recycling (Mesjase-Lech, 2014).

Conclusion

Increasing urbanization and population expansion in Ghana have become major challenges for urban solid waste management. There is growing concern regarding the high rate of waste generation and its management in Ghana. The chapter assessed sustainable solid waste management practices in the urban areas of Ghana through a desk review. It has been established that the increasing generation of solid waste is as a result of increasing population, high rate of urbanization and increasing levels of economic development and consumption. Also, the rapid rate of uncontrolled and unplanned urbanization in Ghana has brought about huge quantities of solid waste in different parts of urban areas left uncollected, leading to public health issues and environmental challenges. The consequence of this is the fragmented and insufficient urban solid waste management with uncollected solid waste engulfing urban residents in Ghana.

The chapter contributes to the waste management literature by highlighting the critical issues affecting sustainable solid waste management in Ghana's urban areas. The challenges confronting

effective urban solid waste management include: poor planning for solid waste management; lack of appropriate solid waste management infrastructure; inadequate skills and capacity of solid waste management staff; and poor public awareness of proper household solid waste separation and recycling technologies. This presents overwhelming evidence of poor solid waste collection strategies which, over the years, Ghana's urban areas are faced with, as regards infrastructural and technical inefficiencies that suggest that these urban areas are lagging behind in sustainable solid waste management.

The chapter concludes that urban areas in Ghana lag behind in terms of adopting appropriate technologies that will lead to sustainable ways of dealing with the challenge of solid waste management. The implementation of appropriate urban solid waste management, leading to the minimization of solid waste generation and efficient collection, can play an important role in urban sustainable solid waste management. Therefore, the future of urban solid waste management in Ghanaian cities will remain a challenge without efforts to discover and apply appropriate local and sustainable strategies and technologies. Also, the proper realization of all rules governing zero-waste for cities can break grounds for urban solid waste management in Ghana.

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CHAPTER FOUR

Achieving Environmental Targets (Internalizing Environmental Externalities)

ABDUL-KADRI YAHAYA

ABSTRACT

This chapter examines environmental targets, environmental externalities, and environmental policy instruments in the context of environment and resource management. In trying to achieve the overall goal of environment and resource management, there is the need for environmental objectives and targets to be set, so that, by relying on environmental policy instruments, positive or negative externalities will occur. Environmental targets are usually set by governments through responsible state agencies such as the Environmental Protection Agency and the Forestry Commission. Environmental targets are crucial because they are a great way to ensure that the attention of people is focused so that a shared vision for the future can be created. Externalities occur when benefits or costs are created for people other than decision takers through economic decisions. Two classes of environmental policy instruments are resorted to in internalizing environmental externalities. They are market-based and non-market-based environmental policy instruments. Market-based environmental policy instruments such as environmental taxes, tradable permits, as well as bargaining and negotiation rely on price as the most effective means of allocating scarce resources based on the forces of demand and supply. On the other hand, non-market-based environmental policy instruments such as command and control (direct regulation) rely on laws, restrictions, rules, and regulations in internalizing environmental externalities. In practice, market-based environmental policy instruments are preferred due to cost-effectiveness. It is, however, noted that non-market-based environmental policy instruments are predominantly used. This is due to the fact that in the late 1960s and early 1970s the state of environmental economics generally

did not go beyond the conceptual level. In contemporary times, the ever-increasing relevance of market-based environmental policy instruments is underscored as far as environmental policy-making is concerned by reflecting their perceived superiority vis-à-vis non-market-based environmental policy instruments.

Keywords: Achieving, Environmental targets, Internalizing, Environmental externalities, Environmental taxes, Tradable permits, Bargaining and negotiation, direct regulation.

Introduction

The purpose of this chapter is to discuss environmental targets, environmental externalities as well as environmental policy instruments in the context of environment and resource management. This is necessary because, in trying to achieve the overall goal of environment and resource management, there is the need for environmental targets to be set, so that positive or negative externalities will occur by means of resorting to environmental policy instruments.

Environmental Targets

In setting up an environmental management system after conducting an initial environmental review and deciding on areas where improvement of environmental performance is required, there is the need for environmental objectives and targets to be set (Ioannis *et al.,* 2016). Environmental targets are means of providing verifiable evidence in trying to meet an environmental objective. Environmental targets serve as avenue for providing short-term goals in the process of achieving objectives of environmental performance (Ioannis *et al.,* 2016).

Several environmental targets can be geared towards achieving one environmental objective. Environmental objectives and targets depend on environmental policy, information obtained from initial review, and register of legislation (Bergman, 2005). When setting environmental targets, the following should be taken into consideration: Individual departments responsible for ensuring that

targets are met, must be identified; there is also the need for someone to be identified to oversee that targets are met and to also monitor implementation of changes; more so, there is the need to ensure that other significant environmental aspects are not indirectly affected by measures taken (Ioannis *et al.,* 2016).

Environmental targets are usually set by governments through responsible state agencies such as the Environmental Protection Agency and the Forestry Commission. Environmental targets are very important because they are a great way to ensure that the attention of people is focused so that a shared vision for the future can be created. Also, environmental targets are instrumental in making the intangible seem tangible and also serve as powerful communication of intent. Lastly, environmental targets, ensure the attainment of overall environmental performance by means of short-term goals (Bergman, 2005). An example of an environmental target in Ghana is the AiChi biodiversity target 15, which states that by the year 2020, contribution of biodiversity to carbon stocks and ecosystem resilience must be enhanced through restoration and conservation of degraded ecosystems by at least 15%. In doing so, desertification will be combated through climate change adaptation and mitigation (Ministry of Environment, Science, Technology, and Innovation, 2018).

There are three types of environmental targets. They are: hard targets, soft targets, and voluntary targets. Hard targets are characterized by narrow scope, short timelines and clear accountability. They are quantifiable in nature and provide description of measurement. For instance, emission targets set by Kyoto Protocol of 1997 are typical examples of hard targets. Based on the Kyoto Protocol, industrialized countries were asked to reduce their average emissions of greenhouse gasses by 5% between 2008 and 2012 using 1990 levels as a point of reference. In response to this, the European Union pledged to reduce emissions by 8% below 1990 levels whereas USA pledged to reduce emissions by 7% below 1990 levels. However, developing countries (including China and India) were exempted from emission reduction (United Nations, 2012).

Soft targets, on the other hand, are broader in scope with a variety

of timelines and without specific accountability. An example of a soft environmental target in Ghana is the Aichi biodiversity target one (1) which states that, at the latest, people should be aware of the values of biological diversity and should also take steps to use it sustainably as well as conserving it by the year 2020. This is to achieve an objective of national contribution to global Aichi biodiversity (Ministry of Environment, Science, Technology, and Innovation, 2018). In order to achieve the Aichi biodiversity target one (1), the international biodiversity day is observed in Ghana every 22nd May to announce the significance of biodiversity conservation. Also, there are several initiatives in Ghana to sensitize people to put a stop to degradation of biodiversity through print and electronic media. There is also a tree planting programme by the Forestry Commission to facilitate life sustenance on land (SDG 15) and to facilitate mitigation of climate change (SDG 13) (Ministry of Environment, Science, Technology, and Innovation, 2018).

Voluntary targets are entered into by choice with an option of opting out. In most instances, they are related to incentives. An example of a voluntary environmental target in Ghana is MDG target 7a, which states that development of country programmes and policies and reversal of loss of environmental resources must take into consideration integration of sustainable development principles (United Nations, 2012). This target aims at achieving MDG 7 which is about ensuring environmental sustainability. Five of the indicators prescribed on MDG target 7a demonstrated full compliance. One of the five indicators has to do with reduction in consumption of substances that deplete the ozone layer. Other indicators, exhibited a much slower progress. Even though, total forest loss was in perpetuation, there was a decline in annual loss of 8.3 million hectares in the 1990s to 5.2 million hectares in the year 2010 (United Nations, 2012). Another example of a voluntary environmental target in Ghana is the MDG target 7b which is on reduction of biodiversity loss by the year 2010. The MDG 7b is characterized by two indicators. They are proportion of marine and terrestrial protected areas and proportion of species threatened with extinction. An evaluation of the two indicators showed a decline or slow progress (United Nations,

2012). The MDG environmental targets are considered as voluntary because Ghana's compliance is by choice. By implication, Ghana can opt out at any time.

In this section, environmental targets have been discussed, taking into consideration the following: Marginal Analysis and Environmental Target Setting; Public Goods and Environmental Target Setting; as well as Health Issues and Environmental Target Setting.

Marginal Analysis and Environmental Target Setting

Marginal analysis is an assessment of the extra cost incurred of an activity compared with extra benefits derived from the same activity. Marginal analysis is resorted to by firms as a decision-making tool in the maximization of their potential profit (Bergstrom & Randall, 2016).

In assessing environmental targets, marginal analysis can be resorted to, with the idea that government, firms, and individuals have little conscious awareness of the marginal unit. Environmental target setting takes into consideration marginal abatement, marginal damage and marginal benefits. This brings into play the idea of marginal abatement costs and marginal damage costs and marginal benefits curves (Ison *et al.*, 2002). Marginal abatement cost is the extra cost to a firm for avoiding emission of the last unit of a pollutant. For instance, when a coal burning power station sets an objective to reduce toxic emissions, the cost of installing an expensive flue-desulphurization plant is counted as marginal abatement cost. Marginal abatement cost measures the cost of reducing an extra unit of pollution. Marginal abatement cost can be negative, especially in a case where low carbon option is comparatively cheaper than the usual option of a firm. As pollution reduces, marginal abatement cost often rises steeply. The marginal abatement cost curve slopes upward from left to right, indicating that the initial reduction in pollutant emissions can be achieved at little extra cost. But as the margin of pollution reduction to be achieved progressively increases, it becomes increasingly costly (Halcombe and Sobel, 2001).

On the other hand, marginal damage cost refers to cost of extra damage to firms and individuals for emitting the last unit of pollutants. The marginal damage cost curve slopes upward from left to right. This means that the waste assimilator (sink) function of the environment has manifested by ensuring the absorption of a given quantity of pollutants without damage. It is, however, noted that each unit of pollutant above the quantity absorbed by the environment imposes increasing amount of extra damage to the environment (Bergstrom & Randall, 2016).

Marginal benefits refer to the additional benefits derived for producing private consumption goods by emitting an extra unit of pollution (Halcombe & Sobel, 2001).

The socially optimal level of pollutant emission is achieved when marginal abatement costs are equal to marginal damage costs (Halcombe & Sobel, 2001). The socially optimal level of pollutant emission results from an intersection between marginal social cost of a pollutant and marginal social benefits of the same pollutant. The socially optimal level of a pollutant is also known as allocatively efficient level of pollutant (Bergstrom & Randall, 2016).

From the foregoing discussion on marginal analysis and environmental target setting, it can be said that benefits and costs are generated from stricter pollution targets. As such, emission targets of pollutants should be set in such a way that aggregate marginal damage from emissions equals the aggregate marginal benefits. Also, the cost incurred in achieving emission reduction will be minimized if there is equalization of marginal cost of emission reduction for all emitters.

Public Goods and Environmental Targets Setting

There are two key characteristics of public goods. They are non-rivalry in consumption and non-excludability in consumption (Ison *et al.,* 2002). Non-rivalry in consumption means that the quantity available to others is not affected by consumption of an individual. Non-excludability, on the other hand, means that individuals who have not paid for a product cannot be excluded from consuming the

product in question. A typical example of a public good is clean air. This is because it is extremely difficult, if not impossible, to exclude individual citizens from its benefits. Also, its use by an individual does not lead to depletion of stock available to other individuals (Hanley, 2011).

Public goods are products that satisfy the characteristics of non-rivalry and non-excludability. A broader category will have elements of these characteristics without fully meeting the criteria of a pure public good. For instance, many products may be non-rival in the sense that additional people can consume those products without detracting from existing consumers' ability to benefit from it. Typical examples include access to game reserves and sanctuaries. In this case, it is possible to exclude consumers from such products. As such, the non-excludability condition may not be applicable. Examples of such scenarios include entry fees to game reserves and sanctuaries (Ison *et al.,* 2002).

In most instances, environmental targets are set taking into consideration environmental public goods. It is, however, worth mentioning that some agri-environmental public goods are without explicit targets (UK-National Ecosystem Assessment, 2011). This may be due to the fact that it is difficult to set quantitative targets for some agri-environmental public goods such as agricultural landscapes and resilience to fire. The impossibility of setting explicit or quantitative targets for some agri-environmental public goods may also be due to relatively new issues such as carbon storage (UK-National Ecosystem Assessment, 2011). In the case of the UK, environmental targets were set in an effort to achieve desirable objectives in dealing with agri-environmental public goods. For instance, in dealing with water quality as an agri-environmental public good, a target was set on good ecological status in all water bodies by 2015 under EC (European Commission) water directive (UK-National Ecosystem Assessment, 2011). Also, in dealing with soil quality and protection as an agri-environmental public good, a target was set on sustainable use of soil under the EC (European Commission) Soil Thematic Strategy (UK-National Ecosystem Assessment, 2011).

Health Issues and Environmental Target Setting

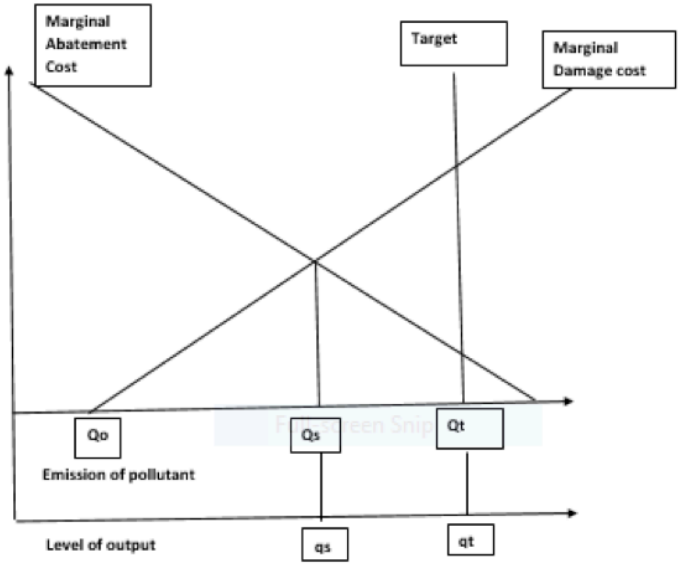
In performing dose response analysis, it is crucial to have a clear idea on the type of dose used in dose response data available. Basically, there are three types of dose in scientific investigations. They are: administered or external dose, target or tissue dose, and internal (absorbed) dose (IPCS, 2004). External dose represents the quantity of chemical or an agent administered to experimental humans or animals. This is normally done in a controlled experiment setting by a specified route at some specified frequency. External dose is often referred to as intake or exposure. Internal dose, on the other hand, refers to a fraction of the external dose that is systematically available and absorbed or enters the general circulation. Tissue dose is an amount of dose present and distributed in a tissue of interest (IPCS, 2004). There are two important determinants of dose. They are duration of dosing and frequency.

Response refers to effects or observation made following exposure *in vitro* or *in vivo*. Possible end points take into consideration a wide range of observation from initial responses such as biochemical alterations to more complicated responses such as development defects and cancer (IPCS, 2004). There are two types of responses. They are: adaptive and adverse responses. Adverse responses are changes in physiology, morphology, development, growth, reproduction or lifespan of a subsystem or organism. Adaptive responses are sometimes tissues or species specific and have varied degrees of variation across individuals (IPCS, 2008).

Dose-response models are mathematically presented and fit into scientific data that explains a relationship between dose and response. Dose response models range from linear models to complicated models which cannot be expressed as a single equation (IPCS, 2008).

In several scenarios, the focus for target setting may involve a variety of non-maximizing approaches in environmental policy areas. For instance, threshold levels of exposure to different types of pollutants are estimated by resorting to the dose-response calculations. A high level of exposure is considered as a theoretically

significant risk to health. Target levels of outputs of environmentally related products are then established, and if they are met, they will ensure that exposure to various harmful substances remains below the recognized threshold levels. Threshold levels in this context, refers to the lowest concentration of toxic substances that may be harmful (Hau & Bakshi, 2004). Fig. 4.1 is an illustration of environmental target setting by resorting to the dose response calculations.



Source: Adapted from Gilpin (2000)

Fig. 4.1 Environmental target setting using the dose-response calculations

From Fig. 4.1, Qo is the minimum pollutant level, Qs is the optimal pollutant level, Qt is the targeted emission level of pollutant, qs is the optimal output level, whereas qt is targeted output level. From the diagram, it can be deduced that the dose-response method has been used to set an environmental target level of output, qt and associated emission of pollutant, Qt. This means that by operating at a targeted output level, qt, targeted level of pollutant emission, Qt is achieved.

Environmental Externalities

Externalities occur when benefits or costs are created for people other than decision takers through economic decisions. These are called external costs or external benefits. For instance, industrial effluent may be emitted by a textile production firm causing a loss of amenity by polluting nearby rivers. In such a scenario, the true cost to society outweighs scarce resources of labour and capital used by the firm in the manufacture of textiles (Holcombe & Sobel, 2001).

The private cost of production by firms is a composition of waybill, cost of raw materials, interest payment, and lease of premises. There is the need to add any external costs that do not appear in the balance sheet of the firm but have resource implications for society, if the true social costs of production are to be assessed (Hellweg *et al.,* 2005). In this case, considering a broader picture of the concept of marginal cost, we can say that:

$$MSC = MPC + MEC$$

where MSC is Marginal Social Cost
MPC is Marginal Private Cost
MEC is Marginal External cost

Marginal External Cost refers to the cost of extra damage to the physical environment by means of output expansion by a unit (Ison *et al.,* 2002). Marginal Private Cost is the extra cost incurred on lighting and heating, maintenance of machinery, transportation, packaging, advertising, labour and raw materials for output expansion (Ison *et al.,* 2002).

However, in some instances, imposers of external cost can be controlled by a legislation such as the Clean Air Act in the USA, which imposes fines for breaches with minimum standards or reduce pollution by means of tax incentives. Also, rewards, in the form of receipts and subsidies, may be given to firms creating social benefits. There is the need for full accounts to be taken for externalities, whether positive or negative. For instance, it can be argued that external benefits may be created by means of reducing roads usage by

railways; thereby relieving urban congestion as well as creating traffic accidents and pollution (Hiltunen, 2005).

In a scenario whereby marginal social cost is higher than marginal private cost (MSC>MPC) because of the existence of a positive marginal external cost (MEC>0), this is termed as negative externality. On the other hand, in a situation where marginal social cost is less than marginal private cost or where marginal social benefits exceed marginal private benefits, it is termed as positive externality (Gilpin, 2000).

Environmental Policy Instruments

Environmental targets are achieved by means of resorting to environmental policy instruments. An environmental policy instrument is course of action enacted by an actor in an attempt to regulate environmental degradation (Ison *et al.,* 2002). Basically, there are two broad classes of environmental policy instruments. They are market-based and non-market-based environmental policy instruments. Market-based environmental policy instruments depend on price as the most effective means of allocating scarce resources based on the forces of demand and supply. Non-market-based environmental policy instruments, on the other hand, are independ on price in allocating scarce resources but rely heavily on rules and regulations, by-laws, laws, and restrictions. However, the specific types of market-based and non-market-based environmental policy instruments have relative merits and demerits. Market-based and non-market-based environmental policy instruments as well as their strengths and weaknesses are discussed as follows:

Environmental Taxes as a Market-Based Environmental Policy Instrument

An environmental tax is a tax on a product or a service which is detrimental to the physical environment; or it is a tax on a factor input used to produce a good or a service (Ison *et al.,* 2002). In a scenario where an environmental tax is exactly equal to the Marginal External Cost, then it is termed as a Pigouvian tax. This was named

after Arthur Cecil Pigou because he was the first to observe such a tax system (Pigou, 2013). Specific examples of environmental taxes are carbon taxes, nitrogen taxes, sulphur taxes, climate change levies, etc.

Strengths of Environmental Taxes

Firstly, environmental taxes enhance environmental effectiveness. For instance, Blow (1999) argues that carbon taxes are very effective in reducing carbon emission. Secondly, environmental taxes promote economic efficiency. In the light of OECD (1999), the performance of an economy is measured by quantum taxes collected.

Thirdly, environmental taxes are transparent in natural resources management. Rajah (1992) argues that environmental taxes guarantee transparency in natural resources management. In other words, when environmental taxes are well designed, they are highly transparent in terms of their coverage and cost. In doing so, it is generally clear which polluters are exempted, what is taxed, and what is the cost per unit of pollution to polluters? Also, the environmental tax systems give firms the freedom to reduce pollution the best way they see fit as opposed to direct regulation where the central government decides how such reduction in emission should be achieved. Lastly, it is an avenue for employment creation (Tax officials and ordinary tax collectors are employed).

Weaknesses of Environmental Taxes

Firstly, environmental impacts of taxes are uncertain. Field (1997) indicates that environmental impacts of environmental taxes are unpredictable. This may be due to information asymmetry. In other words, the uncertainty of environmental impacts of emission taxes may be due to lack of information on the part of government about circumstances that are vital for the effects of policy decisions. Secondly, there is also a tendency of free riding. According to Bowers (1997), environmental taxes may be evaded by people in an attempt of free riding. Thirdly, environmental taxes are a source of government revenue. According to Ingham and Ulph (1991), governments generate revenue through environmental taxes. Moreover, in the environmental tax system, it is often difficult to determine the tax

necessary to attain a socially efficient level of pollution and output.

Lastly, the environmental tax system is an avenue for corruption. This is because, taxes collected may end up in the private pockets of tax collectors (Damania *et al.,* 2003).

Tradable Permits System As a Market-Based Environmental Policy Instrument

Unlike the environmental tax system whereby the tax rate is determined by the tax authorities, the tradable permit system operates in a more decentralized manner by utilizing the market-based approach based on interaction among polluting firms. The tradable permit system is based on the logic that there is the need for trade to be created for pollution. In other words, an avenue whereby pollution permits can be bought or sold (Gilpin, 2000).

There are different types of tradable permit systems. They are cap and trade system, project-based trading system, and rate-based trading system.

Cap and Trade System

In this system, aggregate emission levels are set by the government. Also, market is created by the government for distribution of emission allowances to polluters by means of sales or purchases. It should also be noted that as a result of differences in private abatement costs of polluters, there is variation in emission allowances. Instead of installing expensive pollution control equipment, polluters with high abatement costs are allowed to purchase allowances from polluters with low abatement costs. In cap and trade system, aggregate emission levels are reduced over a compliance period (Ison *et al.,* 2002).

Project-Based Trading System

The project-based trading system is also known as offsets and bubbles. An offset allows a negotiation between a new polluter and an existing source/polluter to ensure a reduction in emission of

the latter. A bubble creates an avenue for all sources of emission to achieve an overall target level in dealing with a particular pollutant. However, offset and bubbles are characterized by high administrative and transaction costs in the control of air pollution (Gilpin, 2000).

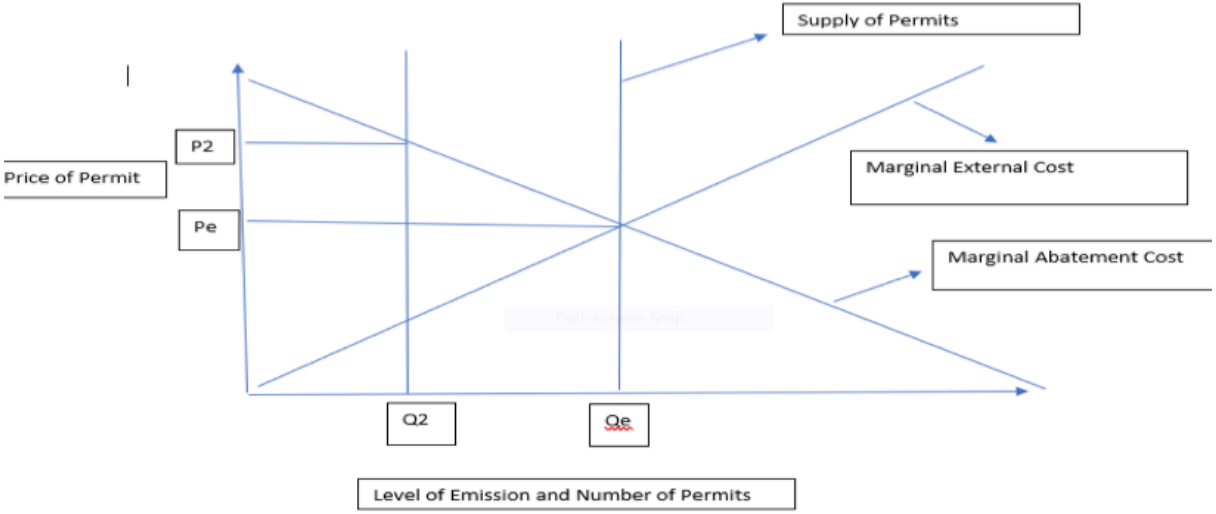
Rate-Based Trading System

In the rate-based trading system, emission rates or performance standards are established. This implies that credit can be earned and sold by firms with emission rate below performance standard to firms with emission rate above performance standard. In this system, there are incentives for firms to improve their emission rate above performance standard since credit can be sold to sources/firms with a higher abatement cost (Gilpin, 2000). Fig. 4.2 is an illustration of changes in price of permits as a result of changes in emission levels.

From Fig. 4.2, MEC (Marginal External Cost) is the additional cost of damage to the physical environment due to output expansion, whereas MAC (Marginal Abatement Cost) is the additional cost incurred for reducing pollution by a unit. From the figure, it is obvious that a reduction in emission levels and number of permits from Qe to Q2 leads to an increase in the price of permit from Pe to P2.

Strengths of Tradable Permits System

Firstly, administrative cost of operating the tradable permits system is comparatively less. According to Ison *et al.* (2002), unlike the environmental tax system, the administrative cost of operating the tradable permit system is comparatively less. This is because the tradable permit system does not employ tax collectors or tax administrators contributing to less administrative cost. Secondly, the tradable permits system is highly democratic. Turner *et al.* (1994) strongly argue that the tradable permit system is highly democratic because it enhances interaction and negotiation among polluting firms.



Source: Adapted from Ison et al. (2002)

Fig. 4.2: Increase in price of permits as a result of reduction in emission levels

Moreover, changed conditions can be met by means of adjusting the supply of permits. For instance, more permits can be issued by the responsible agency in an attempt to relax control over pollution. On the other hand, control over pollution can be tightened by the agency in question by buying back permits from polluters in the open market. This makes the tradable permit system very flexible. Also, the tradable permit system is regarded as a cost-effective system because it provides incentives to polluters with low abatement costs to reduce (abate) pollution and sell the permits that are no longer required.

Lastly, the tradable permit system serves as an avenue for reducing uncertainties that are associated with environmental tax. Current guidelines may be obeyed by the issuing agency in the issuing of permits so as to maximize level of emission that can be safely absorbed by the environment.

Weaknesses of Tradable Permits System

Firstly, firms may pass the cost of purchasing permits to their customers through high prices. Gilpin (2000) argues that operating firms may price their products high in trying to pass on the cost of permits to the consuming public. Secondly, price of permits fluctuates, making it hard for firms to plan for the future. Turner *et al.* (1994) state that firms are unable to plan for the future by virtue of the fact that the price of permit fluctuates. Also, in a scenario where an industry is characterized by a large number of firms, the administrative cost of operating the tradable permits system may be excessive. The tradable permits system has been criticized on ethical grounds. This is because it gives the owner of a permit the right to pollute.

Lastly, it may be difficult to measure pollution levels. This may affect the allocation, sale and purchase of permits. In the light of Ison *et al.* (2002), measurement of pollution levels may not be possible, and this may affect the sale and purchase of surplus permits.

Bargaining and Negotiation as a Market-Based Environmental Policy Instrument

Bargaining and negotiation is based on the insights of Ronald Coase (1960) who argued that in order to attain an optimum level of pollution, a bargain needs to be struck which will then lead to pollution being curbed. There are two groups of individuals in bargaining and negotiation. They are polluters and sufferers. Polluters are people who reduce the ambient quality of the physical environment through their livelihood activities; whereas sufferers are people who suffer the consequences of pollution.

The emphasis of bargaining and negotiation is on assigning property rights to either polluters or sufferers. For instance, if property rights are assigned to polluters, giving them the right to pollute, then those who suffer may find it advantageous to offer large sums of money to polluters in order to stop them from polluting. It is, however, worth noting that sufferers will be willing to do this in so far as this is less than the damage that will be otherwise inflicted upon them. On the other hand, if property rights are assigned to sufferers, giving them the right not to be polluted, then polluters might find it advantageous to offer large sums of money to sufferers to be able to expand output and thereby continue polluting.

There are five approaches to negotiation. They are: structural approach, strategic approach, behavioural approach, integrative approach, and concession exchange approach. These are discussed as follows:

Structural Approach

The structural approach sees negotiation as a conflict between two parties with divergent goals. Here, negotiation outcomes are seen as a function of structural features serving as a determinant of each particular negotiation. Such structural features may include issues involved in the negotiation as well as number of parties (Raiffa, 1982; Bacharach & Lawler, 1981). The structural approach to negotiation has been debunked by virtue of the fact that it places so much

emphasis on power to the neglect of skill as an influencing factor of negotiated outcomes.

Strategic Approach

The strategic approach to negotiation has its root from the rational choice theory, decision theory, and mathematics. The strategic approach has also benefited from conflict analysis, biology, and economics. Unlike the structural approach where emphasis is on means to power, in strategic approach, however, the emphasis is on ends in the determination of outcomes. Strategic models are also logical to models of rational choice where negotiators are seen as rational human beings who make choices from alternatives based on calculations in trying to maximize gains. A typical example of a strategic approach is the prisoner's dilemma as a component of the game theory. Assuming there are two sufferers, namely individuals A and B from pollution discharged from a factory with level of utility of 50 utils each, the sufferers would be thinking of negotiating with the polluting factory. In taking a decision about the situation at hand, there are four scenarios that will play out.

Firstly, if both individuals decide not to negotiate with the polluter, the outcome is that both individuals will continue to suffer; thereby obtaining utility of 50 utils each. Secondly, if both individuals negotiate with the polluter, the cost of negotiation is 70 utils, while major concessions of 100 utils each are likely to be obtained by them. In this situation, benefits of additional 30 utils each are obtained by the two sufferers culminating to 80 utils each for the two individuals. Thirdly, if individual B decides to negotiate while A free rides, the expected utility of A is 90 utils, while that of B is 20 utils. Lastly, if individual A decides to negotiate while B free rides, the bargaining power of the sufferers will be less. As such, gains from negotiation could be only 40 utils. In this case, the expected utility from negotiation is 20 utils for A (the original 50 utils plus the gain of 40 utils minus the cost of 70 utils).

Behavioural Approach

In this approach, the outcome and course of negotiation agreement are determined by individual characteristics and the personality of the negotiator. Negotiation is explained by behavioural theories as interaction between types of personalities in the form of dichotomies. The behavioural approach takes its roots from experimental and psychological traditions. These traditions take the view that negotiations between nations, neighbours and unions are dependent on individuals involved (Zartman, 1978). The behavioural approach holds that successful negotiation between employers and unions, or between nations or neighbours depend on the individuals involved. Conclusively, the behavioural approach places premium on perceptions, trust, persuasion, attitudes, personality, and motivation in negotiated outcomes.

Integrative Approach

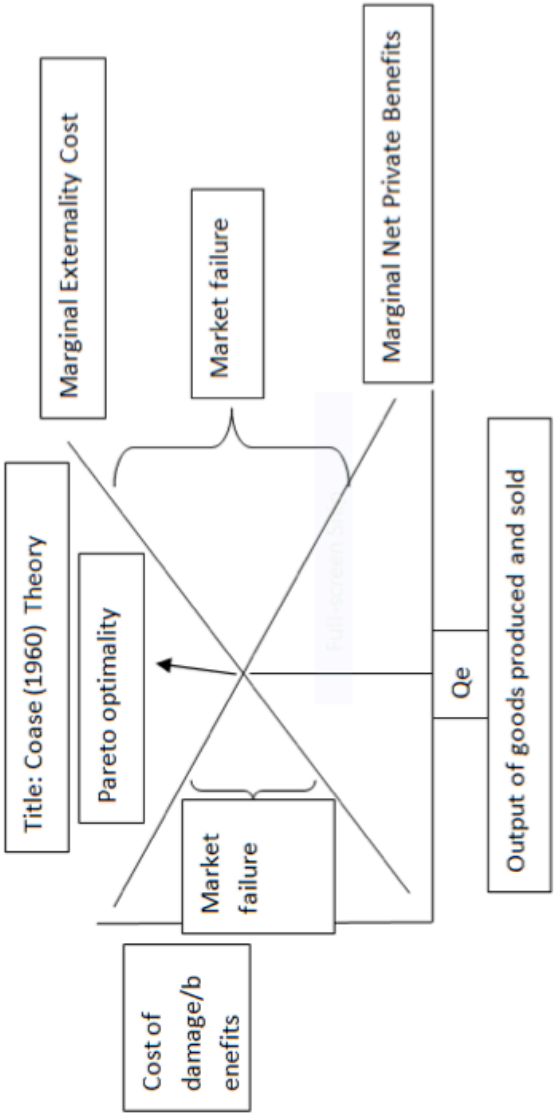
Integrative approaches are seen as a sharp contrast to distributive approaches. In the integrative approach, negotiation is seen as interaction with a potential of win-win. Integrative approaches look for conditions of mutual gain, use objective criteria, and emphasize on the significance of information exchange between groups and parties in solving problems (Lewick *et al.,* 2003). The integrative approach to negotiation takes its roots from political theory, international relations, as well as research from social decision-making and labour disputes. The integrative approach calls for coordination among participants in order to achieve a win-win solution. In other words, integrative approaches depend on cooperation, problem solving, collective decision-making and mutual gains.

Concession Exchange (Processual) Approach

This approach shares characteristics of both strategic approach which relies on outcome and structural approach which deals with power. They illustrate a different kind of learning mechanism. In the light of Zartman (1978), the concession exchange approach sees negotiation as a learning process whereby parties react to the concession behaviour of each other. In this scenario, negotiation entails a series of concessions. By implication, stages of negotiation are determined by concessions. One disadvantage of this approach is that opportunities of finding new mutually beneficial solutions may be missed. In doing so, negotiators may end up in a purely regressive process, which leaves both negotiators with few gains. Fig. 4.3 is an illustration of negotiated solution to externality problem, indicating points of market failure and a point of economic optimum.

From Fig. 4.3, any point before the equilibrium output level is a point of market failure and a desirable point of operation (Maximum benefits will be derived by the individual operator and less harm will be caused to the physical environment). Also operating at any point after the equilibrium output level is another point of market failure and not a desirable point of operation (Less benefits will be derived by the individual operator and more harm will be caused to physical environment). However, the point of pareto optimality is a point of economic optimum. From Fig. 4.3, MEC (Marginal External Cost) refers to the extra cost of damage to the physical environment by expanding output by a unit whereas MNPB (Marginal Net Private Benefit) is the additional benefits derived by society for pollution abatement by a unit.

When property rights are well defined and bargaining is costless, then negotiation between the affected party and the party creating the externality can lead to a socially optimal market quantity. The efficient remedy to an externality is independent of the party who is assigned property rights.



Source: Adapted from Gilpin (2000)

Fig. 4.3: Negotiated solution to externality problem

Strengths of Bargaining and Negotiation

A key advantage of bargaining and negotiation is that it has contributed to the resolution of many conflicts in natural resources management through assignment of property rights. Ison *et al.*, (2002) strongly argue that assignment of property rights to polluters and sufferers have contributed to conflict resolution in dealing with contemporary environmental problems. Secondly, bargaining and negotiation provides defence against market failure by means of a competitive market model. Also, bargaining and negotiation have broadened our understanding that localized/small scale externalities may be internalized by resorting to the market.

Weaknesses of Bargaining and Negotiation

One disadvantage of bargaining and negotiation is that polluters or sufferers may violate clearly assigned property rights. In the view of Gilpin (2000), clearly assigned property rights to polluters or sufferers may be violated.

Bargaining and negotiation are also affected by the assignment problem. This implies that assignment of property rights becomes difficult when many agents are affected by property rights externalities. The Coase theory is most likely to be effective for localized/small externalities involving a few people and firms than more globalized or larger externalities which involve a larger number of firms and people (Hinterberger, 2000). The holdout problem is also worth mentioning as a weakness of bargaining and negotiation. Powers are exercised by owners of property rights over any other person because the Coase solution must be agreed on in the case of joint owners of property rights. This implies that an externality involving so many parties will amplify the holdout problem (Huppes and Ishikawa, 2005). Another problem affecting bargaining and negotiation is the free rider problem. This means that individuals will under invest when investment has a common benefit but personal cost.

Lastly, bargaining and negotiation are affected by transaction cost and negotiation problems. When there are large number of

negotiators on both sides or on one side of negotiation, the Coase theory ignores the fact that it is difficult to negotiate.

Direct Regulation as a Non-Market-Based Environmental Policy Instrument

Specific standards are set by the use of direct regulation in many environmental policies. Direct regulation is also known as command and control. It is a non-market-based environmental policy instrument which is independent of price as the most effective means of allocating scarce resources. In other words, direct regulation relies on restrictions, prohibitions, laws, and by-laws, in regulating environmental degradation. Specific examples of direct regulation in Ghana include laws on wildlife conservation, laws restricting illegal mining, by-laws to prevent bushfires, and close season to increase the population of fishes in water bodies.

Strengths of Direct Regulation

Firstly, enforced laws are instrumental in natural resources conservation. In the light of Vig (2013), command and control (direct regulation) has been very effective in solving first generation problems. Specific examples include passing of the Clean Air Act Amendment by the Bush administration in the USA, and the regulation on Pre-1970 Power Plants in the USA. Secondly, provision is created for sanctions in the case of non-law abiders. Viscusi (1993) argues that in the case of direct regulation, non-law abiders are sanctioned in order to deter others from repeating such acts. Furthermore, direct regulation provides clear outcomes. Ison *et al.* (2002) argue that when regulations are strictly obeyed, outcomes are predictable. Lastly, it is simple to monitor compliance. In the view of Gilpin (2000), compliance to laws can easily be monitored.

Weaknesses of Direct Regulation

Firstly, polluters have little choice about how to meet standards. According to Viscusi (1993), polluters are incapable of meeting

environmental standards. Secondly there are no incentives to research into innovative ways of reducing emissions. Ison (2002) argues that there is no motivation for research into improved ways of emission reduction. Lastly, it is costly for regulators to gather necessary information, leading to inaccurate reporting.

Summary

The chapter defines environmental targets as means of providing evidence in trying to meet an environmental objective. The chapter discloses that there are three types of environmental targets. These are hard targets, soft targets, and voluntary targets. Hard targets are narrow in scope with short timeline and clear accountability. Soft targets are broader in scope with a variety of timelines and without specific accountability. Voluntary targets are entered into by choice with an option of opting out. However, voluntary targets are those often used. They include the targets of Millennium Development Goals as well as the targets of Sustainable Development Goals.

The chapter has also touched on marginal analysis of environmental target setting with an emphasis that the social optimum level of pollution is achieved when marginal abatement costs are equal to marginal damage costs. It is also noted that benefits and costs are generated from stricter pollution targets. As such, emission targets of pollutants should be set in such a way that aggregate marginal damage from emissions equals the aggregate marginal benefits. Also, the cost incurred in achieving emission reduction will be minimized if there is equalization of marginal cost of emission reduction for all emitters.

In dealing with public goods and environmental targets, the chapter indicates that public goods have two characteristics. They are non-rivalry in consumption, and non-excludability in consumption. It is also noted that in the UK, targets were set for some agri-environmental public goods such as water quality as well as soil quality and protection. We are also made to understand that some agri-environmental public goods are without explicit targets.

The dose-response method has been illustrated in this chapter

by indicating how a target can be set for an output in relation to emission of pollutant. On the issue of environmental externalities, the chapter justifies the equation MSC=MPC+MEC. It is also understood that when MSC>MPC, negative externality is said to occur. On the other hand, when MSC<MPC, positive externality is said to occur.

The chapter reveals that environmental externalities can be internalized by resorting to two broad categories of environmental policy instruments. They are market-based and non-market-based environmental policy instruments. It is also noted that market-based environmental policy instruments consist of environmental taxes, tradable permits system, as well as bargaining and negotiation, whereas non-market-based policy instrument is direct regulation also known as command and control instrument. For instance, in trying to reduce sulphur emissions by the use of market-based instruments, sulphur taxes can be imposed on firms which emit sulphur. Alternatively, sulphur emitting firms can negotiate to buy or sell sulphur emission permits in an effort to reduce sulphur emissions. Going by non-market-based policy instruments, sulphur emission can be abated by means of laws passed by the government in order to restrict firms from emitting sulphur. It is revealed that the specific types of environmental policy instruments have varied strengths and weaknesses.

In practice, market-based environmental policy instruments are preferred due to cost-effectiveness. It is, however, noted that non-market-based environmental policy instruments are predominantly used. This is due to the fact that in the late 1960s and early 1970s the state of environmental economics generally did not go beyond the conceptual level. In contemporary times, the ever-increasing relevance of market-based environmental policy instruments is underscored as far as environmental policy-0making is concerned by reflecting their perceived superiority vis-à-vis non-market-based environmental policy instruments.

To sum it all, environmental targets are achieved when environmental policy instruments are used to internalize environmental externalities.

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CHAPTER FIVE

A Ghanaian Perspective on Approaches to Global Environmental Policy Formulation and Implementation

NICHOLAS N-KANG YEMBILAH

ABSTRACT

This article examines the evolution of environmental policy implementation from environmental science to become a distinct field of study, using several disciplines. It looks at how society responded to Rachel Carson's 1962 *Silent Spring*, which led to the realization that there was the need to formulate policies to protect the natural and built environments. Since then, several approaches to global environmental policy formulation and implementation have evolved to address diverse environmental problems. The approaches to global environmental policy are contextualized in Ghana to identify the set of approaches that are needed locally to formulate and implement holistic environmental policies. It chronicles Ghana joining the call to protect the environment in 1972, with the establishment of its first statutory body, the Environmental Protection Council, which later became the Environmental Protection Agency (EPA). The EPA, with other state agencies and departments, have been found to use several approaches to develop holistic policies that would protect the environment and populations at risk of losing homelands and livelihoods. Major approaches in Ghana include mixed scanning of environmental issues, ecosystem management, remote sensing and geographic information systems, regulation and its economic effects, contingent value methodology, economic and financial instruments, alternative dispute resolution, public participation, critical social and ethical issues in preservation, and normative concerns of environmental policy. From a Ghanaian perspective, it is recommended that government agencies and departments should invest in developing the capacity of their human resource on environmental issues so as to consciously incorporate eco-centric and techno-centric perspectives when formulating environmental policy and plans for implementation.

Keywords: Environment, Environmental policy, Governance, Planning, Implementation

Introduction

The problem of poverty and the desire to amass wealth resulted in an increasing awareness of the existence of a global environmental crisis, which is environmental degradation. Concern over environmental degradation came to prominence in the 1960s following the publication of Rachel Carson's (1962) *Silent Spring,* the Torrey Canyon oil tanker disaster (1967), Paul Erlich's (1968) "The Population Bomb," and the first Earth Day (1970). As a result, efforts have been made to investigate and document the state of the global environment (Pearson, 2000) and the nature of global environmental change (Williams, 2007). Major environmental problems that have been identified as issues of global environmental concern include: desertification (Vernon, Paruelo, & Oesterheld, 2006); depletion of fuel wood (Hall & Farrel, 2001); destruction of tropical rain forest and rapid decline in forest cover (Yonkura, Ohta, Kiyono, & Aksa, 2012); modification of coastal ecosystems (Paerl, Dyble, Twomey, Pinckney, Nelson, & Kerkhof, 2002); reduced availability and quality of drinking water (Kohlitz, Chong, & Willet, 2020); depletion of soil resources (Robertson, Crum, & Ellis, 1993); over-exploitation of fish resources (Morato, Watson, Pitcher, & Pauly, 2006); food shortages (Brown, 2002); species extinction and the loss of bio-diversity (Sall, 2007); stratospheric ozone depletion (Solomon, 1999); rapid rising levels of fossil fuels (Mohr, Wang, Ellem, Ward, & Giurco, 2015); and climate change (Schellnhuber, Cramer, Nakicenovic, Wigley, & Yohe, 2006).

The Millennium Ecosystem Assessment reports that global environmental problems were caused by human interventions which rapidly and extensively changed ecosystems over a considerable period of time (Reid, Mooney, Cropper *et al.,* 2005). The rapid change of ecosystems was caused primarily by human demands for food, fresh water, timber, construction material, and fuel (Reid *et al.,* 2005). The Millennium Ecosystem Assessment also found that over

60% of ecosystem services are being degraded or used unsustainably ((Reid *et al.,* 2005). These problems which have assumed global environmental dimensions have resulted in the development of multidisciplinary approaches to study these problems and provide environmentally sustainable solutions to them.

Every field of knowledge focuses on the best way to develop approaches to enquiry and document them. When environmental science became a recognized and distinct field of enquiry, it developed and used several approaches to investigate issues that are of interest to humanity. Over time, it was realized that a combination of methods, theories and frameworks is essential in handling environmental crisis and resource management issues for the development of policy to protect the environment and the resources it is endowed with.

Approaches to the study of environmental policy are not very different from those used by the other social sciences. Data on environmental policy is gathered to empirically prove a case, that may be of interest to environmental protection. Once proven, dialogues between policy formulators and stakeholders could then be engaged in to develop an enabling environment to protect species, habitat, and humanity.

Some analysts predicted that the ecosystem was destined to encounter total failure by anchoring their views on the doctrine of Malthus (Malthus, 1970, 1990). On the other hand, others considered technology and the instincts of human beings to overcome disaster as a means through which Earth's ecosystem would be preserved and if possible enhanced (Boserup, 1981). It is these two contrasting views that influence the development of environmental policy and its implementation, thereby bringing into perspective governance principles and plans. Environmental policy implementation draws on various fields of study to make environmental decision-making effective. The quest to achieve environmentally sustainable decisions with respect to protecting the environment has resulted in the approach (to solving the problems) becoming multidisciplinary in nature, which is the subject for discussion in the next section of this paper.

Multidisciplinary Approach

Analysts who put their faith in technology and human ability to save life envisage the ecosystem as an environment that would always be endowed with abundant natural resources; while advocates of the Malthusian school keep warning against an ecosystem and a world that could be caught in the debauchery of overconsumption, leading to natural disasters (Ehrlich *et al.,* 1997).

Practitioners in environmental policy with the accompanying disciplines of governance and planning with an environmental focus and who have training in the social sciences have made meaningful contributions towards the protection of the ecosystem with the aid of subjects like Eastern Philosophy, anthropology, geography, archaeology, law, among others. This shows without any equivocation that environmental policy with its accompanying arms of governance and planning is an eclectic discipline, drawing resources from every field of study. This is illustrated in section 2 of Ghana's Environmental Policy Act (EPA), 1994, Act 490, which provides, among the functions of the EPA, the multidisciplinary functions of:

- coordinating the activities of bodies concerned with the technical or practical aspects of the environment and serve as a channel of communication between those bodies and the Ministry;
- coordinating the activities of relevant bodies for the purposes of controlling the generation, treatment, storage, transportation and disposal of industrial waste; and,
- securing by itself or in collaboration with any other person or body the control and prevention of a discharge of waste into the environment and the protection and improvement of the quality of the environment (EPA, 1994).

The combination of these fields into a single discipline has engaged the attention of economists, policy analysts, philosophers, and politicians within and outside government, among other scientists. These fields of knowledge have demonstrated the effectiveness of modern views, and the latest technological breakthroughs on the postures of Malthusian and Boserupian advocates on contemporary

environmental issues. The breakthroughs gave rise to an urgent call to pursue policies that would protect and preserve our local and global environments.

Awakening to the Call for Environmental Policy

More than half a century ago, Carson (1962), in her book entitled *Silent Spring*, documented the adverse environmental effects caused by the indiscriminate use of pesticides, which culminated in her accusing the chemical industry of spreading disinformation, with public officials accepting the industry's marketing claims without questioning them. This made the social sciences and other disciplines turn their attention to developing the expertise needed to be able to objectively examine what was hitherto considered to be natural and physical problems.

This, Caldwell (1996) noted, moved humanity from learning about environmental problems to solving them. This fulfilled Hardin's (1968) suggestion that the best ideas should be taken and formulated into policy and applied to real-time problems that affect every resident of the global commons. Ghana joined the call to protect the environment by participating in the Stockholm Conference in 1972 and the Earth Summit in Rio twenty years later. The country formulated its first Environmental Policy in 1995 based on a broad vision inspired by respect for all relevant principles and themes of environment and sustainable development (Aryee, 1998).

Architecture of Global Environmental Policy and Governance

The need to strengthen global environmental governance at the intergovernmental level dates back to the early 1970s (Biermann, Davies, & Grijp, 2009). There are four phases which characterizethe evolution of the architecture of global environmental governance. The first phase took place during the 1972 UN conference on the Human Environment. The second followed the 1992 conference on Environment and Development, while the third followed the 2002 summit on Sustainable Development (Bauer & Biermann, 2005). The Paris Call for Action in 2007 could be said to be the fourth phase

of the evolution of global environmental governance architecture (Biermann *et al.,* 2009).

The first phase of the evolutionary process resulted in the creation of the United Nations Environment Programme (United Nations General Assembly, 1972). It is a subsidiary body of the UN General Assembly and reports through the UN Economic and Social Council. The UN Environment Programme was to evolve into an environmental conscience within the UN system, thereby triggering environmental projects and coordinating UN Environment policies. It has been judged to have failed to fully achieve its objective and became weak, underfunded, overloaded and remote (Haas, 2005).

The Declaration of the Hague called for a more authoritative international body on the atmosphere. In 1992 the United Nations Conference on Sustainable Development (CSD), as a consultative organ of the United Nations Economic and Social Council, served as a forum for deliberation and debate on global environmental issues (Rodd *et al.*, 2002; Biermann *et al.,* 2009). To overcome the perceived ineffectiveness of UNEP and the limited competence of the UN Commission on Sustainable Development, the United Nations General Assembly set up a task force to assess the environmental activities of the United Nations (UN Secretary General, 1998). Following the recommendation of the task force, an Environmental Management Group was created within the UN system. The UNEP Governing Council is required to meet at the ministerial level.

The third phase emerged after the 2007 World Summit on Sustainable Development. This phase was characterized by academic input on the discourse of making effective global environmental participation (Biermann, 2009). Proposals were made calling for an upgrade of UNEP to the status of a World Environment Organization (Biermann, 2000, 2001, 2002). A counter proposal was made, suggesting that a UN Environment Protection Organization, answerable to a UN Trusteeship Council, would be an arrangement that would monitor and make global environmental protection more effective (Desai, 2000). Tarasofsky (2002) pointed out that substantially strengthening 'UNEP and its Global Ministerial Environment Forum' could be a probable avenue for making the institution responsible for

global environmental protection effective. Haas (2004) advocated for the establishment of a Global Environmental Organization that would act as a central point for collecting and disseminating environmental expertise. Kimball (2002) called for the transformation of UNEP into a global environmental organization. Apart from the creation of institutions at the level of the UN to take care of environmental problems, economic dimensions of the environment got injected into the advocacy debate (Whalley & Zissimos, 2002). The political community, led by Speth (2004), supported the call for the creation of a new environmental organization and indicated that there was a strong relationship between development and environmental concerns. They favour the creation of a World Organization on Sustainable Development that would be effective.

In 2003 France advocated for the transformation of UNEP into a UN Environment Organization, which would have "an important and indisputable global centre for the evaluation of our environment" (UN document, 1997; Biermann *et al.* 2009). This proposal was re-echoed by the 2007 Paris Call for Action at the Citizens of the Earth Conference for Global Ecological Governance. It advocated the adoption of a Universal Declaration of Environmental Rights and Duties that would ensure new human rights to a sound and well-preserved environment. As a result of this proposal, the Group of Friends of the UN Environment Organization was established to discuss the mandates and institutional aspects of this organization (Biermann *et al.,* 2009).

In 2005 an Informal Consultative Process on the Institutional Framework for the United Nations' Environmental Activities was established (Berruga & Maurer, 2007). The process aimed at addressing the need for more efficient environmental activities within the UN system. After consulting with country delegations, members of the UN Secretariat, secretariats of multilateral environmental agreements, scientists, business leaders, and non-governmental organizations, it was agreed that a UN Environment Organization should be formed (Co-Chairs Option Paper, 2007). Developing countries, however, were reluctant to support the establishment of a UN Environment Organization because they

feared that environmental governance could threaten the process of their economic development (Persson, 2009). Despite the initial hesitation, developing countries have gradually made progress from opposing the establishment of UNEP to participation and active engagement in discussions aimed at advancing the course of global environmental governance (Nagam, 2005a).

Institutional Framework for Environmental Protection in Ghana

Ghana has abundant natural resources which have played an important role in the country's economic and social development. Unrestrained exploitation of these resources has often not considered the need to guard against the over-use and misuse of these resources. As a result, the unsustainable use of the country's resources has caused irreparable damage to the environment, resulting in deforestation, land degradation, air and water pollution, soil erosion, and destruction of biodiversity, etc. (Kessey & Arko, 2013; Kwakwa, Alhassan & Adu, 2019). Successive governments in Ghana have realized that sound socio-economic development must be based on a socio-economic framework that is environmentally sustainable. Therefore, the conservation and sustainable use of environmental resources and their protection depend on attitudinal and behavioural changes by private and public sector institutions (Fuseini, Issahaka & Kemp, 2015).

Ghana's first steps at protecting the environment was the passage of the Administration of Lands Act, 1962 (Act 123). This was followed by the country's participation in the Stockholm Conference on the World Environment in 1972, marking the beginning of the country making a conscious effort to protect the country's natural and built environments. At the Earth Summit in 1992, Ghana moved a step further towards the objective of living in harmony with the environment by signing the Rio Convention. Chapter 21 sections 266 (Ownership of land by non-citizens), 267 (Stool and skin lands and property), 268 and 269 (Protecting natural resources), of the 1992 Republican Constitution of Ghana requires government to account to the Ghanaian people how the country's lands and natural resources

are sustainably exploited to ensure environmental protection and preservation (Ghana Constitution, 1992). After this Constitution was promulgated, the lead agency to protect the country's environment was established following the passage of the Environmental Protection Agency Act, 1994 (Act 490). This paved the way for a National Environmental Policy to be formulated in 1995.

The policy emphasized that Ghanaians are entitled to an environment that is not harmful to their health and well-being and are enjoined to have the environment protected for the benefit of present and future generations through reasonable legislative and administrative measures (Aryee, 1998). The policy goes ahead to prescribe the method by which the policy should be implemented by indicating that to achieve this and to meet the development needs of Ghanaians, sustainable development is essential. This requires an integrated and coordinated environmental management policy. In formulating a new environmental management policy for Ghana, all stakeholders must be involved throughout the process at all levels of national development (Hens & Boon, 1999).

This view was articulated in Ghana's first environmental policy of 1995. The policy is based on a broad vision of respect for all relevant principles of environment and resource development (Hens & Boon, 1999). Environmental degradation was found to be the result of failing world markets, poverty, and institutional shortcomings at the regional and national levels of the country. The policy for protecting the environment in Ghana was spearheaded by a lead agency called the Environmental Protection Agency (EPA) whose principal task was to ensure that Ghana's resources should be sustainably exploited for development (Dadebo & Shinohara, 1999).

The vision of the policy is to manage the environment to sustain society at large (Hens & Boon, 1999). The main thrust of the mission statement of the policy "is to improve upon the foundations laid by the previous policy and activities implemented under the Ghana Environmental Action Plan" (Hens & Boon, 1999). The policy statement, therefore, stated that it takes account of national environmental priorities while sufficient attention is also given to long-run sustainability concerns. Government ownership of national

environmental objectives is indeed important, but ministries, departments and agencies, as well as other institutions including non-governmental organizations must buy into the policy implementation process to ensure overall success (Hens & Boon, 1999).

Following the formulation of the National Environmental Policy, the Water Resources Commission Act, 1996 (Act 522) was passed to protect the country's water resources. The Act vested surface and ground water in the state and requires the acquisition of a water right to abstract, divert, or use water for any purpose, except in case of emergencies such as firefighting. Then in 1999, the Forestry Commission Act, 1999 (Act 625) was put in place to protect the country's depleting forest resources. The problem of over-exploitation of the country's ocean and inland water resources resulted in the passage of the Fisheries Act, 2002 (Act 625). Mining, which dates back to pre-colonial times, have had laws like the mercury law, and other laws on mining passed during the colonial era into the independence period of Ghana.

However, these laws were scattered and had to be codified into one piece of legislation to make the regulation on minerals and mining more effective. This resulted in the codification of these laws into the Mineral and Mining Act, 2006 (Act, 703). To overcome the problem of land disputes in the country the different legal frameworks that regulated ownership of skin and stool lands was codified into a unified legal administrative framework known as the Lands Commission Act 2008 (Act 767).

Other policies like the Ghana Forest and Wildlife Policy (Ministry of Lands & Natural Resources, 2012) have been formulated to regulate the use of the country's environment and to ensure that the country's natural resources are sustainably exploited. In order to ensure sustainable exploitation of the country's resources while preserving and protecting the environment at the same time, a set of approaches are being used to develop an environmental policy aimed at achieving sustainable development. Some of these approaches are discussed in the following section.

Approaches to Environmental Policy

Mixed Scanning of Environmental Issues at the Micro and Macro Level

Environmental policy, governance and planning have moved from looking at environmental problems to incorporate thoughts that examine environmental problems and solving them from more than one perspective. As a result, Etzioni (1967) talked about the need for mixed scanning of environmental issues at the micro and macro level when developing policy. Organizational studies are encouraging the examination of environmental problems from multiple perspectives by discounting a single theoretical preference or performance measure to enhance the decision-making process (Morgan, 1986). This was the basis for encouraging inquiry with multiple methods, including those in the social sciences, and the natural and physical sciences (Soden & Steel, 1998).

Public opinions on the environment indicated a heightened importance of the environment among people of different nationalities, regardless of the level of development. The outbreak of COVID-19 in December 2019 in China, and which was subsequently declared a global pandemic in February 2020 by the WHO (2020), amply illustrates the importance of the environment. Simply put, environmental concerns are post-materialist issues with basic human concerns, that require meeting basic

needs of humanity. Therefore, research from the social sciences is needed for documenting the degree to which environmental issues need global and local attention. This is the foundation on which environmental policy and decision-making are developed and implemented.

This approach has been applied in Ghana by interviewing 59 CEOs from firms that had well-defined task environments, were autonomous i.e., the firms' strategic decisions are based on the environmental condition and not the policies of mother institutions, and have the structural and behavioural characteristics of well-established entities (Agyapong, Amanor, & Muntaka, 2012).

Ecosystem Management

From the perspective of policy formulation, ecosystem management is a widely used approach in the physical and natural sciences. It is a widely accepted view that ecosystem management in policy formulation becomes further complicated because of values, vested interest between stakeholders, ingrained organizational cultures, and administrative whims (the emphasis is Hennesey and Soden's). However, ecosystem management is useful in committing stakeholders to genuine discourse and enhanced dialogue between stakeholders by providing conceptual frameworks that institutions and actors would find easy to understand and use. In the case of Ghana, Mensah and Amoah (2013) discuss ecosystem management in an article in which they indicated that this approach to ecosystem management is one of the first steps in formulating policy to protect the environment. This is the case because the management of ecosystems involves a stakeholder analysis, which requires the input of government agencies (Ministry of Land and Natural Resources, Environmental Protection Agency, etc.), community members, landlords, educational institutions, law enforcement agencies, and corporate organizations.

Remote Sensing and Geographic Information Systems

Another approach that received popular acclaim in environmental studies and policy formulation is remote sensing and geographic information systems (GIS) (Soden & Steel, 1999). GIS was developed to allow for the automation of large volumes of data on the environment. However, it has to be fully incorporated into the environmental policy process. It should be accepted as a fundamental aspect of understanding the spatial context of environmental issues. The applicability of this approach was used by Alo and Pontius (2008) to determine the fate of forests in southwestern Ghana. The applicability and relevance of remote sensing and geographic information systems were used to study land cover transitions with the objective of detecting systematic landscape changes based on

deviations of observed patterns from random patterns of change. The findings of their research emphasized the importance of considering collective responsibility of commercial loggers, farmers, and other forest user groups in debates concerning forest policy and proposals for dealing with the deforestation problem in Ghana.

Regulation and Its Economic Effects

The sphere of environmental policy also includes regulation and its economic effects as an approach to formulating environmental policy, ever since formal environmental movements emerged as organized forces of political expressions of environmentalism. Economic approaches which have antagonized each other in the quest to formulate policy and plans to protect the environment are market approaches; and government favouring the private sector controlling itself by considering its self-interest. However, externalities caused by failure to take adequate measures to protect the environment, have made regulation through government control a preferred option (Dobra & Wendel, 1999). Regulation has succeeded in many instances, but market-based systems that "promote the achievement of environmental goals more efficiently" is the direction in which the global economy is heading. Hens and Boon (1999) have copiously documented the institutional regulations Ghana has used since 1972 to develop and implement policy to protect the environment. The following institutions and their accompanying legal frameworks are responsible for the evolution and application of Ghana's environmental policy:

In 1974 the Environmental Protection Council (EPC) was established by NRCD 239 as an advisory and research organization. It was responsible for facilitating the coordination of environmental programmes and activities in the country. This was followed by the National Development Planning law of 1989, which established the National Development Planning Commission (NDPC), vesting it with regulatory powers to formulate and advise government on comprehensive national development strategies to ensure that planning and development programmes are effectively implemented

by monitoring, evaluating, and controlling national development programmes, which include the implementation of environmental policy (EPC, 1991). In 1992 Ghana approved a National Environmental Action Plan (NEAP) which was implemented in 1993. The NEAP was used to guide the development of the country's National Environmental Policy. The objective of the policy is to reconcile economic development with natural resource conservation so as to make high environmental quality an essential aspect of the country's economic and social development. In 1994 the Environmental Protection Agency Act (Act 490) was passed, which transformed the EPC into an Agency, giving it full regulatory and enforcement powers to regulate the use of the environment and ensure that government environmental policies are implemented.

Contingent Value Methodology

Contingent value methodology is another approach which economists use to examine issues affecting environmental policy, governance and planning. Contingent value methodology is the "willingness-to-pay" for natural resource and environmental amenities using hypothetical market and survey research. This method is useful for environmental policy and decision-making because it places value or utility on goods and services which were difficult to value. This provides increased opportunity for determining the benefits that would accrue from resources that are not marketable and could be a primary instrument for making decisions and implementing plans on issues related to the environment (Ekstrand & Drapper, 1999). Boadu (1992) employed this approach to examine household water in rural Ghana. Also, Addai *et al.,* (2014) used this approach to examine the willingness of households to pay for improved solid waste management and recommended that environmental policymakers should choose a means of designing an improved solid waste management project.

Economic and Financial Instruments

Economic and financial instruments are used as an approach to formulate policy and implement plans with respect to national parks

(Simon & Doerksen, 1999). Agencies are expected to achieve more targets with fewer resources with regard to managing national parks or game reserves. Because of this, agencies look for other avenues of raising funds to sustain their operations. In Ghana, the wildlife division of the Forestry Commission has called for increased funding to manage the country's protected areas (International Union for Conservation of Nature [IUCN], 2010). This calls for exploring-charging option, and removing institutional obstacles that obstruct the implementation of fee-charging options for national parks to access funds from the public and private sectors of the economy.

Economic and financial instruments for developing and implementing environmental policy in Ghana was the Command and Control (CAC) approach. The CAC approach from the perspective of environmental policy and implementation involves setting standards to protect or improve environmental quality. It has been replaced with the use of economic instruments. Ghana's use of economic instruments to influence environmental policy lies in the fact that Ghana externalized the cost of her resources and products which should have been taken account of when the country's resources and products are being priced. In the context of Ghana, economic instruments which have environmental policy implication are used to control environmental pollution. For instance, the system of imposing taxes and charges to discourage the importation of old cars and obsolete electronic equipment (Hens and Boon,1999).

Alternative Dispute Resolution

An approach that has become useful in environmental issues is Alternative Dispute Resolution (ADR). Because environmental issues involve a broad range of stakeholders with different interests, environmental disputes often retard progress when environmental policy is to be implemented. Going to court could result in antagonistic relationships developing between stakeholders, resulting in total failure in implementing environmental policy initiatives and plans. Therefore, Weber (1999) encourages collaboration as the best alternative to dispute resolution when handling environmental

disputes, instead of going to court to have them resolved. Therefore, policymakers should increase collaboration between stakeholders in the early stages of environmental policy formulation and implementation. In this context, alternative dispute resolution does not cure conflicts that define liberation; instead, it aids in achieving workable and less costly solutions than the courts would provide.

As an approach in Ghana, the ADR Act (Act 798) (GhanaJustice, 2010) was passed, to do, among many things as indicated in section 1 of the Act, to handle matters related to the environment which are of national and public interest. Onyema (2012) gave a detailed account of the provisions of arbitration, customary arbitration, and mediation as procedures of Act 798 for resolving environmental issues of national and public interest. This approach for resolving policy issues affecting the environment was found by Kuusana, Kidido, Appiah, and Mireku (2012) to be an effective approach for resolving environmental disputes, policy formulation, implementation, and resolution. It was noted that respondents explained that ADR was faster than the court process because cases of customary land arbitration are resolved within two judicial sittings. It can therefore be concluded that ADR as laid down in Act 798 and confirmed by Kuusana *et al.,* (2012) is an integral part of available approaches for formulating and implementing environmental policy in Ghana.

Public Participation

The public has become increasingly important in managing environmental affairs. It has posited that multiple methods are effective in discovering public concerns and provide greater insights into differing public opinions about sensitive environmental issues (McCarney, Schreckhise, & Lovrich, 1999). Regulation 17 of LI 1652 of Ghana provides for the public to be consulted when a policy is being formulated for implementation and could have an extensive and far-reaching effect on the environment and by extension public health and livelihood (Environmental Assessment Regulation, 1999). This strategy affords policy formulation agencies the opportunity to reach out to interest groups that are often left out in pro-forma

public participation efforts. In addition to public participation, decision analysis tools are used to evaluate how agencies and other stakeholders share goals or are at great odds in the bargaining process (Lambert *et al.,* 1999). Risk analysis is a framework and an approach for determining the extent of concern for the environment (Tennert *et al.,* 1999), and is an important aspect of public participation.

Critical Social and Ethical Issues in Preservation

Examining critical social and ethical issues in preservation is yet another approach for solving environmental problems. This approach ensures that in the course of protecting natural areas, people in such areas should be provided for against permanent displacement. At-risk individuals living in places that are in danger of destruction become externalities of a policy process which could result in their basic human rights being ignored in the effort to preserve the ecosystem. This calls for a reality check in the policy process to ensure that steps aimed at protecting the ecosystem would include the inhabitants of such places, protecting human rights and the rights of nature.

A classical case in point in Ghana is the report by Hilson and Potter (2005), stating that reforms have allowed the expansion of large scale mining without safeguards, causing adverse effects on the health of local populations. They note that the Mining Division of the World Bank Group indicated that most developing countries either lack transparent and enforceable environmental regulations or have weak institutional capacity to monitor and enforce these regulations (World Bank, 2003). Such reforms and institutional lapses pose the greatest threats to livelihood in the form of cyanide spillage from large scale mining activities, with attendant environmental consequences such as contaminated freshwater sources, fish populations and crops that local people depend on for survival. Such incidents which have social implications and issues of an ethical nature occurred in the Wassa West District, Tarkwa, and Teberebie in the Western Region of Ghana. The incident in the Wassa West District which brought into sharp focus issues of the social and ethical approach for environmental policy implementation was that of cyanide spillage in 2001 involving

the release of large volumes of mine wastewater contaminated with cyanide and heavy metals from a ruptured tailings pond belonging to Ghana Goldfields, into River Asuman and its tributaries, leading to the damage of aquatic life (Hilson & Potter, 2005). They indicated that another spill contaminated a swamp area which provided the locals with mudfish, medicine, and bamboo. Artisanal miners who were forced from their lands secured employment in local farming channels, but they continued to be adversely affected by environmental pollutants released by large scale mining combines. Also, Hilson *et al.* (2005) further reported that in Tarkwa considerable quantities of land and vegetation were cleared for surface mining operations. This caused agricultural land to get degraded, resulting in the reduction in the amount of land available for agriculture accompanied by the shortening of the fallow period.

Degradation caused by large-scale mining has forced *galamseyers* (small-scale illegal gold miners) and farmers off lands, which provided them with their only source of income (Anon, 2001). Brande (1998) discusses the experience of inhabitants displaced from their native homeland with the government doing little to secure their social and economic well-being. Between 1990 and 1998 the Teberebie mining company in Tarkwa displaced about 30,000 indigenous farmers and galamseyers to facilitate its mining operations. The displaced people were deemed by the mining company to be unemployable, and each of them was given a compensation of US$ 2. The displaced people blamed the government for not doing much to protect them against such treatment. In short mining, communities enjoy little benefit but bear a greater part of the negative impacts. These incidents show environmental issues with social and ethical dimensions which call for the engagement of the social and ethical issues approach when formulating environmental policy for implementation.

Normative Concerns of Environmental Policy

Normative concerns of environmental policy is an approach that seeks to address issues related to environmental justice and environmental ethics. Environmental justice, a socio-political movement that

articulates environmental issues from a social justice perspective is concerned with the level of responsibility for environmental degradation and the obligation to help address environmental problems, especially among those who harvest resources with no regard for the consequences (Pulido, 2001; West, 1999). In this regard, developing countries must adopt strategies to protect their environment and resource interest from resource-hungry industrialized nations. As a result, environmental justice has become a cornerstone for environmental policymaking and implementation (West, 1999). Allied to environmental justice is environmental ethics which seeks to alter society with regard to keeping threats to the environment in check (Lamb, 1999).

The normative approach was found by Ramcilovic-Suominen and Hansen (2012) to be applied in managing forest resources in Ghana by controlling how inhabitants could use forest resources. Norms which were adhered to in this approach to regulate the use of forest resources in the country are the prohibition of early cultivation of crops and burning of land associated with the cultivation, prohibition of unauthorized fire in forests or farmlands for any purpose (farming or hunting) in the dry season, obligations to make fire belts and to attend to fire when used for agricultural practices.

Conclusion and Recommendations

To conclude, policy on the environment and plans for their implementation come from many disciplines to arrive at holistic preservation and conservation strategies for implementation. The Malthus doctrine and the Boserup thesis fundamentally influence the development and implementation of environmental policies. In this regard, policy formulation in Ghana should be hinged on Malthusian and Boserupian expositions on resource availability and exhaustion, accompanied by projections on the survival of Ghanaian society. This projection should guide policy formulation and implementation based on all the approaches for the formulation of environmental policy, viz: mixed scanning of environmental issues at the micro and macro level; ecosystems management; remote sensing and GIS;

regulation; contingent value methodology; economic and financial instruments; alternative dispute resolution; public participation; social and ethical issues in preservation; and, normative concerns of environmental policy. These approaches should be fused with gaianist or communalist concerns of eco-centric environmental justice, or with accommodationist or interventionist concerns of environmental justice, all of which are extensions of environmentalism. Government agencies and departments vested with the power to formulate policy for environmental protection should have professionals trained in the fundamentals of environmental policy, namely: environmentalism; environmental movement; environmental justice; environmental hazard; environmental perception; environmental economics; resource economics; governance; and, environmental planning. A collection of environmental professionals firmly grounded in the concepts of environmental issues and approaches to environmental policy formulation and implementation would ensure well informed environmental protection policies which would guarantee the safety of present and future generations of Ghana.

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CHAPTER SIX

Environmental Assessment Decentralization in Ghana: Benefits and Challenges

JOHN BOSCO BAGURI SUMANI

ABSTRACT

Environmental assessment (EA) is an environmental planning strategy mostly employed to identify environmental and socio-economic impacts and at the same time proposing mitigation measures for decision-making purposes. EA in Ghana was decentralized to EPA Regional and Zonal Offices in order to address challenges bred by concentration of EA decision-making at the national level. This chapter will be used as a teaching and learning tool for Environment and Resource Management students. The author used literature review and content analysis of reports supported by his personal knowledge and experience working with EPA. The study accordingly found that the EA decentralization initiative is yielding speedy processing of EA applications, creation of awareness about EA activities at the local level and building capacities of local stakeholders. Some challenges associated with the implementation of the EA programme include: no formal evaluation of the programme at the end of the pilot phase, bureaucracy and delays due to the involvement of multiple stakeholders in the EA process, centralized decentralization (i.e., deconcentration) and inability to mobilize adequate financial resources to fund EA decentralization activities. The author, therefore, recommends: (i) periodic evaluation of the programme, (ii) effective devolution of EIA functions, (iii) timely release of the Operational Fund to the local EPA offices, (iv) retention of an agreed percentage of the processing and permit fees at the decentralized offices and (v) continuous training of EPA staff and their collaborators at the Regional and Zonal levels.

Keywords: Environmental Assessment, Decentralization, Benefits, Challenges, Ghana

Introduction

Environmental assessment (EA) decentralization is a tool mostly used to promote effective, efficient, and timely environmental permit decision-making, especially at the local levels. This has the potential to reduce environmental degradation and make development sustainable and acceptable to the relevant stakeholders at the local level.

Environment is the bank of resources that humanity depends on for their survival. The environment is also a prime component in the decision calculus of sustainable development policy-makers and practitioners. Therefore, a sustained environment is a pre-condition for sustainable development. Because of the importance of the environment and its resources for achieving sustainable development, a variety of strategies have been devised to ensure sustained environmental planning and management. These strategies include environmental awareness creation and sensitization, environmental legislation and regulation and environmental planning and Assessment (Amlalo, 2002).

Even though environmental assessment (EA) and environmental impact assessment will occasionally be used interchangeably, it is important to clarify their meanings in order to prevent confusion. In this regard, EA encompasses a basket or a wide range of environmental planning and management tools, including registration of undertakings, preliminary environmental assessment (PEA), environmental impact assessment (EIA), regional environmental impact assessment and strategic environmental assessment (SEA). These tools are classified based on: the depth and scope of assessment required; the magnitude and scale of the impacts; the number of activities, projects, policies and programmes to be covered; and the geographical scope. For instance, regulation 3 of the Environmental Assessment Regulations (LI 1652, 1999) requires proponents to conduct a full-scale environment impact assessment and submit an environment impact statement (EIS), i.e., the accompanying report to EPA for permit decision-making purposes. These are undertakings with potential significant adverse impacts on the environment and

public health. The LI 1652 (1999) also refers to these development projects as schedule 2 undertakings. EIA, on the other hand, denotes studies involving the systematic identification, prediction and evaluation of environmental and socio-economic impacts associated with proposed undertakings documented and presented to the appropriate authority for environmental permit decision-making purposes (Bisset, 1987; Asit & Agarwala, 1992; Canter, 1996; EPA-Ghana, 1996). In short, EIA is a sub-set of EA or one environmental planning strategy from the basket of tools mentioned above. Here, the basket of tools refers to EA. This clarification is necessary for understanding the benefits and challenges associated with Ghana's EA decentralization programme.

Environmental assessment (EA) has the potential to support sustainable development (Kennedy,1999). It does this by reconciliating socio-economic development and environmental protection (Biswas & Agarwala, 1992). However, whether EA promotes development or not is a subject of contention between die-hard economists and environmentalists. Thanh and Tam (1992) report that some developers in the past were implementing their projects without caring for the environment, often sparking protests, with some environmentalists; and ecological economists also blaming developers whose activities were degrading the environment with impunity. To Thanh and Tam 1992), the argument or debate has been reduced to "development versus environment" (p3).

Both schools of thought have some merits in their arguments. This argument is premised on the fact that the environment is meant to serve the needs of humanity, hence, the need to harness the environmental resources to satisfy human needs. This does not, however, mean humans should or can interact with the environment anyhow. This implies extracting natural resources to provide human needs without compromising the ability of future generations to also satisfy their needs. Biswas and Agarwala (1992) vividly captured this position in their book *Environmental Assessment for Developing Countries* when they reported the view of the global south in the early 1990s as "the environment must not be ignored but development must not be impeded" (pvii). This quotation reports the aspirations

of both the environmentalists and economists and is also hinting at sustainable development.

Environmental assessment is often employed to promote sustainable development by reconciling socio-economic development and environmental protection (Kirchhoff, 2006). However, implementation of EA in most countries often breeds unintended challenges, including high costs of EIA studies, use of foreign methodologies, bureaucracy and the associated corrupt practices and delays; mainly due to centralization of EA activities at National EPA Offices (Ebisemiju, 1991; EPA, 2004). This makes some developers to think that environmental regulators are using EIA to frustrate developers with other investors suggesting that it should be discarded (Doberstein, 2004).

However, it is the author's view that EA has the potential to support sustainable development, and as such, should be maintained and enhanced. In other words, concrete and practical steps should be initiated to address problems militating against the smooth operationalization of EA in developing countries, especially in Ghana. One such strategy is EA decentralization, which is the focus of this chapter.

Environmental Assessment decentralization programmes have been rolled out in some developing countries as a way of addressing challenges associated with centralized EIA systems in countries practising unitary governments, including Ghana. Even though Ghana embarked on the EA decentralization journey since 2004 (EPA, 2004), the author has not come across any study that specifically assessed the benefits and challenges of EA devolution in Ghana even though such studies have been conducted in other countries. This study has, therefore, been undertaken to contribute to the closure of this gap in our knowledge by attempting to identify the benefits and challenges associated with the implementation of Ghana's EA decentralization programme so far. As a contribution to a book that aims at promoting teaching and learning in environment and resource management, this chapter has the potential to introduce students and teachers to EA decentralization in Ghana, including its benefits and challenges.

In addition to the introductory section above, the remaining sections of this Chapter are organized into: (i) A brief methodology, (ii) Decentralization in Environmental Assessment, (iii) Conditions precipitating EA decentralization, (iv) Institutional arrangements and functions within the EA decentralization process (v) piloting and operationalization of EIA decentralization in Ghana, (vi) Benefits and challenges of EA decentralization and (vii) Conclusions and recommendations.

Approach to the Study

This study is a purely qualitative enquiry into the benefits and challenges of EA decentralization in Ghana. I employed a blend of information and data collection strategies to identify the benefits and challenges associated with the implementation of the EA decentralization initiative. I particularly engaged in intensive and extensive literature review, covering the EA decentralization programme in Ghana and other developing countries with environmental and socio-economic conditions similar to those of Ghana. Other methods used to generate data for this Chapter included content analysis of relevant reports and key informant interviews with some key EPA staff and other relevant stakeholders in the EA decentralization programme (i.e., some members of the Technical Review Committee). The content analysis covered EPA reports, official documents and correspondences. The criteria used in selecting reports for the content analysis included documents that contained information on decentralization of EA decisions and activities. Key informants were also purposively chosen, i.e., EPA staff and other members of the Regional Technical Review Committee (RTRC) involved in the assessment of EA applications.

The author's personal knowledge, experience and insights acquired as a former employee of EPA in charge of EA in the Upper West and Northern Regional Offices complemented the aforementioned data and information sources. In the Northern Region in particular, I was the secretary to the Regional Technical Review Committee (TRC), a structure formed under the EA decentralization

programme whose members are responsible for reviewing applications for environmental permits (EPs). The experience and insights in EA offered me the opportunity to distil information from EA decentralization activities to write this Chapter.

Decentralization in Environmental Assessment

Decentralization in general connotes the transfer of power and authority from the centre to the local level for decision-making and implementation purposes. To paraphrase Cistulli (2002), decentralization is the process whereby authority and responsibilities are transferred from the central government agencies to local levels, i.e., local government units, communities and the private sector. In the context of environmental assessment in Ghana, decentralization loosely denotes the devolution of environmental permit decision-making and implementation to local units such as EPA Regional, Zonal and Area Offices. These decentralized Offices work in collaboration with the Metropolitan, Municipal, District and other local level stakeholders.

Even though environmental assessment is acclaimed to be a vehicle for proactive environmental protection (Biswas & Geping, 1987; EPA Ghana, 1996; Doberstein, 2003; Biswas & Agarwala, 2013), its concentration at the national levels, especially in unitary states makes it a less effective environmental planning and management strategy (Ofori, 1991; Ebisemiju, 1993; EPA Ghana, 2004). This makes a sound argument for decentralizing environmental assessment activities to the local levels (as discussed below).

Conditions that Precipitated Environmental Assessment Decentralization in Ghana

The proposal to decentralize environmental assessment in Ghana was initiated by management of EPA-Ghana in 2004. The decision to delegate EA functions to the Sectoral Departments (SDs) at the Head Office (Accra) and Regional, Zonal and Area Offices (i.e., the local levels) was precipitated by a plethora of factors. These

conditions included bureaucracy in processing applications for Environmental Permit decision-making, low capacity of staff, low public participation in EA activities, loss of application files and other relevant documents in addition to public complaints against the EPA (Appiah-Opoku, 2001; EPA, 2004). The effects of these conditions include delay in granting Environmental Permits (EPs), bribery and corruption, low awareness of EA processes and procedures and reduction in revenue to the Agency (EPA, 2004). The cumulative effect was the loss of confidence in the EIA system with some potential developers implementing their projects without recourse to EPA for environmental permits. It is clear from the foregoing submissions that the effects of concentrating EA activities at the national level is not only affecting investors adversely but also EPA and the government at large.

Since 2009, the concerns expressed above have been authenticated by both my undergraduate and graduate students during Environmental Impact Assessment, Monitoring and Auditing lectures and discussion sessions. In one instance, I invited the Regional Director of EPA-Upper West Region to give a lecture to my EIA students where the former had the opportunity to respond to some of the concerns indicated above.

To address the challenges enumerated above as well as improve compliance with EIA requirements, EPA took the initiative to decentralize EA implementation processes and activities to its Sectoral Departments (SDs) and Regional and Zonal Offices (R/ZOs). The SDs are the Built Environment Department for linear and built sector undertakings, Manufacturing Sector Department for manufacturing sector undertakings, Mining Department for extractive sector undertakings, and Natural Resource Department for renewable sector undertakings.

In spite of the core role of EA in environmental planning and management, all applications for Environmental Permits (EPs) from the then ten (10) Regional and three (3) Zonal Offices (Tarkwa, Tema and Amassaman) were sent to the Environmental Assessment and Auditing Department (EAAD) at the EPA headquarters, Accra, for processing and review. For instance, EPA (2004) revealed that EA,

which is an environmental planning and preventive tool accounted for 60% of all environmental protection activities in Ghana. It is, therefore, not surprising that the EPA Governing Board and Management, saw the need to decentralize EA operations to the then ten (10) Regional and three (3) Zonal Offices and the four (4) SDs.

The goal for rolling out the EA decentralization programme was to promote sustainable development in Ghana by taking proactive environmental planning and permit decision-making issues to the doorsteps of potential developers and the general public. The decentralization policy seeks to promote compliance with EA requirements throughout Ghana. The specific objectives of the policy aim at:

- reducing the EA application processing time
- improving service delivery to clients, and
- enhancing the image of EPA

The goal and the accompanying objectives mentioned above are to be achieved through a number of institutional arrangements and their respective functions. In the chronology of things, a discussion on the piloting of the EA programme preceded the institutional arrangement.

Piloting and Operationalization of EA Decentralization in Ghana

To ensure the sustainability of novel initiatives such as initiating agricultural insurance programmes in developing and transitional economies, Smith and Watts (2009) and Banerjee (2012) recommend the conduct of pilot studies. These authors employed the pilot study approach to determine the feasibility, scalability and sustainability of index-based insurance programmes for low-income countries. Reasoning along the same line, EPA-Ghana also put its novel EA decentralization programme to the pilot study test.

Piloting of EA decentralization was conducted in four out of the then ten administrative regions, namely, The Greater Accra, Ashanti, Western and Northern Regional EPA Offices. These pilot regions represented the Coastal, Forest/Middle Belt and Savannah Agro-ecological Zones (Covering all the Agro-ecological Zones in Ghana).

The piloting was done from 2004 to 2015, and was up-scaled in 2016 to cover the then remaining six regions.

The original plan as stated in the proposal document was to pilot the EA decentralization initiative for nine months, and to evaluate it to determine the feasibility for up-scaling to the remaining six (6) regions. However, it was not until 2016 when the EA decentralization was extended to the remaining six (6) regions, which are Brong Ahafo, Volta, Eastern, Central, Upper East and West Regions. According to an informant, there was also no formal evaluation of the programme, thus, losing the opportunity to document important lessons and best practices. This notwithstanding, most key informants said the pilot scheme chalked a number of successes, which informed the decision to up-scale the programme to the other six (6) regions.

The Regional and Zonal Offices since 2016 have been receiving and reviewing a variety of EA applications. These applications are captured by LI 1652 (1999) under a wide category of undertakings, including agricultural, health, hospitality, construction, mining, forestry/logging and recreational activities. Other small to medium-scale impact assessment applications being reviewed by Regional and Zonal TRCs are: fishing, pesticides, water resources development, utilities and light industrial undertakings. To simplify the category of decentralized projects, the Acting Director of EPA through a letter dated 17 March, 2017 detailed the devolved undertakings as shown in Table 6.1 (see p.114).

Institutional Arrangements and Functions Associated with EA Decentralization in Ghana

Establishment of institutional structures are necessary for the execution of any project or programme. In recognition of this fact, management of EPA instituted three EA decentralization implementation structures, including Environmental Assessment and Auditing Department (EAAD), SDs and the Regional and Zonal Offices (R/Zos), discussed in detail in the next section.

Table 6.1: List of Decentralized Projects

Category of Projects	**Remarks**
Maternity Home, Clinics with OPD, Clinical laboratory Services and up to ten (10) beds	These projects are exclusive of X-Rays MRI, chemicals with radioactive properties and Pharmacies
Offices and Shops	
Warehouses	Excludes those for storing chemicals and hazardous materials
Restaurants, Lodges, Hostels, Motels, Guest Houses and Hotels	Up to 39 rooms
Water supply projects (e.g. boreholes, Corporate and Business Registration Department (CBRD) projects, etc.	
Scrap dealers, scrap yards and used oil	Must be located in a light industrial area
Small-scale Mining Activities	Up 25 acres
Sachet Water Production	
Churches and Mosques	
Educational Institutions	It excludes multi-purpose schools with boarding facilities, play grounds, etc.
Washing Bay	Must be located with a well-drained area with proper drainage facilities
Car Parks	
Play Grounds	There should be adequate buffer of about 50 metres between the playground and residential facilities
Plantation Development of: Less than 40 ha 40-100 ha	Micro Minor
Aquaculture	
Chemical and Pesticides Licensing: Retailing Commercial Applicators Warehouses Scrap and Waste Oil	All small and medium-scale applications All small and medium-scale applications All small and medium-scale applications All applications
Communication Masts	
All Renewals for the above Projects	

Environmental Assessment and Auditing Department

The Environmental Assessment and Auditing Department (EAAD) is the coordinating body for EA in Ghana. Before the EA decentralization, the EAAD was the main department responsible for conducting EA in Ghana with a little support from a few Head Office Departments and Regional/Zonal Offices. Under the current EA decentralization arrangement, some of its functions have been ceded to SDs and EPA Regional/Zonal Offices. This notwithstanding, the EAAD still maintains some of its traditional functions it claims necessary for the success of the EA decentralization initiative. These functions involve coordination of EA applications at the national level, taking prompt actions to ensure that stipulated time schedules are met, provision of training/capacity development and giving orientation to SDs, Regional/Zonal and other collaborating staff, facilitating institutional collaboration and co-operation in EA among relevant staff of MMDAs and MDAs, and storing EA reports and relevant documents for easy retrieval. Other functions include preparing abstracts for publication, having quality assurance role over all EA review work (Environmental Permit schedules and conditions) and EA monitoring, research and investigations. Under the new EA decentralization regime, the Regional/Zonal Offices are required to submit all schedule 2 and 5 undertakings to the EAAD for processing and review even though it may obtain inputs and support from the R/ZOs and SDs. Schedule 2 and 5 undertakings are high-impact projects that require full-scale environmental impact assessment.

The supervising and coordinating role of the EAAD at the national level in Ghana and elsewhere has been interpreted differently in the literature. For instance, Bedner (2009) in his research into the consequences of EIA decentralization in Indonesia found both positive and negative effects associated with devolution of EA function to the regional and zonal level. To him, EIA decentralization brings EA activities to the local level, thus, increasing awareness, participation, transparency, accountability and compliance with EA requirements and water pollution regulations.

This author also recommended the need for Environmental Impact Assessment Authorities at the National headquarters to supervise review of EA applications at the local government and community levels for purposes of quality assurance and weak capacity at the local level. Even though this intervention by national level authorities is necessary, undue interference could also lead to centralization of the decentralized activities and function, thus, stifling initiatives and frustrating local level EA efforts.

Sectoral Departments

The Sectoral Departments are responsible for the various environmental components (air, water, soil and land) development projects may impact them positively or negatively. Under the EA decentralization policy, the SDs are expected to provide the relevant information and updates to inform review of EA applications and EP decision-making. The SDs are also required to provide expertise in their respective sectors, offer training and capacity building as well as support Regional/Zonal staff and other collaborators in addition to identification of gaps and inconsistencies in the EA process. It is fair to state here that the concentration of power and authority at the EAAD and SDs levels in the past and even now does not inure to the effective functioning of the EA decentralization programme since the local levels are not given the free hand to recruit personnel with the requisite expertise to implement the policy.

Regional and Zonal Offices

EPA management decided to decentralize EA administration to the Regional and Zonal EPA Offices because these offices are in close proximity to the potential developers. Before the EA devolution, the EPA R/ZOs were used as conduits for submitting inputs and completed applications to the EPA headquarters in Accra and distribution of permits to local level proponents. The volume of applications from all over the country was beyond the capacity of the Head Office alone, leading to bureaucracy, delays, frustration

of potential developers and ultimately reduced compliance (EPA, 2004). To ensure speedy processing and review of EA applications, the EPA Governing Council and Management took the decision to regionalize EA activities.

Under the decentralized EA regime, Regional and Zonal Offices are tasked to receive all EA applications and the associated documents in the areas they have jurisdiction for processing and review of EA applications. In addition, these local offices also conduct registration of both proposed and existing undertakings, site visitations, screening inspections, public hearings and review of low-impact applications and reports (e.g., PER, Scoping Reports and Annual Environmental Reports). They also collaborate with other technical departments of MMDAs and MDAs to conduct EA, advise proponents on all aspects of EA applications, forward documents on high-impact projects to SDs and EAAD at the national headquarters as well as store all documents on undertakings at the Regional and Zonal levels.

The Regional and Zonal Offices are the lead entities for EA activities in their respective jurisdictions and are responsible for all schedule 1 development projects, i.e., undertakings that require only registration or have low environmental and socio-economic impacts. The decentralized units are also expected to consult the relevant SDs and or EAAD for the preliminary roles they play with respect to schedules 2 and 5 undertakings (i.e., high-impact undertakings) and any major decision that may have legal and financial implications for EPA.

The schedules 2 and 5 projects which require the full EIA journey falls under the purview of EAAD and the SDs per the EA decentralization policy. The Regional and Zonal Offices where these high-impact projects are located do preliminary field visitations, neighbourhood consultations and environmental assessments before handing undertakings over to the national level offices. Even then, it was revealed by some EPA staff that sending all schedules 2 and 5 undertakings to the National level amounts to concentration of EIA functions in the hands of the EAAD and SDs, thus, making the so-called decentralization inefficient.

Technical Review Committees

The EA decentralization programme created a three-layered Technical Review Committee system (TRCs) with each at the National, Regional and Zonal levels. These committees have been tasked to review EA applications for EPs at the different levels. These committees, whether at the National, Regional or Zonal level have membership from the relevant and specialized MMDAs and MDAs. They can also co-opt other specialists whose expertise and services are needed, depending on the type of sectoral undertaking.

The National TRC reviews EA applications relating to projects with large-scale impacts with national and international ramifications, e.g. large-scale irrigation dams, big manufacturing companies and large-scale mining companies. These may stem from a first level screening decision recommending full-scale EIA study or a Preliminary Environmental Assessment (PEA) with large-scale impacts, thus, requiring full-scale EIA analysis. According to the Environmental Assessment Regulations, LI 1652 (1999), such projects fall under schedules 2 and 5 undertakings and are required to go through the entire length and breadth of the EIA process. The National TRC also reviews Strategic Environmental Assessment Reports and Environmental Management Plans. These large-scale impact projects have huge financial burden and legal implications, and therefore, require the eyes and ears of the National TRC during the EA process.

The Regional TRCs are responsible for reviewing EA applications with small to medium-scale impacts. These projects are listed under schedule 1 undertakings per LI 1652 of 1999. Even though the Regional and Zonal level TRCs have the lead EA review role over these projects, the National TRC with the support of the SDs and EAAD, performs quality assurance role over the lower level review processes and recommendations. The Regional and Zonal TRCs also provide support and inputs from their areas of jurisdiction to the National TRCs during the review of schedule 2 and 5 undertakings and environmental management plans (EMPs).

Benefits of EA Decentralization

Although no formal evaluation of the EA decentralization programme has been conducted, my observations as a former EPA staff, review of relevant documents and interactions with some EPA staff, collaborators and developers (key informants) revealed that the programme recorded moderate successes, with some failures. It was, for instance, reported that the EA decentralization programme enhanced the capacities of EPA staff at the Regional and Zonal Offices in addition to some TRC members from the relevant MMDAs and MDAs. This is because the Decentralization policy came with a series of training programmes for Regional/Zonal staff and other RTRC members. A Regional Director of one of the EPA Offices said: "I attended a number of training programmes on various aspects of environmental assessment with my other three staff at the Institute of Environmental Studies [i.e., the EPA Training School at Amassaman] and more will be coming." Ghana's EA decentralization is not the only initiative reporting capacity development benefits to staff of local environmental protection agencies and their collaborators. Kirchhoff's (2006) research on capacity development for EIA revealed that the devolved EA system in the continent-size Brazil expanded capacity development to staff of the environmental management departments in the various Provinces.

Some scholars, policy-makers and EIA practitioners have argued that the main reason for decentralizing EA activities to the local level is to ensure that permit decision-making takes place at or close to the point of projects impacts as well as promote participation in the EA process by the local stakeholders. For instance, Ruffeis *et al.* (2010) found that the EIA decentralization exercise in Ethiopia encouraged public participation in the programme. Also, Doberstein (2004) reported that decentralized EA made use of local knowledge in Vietnam, which Johannes (1993) Stevenson (1996), and Appiah-Opoku (2001) claim is important in ensuring effective EIA implementation, especially in developing countries. This study also came out with similar findings. It was, for instance, revealed that the decentralization programme brought environmental

impact assessment to the doorsteps of many stakeholders, especially developers requiring environmental authorization before commencement of operations. Prior to the devolution of EA to the Regional and Zonal Offices, proponents from the ten regions used to travel several times to the EPA Headquarters in Accra to follow-up on their applications for EPs, endangering their lives and resulting in bribery and corruption, which an informant labelled as "adding weight to their applications." The EA decentralization programme reduced these negative practices and enhanced service delivery. Other achievements of the programme include increasing awareness of the requirements and benefits of EA, improved compliance with EA requirements, reduction in EA application processing time, and more importantly, local people incorporating their indigenous knowledge into the EA process.

Other benefits of EA decentralization include mainstreaming environmental issues into physical and development plans at the local levels. According to Ahwoi (1989) and Aryee (1994), Ghana's decentralization policy and local government Act (Act 625, 2006) empower MMDAs and Regional Coordination Councils to formulate their own planning schemes, both physical and development plans to propel their socio-economic developments. To ensure that the anticipated development is sustainable, the environment should not be ignored (Biswas and Agarwala, 1992). The EA decentralization programme, therefore, offers an opportunity to reconcile socio-economic development with environmental protection at the local level. To ensure sound and sustainable development, Wathern (1988) in his textbook, entitled "Environmental Impact Assessment: Theory and Practice" recommends that local government units should integrate environment concerns into the plan-making process so that the environmental protection measures can be implemented simultaneously with the execution of the plans. He further reported on how some local government units are conducting strategic environmental assessment on their development plans.

Some EPA staff and their collaborators also reported that the EA decentralization programme is making it possible for them to mainstream environmental issues into their Medium-Term

Development Plans (MTDPs) based on the National Development Planning Commission (NDPC) guidelines. The NDPC guidelines in particular, require all decentralized departments and agencies to make presentations to the District Planning Coordinating Unit (DPCU) to be incorporated into the development plans. Some staff of the Regional, Zonal and Area EPA Offices also claimed they facilitated the conduct of strategic environmental assessments on the MTDPs of some MMDAs informed by a handbook for District Development Plans Sustainability Appraisals. This makes it possible for conflicting policies to be identified and streamlined. For instance, I was also involved in the SEA of the 2002-2004 MTDP of the then Wa District Assembly (now a Municipality). Here, the SEA team and other members of the DPCU were able to identify conflicting policies. In particular, there was a policy in the plan promoting the construction of irrigation dams. This, it was feared, would breed mosquitoes. This agricultural policy contradicted a health policy also aimed at promoting improved human health. Without the SEA facilitated by EPA and NDPC staff at the Regional, Zonal and Area Office levels, these conflicting agricultural and health policies would have gone unnoticed even with EA of the individual projects. Since EPA staff at the local level are already aware of the individual projects in the plan that require EA, they can simply follow-up to ensure that the plan implementers adhere to the EA regulatory requirements.

Challenges of EA Decentralization

In spite of the benefits derived from the EA decentralization programme, it is important to note that the policy did not achieve 100% success but certainly performed better than the pre-EA decentralization period.

The first challenge of the EA decentralization programme is the fact that no formal evaluation was conducted before upscaling it even though the proposal recommended it. The essence of every pilot scheme is to offer opportunity to project implementers to identify what works and what does not work so that the rough edges can be smoothened during the upscaling phase. For instance, Smith and

Watts (2009) caution that project evaluation is necessary in order to identify best practices and lessons which can be incorporated into the re-design of the project before upscaling and expansion. Banerjee (2012) also recommended the conduct of evaluation on pilot schemes so as to reduce or avoid post-project implementation mortalities. In spite of these pieces of advice in the literature, Management of EPA did not formally evaluate the piloting of the EA decentralization policy, thus, lost the opportunity to learn from the programme's pilot phase.

The second problem emanating from the EA decentralization programme is what I term 'centralized decentralization.' By this, I mean the unwillingness of the EPA head office or the EAAD to genuinely devolve EA implementation issues in the true sense of the word to EPA Regional and Zonal Offices. Under the EA decentralization programme, for instance, the Regional and Zonal Offices are still expected to send all applications requiring full-scale environmental impact assessment to the EAAD for processing with the local offices playing supportive or peripheral roles. Under the current arrangement, all approved EA applications by the local offices are also sent to the EPA National headquarters for quality assurance purposes. While it is a good idea for the EAAD and the SDs to play the quality assurance and supervisory roles over the work of the Regional and Zonal Offices, holding on to a lot of power and authority at the centre can also stifle initiative at the local level. This may be interpreted as giving something with the right hand and clandestinely taking it back with the left hand. This concern is not peculiar to only Ghana's EA decentralization programme but is also reported in other developing countries practising EA decentralization. For instance, Bedner (2009) indicated that EIA decentralization in Indonesia has not led to any meaningful change. To him, the Central and Provincial Environmental Protection Authorities were implementing EIA at the centre due to capacity deficiencies at the local levels.

The third challenge confronting the effective implementation of most EA decentralization programmes in developing countries, including Ghana is weak capacity to evaluate environmental impact statements and management plans. Even though Ghana's proposal

to decentralize EA acknowledged this fact and rolled out a number of orientation and training programmes to address this challenge, it could not completely address the capacity needs of EPA Regional and Zonal offices. This is because environmental problems are complex and ever-evolving, and therefore, requires continuous training. The EPA Regional and Zonal Offices are not getting the full complement of the required training they require to execute the EA decentralization programme effectively and efficiently. It is, however, surprising that EPA has a state-of-the-art Training School, i.e., the Institute of Environmental Studies at Amassaman that trains EA practitioners and other environmentalists from neighbouring and other African countries, and yet, EPA staff at the R/ZO levels still have capacity deficiencies. This makes one wonder whether this is deliberate in order for the EAAD and the SDs to hold on to the review of environmental impact statements (EIS) and environmental management plans (EMPs). This challenge can be seen in other developing countries, including India and Brazil, as pointed out earlier.

Fourthly, the EA decentralization programme dwells heavily on multiple stakeholder and inter-sectoral approaches to addressing environmental challenges just like the original centralized EIA system based at the EPA headquarters. This is because effective EA review requires multiple stakeholder involvement and perspectives to be able to identify the diverse adverse impacts with the associated mitigation measures. While seeing multi-stakeholder participation in the EA process in this regard as a positive thing, it also has the other side of the coin. For instance, the involvement of many stakeholders in the EA process can create unnecessary bureaucracy and delays. This is because the multiple stakeholders usually come to the TRC meetings with their different views, policies, regulations, leading to debates, arguments, multiple visits to project sites and postponement of review sessions. This has the tendency to delay the EA decision-making process — a situation Sumani (2018) described as rolling out a solution that creates further problems. This is what Bedner (2009) also refers to as increasing vertical disputes among EA stakeholders when participants in the EIA process from the District

and Provincial levels are involved in EP decision-making processes. According to this author, the increased number of stakeholders at different governmental levels involved in environmental assessment activities in Indonesia bred disputes and conflicts as a result of their different views, roles, statuses and interests.

Fifthly, inadequate financial resources to fund the various decentralized activities associated with the conduct and review of the EA applications at the local level was reported as one of the key challenges confronting effective EA decentralization. EA involves a number of activities, including screening inspections, site visits, servicing of TRC meetings and organization of public hearing. All these activities require financial resources to carry out. Under the current EA decentralization programme, Regional and Zonal Offices are expected to use a portion of their Operational Fund (Imprest) to finance the decentralized EA activities. Instead of retaining and using a percentage of the processing and permit fees to fund EA activities as previously agreed upon, these local units are rather expected to pay these fees to EPA/Accra and the latter will in turn release the quarterly Operational Fund to the Regional and Zonal Offices. However, the operational fund can be in arrears for several quarters, some key informants revealed, thus, crippling EA decentralization activities. Some key informants also indicated that the EPA Board and Management have been reducing the operational fund over the years on the grounds that some EPA R/Z Offices have not been meeting their financial generation targets. I term this demand on EPA R/Z Offices to meet their financial targets as "commercialization of environmental protection services." Even though EPA now pays its staff, it needs to look for smart and innovative ways e.g. writing proposals for funding support, increasing some fees and making convincing arguments to use funds from the National Environment Fund (NEF) to fund EA activities rather than turning the environment into commodities for sale. This has the tendency to substitute environmental protection for money generation, which may defeat the mandate and objectives for establishing EPA in general and the EA decentralization programme in particular.

Regarding how EPA R/Z Offices fund their decentralized EA

activities, a key informant had this to say, "in most cases, these monies [the Operational Fund] never came and we either have to postpone the EA activities or look for money from elsewhere to carry out these activities." The inability to fund EA activities at the local level is common to most developing countries which are implementing EA decentralization initiatives. Kirchhoff (2006) reports that EIA decentralization in Brazil does not produce equal results as less endowed States (Regions) lack the human and financial resources to carry out EA activities promptly. In this case, more endowed States are able to mobilize adequate financial resources to service their EA activities while the contrary applies to poorer States. The picture painted about Brazil in the literature is not different from what has been observed in Ghana. For instance, EPA Regional Offices in Greater Accra, Ashanti, Western and Eastern Regions and the Zonal Office at Tema and Tarkwa are able to collect adequate processing and permit fees to fund their EA activities. This is because there is high density of activities requiring EA unlike the rest of the country where these activities are few. This implies that the quantum of the operational fund these well-endowed areas usually get is more than what the less endowed areas get because the amount of imprest to be allocated is a function of processing and permit fees collected and transferred to EPA national headquarters.

Conclusions and Recommendations

In conclusion, EPA-Ghana has incorporated EA into its basket of environmental planning and management strategies aimed at promoting sound and sustainable development. In spite of the role of EA in promoting sustainable development, its centralization at the national level limited the realization of its full potential throughout Ghana. The centralization of EA activities at the national level resulted in bureaucracy, delays and corruption, thus, denting the image of EPA and starving it of revenue. To address these challenges and maximize the environmental and socio-economic benefits emanating from environmental planning and management, a decision to decentralize EA administration and implementation activities to the Regional and Zonal levels was a step in the right direction. This

is because the decentralized EA programme contributed towards addressing or reducing some of the negative effects associated with EA centralization enumerated above.

EIA decentralization has reversed most of the challenges created by concentration of EA activities at the national level. The data, for instance, revealed that EA decentralization did not only bring EA activities to the doorsteps of proponents and enhance the capacities of local stakeholders but also reduced the processing periods of EA applications for EPs. This leaves the EAAD and the respective SDs to concentrate on their quality assurance and supervisory roles and other non-EA activities and functions. Processing and reviewing EA applications at the various Regional and Zonal Offices reduce the processing time and pressure at the centre. This also has the effect of reducing bureaucracy, delays and bribery and corruption, thus, improving the efficiency and effectiveness of EA and enhancing the image of EPA. Cumulatively, this has the ultimate effect of enhancing the environmental sustainability and promotion of sustainable development.

This research also concludes that the EA decentralization programme did not achieve 100% success rate as envisaged in the proposal document. This is because some unintended challenges militated against the effective and efficient implementation of the programme. Some of these challenges include inadequate financial resources to fund some EA decentralized activities, weak capacities of Regional and Zonal staff, centralized decentralization, i.e. unwillingness of the EAAD and SDs to allow Regional and Zonal Offices the free hand to operate in the name of ensuring quality assurance and supervising their activities. These conditions have the effect of stifling local initiatives and dampening the morale and spirit of staff at the Regional and Zonal levels. To address these challenges, the author recommends a re-design of the EA programme to incorporate the following measures:

- Proper devolution of EA functions and authority from the EPA national level to the Regional and Zonal Offices to avoid the situation of centralized decentralization.
- Periodic evaluation of the programme by the National,

Regional, Zonal Offices and the Ministry of Monitoring and Evaluation or some such body so that lessons and best practices can be documented, shared and incorporated into the re-designs of the programme, going forward.

- Continuous training of staff at the decentralized levels by EAAD and the relevant SDs since environmental challenges are complex and ever-evolving.
- Instituting adequate financial mobilization strategies to fund EA decentralization activities, i.e., timely release of the Operational Fund and retention of a portion of processing and permit fees collected at the Regional and Zonal levels before transferring the rest to EPA National Headquarters, Accra. EPA Management and the Regional and Zonal Offices can agree on the percentage to be retained. Special considerations should be given to less endowed Regions and Zonal Offices which cannot mobilize adequate financial resources to fund their EA activities at the local levels.

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CHAPTER SEVEN

Towards Understanding Co-Management of Small-Town Water Systems in Ghana

SAMUEL TWUMASI AMOAH
ENOCH AKWASI KOSOE

ABSTRACT

In this chapter we consider what 'co-management' as a concept might offer us in theorization of the management of small-town water systems. Although co-management is gaining currency in natural resource management and beyond, there has been little effort that pays attention to how co-management of small-town water systems might be conceptualized and what its nuanced specificity might be. In presenting a conceptualization of co-management as a framework, we bring the concept into conversation with particular debates around small-town water systems and argue, first, that co-management provides a useful basis for thinking of the management of small-town water systems as a practice; second, that it is particularly useful for considering the management of small-town water systems as processual and relational. We argue that there is a productive debate and considerations to be given by bringing the co-management concept and small-town water systems into dialogue. We examine the prospects and challenges of co-managing small-town water systems.

Keywords: Co-management, small-town, water systems, potable water, Ghana

Introduction

The provision of potable water remains a topical development issue for all governments across the globe. To this end, providing safe and affordable drinking water to all is reinforced by the Sustainable Development Goal 6. To do so in Ghana, the small-towns water

supply system emerged in 1994 under the community water system (CWS), which is a decentralized water supply delivery system under community ownership and management. A small-town water system is defined as piped system serving a community with inhabitants between 2,000 and 50,000 that is willing to own and manage its water supply system (CWSA, 2003). While the focus of small-town water systems is well mapped, the significant challenge remains particularly in terms of the appropriate management approach to ensure that safe and potable water is provided in a sustainable manner.

Consequently, the co-management framework intended to facilitate sustainable natural resource management such as small-town water systems has gained prominence as a critical trajectory to achieve such an objective (Diver, 2016). As an important prerequisite for this framework, Fox (2007) argues that it enables multiplicity of social actors to negotiate, define and guarantee among themselves equitable share of the management functions, entitlements and responsibility for a given territory, area or set of natural resources (in this case, small-town water systems).

This chapter brings the co-management concept into conversation with particular debates around small-town water systems. By doing so, we seek to enhance an understanding of the fact that co-management provides a useful basis for thinking of the management of small-town water systems as a practice that is processual and relational.

The rest of the chapter is organized as follows: after the introductory section we provide an overview on the evolution and debates on co-management as a framework. The subsequent section contextualizes the paradigm shift from centralized leviathan management to co-management approach with respect to natural resource management. The historical perspective of small-town water management in Ghana is discussed in the following section. In the next section, we tease out some prospects and challenges associated with the use of co-management framework for small-town water systems. The final section provides some concluding thoughts and recommendations.

Understanding the Co-management Concept

Co-management as a framework has gained prominence and emerged as a new groundswell of decentralized natural resource management since the 1990s, particularly in many Global South countries (Kimengsi, Bhusal, Aryal, Fernandez, Owusu, Chaudhary, & Nielsen, 2019). Co-management is defined as a negotiation process which encompasses multiplicity of stakeholders who define and guarantee equitable sharing of the decision-making arrangements, planning and management functions, rights, obligations, and benefits that will be accrued in the management of natural resources (Plummer, Baird, Dzyundzyak, Armitage, Bodin, & Schultz, 2017). It has been considered as a process of power sharing, institution building, trust building, social learning, problem solving, and governance with each posing specific challenges to be addressed and alternatives to be balanced by the actors engaged (Berkes 2007). The framework has a growing influence across natural resource management discourse because policy-makers, researchers and analysts appreciate it as one of the participatory natural resource management models that is strongly connected to the notion of governance (Carlsson & Berkes, 2005).

Co-management is hinged on a partial devolution of power to local communities, which usually occurs in response to pressure from international institutions challenging the status quo which was marked by centralization (Ballet & Komena 2009). The devolution could take the form of informal, quasi-formal, or formal arrangements (Plummer *et al.,* 2017; Haller, Acciaioli, & Rist 2016). Notwithstanding the prevailing resource status, actors involved in co-management processes usually seek to promote their agenda and interests (Guerbois, Dufour, Mtare & Fritz, 2013; Fischer, Wakjira, Weldesemaet & Ashenafi, 2014). Generally, the co-management framework replaces the centralized, top-down hierarchical management command and control models of resource management, which tends to relinquish responsibility of management away from those whose interest is to exploit the resource (Richerson, Boyd & Paciotti, 2002). It mirrors the relationship and formal agreement

between the state and community level actors (Ballet *et al.* 2009; Carlsson & Berkes 2005) who are largely motivated at different levels to participate in this process. Insights arising from this definition aim to fuse together two opposing objectives — human development and natural resource conservation to achieve a mutually beneficial relationship and outcome in which both objectives are achieved as championed by their respective stakeholders (see Ballet *et al.,* 2009; Kimengsi *et al.,* 2019). This entails a qualitative shift in the role of the state, which is far from withdrawing and assuming less relevance; rather the state remains an important and key actor in the co-management process (Ratner & Allison, 2012). Applying participatory approaches such as co-management in natural resource management has therefore been acknowledged by development practitioners as an effective pathway for managing existing conflicts at the same time minimizing the tendency for future conflicts to occur (FAO 2014) when it comes to resource management such as small-town water systems.

Co-management, considered as a governance system entails relational networks among heterogeneous sets of actors. This stance challenges the presumption of formal and often dualistic power sharing agreements and directs attention to the process of problem-solving (Carlsson & Berkes, 2005). For better understanding and practice of co-management framework to improve the governance context for natural resources, in this case, small-town water systems, there are various crosscutting concepts and approaches, which include the following: Social Communication approach, Adaptive Management approach, Pluralism approach, Governance approach, Social Communication approach and Conflict Management approach (Jaireth, 2007; Opoku Mensah & Amoah, 2013).

From the foregoing, adaptive management considers management of natural resource as experimental from which knowledge is incrementally gained through the feedback mechanism of social learning that we can learn from implemented activities and that Natural Resource Management (NRM) can be improved on the basis of what has been learnt. Pluralism approach involves the situation whereby autonomous and independent (or inter-

dependent) groups freely interact and collaborate on Natural Resource Management related issues on the basis of different views, interests and entitlements. The mobilization of the capacities and energies of people to enhance their knowledge and skills by involving them in NRM is the focus of Social Communication approach. The Conflict Management approach emphasizes the promotion of dialogue and negotiation in a non-violent process towards constructive rather than destructive results towards co-management of NRM. Putting these together, the analysis in this chapter draws from the above concepts to highlight the benefits, prospects and challenges when a small-town water system is co-managed. It is worth noting that there is a stark distinction between community management and co-management. Although community management and co-management are concepts that are used interchangeably, the former involves a situation whereby natural resources are solely managed by local communities; the latter brings together several state and non-state players (state, local authorities, non-governmental organizations, local communities, etc.), making the communities just one of the key players in the process (Ballet *et al.,* 2009). The paradigm shift from a centralized natural resource management approach to co-management framework is developed in the next section.

From Centralized Leviathan Management to Co-management Approach

Prior approaches to natural resource management were driven by state agencies forcing down their conservation agenda on local people (Jagger, Sellers, Kittner, Das & Bush, 2018). However, in the past four decades there has been growing interest in community-based natural resource management sometimes termed co-management involving varied forms of implementation along a range of more community control (Pomeroy & Williams, 1994; Pomeroy & Berkes, 1997; Allison & Ellis, 2001; Nielsen, Degnbol, Viswanathan & Ahmed, 2003; Berkes, 2009). As much as the diverse roles played by different stakeholders in co-management are crucial for success, grasping the interactions between formal and informal institutions is crucial

(Etiegni, Irvine & Kooy, 2017). Community-based management approaches fit well within an overall development milieu that supports good governance, decentralization and poverty reduction processes (Sokhem & Sunada, 2006). However, earlier scholarship focused on the community part of the co-management framework with relatively little attention paid to the critical role and activities of government (Pomeroy & Berkes, 1997) hence the emphasis on the co-management concept when it comes to small-town water systems. It has been argued that the centralized approach or state-driven management approach failed in several contexts to address and meet the objectives of preserving natural resources and the related social complexities (Chhotary & Stoker, 2009), resulting in negative repercussions on the socio-ecological dynamics of conservation sites (Mishra, 1982; Haller *et al.,* 2016). Critical in this discourse is the role of community participation.

Bringing co-management which entails participation into conservation with natural resource management is not a new phenomenon (Arnstein, 1969; Evans, Flores, Larson, Marchena, Müller, & Pikitle, 2017). Considering it as a catalyst of social change, it also challenges state control with respect to the management of natural resources (Ballet *et al.,* 2009; Fals Borda & Rahman, 1991). A growing body of literature has theorized that the motivation behind participation in natural resource management is that people are motivated by their embedded socio-cultural, economic, and political benefits (Coulibaly-Lingani, Savadogo, Tigabu, & Oden, 2011; Ranjit, 2014). The six levels of participatory behaviour [Nominal participation, Passive participation, Consultative participation, Activity-specific participation, Active participation and Interactive participation] presented by Agrawal is a useful tool to appreciate different forms of participation (Agrawal, 2001). But it is equally important to indicate that several factors that go beyond perceived benefits can shape people's decision to participate.

Co-management is viewed as the most promising and widely used approach in development practice. It is believed that active community participation leads to more empowerment of the target groups, transparency and sustainability of development projects

such as small-town water systems (Eguavoen & Youkhana, 2008; Marston, Hinton, Kea, Baral, Ahuja & Costello, 2016; Haldane, Chuah, Srivastava, Singh, Koh, Seng & Legido-Quigley, 2019). There is evidence of community participation effectiveness in achieving positive outcomes at the organizational, community and individual level (Haldane *et al.,* 2019). This approach has long been declared as a model for managing small-town and rural water supply and has been equally applied in the management of water systems in many developing countries to deal with the deficient water supply and sanitary situation (Schouten & Moriarty, 2003; Lockwood, 2004; Harvey & Reed, 2006; Eguavoen & Youkhana, 2008; Lockwood & Smits, 2011; Miakatra, 2014; Hutchings, Franceys, Smits & Mekala, 2017; Machado, dos Santos, Alves & Quindeler, 2019). Nyarko (2007) is of the view that the widespread implementation of community management or co-management of water supply system is due to:

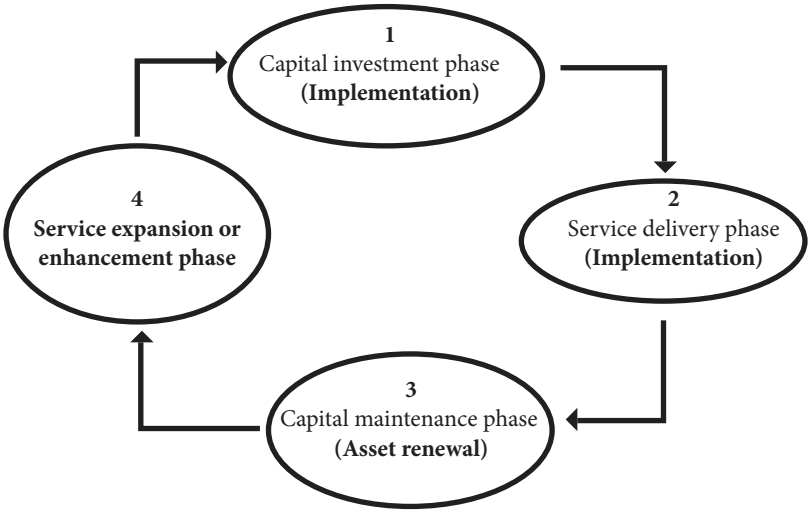
- The supply-driven approach in small-town and rural water supply delivery led to management inefficiencies because of limited government capacity and commitment. Consequently, sustainability levels were low and the community management appealed to many governments as it relieved them of their responsibility for operation and maintenance.
- Community management has become a convenient model for shifting responsibility for on-going operation and maintenance from facility provider to end user. It is therefore most suitable to the project approaches adopted by NGOs and bilateral organizations.

Furthermore, community management of water supply is recognized to be critical for its implementation and success. It has played an important role in the expansion of water services in small-towns and rural areas (Hutchings *et al.,* 2017). Also, it has proven to be an alternative strategy in view of the increasing evidence that systems are more sustainable when designed, established and operated by the community (Machado *et al.,* 2019). According to McCoomon *et al.,* (1990), community management has been proposed as one possible alternative strategy in view of the increasing evidence that systems

are more sustainable when designed, established, and operated by the community. However, Hutchings *et al.* (2017) are of the view that the initial results of community participation in implementation of water systems do not yield immediate positive results because communities were not fully participating in key decisions let alone take full control of the water systems.

Relatedly, community management as an approach has been defined as one in which communities should be involved in the development of water supply systems, take ownership of them and have overall responsibility for their on-going operation and maintenance (Harvey & Reed, 2006; Moriarty, Smits, Butterworth & Franceys, 2013). The co-management of water service delivery can be characterized in four phases (see Fig. 7.1) (Hutchings *et al.,* 2017):

- Phase one is the capital investment or implementation phase in which the physical systems are built i.e. the development of the initial or new construction of the physical system.



Sources: Based on Lockwood and Smits (2011); Hutchings *et al.* (2017)

Fig. 7.1: Phases in the service delivery process

- Phase two is the recurrent cost-support service delivery, in which consumers receive the desired water supply, enabled by appropriate operation and minor maintenance which in turn has to be supported by a suitable level of administration.
- Phase three is described as the capital maintenance phase, where major replacements and renewal of physical assets take place. This phase is often not very discretely defined, as such activities are steps towards the physical assets reaching the end of their working lives.
- Phase four, the process continues when the need for a significant upgrade of the services is required to expand or enhance the service i.e. delivering additional boreholes as a village expands geographically or the numbers of consumers develop through population growth.

Historical Perspective of Small-Town Water Management in Ghana

Access to water is an essential community need and can only be achieved at the local level. This makes water a valuable entry point for stimulating a community's capability to organize and manage its own development priorities (Evans & Appleton, 1993). Ghana's drinking water sector over the years has gone through reforms (Braimah & Kheni, 2013). The reforms have seen changes in the institutional arrangements, aimed at improving water services and the provisioning of drinking water in Ghana (Nyarko, 2007; Braimah, 2010; Braimah & Kheni, 2013). Drinking water reforms started in 1928 in the then Gold Coast when the Hydraulic Division of the Public Works Department (PWD) was established as the first water supply system in Ghana (Nyarko, 2007; Braimah, 2010). The Hydraulic Division of the Public Works Department (PWD) was responsible for the urban water supplies in Ghana (Braimah & Kheni, 2013). After 20 years of operation of the Hydraulic Division, the Rural Water Department of PWD was established for the supply of drinking water to rural areas. However, in 1958, the Hydraulic Division and the Rural Water Department were merged to form the Water Supply Division of the PWD (Nyarko, 2007). Subsequently in

1965, the Water Supply Division of the PWD was transformed into the Ghana Water and Sewerage Corporation (GWSC) by Act 310, 1965 (Nyarko, 2007; Braimah, 2010).

With the coming into force of GWSC Act 1965 (Act 310) GWSC managed Ghana's urban and rural water supplies until 1994 when yet another reform was implemented (Braimah & Kheni, 2013). The 1994 drinking water reforms in Ghana saw the decoupling of small-town and rural water supply from urban water supply. The purpose was to ensure sustainability in the drinking water sector by allowing small-towns through community ownership and management (COM) arrangements to manage their water supply. This stems from the fact that government operated and managed community water supply systems were unsuccessful and proved to be unsustainable (World Bank, 1993). Also, the centralized supply driven approach of water project proved unsuccessful and unsustainable because of technical and financial issues, lack of human capacities and technical means, complex cultural, socio-economic and political realities of communities and the fact that most decisions are taken outside formal organization (Eguavoen & Youkhana, 2008).

Furthermore, the supply driven approach to community water supply led to poor access to water services and maintenance of the water facilities and lack of continued flow of government resources. In addition, the increasing cost of operation on the government budgets brought about the realization that water supply systems cannot be managed effectively and efficiently without community participation (Evans & Appleton, 1993). This led to the separation of rural and small-town water supply from the urban water supply. The separation of rural and small-town water supply from urban water supply, sought to focus GWSC on the larger urban systems "where utility-based operations are financially viable," and enable rural communities and small-towns to benefit from managing their own water supply systems (World Bank, 1994). This assertion cannot wholly be the case because communities managed their small-town water systems prior to the establishment of Water Supply Division of the PWD in 1958 which was cancelled in favour of GWSC management (MWRWH, 2006; Braimah & Kheni, 2013).

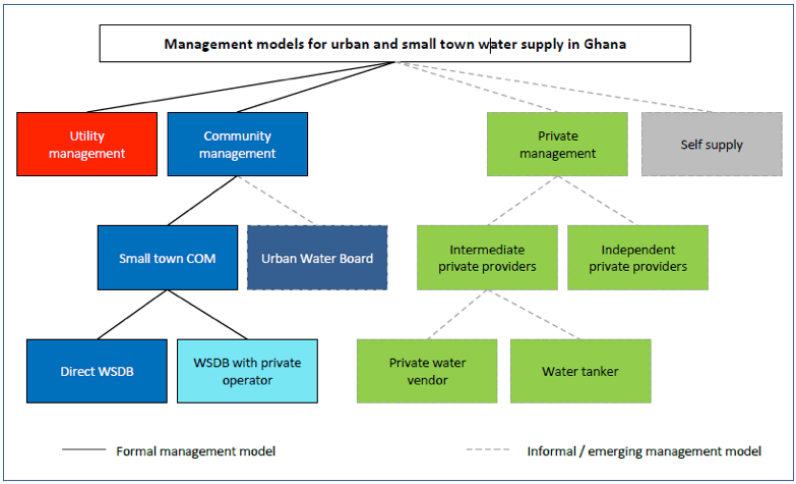
The reforms of 1994 led to the implementation of the National Community Water and Sanitation Programme (NCWSP) with the creation of the Community Water and Sanitation Department within the Ghana Water and Sewerage Corporation to be responsible for the rural and small-town water supplies (Nyarko, 2004; MWRWH, 2006). By the Community Water and Sanitation Agency (CWSA) Act 1998 (Act 564) (CWSA, 2004; MWRWH, 2006), the Community Water and Sanitation Department became an autonomous agency, Community Water and Sanitation Agency (CWSA, 2004; Braimah & Kheni, 2013).

The small-town water system sector emerged as a decentralized system under the community ownership and management (COM) (Nyarko, 2004). The decentralization of administrative responsibilities in the water sector was promoted in the mid-1990s (Eguavoen & Youkhana, 2008). The COM arrangement is linked to the District Assemblies while the supposedly financially viable urban water supply was managed by the public, corporatized utility (MWRWH, 2006; Braimah & Kheni, 2013). The CWSA adopted the Community Ownership and Management (COM) and the District Ownership and Management (DOM) (Briamah & Jagri, 2007) for the management of rural and small-town water supply systems because these concepts (COM and DOM) stem from the principle of subsidiarity that emphasizes assigning responsibilities according to capabilities (Kokor, 2001; DeGabriele, 2002) and also as a means of ensuring sustainable water supply to rural areas and small-towns in Ghana (Briamah & Jagri, 2007).

In Ghana, three different management options are realized for small-town water supply systems as a result of the water sector reforms: centralized state management, public-private partnership and community-based management by water and sanitation management teams (WSMTs) (Eguavoen & Youkhana, 2008). However, Adank & Tuffour (2013) identified two management options for small-town water supply systems in Ghana which has various models under them: water and sanitation management teams (formally called Water and Sanitation Development Board (WSDBs) and private operators (PO). Adank & Tuffour (2013) further indicated (see Fig. 7.2) that the main

models for delivering water services in urban areas and small-towns in Ghana include:

(i) the utility management model
(ii) the community ownership and management model; and
(iii) the private management model



Source: Adank & Tuffour (2013)

Fig. 7.2: Management models for urban and small-town water supply in Ghana

Table 7.1 presents an overview of the main management models, and the types of schemes managed under these models (see Adank & Tuffour, 2013). Small-town water supply systems have increasingly become a popular method of potable water service delivery in Ghana. Community members are responsible for the operation and maintenance of the water system through the tariffs, but legal ownership of assets rests with the Assemblies who represent the government at the local level (Nyarko & Hayward, 2011). Increasingly, multi-village pipe systems are being implemented for cluster of towns and/or villages when there are water resource constraints in the individual communities (Nyarko *et al.,* 2011).

Table 7.1: Overview of the Main Management Models

Main management model	**Management model**		Type of scheme
Utility	Utility management		Piped scheme
Community Management	COM in small towns	Direct WSDB management	Independent single-town piped scheme
			Independent multi-town piped scheme
			Piped scheme with bulk water supply from utility
		WSDB management with private operator	Independent single-town piped scheme
			Independent multi-town piped scheme
	Community management of bulk water supply in urban areas		Piped scheme or storage tank with bulk water supply from utility
Private Management	Intermediate private provider	Tanker service	Water tanker
		Water vendor	Storage tank, with bulk water supply from utility
			Storage tank, with bulk water supply from tanker services
	Independent private provider		Independent point source
Self-supply	Self-supply		Independent point source

Source: Adank & Tuffour (2013)

For effective and efficient management of potable water supply in rural and small-town systems, District Water and Sanitation Teams (DWSTs) were constituted in the District Assemblies. The task of the DWST has been to allocate facilities within the district and to monitor water projects (CWSA, 2010). At the community levels, management of water facilities is undertaken by two bodies; the Water and Sanitation Committees (WATSANs) and the Water and Sanitation Boards (WSDBs) (Sun *et al.,* 2010; Adank & Tuffour, 2013). While the WATSANs are in charge of the daily operation and maintenance of either boreholes fitted with hand pumps or standpipes, the WSDBs manage water systems in small-towns. Unfortunately, access and reliability of drinking water supply in small-towns in Ghana remain poor (Sun, Asante & Birner, 2010; Ameyaw *et al.,* 2014).

The decentralized sub-sector of drinking water supply forms two management structures: community-based management in villages up to 2,000 inhabitants with hand pump; and piped systems in small-towns of 2,000 to 5,000 inhabitants (Eguavoen & Youkhana, 2008; Adank & Tuffour, 2013). It is worth noting that there is a difficulty in differentiating these systems due to a crossover of systems in small-towns (Eguavoen & Youkhana, 2008). The CWSA therefore defines a small-town as a community with population of 2,000 to 50,000 (Manu, 2001; CWSA, 2004; Nyarko, Oduro-Kwarteng & Adama, 2006; Braimah, 2010; CWSA, 2010). That is, areas of populations above 50,000 are urban, and less than 2,000 rural, therefore towns under 5,000 inhabitants would fall under the mandate of CWSA (CWSA, 2004; CWSA, 2010).

Prospects and Challenges of Small-town Water Management in Ghana

As stated earlier, small-town water systems are managed by water and sanitation management teams (WSMTs) in Ghana (Fielmua 2011). One of the prospects of co-managing small-town water supply systems is that the management model of WSMTs varies depending on the size and complexities of each system (Kumasi, 2018). For instance, if the small water system is serving between 2,000 and

10,000 inhabitants, the management, operation, maintenance and the financial management of the system is carried out by the WSMTs and the team pays technical and operator staff employed by the WSMT and DWSTs. However, if the water system serves over 10,000 inhabitants, the technical and management functions of the WSMTs are contracted to a private operator. The private sector involvement can range from operation and maintenance contract with local professionals to the transfer of the whole system management to a private operator with oversight from WSMTs. Regardless of this arrangement, the WSMTs exercises an overall management responsibility for the small-town systems and are required to ensure that sound administrative, technical and financial management practices are observed (Harvey, 2005; CWSA, 2010; Burr *et al.,* 2013; Kumasi, 2018). These arrangements are creative water management solutions that focus on democratic participation, accountability as well as community activism. The basic principle of the model is that communities benefit from an improved water supply, own the water system and have responsibility for its operation and maintenance (Lockwood, 2004).

The COM model through WSMTs managing small-town water system is also commendable as it has increased rural water coverage (Fielmua, 2011; Kumasi, 2018). On that achievement, Kumasi (2018) argues that small-town water systems in Ghana can be self-financing and sustainable if realistic tariffs are charged, and the revenue properly managed and accounted for (also see Fielmua, 2018). Also, Braimah, Amponsah & Asibey (2016) are of the view that communities' involvement in the operation and maintenance of water facilities should be cost-effective to ensure sustainable provision of water to small-towns in Ghana. In spite of these prospects, other studies in Ghana (Nyarko *et al.*, 2007; Braimah *et al.,* 2016; Agyapong, Asiamah & Andani, 2017; Kumasi 2018) on small-town water systems' sustainability have revealed weaknesses in the operation and maintenance management in the areas of cost recovery, finances and governance of small-town water systems, resulting in declining service levels.

The gap that exists in the implementation of the small-town

water systems is lack of enforcement of the by-laws and the failure to ensure that district assemblies provide direct support to the WSMTs. It is considered that when service providers comply with all the by-laws they are in a good position to provide a service that lasts (Kumasi, Adank, Dickinson, Abbey, Chimbar, Atengdem & Agbemor, 2014; Kumasi & Agbemor, 2018). Nyarko (2008) further revealed that a major challenge hindering management of small-town water supply systems is that the systems are not operated and maintained in a sustainable manner due to technical, institutional and financial mismanagement. Briamah *et al.,* (2016) iterated that there is a substantial gap between the current institutional and human resource capacities and the requirements for achieving the SDGs. This confirms Sarpong-Manu's assertion that the challenge of small-town water supply systems is the lack of community ownership and managerial skills. Also district assemblies lack the required human and financial capacities to render the technical and advisory support expected of them. The resultant outcome is the poor functionality of small-town and rural water points, leading to poor asset management. The cause of the poor services is the lack of sound financial management, accounting and auditing practices, and lack of preventive maintenance by the WSMTs (Franceys, 2010). Lack of routine maintenance of water system facilities is attributed to the scarcity and high cost of spare parts as well as WSMTs inability to procure them on time whenever there was a breakdown in their water facilities (Briamah *et al.,* 2016).

Also, the lack of systematic maintenance is due to inadequate funding and unreliable cash flow for capital maintenance expenditure from WSMTs and districts which affect service delivery level and sustainability of water supply systems (Moriarty *et al.,* 2013; Burr, Kumasi, & Franceys, 2013; Kumasi *et al.,* 2014; Kumasi, 2018). A critical setback to the sustainability of small-town water systems is the ineffectiveness of WSMTs. This is attributed to the voluntary nature of the service they render (Briamah *et al.,* 2016). WSMTs work largely on a voluntary basis with no direct financial returns. Therefore, WSMTs' unwillingness to invest their time and resources into their works is partly because there is no incentive for them to

work (Sevlo 2010; Carter 2010; Osumanu 2013; Kamruzzaman, Said & Osman, 2013). Though small-town water systems and their managers are confronted with challenges, researchers (Acheampong, 2009; Braimah *et al.*, 2016; Kumasi, 2018) have argued that the local and socio-economic conditions, geophysical characteristics (rainfall pattern and ground water quality) and willingness of residents to pay for water services of small-town water supply are underlying factors affecting performance of the systems. According to Kumasi (2018) the socio-cultural context of communities plays a key role in determining their willingness to pay for water. These culminated in considerably low demands for small-town water supply which adversely affect production levels. Also, Smat & van Wijk (2002) assert that water supply projects have often overlooked the different nature and history of small-towns and use the same technology, service level, management and financial system as in urban areas for small-towns and the resultant effect is the unsustainable water delivery services. The response to this is the use of a demand responsive approach. The demand responsive approach recognizes the different types of community needs with regard to technology service levels, local maintenance, management and financial arrangement (Lockwood, 2004).

Concluding Remarks and Recommendations

The co-management of small-town of water system is a critical focus of water governance geared towards ensuring sustainable provision of safe and potable water to citizens. In this chapter we argued that a strong and effective co-management arrangement in the context of small-town water systems is a critical component towards the realization of SDG 6. Notwithstanding the identified challenges including weaknesses in the operation and maintenance management in the areas of cost recovery, finances and governance of small-town water systems, resulting in declining service levels, a decision-making process that creates conducive setting for full participation of stakeholders to negotiate their interests should be intrinsically motivated. Understanding and approaching co-

management from a participatory prism presents arrangements that promote creative water management solutions that focus on democratic participation, accountability as well as community activism. This will contribute to improving water supply, ownership of the water systems and enable actors to take responsibility for water system operation and maintenance. This can enhance self-financing, sustainability if realistic tariffs are charged, and the revenue properly managed and accounted for. To adopt co-management in order to ensure sustainable small-town water supply systems, we recommend that small-town water systems should not overlook the different nature and history of small-towns by deploying a demand responsive approach that recognizes the different types of community needs in terms of communities' social structure, local maintenance service management and financial arrangement.

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CHAPTER EIGHT

Connecting Ghana Water Company Limited's Services to Rural and Peri-Urban Areas: Tariff and Access Implications

FRANCIS ISSAHAKU MALONGZA BUKARI

ABSTRACT

In Ghana, urban and rural water services are delinked by service delivery models in order to ensure fairness in access. However, there is continuous extension of urban piped water services to some rural and peri-urban areas. The main objective of this chapter is to examine how Ghana Water Company Ltd., as an urban utility company, treats rural and peri-urban areas connected to its services in terms of tariff levies and the implications on water access. Using only literature review, findings indicate that there is no preferential treatment, causing tariff arrears and poor access to water in rural and peri-urban areas.

Keywords: Peri-urban, Rural, Water, Tariff, Access, Ghana Water Company Limited.

Introduction

Potable water is very essential because it is domestically useful for drinking, cooking and cleaning; a raw material for industrial and agricultural production; and an ingredient in all poverty reduction programmes (Bukari, 2017). The important nature of water as a basic necessity of life explains why nations ensure the rights to equal access through various models and policy implementations. In Ghana, there are two main models of public water services, namely the Utility Management model (UMM) and the Community Ownership and Management (COM) model.

The Utility Management Model (UMM) is neoliberal in nature, characterized by private sector participation, cost recovery, and removal of government direct subsidies on public potable water services, as conditions of the Structural Adjustment Policy and Economic Recovery Programmes (Gusky, 2010). By 1992 the Dublin Conference on International Water and the Environment, which advocated for the recognition of the economic value of water supported the neoliberal inclination and gave momentum to the development of the UMM (Anokye, 2013; Gbedemah, 2010). In Ghana, the UMM was implemented for urban areas with the establishment of the Public Utilities Regulatory Commission in 1997 to regulate urban water tariff and service conditions, while the Ghana Water Company Ltd., was mandated for urban water services in 1999. The emphasis on the imposition of tariffs on water due to the cost recovery orientation and the use of high cost technology involving treated surface water sources made it necessary to restrict the associated services to urban areas, due to the relatively high average household income, prevalence of formal and informal sector employment opportunities, high demand for potable water for productive and domestic uses, and the heterogeneous nature of the population by class extremes (Mondal, 2015).

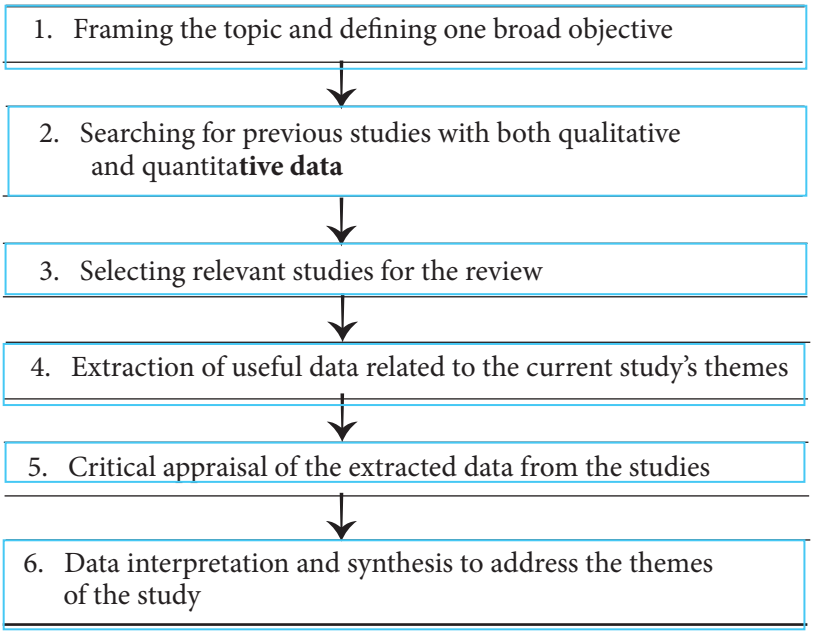
On the other hand, the COM model is pro-poor, entailing appropriate and low-cost technologies, direct subsidization of investment capital cost, and flexibilities in tariff imposition and payment conditions (Adank & Tuffour, 2013). In Ghana, the establishment of the Community Water and Sanitation Agency (CWSA) to manage rural source water facilities and small town tap systems, and the delegation of water tariff and service regulation conditions to District Assemblies, with emphasis on community participation, exemplified the pro-rural and peri-urban nature of the COM model. This is because rural areas in Ghana have low average household incomes with the poor majority, high levels of unemployment in the formal and informal sectors, and predominantly subsistent food crop farmers (Bukari & Abagre, 2013).

Despite clear separation of rural/peri-urban and small-town water services from urban water services, the Ghana Statistical

Service (2014a) indicates that urban water services of the Ghana Water Company Ltd., are still extended to rural communities in most metropolises and municipalities. The main objective of this chapter is to examine how Ghana Water Company Ltd., as an urban utility company treats rural and peri-urban areas connected to its services in terms of tariff levies and the implications on water access. By organization, this chapter covers the introduction, methodology, models of water services, socio-economic conditions of rural and peri-urban areas and the water policy contexts, relevant principles of the national water policy, evidences of urban water extension to rural areas, water tariff structures, willingness and abilities of rural and peri-urban areas to pay tariffs, and implications on water access.

Methodology

The systematic review study design was used in the compilation of this chapter. By this method, one broad objective was first formulated (Impellizzeri & Bizzini, 2012). The objective was: "To examine how Ghana Water Company Ltd. as an urban utility company treats rural and peri-urban areas connected to its services in terms of tariff levies, and the implications on water access." This was followed by searching for published journal articles, books, institutional reports and student dissertations, among others, with both quantitative and qualitative data; selection of relevant studies for the review; extraction of useful data; critical appraisal of the data from the studies; and interpretation and synthesis of findings to address relevant themes contributing to the broad objective (Armstrong *et al.,* 2011). The themes addressed under the broad objective were models of water services, socio-economic conditions of rural and peri-urban areas and the water policy contexts, relevant principles of the national water policy, evidence of urban water extension to rural areas, water tariff structures, willingness and abilities of rural and peri-urban areas to pay tariffs, and implications on water access. Since this chapter is intended as a teaching material, relevance of themes to the subject matter and their logical order would be of interest. Fig. 8.1 is a summary of the systematic review process.



Source: Modified from Impellizzeri & Bizzini (2012)

Fig. 8.1. Systematic review process for the study

Models of Water Services in Ghana

This section describes the two main models of water services in Ghana, namely the Utility Management Model (UMM) and the Community Ownership and Management Model (COM).

Utility Management Model and Water Tariff Conditions

The Utility Management Model (UMM) is typically an urban water supply model with well-defined framework of institutional and regulatory arrangements for the provision of high-level water services through household, institutional and public connections (Adank & Tuffour, 2013). The UMM is characterized by removal of government direct subsidies, imposition of regulated water tariffs under cost recovery, and private sector participation (Gbedemah,

2010). The Ghana Water Company Ltd. (GWCL) is responsible for water infrastructure, rehabilitation, expansion, and contract awards to private sector participants under this model (Adank & Tuffour, 2013).

The UMM is substantiated in Ghana with the establishment of the Public Utilities Regulatory Commission (PURC) to regulate water and other utility tariff (using an automatic adjustment formula [AAF]) and service quality in 1997, the switch from Ghana Water and Sewerage Corporation (GWSC) being responsible for both rural and urban water services, to Ghana Water Company Limited (GWCL) to be in charge of only urban water services in 1999 (GWCL, 2012a; PURC, 2005). Before this development, water was provided as a social good through a supply-driven approach under the GWSC without consumers' expressed demand. Water infrastructure, payment of subventions to the corporation, and cost of maintenance and repairs were funded by the international community (Manyire & Asingwire, 1998). Accordingly, there were no tariffs on potable water to generate pro-poor discourses, which was in line with the United Nations (UN) Declaration of Water as a Right in 1977 (UN, 1977). The unresolved challenge is whether GWCL still extends urban water and tariff conditions to rural and peri-urban areas, and how such communities fair in terms of tariff payment and access to safe water, especially if there is a different model that serves such communities. The next sections unfold the story.

Community Ownership and Management Model and Water Tariff Conditions

The Community Ownership and Management Model (COM) is mostly applicable to non-urban water service delivery, such as rural, peri-urban and small towns, which are not covered by GWCL under the UMM (Adank & Tuffour, 2013). In Ghana, the COM is implemented under the National Community Water and Sanitation Programme by the Community Water and Sanitation Agency (CWSA). The COM model was thus, established to ensure equal and affordable access to safe drinking water by small towns, rural

and peri-urban communities. This started with the transformation of the Department of Rural Water Development (DRWD) of the GWSC to the Community Water and Sanitation Agency (CWSA) by Community Water and Sanitation Agency Act 564 of 1998, as a semi-autonomous body. The agency works in cooperation with the Ministry of Local Government and Rural Development (MLGRD), District Assemblies, District Water and Sanitation Teams (DWST), communities, donors, non-governmental organizations (NGOs) and contractors as the stakeholders for the management of rural and small-town water services (Agyenim, 2011; Biritwum, 2004).

Point source low-cost water facilities are usually used, such as boreholes fitted with hand pumps, with a low per capita cost of $50 per unit, compared to $320 for a treated surface piped water system (Edwards & Cameron, 2011). Services under COM therefore tend to have lower tariffs, and are mostly provided as aid and donations from NGOs (GWCL, 2012). As such the services are free in most rural communities. These together with the community participation component, through which households only contribute to meet the cost of maintenance make the COM model pro-poor (see also Ikpindie, 1990). Before ascertaining the connection of urban water to rural areas despite this clear separation of the services, is there any justification for preferential treatment of rural and peri-urban areas? The next section attends to this question.

Socioeconomic Conditions of Rural and Peri-Urban Areas and the Water Policy Contexts

Rural areas are characterized by smaller populations (below 5,000), over dependence on subsistence agriculture; high unemployment in the formal sector; low incomes; and low levels of access to basic services (e.g. water, electricity, schools, hospitals and road networks) (Noakes & Franceys, 2014). On the other hand, apart from higher population concentration (5,000 and above), urban areas are characterized by being political and administrative centres — centres of higher order services; having diminished agricultural participation; and having heterogeneous populations by class extremes based on

the richest and the poorest (Mondal, 2015). According to Norström (2007), a peri-urban area is an interface between rural and urban, strongly impacted by urban characteristics, but largely serving as wider markets for farm produce, increasing demand for land due to urban expansion; and supply of labour to urban areas. The specific aspects of rural and peri-urban areas that impact on willingness and ability to pay for water are explained below.

Gender

According to the World Health Organization (2015) gender refers to the socially constructed roles, behaviours and activities that a society ascribes to men and women. Some socio-cultural factors such as the traditional system of inheritance and its effects on access to productive resources such as farm land, and the right to independent decision making for the attainment of self-ego needs tend to discriminate against women in patriarchal societies (Abagre, Bukari & Apusigah, 2017). In the mainstream literature, the task of paying for potable water is mostly borne by housewives in rural communities, which has often accounted for poor tariff payment due to their low income status (Kendie, 1992; Mugabi & Kayaga, 2010). Under such circumstances Katakura and Bakalian (1998), Kendie (1997) and Water Partners International (2007), argue that women should be involved in rural water supply projects in choosing the technology based on cost and tariff implications. The practicability of this contention is worth further investigation.

Education

In 2010, about 89.54 percent and 79.17 percent of urban males and females respectively were literate. Comparatively, 69.9 percent of rural males and 55.94 percent of rural females were literate (GSS, 2013). Inadequate formal educational qualifications for formal sector employments in rural areas means that they lack access to sources of regular wages or salaries, which leads to poverty, since the non-formal occupations such as food cropping are not rewarding

enough (Adhikari, 2011). Littlefair (1998) also notes that in water service schemes where water must be treated as economic good, the educational status of users influences their understanding of the different values of the treated water from the untreated, which invariably influences their willingness to pay. Todaro and Smith (2006) however, stress that apart from education, multi-pronged approaches including poverty reduction strategies are needed for sustainable patronage of services. Since poverty reduction does not fall in the jurisdiction of urban water companies, an exploration of alternative methods of addressing the problem of extending their services to rural and peri-urban areas is required.

Occupation

Occupational activities are classified under the primary sector consisting of agriculture, forestry, fishing and mining; the secondary sector composed of industry or manufacturing; and the tertiary sector, consisting of services such as education, financial services, marketing and distribution (Bastos & Perobelli, 2012). Other writers further identify the quaternary sector, related to research, information and the administration; and the quinary sector related to high level decision making in large organisations (Getis et al., 2006). The income for engagement in the activities of the various sectors increases in an ascending order due to the increasing level of skill and value of services. In Ghana, only about 9.5 percent of urban residents are in agriculture, compared to 39.2 percent of rural residents (GSS, 2013). In rural north Ghana, about 97 percent of the rural population are engaged in food crop farming, while 82 percent produce for subsistent consumption (Ghana Statistical Service, 2008). This is relevant in understanding how the incidence of poverty and the extension of urban water and tariff conditions to them affect household ability and willingness to pay the tariffs.

Low-income/Poverty

Poverty is considered as the manifestations of general scarcity and lack of the basic needs of life such as food, potable water, clothing

and shelter; comparative economic inequality on spatial basis such as rural and urban (World Bank, 2011); or specifically termed as income poverty when household income falls below a specified threshold such as $1 per day (United Nations Education, Scientific and Cultural Organisation [UNESCO], 2016). On the other hand, relative poverty is based on the premise that poverty is influenced by social institutions through the creation of conditions that perpetuate the cycle of poverty (Rank, Yoon & Hirschl, 2003).

In Ghana, the absolute poverty line is $1.83 per day and affects about 24 percent of the population, while the extreme poverty line is $1.10 per day involving above 8 percent of the population (Ghana Statistical Service, 2014b). These are the bases of classification of all settlement types by poverty incidence. The northern zone has the highest poverty incidence of about 30 percent for the urban and 55 percent for the rural areas. Thus, determining whether rural and peri-urban areas connected to urban water services under cost recovery conditions is not an attempt to subject them to relative poverty is of interest.

Traditional Beliefs

Traditional belief refers to the oral traditions that constitute a people's sources of religious faith. Among these is the belief in the Supreme Being (God) as the creator of the universe (Bukari, 2017). This belief has a relationship with water poverty. For instance, Akpabio (2011) and Bukari (2011), report how beliefs in water as a gift of God adversely affects rural people's willingness to pay water tariffs. Engel, Iskandarani and Useche (2005) observed that the influence of traditional belief on willingness to pay for water decreased with levels of education. Thus, illiterates are more likely to adhere to customs and religious belief systems in the payment of water tariffs than non-illiterates. Impliedly, planning of rural and small-town water services in the context of urban water networks should incorporate the people's belief systems (Brookshire & Whittington, 1993). However, interventions that seek to eliminate the effects of traditional beliefs in rural areas that are connected to water systems under cost recovery-

based tariffs through stakeholder complementarities have not been explored.

Relevant Principles of the Ghana National Water Policy

The Ministry of Sanitation and Water Resources (MSWR), previously called the Ministry of Water Resources, Works and Housing (MWRWH), developed Ghana's National Water Policy in order to address water related problems. The basic principles of the policy are guided by Ghana Poverty Reduction Strategy (GPRS), the MDGs and Africa Water Vision for 2025 (MWRWH, 2007). The important aspects of these principles, so far as the needs of rural and peri-urban communities are concerned, include the fundamental rights of all people without discrimination to safe and adequate water to meet basic human needs; subsidiarity in order to ensure participatory decision making at the lowest appropriate level in society; improving access to safe water supply and sanitation to reduce the proportion of population without access to basic water and sanitation by 50% by 2015 and 75% by 2025; promoting efficient and sustainable use of water to address food security, income generation and reduction of cases of malnutrition; solidarity, expressing profound human companionship for common problems related to water; and empowerment and capacity building for improving equity, gender sensitivity and pro-poor water governance and policy (MWRWH, 2007). An examination of the practical aspects of urban water extensions to rural and peri-urban communities would indicate whether the principles are followed, alongside the models of water services.

Evidence of Extension of Urban Water Services to Rural and Peri-Urban Areas in Ghana

Table 8.1 shows that GWCL's services are still extended to rural and peri-urban areas under most of the metropolitan and municipal cities in Ghana, despite the existence of the COM model for such communities. This situation generates interest in the water tariff

structures and whether rural and peri-urban areas are given special treatment; are they able and willing to pay for the water? What are the consequences of low-income households in rural and peri-urban areas failing to pay the water tariffs? The next sections address these queries.

Table 8.1: Extension of Urban Water Services to Rural and Peri-urban Areas by GWCL

Metropolis/Municipal	Peri-urban (% coverage)	Rural (% coverage)
Bolgatanga	28.4	3.5
Sunyani	16.5	3.4
Ho	40.8	20
Tamale	45.2	23.3
Sekondi-Takoradi	29.9	39.7
Cape Coast	14.8	26

Source: GSS (2014a)

Water Tariff Structures

This section discusses the water tariff structures used in urban water service delivery. Water tariff is a price determined by regulation or country's public utility laws, and imposed by a public company for water supplied to its customers, the purpose of which is to recover the cost of services (Brook & Smith, 2001; OECD, 1987). Some reasons for water tariff imposition include the following:

- water tariff gives economic value to water, which is a scarce resource
- water tariff ensures efficient production, equity in distribution, conservation and sustainability;
- water tariff increases coverage to low-income areas through extra water charges to urban domestic and industrial users;
- water tariff helps water utilities to understand and adopt mechanisms that promote sustainable revenue strategies;
- the processes of water tariff imposition enable service providers to focus on specific performance improvement areas by advancing

technical, commercial, and operational efficiency (e.g., leak reduction, billing and collection, customer service);
- efforts in water tariff imposition could also ensure that successful achievements remain sustainable and viable in the long term through arrangements such as performance agreements, monitoring and evaluation (Bukari, 2017: 70).

The basic water tariff structures, largely reported by Bukari (2017, pages 70-82) are as follows:

Linear Tariff

This is the type of tariff charged based on the proportion of water consumption. It is irresponsive to income and so regressive to the poor (OECD, 1987). The effect of this is that poor households in rural and peri-urban areas connected to such services might cut down their consumption of the safe drinking water below what is needed for decent living or not connect to the water network at all (Foster &Yepes, 2005). So, this is not practiced in countries where social welfare is a priority.

Increasing Block Tariff (IBT)

This involves an initial lower block of consumption being free of charge (the lifeline rate), to cater for the poor consumers, after which subsequent blocks attract tariff in volumetric water systems (Whittington, 1992). Although IBT is pro-poor, when the urban poor, rural and peri-urban low-income households are connected to such services through public standpipes there are tendencies for increased demand to push up consumption far above the lifeline rate to defeat the objective of IBT (Nkrumah, 2004). IBT is applicable in Ghana, Spain, and the Middle East, among others. Cardone and Fonseca (2004) are of the view that in services for low-income areas, the determination of the lifeline block and the tariff setting process should be done through consultation with the local people. This facilitates the identification and integration of the real needs of the poor with cost recovery initiatives.

Decreasing Block Tariff (DBT)

Under this, there is a higher tariff per unit of water at an initial lower block, after which the tariff decreases as consumption increases (Whittington, 2002). Decreasing Block Tariff, therefore, penalizes low consumers, usually the poor, who are thought to generally use lower amounts of water, and rewards larger commercial users. It also encourages waste of water in an attempt to enter the higher blocks of lower tariffs, which could negatively impact on the scarce natural water resources. It is therefore not recommended for extension to low-income rural and peri-urban households. This tariff structure is practiced in the United States and Canada, but not in Ghana and other developing countries.

Differentiated VolumetricTtariff (DVT)

This involves some differentiations in the volumetric tariff structures by adjustments in water tariffs according to customer stratifications on income basis. Thus, in the increasing block tariff, the lower block could be increased for standpipes in low-income communities with larger number of households per standpipe, by increasing the subsidy for that block (OECD, 1987). This means that the water utility company needs to have adequate data on customers based on segmentations by income levels and spatial locations to be able to practice price discrimination through tariff differentiation (Blanc, 2007). If an urban water utility is to extend services to small town, rural and peri-urban low-income households, Fankhauser and Tepic (2005) recommend that a threshold should be defined for those eligible for subsidy. The subsidies could be direct, by a state paying an amount of money directly to the water company to defray part of the cost of services to the target beneficiaries. It could also be a cross-subsidy, implying that the utility charges extra amounts of tariff on urban and commercial users in order to support services to the poor (WaterAid, 2009).

The determination of the threshold could be by a stratification

of target communities by household income through household surveys (low, middle and high income households), or by geographical segmentation on the basis of rural, peri-urban and urban. In developing country applications, McPhail (1993) also explains how the public water sector of Morocco for example, applied the 5 percent rule, after a survey that made customer segmentations possible. The five percent rule according to the author is based on the premise that once the cost of a service falls below five percent of the customer's income, it is considered affordable enough to stimulate demand. The flexibilities of differentiated tariff make it possible for utilities in developing countries to introduce two tariff structures at a time, such as increasing and decreasing block tariffs. Customers are then allowed to choose according to their consumption needs and abilities to pay (Joskow, 2005; World Blank, 2007).

In Ghana, the PURC approves the application of the increasing block tariff for low-income areas, as well as the application of cross-subsidies as means of the differentiation of tariff among customer categories (PURC, 2005). Rural and small-town water services also depend on the appropriate technology approach, making tariffs affordable. It is the deviation from these obvious service and consumer differentiation that generates further inquiry into the tariff situation.

Flat Rate

The flat rate is also non-volumetric, and based on a single charge for a service delivered irrespective of the level of water used by the customer (GWCL, 2012). For instance, in the City of North Bay in Canada, about 14,000 residential water users pay flat rates, but the bill is actually composed of two elements: a fixed charge covering a basic charge, provision for water filtration plants, sanitation for each apartment and a variable component based on the water outlets (Whittington, 2002).

The fixed charge is irrespective of the number of outlets, except the sanitation aspect which is a percentage of the total variable charge. On the other hand, there are individual flat rates for various

types of water consuming facilities in a dwelling. Thus, the variable component means that a dwelling with more of these facilities pays more of the associated flat rates to determine the total flat rate paid. The billing system is said to be flat because the charges are not based on the quantity of water consumed (Whittington, 2002).Carey and Sunding (2001) and the World Bank (2007) report that in some countries such as the United States, piped water utilities serving poor households, areas on major lakes and rain scarce regions use lifeline models and favourable flat tariff structures. The arguments are that for those on major lakes, emphasis on cost recovery through higher tariffs cause sharp declines in demand for the water and a subsequent fall in the revenue of the utility, due to abundance of unimproved alternatives.

In view of the problem of choosing tariff structures suitable for the various customer categories, Water and Sanitation Programme South Asia (2008: 3) asserts that whatever method is used, the tariff strategy should include "robust record keeping and billing procedures; updating customer databases; outsourcing billing activities and using improved technology; and encouraging and incentivising staff to undertake billing and collection functions more diligently". However, the complexity of low-income status of households in rural and peri-urban communities makes it difficult to predict whether a focus on the tariff determination and effective collection processes would be adequate to promote willingness to pay.

Willingness and Abilities of the Rural and Peri-urban Communities to Pay Urban Water Tariffs

Willingness to pay determines the maximum amount of money an individual is willing to pay in order to benefit from a particular good or service, while ability to pay is a subjective judgment based on some assumptions as to what should be considered as fair for people to pay for a particular good or service (Rina &Rosminah, 2011). In other words, consumers may indicate what tariff they would be willing to pay for water, but what they could actually pay depends on the proportion of their disposable income that could be spent on water

(Bukari, 2017). The socio-economic differences between rural, peri-urban and urban communities do not only account for differences in water service stratification, but also differences in willingness and ability to pay. With a focus on low-income households connected to urban water services, the focus is on payment of tariffs at public standpipes, due to possibilities of cost sharing in terms of connection charges, repair and maintenance and tariff payment. For the urban poor, small town, peri-urban and rural low-income areas, clusters of houses are connected to public standpipes, and monthly water bills are issued based on volumetric meter readings (WaterAid, 2005).

According to Bukari (2011), Ghana Water Company Ltd. usually has an agent for each standpipe in the communities. The agents are told the amount to charge for containers of various capacities, beginning from 18ltrs. Thus, those below 18ltrs attract no charge, to make provision for the lifeline for extremely poor persons who cannot afford to pay for drinking water. The agents collect the tariffs on cash-and-carry or pay as you fetch basis, unlike the rich and middle-income households on private connections who pay monthly. The agent sums up the daily tariffs collected up to the end of the month to pay the value of the monthly water bill issued by the company. There is empirical evidence that water tariffs collected varies by customer segmentation by settlement types and average household income size, as presented in Table 8.2.

The data in Table 8.2 shows the outcome of a willingness to pay study, conducted in rural, peri-urban and urban areas of the Northern and Upper East Regions of Ghana by Bukari (2017). Within the period of the survey, the average monthly household income of Ghana was GHc446, and the commonest quantity of water drawn and paid for at public standpipes was 54ltrs (aluminum basis) worth 20 Ghana pesewas (20GHp). Table 8.2 shows that 85% of the sample population earned, while only 15% earned up to, or above the average national household income. It also shows that 85% of the urban high income group (earn GHc446+) were willing to pay the market tariff of 20GHp or more, compared to 35% of peri-urban and 11% of the rural counterparts, willing to pay the approved tariff. Among the low income (earn GHc445 or less), 50% was willing to pay less, compared

to 70% of the peri-urban and 66% of the rural counterparts.

Willingness to pay water tariff is therefore lower for rural and peri-urban communities connected to urban water systems, but higher for the urban dwellers for which the services are intended.

In terms of ability to pay, Bukari (2017) indicated that averagesof 100% of the urban, 37% of the peri-urban and 31% of the rural

Table 8.2: Willingness to Pay for Water by Household Income Level

			Average monthly Household Income		
Settlement type	Willingness to pay per basin of water	Descriptive	GH¢445 or less	GH¢446 or more	Total
Urban	Less than 20GHp	%	50	16	40
	20GHp or more	%	50	84	60
	Urban total	%	100	100	100
Peri-urban	Less than 20GHp	%	70	65	68
	20GHp or more	%	30	35	32
	Peri-urban total	%	100	100	100
Rural	Less than 20GHp	%	66	89	68
	20GHp or more	%	34	11	32
	Rural total	%	100	100	100
Grand total		%	85	15	100

Source: Bukari (2017)

households were capable of affording the approved tariff of 20GHp

for aluminum basin of water per day. This has often amounted to high water tariff arrears, to the extent that in 2008, about 79% of annual water tariffs was in arrears for rural communities along the Dalun-Tamale Corridor of the Northern Region under the services of GWCL (Bukari, 2011).

Effects of Urban Water Tariff on Rural and Peri-urban Areas' Access to Safe Water

Galaa and Bukari (2014), report that low willingness and abilities of rural and peri-urban areas to pay for water tariffs imposed on them by urban oriented GWCL result into disconnections, refusal of the GWCL to attend to technical breakdowns, and slow response to further requests for service connections. The effect is that, affected households have inadequate access to safe water for consumption, sanitation and hygiene practices, while others resort to unsafe water use. These expose them to water-wash diseases such as dehydration, scabies and gingivitis, and water-borne diseases such as cholera and hepatitis A (Bukari, 2017). Thus, recommendations to address such problems are necessary.

Conclusions and Recommendations

The imposition of tariff on water is consistent with the National Water Policy principle, concerning the recognition of the economic value of water. Given the low income status of such communities, the principles of the fundamental rights of all people without discrimination to safe and adequate water; the principle of subsidiarity in order to ensure participatory decision making at the lowest appropriate level in society; and the principle of solidarity, expressing profound human companionship for common problems related to water, have not been adequately integrated into the conditions for urban water extension under the UMM model to the rural and peri-urban areas.

In order to ensure that the principles of empowerment and capacity building for improving equity, gender sensitivity and pro-poor water governance and policy under Ghana's Water Policy are

well implemented, rural and peri-urban communities with adequate groundwater resources but connected to GWCL services with tariff challenges should be shifted to the Community Water and Sanitation Agency for low-cost borehole with hand pump services under the COM model. This could enable NGOs to come to their aid with donor funded projects, involving only contribution for facility maintenance and repairs. For water-scarce communities without alternatives, Bukari and Abagre (2013) proposed a Multi-factorial Pro-poor Community Water Service Model, which recommends collaboration between the district assemblies, NGOs and beneficiary communities to pool resources together for economic empowerment interventions, especially for women, to improve their willingness and abilities to pay water tariffs. Other recommended measures include introduction of direct subsidies by government, application of differentiated tariffs through collaboration between the PURC and GWCL and the allocation of part of cross-subsidies for tariff reduction for the affected communities.

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CHAPTER NINE

Teaching, Learning and Applying Geographic Information Systems: What You Need to Know

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ABSTRACT

Geographic Information System (GIS) is a rapidly evolving field that is gaining a lot of interest from academic departments, teachers, students, government and industry, each having a different purpose for the GIS. In an environment where GIS is still an evolving field, with many attractive application areas, GIS remains surrounded with many misconceptions as to what it is and its purpose. With the proliferation of GIS in the academic institutions in Ghana, there is confusion as to whether GIS is a tool or a science, which has contributed partly to how it is taught, learned and applied. In this respect, GIS is a double-edged sword which, if not properly handled, can be detrimental rather than beneficial to society. There are basic principles and conceptual issues that are not clearly understood. As a result, GIS may not always be serving the needs of society effectively. This chapter discusses some of the issues surrounding GIS from the historical, conceptual and applications to the challenges. This will clarify some of the issues, which appear very technical to beginners in GIS and also enhance the teaching of GIS in our institutions.

Keywords: Geographic data, GIS applications, hardware, information, location, software

Introduction

Geographic Information System (GIS) attracts many professionals, training institutions and students and fits well within global digital and information technology (IT) development trends. The proliferation

of its applications means that training institutions, students and organizations want to teach, learn and implement GIS often without a critical thought of the real purpose of a Geographic Information System and what it entails. Decisions to run a GIS programme or course within a teaching department, to learn GIS as a student, or to implement a GIS as an organization have many implications for the realization of the decisions. Failure to understand the real purpose of a GIS before making a decision to teach, learn or implement it, may therefore, affect the quality of the outcome of the decision.

In Ghana, GIS is taught at the tertiary level, which means it is introduced to students the first time mostly as a course in their undergraduate studies or professional development. The majority of the tertiary institutions do not run GIS as a programme in which it is taught and learned in breadth and depth, from principles to applications for the duration of an undergraduate programme. This means much more information is still needed to inform teachers and students how GIS is taught, learned and practised in Ghana.

Academic institutions in Ghana are faced with the dilemma of either teaching GIS as a science or as a tool. Consequently, the teachers are also confronted with a lack of clear direction as to whether to:

- teach GIS, in which case both the theoretical and practical aspects of GIS are taught;
- teach about GIS, whereby only the theoretical aspects of GIS are taught to understand the GIS language but unable to practise GIS; or
- teach with GIS, in which case GIS is taught as a tool in another course to facilitate the understanding of that course but not GIS. Here, the emphasis is just on the practical aspect that is relevant for a specific course.

This confusion is transferred to the students as to whether they are learning GIS, learning about GIS or learning with GIS. The purpose of teaching, learning and applying GIS is to reduce these uncertainties and confusion by giving a historical perspective of GIS, the basic concepts, the anatomy of a GIS, the application areas and some challenges one is likely to arise in teaching, learning and

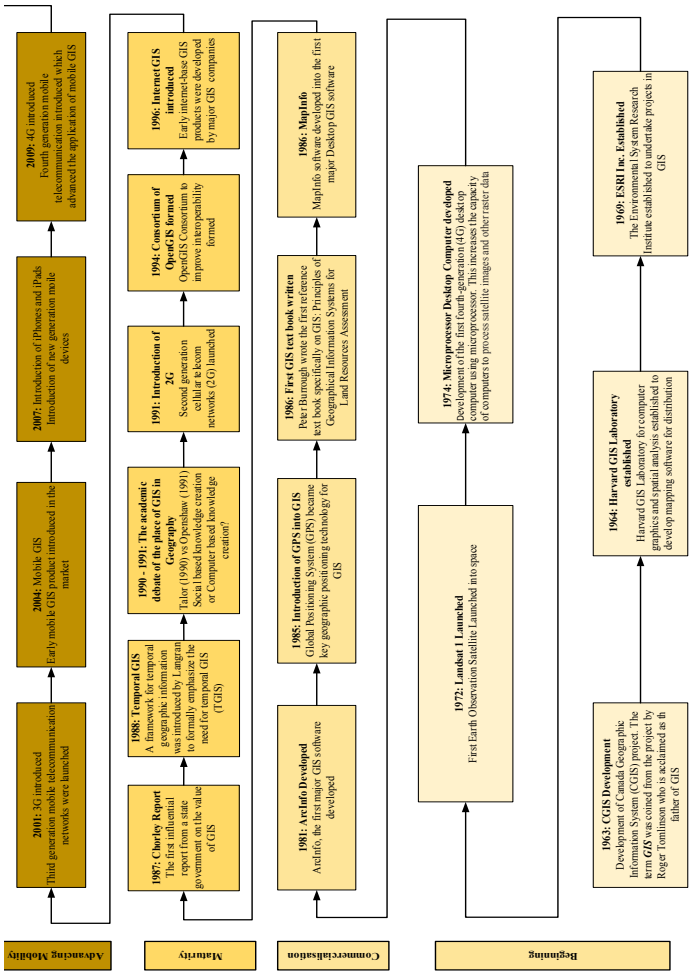
applying GIS. However, it should be added that this chapter does not exhaust the above issues. Therefore, the content of the chapter is more of a summary that targets young GIS teachers, undergraduates and graduate students who are preparing to take GIS courses for the first time and need basic information about GIS as a guide.

Major Historical Milestones of GIS

It is important to any critical field of inquiry that its practitioners know about the origins of the decisions that were made; those that were accepted and those that were rejected and yet shaped the field (Pickles, 1999). For many people, GIS is synonymous to computer but that is not necessarily the case. Also GIS has been there before the advent of the computer, although the computer has come to facilitate GIS applications by improving upon the analytical capabilities, efficiency and effectiveness in handling huge data and many different datasets at a time. In the view of Kennedy (2013), the computer-based GIS has greatly influenced how decisions are made about land use planning, navigation and resource allocation. It has therefore gained prominence over the manual GIS because:

- of the many shortcomings of using paper maps for decision-making;
- computers have become greatly faster, bigger (in terms of memory size), and cheaper;
- there is the need for sophisticated data structures and efficient ways to represent the infinitely detailed human environment.

GIS started in a manual form without the presence and aid of computers. A classic example of GIS without computers is the analysis of cholera infection in London that was undertaken by John Snow in 1854 and which eventually convinced the world that cholera was a water-borne disease. He depicted and analyzed the distribution of cholera infections, which led to the identification of the source of the disease — a contaminated water pump. In this analysis, John Snow plotted the locations of cholera infected persons and found that the points were clustered around a hand water pump. This spatial finding



(Modified from Information Resources Management Association, 2013: 153)

Fig. 9.1: Major Chronological Advances in GIS

informed the decision to remove the handle of the pump, which led to reduction in the cholera cases. Modern day computer aided GIS started in the 1960s and is currently attributed to Roger Tomlinson, who is referred to as the father of GIS in the GIS literature (Fu & Sun, 2011; Blake, 2009).

The fast and changing developments in the computer and information technologies have made GIS very dynamic in terms of teaching, learning and application. It is not certain when it will achieve relative stability as the computer and IT continue to change. GIS has gone through milestones, especially from the 1960s to date (2020) as summarized in Fig. 9.1.

Concepts and Issues

Geographic Information Systems (GIS)

Again, GIS has no universally accepted definition that explains it accurately and comprehensively, partly due to the existence of complementary and contradictory definitions, which compete for supremacy or acceptance (Albert *et al.,* 2000). One other reason is the involvement of many different professionals in the use of GIS for many different purposes (Galati, 2006; Bolstad, 2016).

Chrisman (1999) is of the view that the GIS literature is replete with definitions of the term GIS, although there is little reflection about these definitions. When definitions are accepted through propagation from one author to another based on the principle of *stare decis*, they become dangerous (Chrisman, 1999). GIS is in such a situation with many definitions yet lacking an adequate, stable and universally accepted one. Some of the definitions are even in conflict with the context in which they are stated. In the current situation of multiplicity of definitions of GIS, no definition should be accepted and applied without questioning. This suggests that every definition of GIS must be critically analyzed to understand its conceptual basis before usage. For teaching, learning and application purposes, it is good to understand the context of a definition and its application before deciding on its appropriateness.

That notwithstanding, it must be noted that in the particular case of GIS, definitions are critical and cannot be downplayed because they play a role in negotiating agreements among the diverse actors who are required to make GIS work (Chrisman, 1999). Additionally, the meaning that is assigned to GIS can influence the way in which it is taught, learnt and applied (Tomlinson, 1987). For that matter, the search for an adequate definition is not over. Existing definitions have undergone critical analysis (Cowen, 1988; Maguire, 1991; Burrough & McDonnell, 1998; Chrisman, 1999) with the aim of understanding the gaps and challenges they create in practice. Currently, GIS definitions have been categorized differently in different literature. The following authors have defined GIS thus:

- Cowen (1988): Process-oriented, application, toolbox, and database.
- Maguire (1991): Database, map based and the spatial analysis-based definitions;
- Burrough and McDonnell (1998): Tool-box based, database, and organization based;
- Chrisman (1999): Systems Approach, Content (Maps and Databases), Toolkit Approach, and Changing the Subject Approach. Chrisman then extended the categories of GIS definitions by adding an activity-based definition.

For the purposes of this chapter, it is important to examine some of the fundamental definitions of GIS. The definition of GIS by Burrough (1986), Environment Systems Research Institute (Kennedy, 2000), Fu and Sun (2010) are presented here. The definition of Burrough is important in this analysis because he wrote the first textbook of GIS and it is important to appreciate his concept of GIS at the time. Besides, definitions of GIS by the pioneering authors have given GIS some orientations which have generated some academic debates in literature (Taylor, 1990; Openshaw, 1991) and have influenced how GIS is currently conceived, taught, learnt and applied.

Burrough defined GIS as a:

> Set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes (Burrough, 1986 p.6).

Kennedy conceived GIS as a:

> collection of computer hardware, software, and geographic data for capturing, storing, updating, manipulating, analyzing, and displaying all forms of geographically referenced information (Kennedy, 2000: 42).

Fu and Sun view GIS is a:

> system of hardware, software and procedures that capture, store, edit, manipulate, manage, analyse, share and display geographically referenced data (Fu & Sun, 2010: 4).

Key to all the above definitions of a GIS is the composite 'where and what' (Bolstad, 2016). These have emphasized location (where) and attributes (what) of geographic features (Chang, 2019). The composite 'where and what' is referred to as geographic data. Further examination of the above definitions of GIS revealed that a GIS comprises two main parts. The first part of the definition (a collection of computer hardware, software, procedures, and geographic data) presents an explanation of the components of a GIS proper while the second part (capturing, storing, updating, manipulating, analyzing, and displaying, sharing, geographically referenced information) presents the purpose of a GIS.

People, and their skills and experiences, are a critical part of realizing the objective of a GIS (MacFarlane, 2005; Tomlinson, 2007). From the perspective of Roger Tomlinson, these definitions missed people and their skills:

> No GIS can be successful without the involvement of the right people. A real-world GIS is actually a complex system of interrelated parts, and at the centre of the system is a smart person who understands the whole system (Tomlinson, 2007: 1).

Roger Tomlinson thus emphasizes the need to recognize the critical place of the GIS expert in teaching, learning and applying GIS. What this means is that a system of computer hardware, software and data in themselves cannot perform the functions of a GIS and yield the expected results without the critical role of an expert. In fact, the real emphasis of Tomlinson is the need to develop the right human expertise of the GIS since it has implications for teaching, learning and practical implementation of a GIS. Furthermore, in his conceptualization of GIS, he also highlighted the need to invest in GIS for the needed benefits (the information products) and he identified the parts of a GIS on which the investment should be focused: the data, soft and hard ware (see Fig. 9.2). Ironically, he failed to emphasize that the human resource is the first point of critical investment.

As the information world advances, GIS becomes more complex and more difficult to define based on technology. For instance, Bolstad (2016) and Fu and Sun (2010) highlighted the distribution and share of information in their definitions of GIS. This points out the need for internet resources in the teaching, learning and physical implementation of GIS if data and information have to be distributed and shared efficiently and effectively. With the introduction of the Internet of Things (IOT) and fifth generation (5G) internet, in addition to the already growing Web GIS, new dimensions of GIS (e.g. World Geographic Information Systems WGIS) will emerge, which will make it efficient, effective and easy to share data and information.

The early computer-aided GIS focused on problem solving domain rather than science domain or a hybrid of the two. Many people therefore viewed GIS as a tool. This is clear in the definitions as they emphasized the components, purpose, input and output of the GIS. However, the view of GIS as a tool generated a heated debate in the early GIS literature (Taylor, 1990; Openshaw, 1991). One major criticism of GIS in its early days was its philosophical basis as a social science (Taylor, 1990). For instance, popular definitions of GIS have created the following three dilemmas within the academic community community (Pickles (1997):

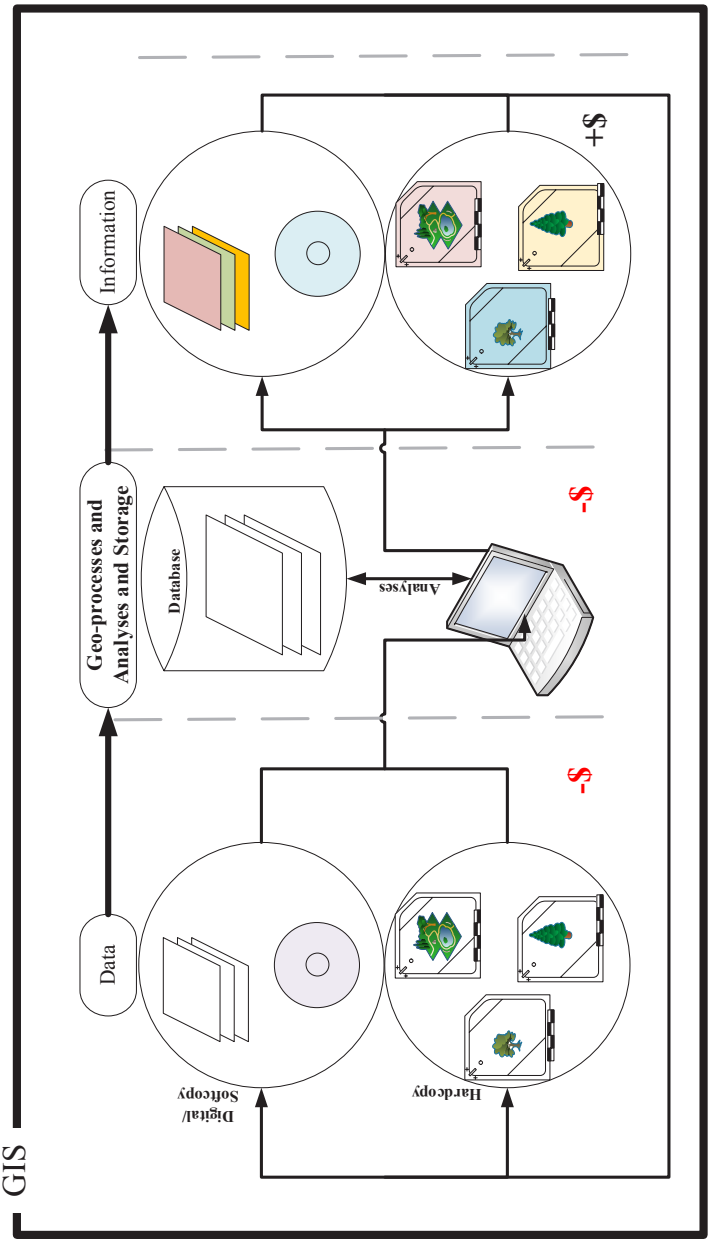


Fig. 9.2: Adapted from Tomlinson (2004: 2)

- tool or science;
- training or education; and
- science or studies.

Besides, the training institutions are also confronted with the following:

- teaching GIS in which case, one will want to teach the science and tool of it;
- teaching about GIS, in which case the focus is on the theoretical prospects and application areas of GIS;
- teaching with GIS, in which case the focus is on GIS as a tool to enable students apply it in a particular programme or course.

The early definitions were overly tied to technology, which changes quickly and makes the definitions obsolete with time. The substance of the definition should focus on theory rather than devices or technologies, which change rapidly (Tobler, 1976; Chrisman, 1999). The purpose of the GIS, if clear, could help reduce the confusion surrounding the focus of teaching GIS. For academic purposes, the broader purpose is either education or training (Kemp *et al.,* 1992). Also, GIS education focuses on the principles and conceptual issues which surround GIS while GIS training emphasizes the technical skills necessary to operate specific GIS packages to facilitate various applications. These are translated into the objectivism and constructivism paradigms as the philosophical models of teaching GIS (Dekolo & Oduwaye, 2005). Objectivism holds that there is a real world in which knowledge can be transmitted from the knower (teacher) to the learner, while constructivism holds that knowledge is constructed by the learner (Dekolo & Oduwaye, 2005; Bennarz, 1995).

These issues emanate from the early definitions of GIS, which focused on GIS as a tool with little emphasis on the 'science' and 'studies' aspects of it. From the academic debates in literature, there is still a need for a definition that satisfies the science and studies requirement to bring to rest the issue of being a tool, which will keep

surfacing as and when the need arises.

In summary, the issues of definitions of GIS are extended here by suggesting that Geographic Information System is the study of where what happens, when it happens, how it happens, and why it happens. This leaves the emphasis on the tools of GIS as in the conventional narrow technological system-based definition of GIS and focuses on knowledge creation as in the 'science' and 'studies' of GIS. In this suggestion, the where what happens is paramount. Knowing where what happens, when it happens, how it happens, and why it happens is critical to how one understands and relates to one's local and global environments (Campbell & Shin, 2012).

Conceptual Elements of GIS

GIS is often conceived as a composite term, thus missing the real meaning of the individual sub-systems (Geographic, Information, and System) and their relationship with one another. A clear understanding of these conceptual sub-systems enhances the overall understanding of GIS. In this section, the sub-systems of the composite GIS and their relationships are explained.

Geographic (Geospatial) Data

Geographic (Geospatial) data describe objects or features on the earth surface, in terms of their location and attributes (properties) and their relationships. The metrics of distance, area, volume and direction are derivatives of location. Besides location, spatial dependency is a neglected property of space but a key concept in understanding and analyzing spatial phenomena/features. Location is described in different terms: nominal, relative and geographic (Campbell & Shin, 2012). Nominal location simply defines a name of a position on the surface of the earth. Relative location defines a position in relation to known position while geographic location defines a position on the surface of the earth using earth-based spatial reference systems.

Of these forms of location, GIS places emphasis on the geographic location because it provides unique identity of every position on the surface of the earth with the accuracy of the

instrument for recording the location as a major limiting factor. Thus, location of a feature is described according to a spatial referencing system, which is either a geodetic or a cartesian system (Campbell & Shin, 2012, Gordillo & Laurini, nd). The geodetic coordinate system uses Latitude, Longitude and Altitude while the cartesian (projected/plane) coordinate system uses X, Y and Z to define the location of a feature on, above or below the earth surface (Gordillo & Laurini, nd; Khosrow-Pour, 2018). Locational data of features are referred to as geographic data proper while the descriptive data are referred to as attribute data. Thus, the location data are considered the skeleton of the GIS while the attribute data are then the flesh of the GIS.

It is important to note that, not all the properties of space are meaningful in both spatial systems. Location, direction and spatial dependency will provide meaningful data when measured in any of the two spatial systems but linear distance, area and volume will provide meaningful information when measured in the Cartesian spatial reference system. Therefore, the choice of the reference system depends on the specific GIS analysis required (linear or angular), the extent of the geographic space under consideration (sub-national, national, regional or global) and the expected users (local or global) of the GIS product.

Generally, most spatial features and phenomena present among themselves a relationship that depends on location and distance. This spatial relationship or dependency is what Tobler's First Law of Geography explains as:

> Everything is related to everything else, but near things are more related than distant things (Tobler, 1970: p.236).

Spatial dependency is present in every direction and becomes weaker as the features or phenomena become more dispersed. It has application relevance in the analysis of health and diseases in space, identification of sources of pollution, spatial interpolation (see Miller, 2004), spatial sampling in times of resource assessment (see Lance *et al.,* 2014) and spatial data exploration for spatial bias and spatial data correlation (Michell, 2012).

Information

Information is often termed as the heart of a GIS. It is derived from the analysis and interpretation of data facts about features or symbolic representation of features. Geographic Information can be considered as the answer to a question, i.e. about what is where and when (de Man, 1988). Three characteristics of good information are its relevance, accuracy and timeliness (MacFarlane, 2005). The value of information depends on its societal needs, timeliness, its context, the methods used to collect and process the data and the accuracy of the data used.

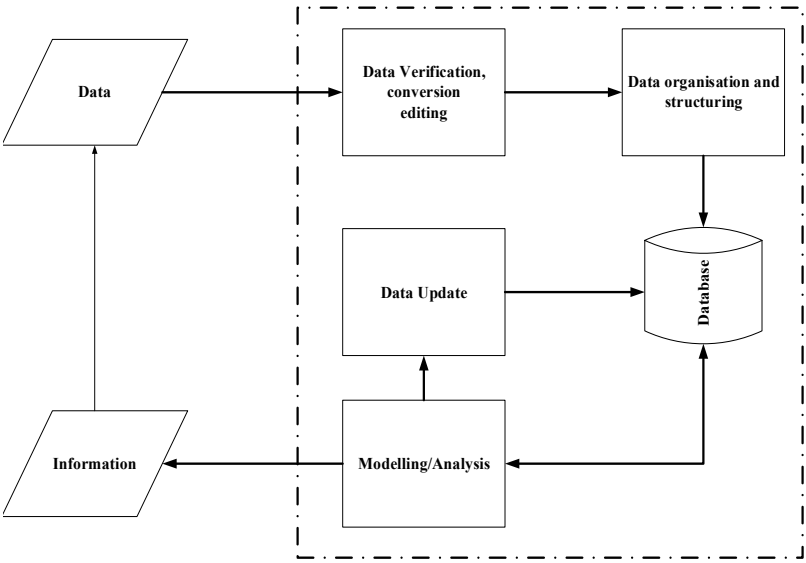
In GIS, there is a thin line between data and information (Fig. 9.3). It is therefore not out of place to read, "information is data" and "data are pieces of information," all depend on the context from which one is looking at data or information. Data are pieces of information in the sense that data are processed and analyzed to generate information and thus answer questions. Information becomes data when it undergoes further processing and analysis to generate new information. For instance, an existing hard copy map, which serves as information for a certain purpose, can be further digitized, updated, analyzed and a new map produced for either the same or a different purpose.

System

The 'S' in the GIS is conventionally interpreted as System. Currently, it has been interpreted in different ways and in some cases with a complete replacement of the S, e.g. Geographic Information Technology. The different meanings given to the S translate into different meanings of GIS. Conventionally, the S denotes system, which focuses on the technology for the acquisition and management of spatial information (Forer & Unwin, 1998).

These include the hardware (computer, GPS receivers, plotters, scanners, etc.), software, procedures, etc. Also, a system means an integrated component of two or more parts that function as a whole to produce a desired result. This means a system can be simple or

complex, depending on its purpose and parts that interact and function as a unit component. Also, a system is more than just putting the different components together.



Modified from Fazal (2008: 85)

Fig. 9.3: Relationship between Geodata and Geoinformation

Each part of the system may function separately as a single unit or together with some other parts of the system as a sub-system but what is key is that the individual parts must work to support the larger system to function as a unit. For example, if the computer unit functions well but does not accept the GIS software, the role of the computer in the GIS is defeated. It is important to understand that a GIS is rarely a personal system and that organizations are key part of a GIS (MacFarlane, 2005). This is because it is the organization that must define the purpose of the GIS, provide the resources (financial, material and human), set the protocols for the set up and operations of the GIS, etc. Therefore, an understanding of how an organization manages data and uses information in management decisions is

critical for effective implementation of GIS.

Also, the S is used as Science giving a different meaning to GIS. Thus, Geographic Information Science concentrates on the underlying conceptual issues of representing data and processes in space and time (Forer & Unwin, 1998; MacFarlane, 2005).

The S in GIS also stands for Studies in which case the GIS does not simply focus on the technical and conceptual underpinnings of the use of geographic data, but also the social, legal, and ethical issues which are arguably of greater importance and equal complexity in the understanding and application of geographic information (Forer & Unwin, 1998).

Application

Components of GIS

At the implementation and operational level of GIS, it is important to appreciate the various parts of the GIS because it has implications for financial decisions. The components of GIS differ from organization to organization, depending on the purpose of the GIS within the organization and the level of the GIS technical expertise in the organization.

There are five conventional components of GIS, which are Hardware, Software, Brainware (People), Data and Procedures/ Methods (Fig. 9.4). However, there has been the introduction of a sixth component, the internet, by some authors and experts. The introduction of the internet into the GIS components is possibly motivated by two main factors: (1) the need to acquire or share timely geographic data and information, and (2) the demands of time and technology. These components are critical to a successful implementation of a GIS. These components and their relationships are illustrated in Fig. 9.4. It is important to understand each of these components and their roles in the GIS.

Hardware

The basic hardware for GIS consists of the computer system on which the GIS software runs (Fazal, 2008).

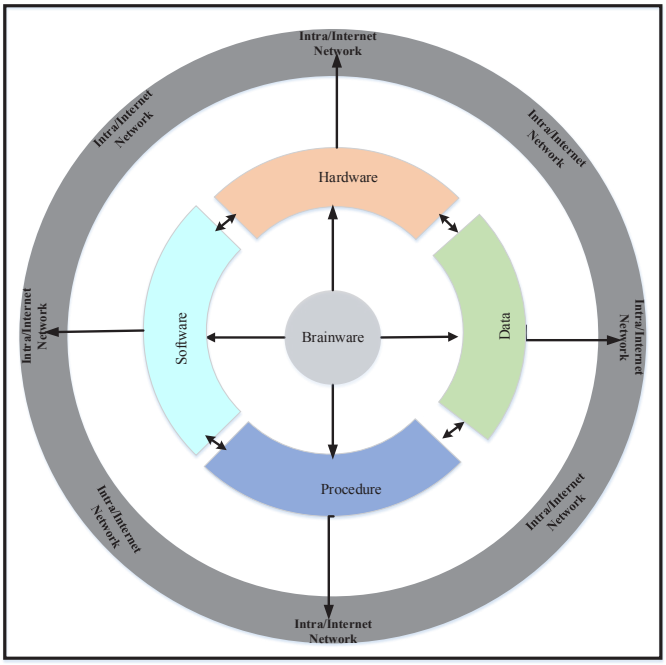
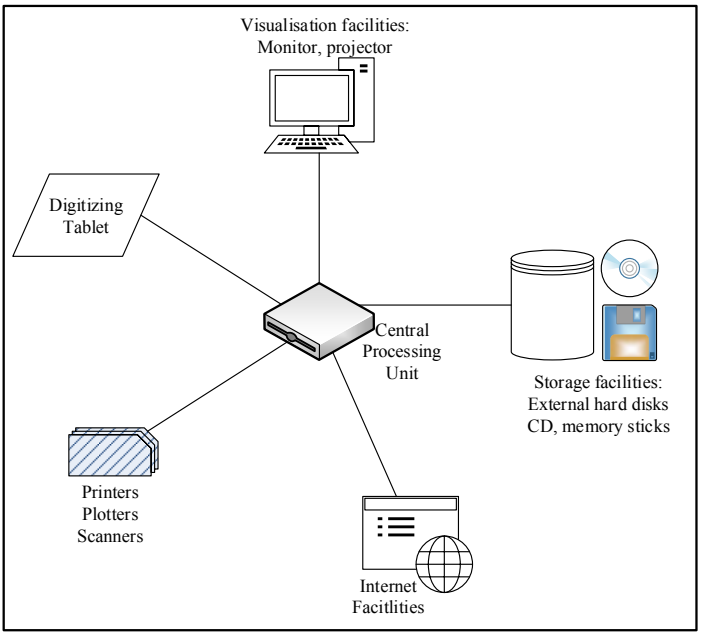


Fig. 9.4: Components of a GIS and their Relationships

However, depending on the purpose of the GIS, the hardware may include digitizing tablets, plotters, scanners, printers and internet facilities. Fig. 9.5 shows these hardware components and their possible relationships within the hardware sub-system of the GIS. In the relationship among the hardware components, the computer (CPU) is central to the functioning of the hardware sub-system. The computer hardware component ranges from personal to super computers, which have efficient processors to run the software packages and sufficient memory to store enough information (data). The type of hardware determines the type of software used and the speed at which a GIS will operate. To a small degree, it may influence the technical level of the people or the brainware who will operate the GIS (Fazal, 2008).



Modified from Murayama & Estoque (2010: 15)

Fig. 9.5: Hardware System of a GIS

Software

The GIS software comprises the computer programmes and the user interface that drive the hardware. The software may not necessarily be a GIS package/programme but other programmes that serve as base programmes for the hardware to function e.g. the operating system of the computer.

There are many GIS software packages, which are currently in use for training and application in the research and industrial environments. These software packages are grouped under:

- commercial, which requires annual subscription fees or a one-time perpetual license; and
- free, which can be downloaded and used without any charge to the developers.

Because of the cost implications for the implementation of GIS, it is necessary to understand these two groups of software packages. The commercial packages can be very expensive and for individuals and organizations on limited budget. It may be better to go for the free software packages but that depends on the purpose of the GIS. If a free software package is capable of achieving the purpose of the intended GIS, why will you want to pay for a different one? Additionally, a GIS software is either open or closed source. Open-source software is software that is distributed freely to the general public under a licensing agreement that allows computer source codes to be viewed, shared and modified by the users. Closed source software is a proprietary software (sourcecode is not shared with the general public), which is distributed under a licensing agreement to only authorized users with private modification, copying, and republishing restrictions. Also, it is important to understand that GIS software packages can be run on three main platforms:

- Desktop.
- Online/cloud.
- Mobile.

A desktop platform is installed directly onto a desktop or laptop computer and the programme is run on that computer. The data for the GIS are stored on a local hard drive of that computer or on an external hard disk. For organizations doing geo-scientific research, complex spatial analysis, and 3D rendering — these platforms are an attractive option. Online GIS is most frequently run on cloud servers: eliminating the need for installation and local data storage. With cloud-based GIS platforms, users can make updates in real-time, access data from anywhere, and share information quickly. Most online GIS platforms operate on a monthly or yearly subscription basis. This stands in contrast to desktop platforms, which are more expensive upfront, but only require a one-time payment. Mobile GIS is, technically, a sub-category of online GIS. Most mobile devices do not have the processing power necessary to run GIS software locally, and so rely on cloud-based mobile applications. Some GIS software packages offer mobile functionality as a built-in feature, while others

require additional purchase of a separate mobile programme. The choice of the software depends on the purpose of the GIS, the skills of the technical expert and the hardware.

GIS Geography has listed 22 GIS software packages and has rated these packages on a scale of 0 to 10, based on their cartographic, analytical, editing and data management capabilities (Table 9.1).

The brainware refers to the GIS operators and users of the information product. The brainware comprises both technical specialists/operators, who design and maintain the system and information users who include everyday decision-makers. Operators plan, implement and execute a GIS to draw conclusions for decision-making. GIS is of limited value without the people who manage the system and develop plans for applying it to solve real world problems.

The identification of GIS specialists versus end users is often critical to the proper implementation of a GIS. For many organizations, the issue really is not the identification of the end users but rather the GIS specialists who are in short supply in the organizations. Many organizations therefore design and develop organizational GIS around one specialist. A GIS that is designed, developed and used by a single person but remains a mystery to all others in that organization, is of little use if the person is out of office.

On the other hand, if an organization undertakes to train a large number of staff on GIS, regular application of the GIS to retain and develop the knowledge acquired would be expensive. The cost of regular GIS training might be out of the means of organizations due to lack of or insufficient resources.

Data

Geographic data are the backbone of GIS. The generic data types in every GIS reflect the traditional data found on maps:

- Coordinate data, which describe the absolute or relative location of geographic features.
- Attribute data describe the characteristics of the geographic features. The attribute data can be quantitative or qualitative in nature. To these two, a third type may be added, namely temporal data. The fact that objects and features on the

Table 9.1: Rating of Major GIS Software Capabilities

SN	Software	Use Accessibility	Rates (Out of 10 marks)			
			Cartography	Analysis	Editing	Data Management
1	ArcGIS Desktop	Paid License	9.8	9.6	9.7	9.8
2	ArcGIS Pro	Paid License	9.9	9.8	9.9	9.7
3	QGIS	Free	9.7	9.7	9.6	9.5
4	GeoMedia (Hexagon)	Paid License	8.7	8.3	8.7	8.6
5	MapInfo Professional	Paid License	9	8.2	8.7	8.1
6	Feature Manipulation Engine	Paid license	4.9	9.9	8.5	9.3
7	Global Mapper	Paid License	7.9	8.5	8.3	7.5
8	GvSIG	Free	7.7	8.8	7.6	7.7
9	GRASS GIS	Free	6.1	9.8	7.4	7.5
10	WhiteBox GAT	Free	8.3	9.5	5.4	6.6
11	GE Smallworld	Paid License	5.8	7.1	8.6	7.5
12	Manifold GIS	Paid License	5.8	8.7	6.9	7
13	AutoCAD Map 3D	Paid License	7	6	9.1	5.5
14	Maptitude	Paid License	7.3	7	6.7	6.5
15	MapViewer	Paid license	8.4	4.9	6.9	6.8
16	ILWIS	Free	5.9	7.7	6.5	6.6
17	SAGA GIS	Free	4.1	9.8	5.4	6.9
18	GeoDa	Free	7.3	8.1	5.5	4.9
19	Bentley Map (Open Cities)	Paid License	6.2	6.8	6.7	6
20	IDRISI	Paid License	6.1	6.7	5.9	5.5
21	UDig	Free	4.7	4.5	5.5	4.9
22	OpenJUMP GIS	Free	4.8	4.7	5.2	4.5

earth's surface are not static but rather subject to change over time led to the development of temporal GIS in the late 1980s and early 1990s (Langran & Chrisman, 1988; Langran, 1992). Langran and Chrisman (1988) realized the limitations of a temporal GIS and the need for temporal data in GIS. They developed a framework for temporal GIS in 1988. This and later developments in temporal GIS enabled researchers to study (sometimes continuous) geographical processes such a sea level rise and deforestation in both time and space. One generic temporal GIS data is the state of a spatial object or phenomenon over time (Langran & Chrisman, 1988).

Geographic data can be collected in-house, purchased from a commercial data provider or obtained freely from other data houses through the internet. The integration of spatial data, and attribute data stored in a Database Management System (DBMS) is a key functionality of GIS. Whatever the geographic data, two critical aspects that require attention are the coordinates and the projection systems. This is because a basic principle in GIS is that two or more datasets that need to be overlaid, must be based on the same spatial reference, which is determined by the projection systems and the coordinates (Chang, 2019).

In this respect, it is important to examine the metadata of the data, if available. Metadata is data that describes the geographic data (e.g. who collected the data and how), and which helps the user to decide whether or not the data is fit for purpose. Geographic data without metadata is unreliable and should be treated with caution. Other aspect of geographic data that is worth consideration is the format of the data: vector or raster. The format of the data is largely dictated by the purpose of the data and the analysis to be performed on the data.

Procedures/Methods

A successful GIS operates according to a well-designed plan, data standards and rules, which are the models and operational practices

unique to each task and to each institutional organization. There are various techniques used for data collection, processing, analysis, visualization and the application of the information product (map, table, etc.). As usual of most organizations, the introduction of sophisticated technologies or tools can only be effective if they are properly integrated into the entire organizational strategy and operational system. Attempts to implement a GIS without regard for a proper organizational commitment may result in an unsuccessful system.

Internet

With rapid development of information technology (IT), the network of computers and people have become very crucial and without which no rapid communication or sharing of digital information can occur efficiently and effectively. GIS today relies heavily on the Internet, for acquiring and sharing large geographic datasets. The Internet has facilitated the development of other aspects of GIS, for instance Web GIS which uses web-based technology for mapping, collecting, sharing and analyzing geospatial information (Fu & Sun, 2011).

Application Areas

Many applications of GIS are currently driven by location intelligence i.e. the understanding of why things happen where they do. Everything that happens, happens somewhere and happens for a reason. Knowing what is where and why it is there facilitate intelligent management decisions (Fu & Sun, 2010). GIS provides answers to the what, the where, the when and the why of resources to facilitate their development and management. A GIS provides both spatial and non-spatial pieces of information that form strong basis for decision-making in terms of sustainable management of resources and development as a whole. A GIS for management decision support is designed to answer five fundamental spatial questions (Campbell & Shin, 2012):

(i) The question of location of features.

- What is it?
- Where is it?
- How much of it is there?

(ii) The question of pattern of features in space. What spatial patterns exist or do not exist among features? This question looks for and identifies spatial associations or absence of associations among features.

- What is the feature?
- Where is the feature?
- What is the boundary of the feature?
- Is the occurrence of the feature spatially clustered or dispersed?
- Is the occurrence of the feature local or global?

(iii) The question of trend of features in space. This combines location and time. What has changed over time? What is the feature?

- Where is the feature?
- Has it always been here?
- How has it changed over time and space?
- What causes change?

(iv) The question of condition.

- What is the feature?
- Where is the feature?
- Has it always been here?
- How has it changed in size and over space?
- What is the cause of the change?

(v) The question of cause-and-effect spatial relationships among features. The question of cause and effect explains the effects of initiating a certain cause on a feature. It is sometimes referred to as a what-if analysis i.e., cause and change.

- What is the feature?
- Where is the feature?
- Is it associated with other features?
- What is the nature of this association?
- How much interaction occurs between the locations?
- What happens when a change is introduced to a feature?

Answers to these questions are incomplete without the answer to the underlining why question, which is embedded in each of the five questions. These spatial questions are applicable to nearly every field of study and work, suggesting that GIS can be applied in nearly every field, ranging from agriculture to transportation (Fig. 8.6) and their sub-fields (Wieczorek & Delmerico, 2009). For instance, in the management of natural resources, overlay of satellite images, and socio-economic datasets in a GIS environment can reveal the impacts of human beings on the environment. In health, Web GIS played an important role in the management of the COVID-19 pandemic. Web GIS was used in mapping the spatial transmission of the virus, tracing potentially infected persons, allocation of resources, highlighting hotspots of the cases across the world (Zhou *et al.,* 2020).

Challenges

Challenges exist in the teaching, learning and applications of GIS and can change the focus of an academic GIS programme or end a long-term GIS application abruptly. The challenges range from academic issues through funding to implementation. The challenges are interconnected and influence one another either directly or indirectly. They must be treated as a system or sub-systems and tackled from a system point of view. The presentation of challenges of GIS cannot be exhausted in this section and will concentrate on lack of funding for GIS facilities, misconception that Global Positioning System (GPS) is GIS, lack of National Spatial Data Infrastructure, multiplicity of map projections and coordinate systems, access to data and telecommunication facilities, balancing GIS knowledge and GIS skills.

The major challenge to providing practical skills in GIS is lack of funding for the acquisition and maintenance of GIS learning facilities namely, hardware (computers, GPS, plotters, etc.) and commercial software (Acquah *et al.,* 2017). Management of organizations rarely understands the value of GIS in critical management decisions; thus many GIS development efforts in many public institutions are either underfunded or prematurely abandoned for lack of funds. In addition, many GIS training institutions tend to provide students

with the knowledge without the skills due to lack of the requisite training facilities. For an effective use of GIS, there is the need to have a good balance between knowledge and skills in GIS.

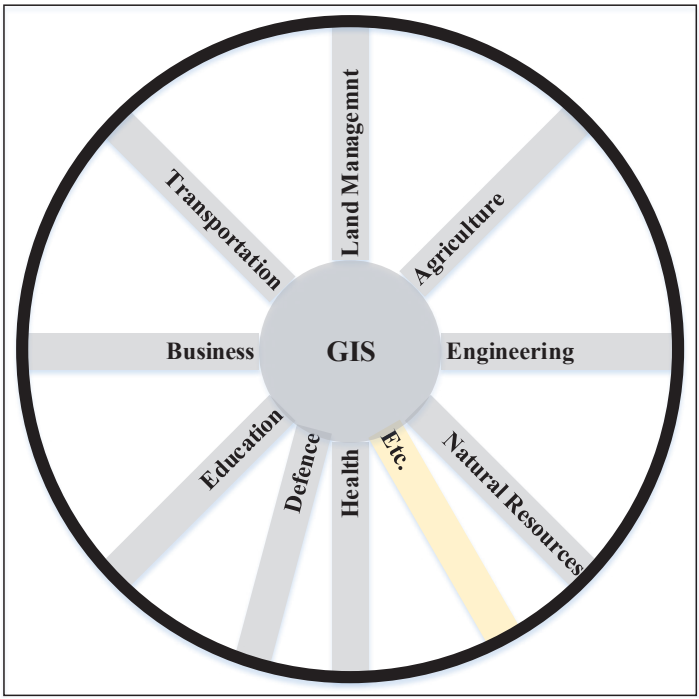


Fig. 9.6: Major application areas of GIS

Lack of computer skills is a challenge to effective GIS training. Developing good skills in GIS requires various levels of computer skills. Insufficient computer skills tend to affect the ability to apply GIS efficiently and effectively. Importantly, a lack of basic computer programming skills affects the ability of GIS users to be innovative in the use of GIS in simulating and solving real world problems. This results in under-utilization of GIS functions and under-estimation of the power of GIS in solving real world problems, which tend to underrate the impact of GIS on society (Acquah *et al.*, 2017). These

shortcomings are sometimes attributed to how GIS users, both technical and end users are trained, as emphasized below:

On the one hand, there are excellent postgraduate courses in GIS but these tend to be very focused on geography — which is not a bad thing — but you do not tend to get the computer skills you need. On the other hand, there are intensive computer science courses that fail to provide the geographical knowledge needed. It is hard to get the right mix (Vandenbroucke & Vancauwenberghe, 2016: 8).

GIS training should not only be based on techniques and applications but on the debates, which have been generated in the past or the politics of geographical information (Dun *et al.,* 1997). Current GIS education is a result-oriented training i.e. data analysis, presentation, and communication (National Research Council, 2006). This creates knowledge gaps in data exploration (hypothesis generation and concept synthesis) upon which data analysis, presentation, and communication predicate (National Research Council, 2006). Consequently, GIS users are more interested in information from a 'black box' (GIS).

In addition, there is a misconception that GIS is synonymous with GPS technology used in GPS receivers, smart phones, smart watches, cars, etc. This simplistic view of GIS has serious negative implications for its implementation. Misconstruing a GIS to mean GPS creates the impression that by having a GPS receiver of some form means that one has GIS or can implement a GIS application to support management decisions. GPS may be used as a data capturing system for a GIS, but such is however a small portion of a GIS. As explained early on, data constitute just one component of the GIS anatomy. The unfortunate misconception that GIS is GPS was the understanding many government institutions had at the early stages of GIS, especially in Ghana. Even today, after the country has made significant advances in GIS development and implementation, some government organizations still have this understanding of GIS.

The wrong perception of GIS as GPS is manifested in the acquisition of GPS receivers by many government institutions, which have been used to collect geographic data. The data are there but of limited use to critical management decisions because they cannot be

processed and analyzed. Clearly, this cannot be the purpose of the simplest GIS.

One major challenge of GIS in Ghana is the lack of a National Spatial Data Infrastructure (NSDI) to ensure the existence of Spatial Data Infrastructure (SDI) policies, spatial data standards, metadata, thematic national database, spatial data clearinghouses, coordination of data user orgnanizations and institutions (Folger, 2009; Groot & McLaughlin, 2000; FGDC, 1996). Although the establishment of and investment in NSDI is of similar importance as physical infrastructure, it has not received the necessary attention. Consequently, there are unreliable geographic data everywhere, which are being generated or funded with state resources, which could have been invested in a functional and reliable NSDI. Without a functional NSDI, GIS may be a threat to national development because decisions based on wrong data cannot advance national development. Using wrong data may be worse than having no data because the effects of any decision based on wrong data cannot be better than the quality of that data.

Furthermore, multiplicity of projection and coordinate systems is a serious challenge to geographic data acquisition. A basic principle in GIS is that, for data layers to be overlaid, it must have the same coordinate system; but the existence of many different map projection and coordinate systems serving different purposes used by many different data producers makes it difficult for GIS practitioners to handle data from many different sources (Chang, 2019). The situation is worsening by on-the-fly projection, which makes it difficult to detect incompatible projection systems during data overlay, especially those who learned GIS as a computer programme without the basic principles of GIS or geography. The overlay of data of different projection and coordinates will produce wrong maps if care is not taken. The consequence of this is not too different from the lack of National Spatial Data Infrastructure (NSDI).

Access to data is still a big challenge for many developing countries. The challenge comes mainly in the form of financial and skilled labour constraint. It is estimated that acquisition of geographic data accounts for about 90% of the overall cost of developing a GIS (Jacob & Olajide, 2011; Uluocha, 2007). Where funds are available,

it requires trained personnel to collect quality data on the ground for reliable GIS. In the developing countries, especially Africa, these trained personnel are inadequate for spatial data collection. In the event that one is able to purchase the data, transmission facilities namely, internet may still be an impediment if the transmission system is not efficient. Geographic data can be very bulky and transmitting it through the internet requires an efficient internet system.

Conclusions and Recommendations

This chapter has presented a summary of some historical developments, concepts and issues, applications and challenges of GIS with the aim of supporting the many beginners in the study and applications of GIS while initiating further discussions on the academic debates that accompanied the introduction of GIS into the academic field.

Over the past five or six decades, computer-based GIS has grown in the developed world and has become a global discipline, albeit still a fairly new discipline in some parts of the developing world. The awareness of GIS continues to increase through education and training, thus widening its application scope. There are many prospects in the application areas of GIS as the world faces problems from increasing population, climate change, loss of natural resources and environmental pollution. The prospects for the application of GIS in the future are brightened by improvement in the global internet system e.g. the introduction of 5G internet facility.

Although the phrase, geographic information system, is common in the geospatial literature and in practice, there are misconceptions about key aspects of it that still undermine its relevance, implementation and critical application in sustainable development. While the main challenge of GIS in the developed world is making GIS more innovative, its main challenges in the developing world are still rudimentary, ranging from conceptual issues, effective design of academic programmes and courses, learning and applications. A clear purpose of the GIS is very important; and carving a clear purpose for GIS programmes is

still a major challenge. Academic programmes should focus on Geographic Information Science/GeoInformation/ GeoInformatics or on Geographic Information Studies, depending on whether the emphasis is on physical science or social science. GIS should then be seen as the generality of the various applications of GIScience and GIStudies. The teacher, student or practitioner of GIScience or GIStudies must understand the objectives of teaching, learning and practising GIS. A stable definition of GIS is still of need and should be focused on the where what happens, when what happens, how what happens, and why what happens instead of simply focusing on the technology of GIS.

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CHAPTER TEN

Ghana's Cadastral Surveying Process and the Inherent Legal Remits

PROSPER BASOMMI LAARI

ABSTRACT

This chapter explores aspects of the legal remits of cadastral surveys that arise due to the low level of awareness on the part of clients and practitioners in Ghana's land sector. It sheds light on the different plans available and their respective applications and expounds on the legal contexts for creating cadastral plans. Specifically, it highlights the significance of the law in land surveying and how the complementary legislation, LI 1444, filled critical gaps in the Survey Act, 1962 (Act 127). The chapter reveals that cadastral plans are the only legitimate plans for all land transactions that involve land registration. Most importantly, it discusses the significance of the current legal regimes in reducing unlicensed or unprofessional activities, improving standards, and promoting civility in Ghana's cadastral survey practice. Therefore, this chapter contributes to the efficient and legal process of cadastral surveying and the promotion of standards due to this regime.

Keywords: Cadastral, Survey Act, Land Surveying, Land Registration, Legal Regime

Introduction

The practice of cadastral surveying is the act of producing cadastral plans to be attached to deeds and instruments in the description of boundaries of landed properties. There are various methods with varying degrees of accuracies (Dimitrios *et al.,* 2018). A cadastral (geodetic) survey is carried out to establish cadastral data of land plots (Mika & Leń, 2016). It is the main foundation that satisfies a land register's initial requirements by defining the parcels of land, which constitute the objects and units of the land record, thereby

settling appropriate administrative and economic sub-division of the territory concerned (Fosu & Derby, 2008). Therefore, it is a more interactive land administration survey system that involves adjudication, boundary definition and demarcation, surveying, registration, dispute resolution, and information management (Cheng & Tang, 2002). This may also include measuring and mapping new or changed legal parcel boundaries and re-establishing lost boundaries and resolving disputes over boundaries or other interests in real property (Chileshe & Shamaoma, 2014).

Land documentation and registration have seen a lot of transformation, all to improve the system and enhance the efficiency in land delivery in Ghana. A plethora of evidence abounds in the world on land registration providing better access to formal credit, higher land values, higher land investments, and higher output/income in many areas (Feder & Nishio, 1998; Lipton & Saghai, 2017; Nguyen, 2012). This forms the reason for proper and efficient documentation in the land registration process.

Cadastral plan acquisition is the most important step in the land registration process. Over the years, many unlicensed and unsuspecting land agents have used crude means of registering their lands with plans other than this legally stipulated document. Many have used a certified plan with its attendant challenges though accepted by law in some instances. The laws in administering cadastral surveys in Ghana are replete in the nation's law books and Surveying Technical Guidelines.

The Gold Coast Survey Technical Instructions, the Survey Act of 1962 (Act 127) (Government of Ghana, 1962) and the Legislative Instrument (LI 1444) provide the legal framework for cadastral survey administration. Moreover, the Lands Commission Act of 2008 (Act 767) also empowered the Survey and Mapping Division (SMD) to supervise, regulate and control the survey and demarcation of land for land use and land registration purposes. Consequently, this has further strengthened cadastral practice with the regulation of certification still clothing the Director of SMD in the process. For many years, there has been confusion on the differences in the use of a cadastral plan, a certified plan or a site plan. The wanton abuse

and misrepresentations from industry players and unsuspecting land interest clients have been a sense of worry, conflict and land litigation in Ghana.

The first point of call for any cadastral or land surveying is engaging the services of a licensed surveyor and not just an individual with a certificate in Land Surveying or Geodetic/Geomatic Engineering. In fact, being a member of the Ghana Institution of Surveyors (GhIS) does not automatically qualify a person to carry out this type of assignment unless the work is of engineering nature only, and requires no approvals or is not intended for registration purposes.

The next sections of this chapter explores the relevant plans, the processes and legal remits of cadastral survey practice, and the implication of the applicable laws that aid in improving standards, accuracy, and civility in the land surveying profession.

Plan of Survey

A Plan of Survey describes different types of plans depicting legal boundaries. Survey plans are prepared for official registration purposes or for the private use of an individual or corporation. These are real depictions of the reality on the ground or planned features to represent. They can represent very small or large areas transcending beyond 50 acres of properties. Surveyors typically prepare them as the best way of establishing an entitlement to a piece of land. Various plans exist in the chain, including Certified plan, Composite plan, Approved plans, Parcel plan and Cadastral Plan.

Certified Plans

Certified plans are prepared by licensed surveyors to show the final boundaries of the lots and parcels. They are prepared to meet the minimum standards for plan content, such as having grid lines, showing the bearings and distances of links and connection links and a certification by the surveyor. These plans are no longer adopted by the Lands Registry for legal registrations since the current registration

regime requires the verification of the plan by an official surveyor (i.e. the Director of Surveys). That notwithstanding, certified plans could still be used as a guide for applying for utilities and providing a guide for searches on land, among others. They purport to provide accurate land boundaries, as defined by the Director (Survey and Mapping Division of the Lands Commission), and also give the exact measurements by which boundaries may be demarcated or re-demarcated on the field. Such a plan must be certified by a licensed surveyor in accordance with certification designed and directed by the Director of Surveys.

Composite Plans

A composite plan is a single plan created by joining two or more separately themed plans together. Composite mapping involves overlaying and combining data types from two or more map overlays to create a map displaying a combination of information from the different thematic maps. Colour assignment is used to bring out differences between the various themes in the composite.

Approved Plans

All legal surveys and descriptive plans must be examined and approved prior to becoming part of the Land Surveys Directory.This is a way of ensuring that the integrity of the system is maintained. Approval is given only when a plan is certified by a Licensed Surveyor and the preparation of the plan conforms to the standards of accuracy and form, as prescribed by the applicable regulations or as directed by the Director of Surveys.

Parcel Plans

A parcel plan is generally a large-scale map of an area showing all of the property parcels and their use, the boundaries and the distance between them. These are layout plans that are utilized by the Land Use and Spatial Planning Authority.

Cadastral Plans

A cadastral plan is a map or plan purporting to show boundaries of land with accuracy, as defined by the Director of the Survey and Mapping Division of the Lands Commission. This plan is made in conformity with the result of a survey carried out by an Official Surveyor or Licensed Surveyor. It must indicate the exact measurements by which the boundaries may be demarcated or re-demarcated on the ground and provide all the details on the parcel and within 30m radius of the parcel. Furthermore, it must be approved and signed by the Director of Surveys, whether made by an Official Surveyor or by a Licensed Surveyor.

The other plans are pretty much simple to operate. Conversely, confusion lies in the use of certified plans and cadastral plans and the fact that cadastral plans are not replaceable as far as land registration is concerned. Both certified and cadastral plans go through the same processes, but the former does not require the approval of the Director of Surveys. After the promulgation of the Land Title Registration Law (PNDCL 152) in 1986, certified plans were acceptable for deeds registration. However, to avoid duplication of certified plans for the same parcel of land, a Legislative Instrument, LI 1444, was passed in 1989 to regulate the technical conduct of cadastral surveys in Ghana. The LI requires that the Lands Commission (represented by the Director of Surveys or his appointed representative) authenticates and verifies works submitted by the License Surveyor. This approved certified plan, referred to as a cadastral plan, is the only legitimate plan for land registration. That notwithstanding, certified plans are admissible in all other forms of land surveying or spatial consideration other than land registration.

Cadastral surveys in Ghana are regulated by the Survey Act of 1962 (Act 127), which mandates the Director of Surveys to carry out such surveys through official surveyors in the Surveying and Mapping Division of the Lands Commission who are directly under him or her to license experienced surveyors, most of whom are in private professional practice and are members of the Ghana Institution of Surveyors (GhIS). There is still confusion surrounding cadastral

plan use or knowledge, particularly in land registration. Due to the long winding processes to get these documents, many tend to rely on certified plans or site plans from the Land Use and Spatial Planning Authority (Edwin & Glover, 2020; Williamson, 1985). In Mauritius, the Director of Surveys wields the same power. According to their Cadastral Survey (Land Surveys) Regulations 2013 GN No. 119 of 2013 "the Chief Surveyor may, pursuant to his powers under the Act, issue Guidelines, Directions and Notices to land surveyors to regulate the practice of land surveyors, and to set standards for land survey work in respect of geodetic survey control, cadastral land surveying practices, survey accuracy, marking, plans, data and data formats, survey plan and document registration procedures, and any other matter related to surveying practices, the coordinated and the Digital Cadastral Database (DCDB)" (Allam, Dhunny, Siew, & Jones, 2018). This is also applicable in New Zealand as only surveyors who hold a license from the Cadastral Surveyors Licensing Board are allowed to undertake cadastral survey, but they have, however, mixed traditional options to mitigate cadastral risk (Coutts, 2011).

Process of Executing a Cadastral Survey and its Basis in Law

The following is the step-by-step process of executing a cadastral survey in Ghana. Fig. 10.1 summarizes the process in two steps: (1) the main process and (b) detailed steps of executing cadastral survey.

The licensed surveyor or an official surveyor introduces themselves, in accordance with the Survey Act,1962 (Act 127) Section 6 (1), and educates the client about quacks (popularly known as 'goro boys') in the industry, as recommended in Act,1962 (127) Section 6 (2 and 3). A meeting is then arranged for a detailed discussion with client.

The surveyor meets with client for detailed discussions on client's needs (Common Practice) and explains to the client the things required for the preparation of the plan, including costs and information on: the exact location; and ownership details (name/ family, region, expected size, etc.), LI 1444 Regulation 4 (1a and 2) supports (2) above.

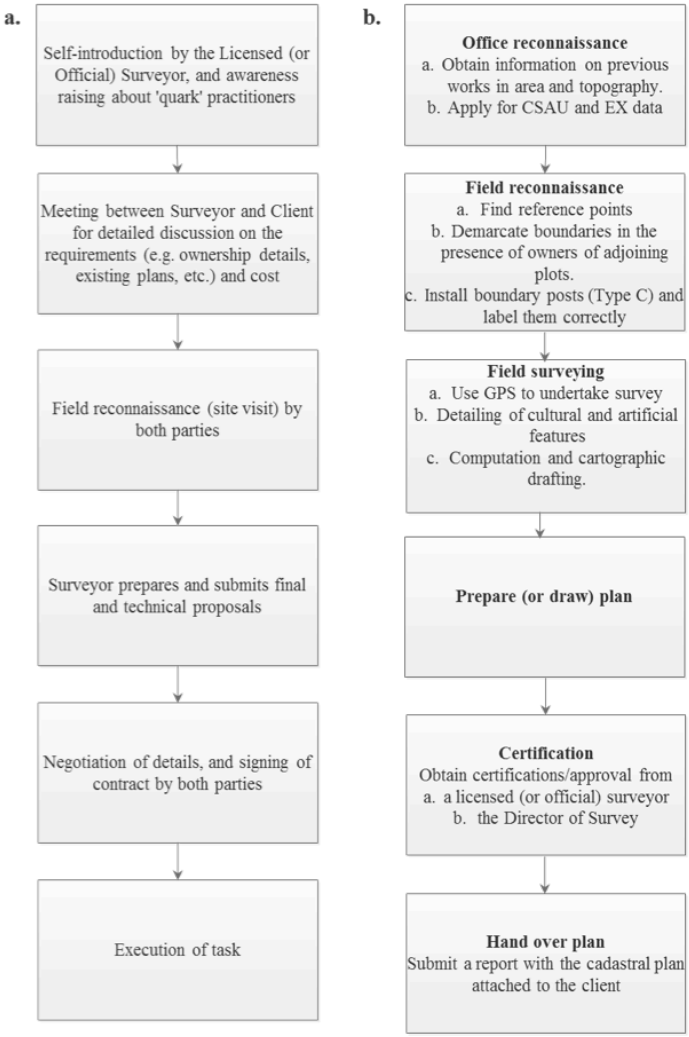

Fig. 10.1. (a) Main Cadastral Survey Process and
(b) Steps in Executing the Cadastral Survey Task

According to Regulation 15 (1) of the LI 1444, a request for existing plans is also to be made. In this meeting, it is common

practice to schedule for a field reconnaissance.

Field reconnaissance or site visit is needed for the appreciation of the site conditions in order to plan a successful project. During such visits, it is a common practice to observe the topography, type of vegetation and river boundary as well.

After the field appreciation, it is a common practice to prepare and submit to the client financial and technical proposals in consultation with the scale of fees by surveyors. The Public Procurement Act, 2003 (Act 663) also provides and prescribes the procurement processes to be followed.

Negotiate with the client as provided in the Procurement Act and document all agreements on the terms of reference and costs.

Conventionally, both parties sign the agreements into a contract that binds them to play defined roles for successful completion of the project. The Procurement Act confirms the signing of contracts.

Job Execution

Office reconnaissance: Usually, the surveyor undertakes office reconnaissance to acquaint themselves with previous survey work(s) within the area; obtain topographical sheets from Survey Department; apply for a regional number from the Client Service Access Unit (CSAU) and examination data (EX Data), in accordance with Regulation 15(2) of the LI 1444, and the technical guidelines.

Field reconnaissance: It is also common practice to undertake field reconnaissance in order to find beacons, point of departure; visit the SMD, and observe all protocols as prescribed in Act 127 (1962) Section 19(1), and Cap 159 Section 14(1). Act 127 (1962) Section 16 requires the surveyor to demarcate the boundary of his/her client in the presence of those with whom they share boundaries.

Once the stakeholders agree on the boundary, Act 127 (1962) Section 13(1 and 2) and Section 16 provide for clearing along the borders, planting boundary posts (type C pillars) and labelling them serially. The technical guidelines, as well as common practice, require the testing of the point of departures.

Method of survey: A calibrated and approved total station or

GPS must be used to make observations on the established boundary posts; download and post process; computations for bearings and distances; drafting and plotting of plan to scale; certify plan by licensed surveyor; prepare file for submission to the Director of Surveys (SMD) or the regional representatives for approval as prescribed in common practice; technical guidelines, Regulation 3.5 and LI 1444 Regulation 4 and 5.

With the approval completed, a report is prepared, and the cadastral plan attached to the report and submitted to the client as the technical guidelines provided in Regulation 3.10.

DISCUSSION

Legal Process in Carrying Out Cadastral Surveys or Producing a Cadastral Plan

According to Act 127 (1962) Section 6(1), "No person other than an official surveyor, a licensed surveyor, or any public officer making or preparing any plan in the course of his duties as such shall survey any land for the purpose of preparing any plan for attachment or any instrument of conveyance, leases, assignment, charge, or transfer." In simple terms, cadastral surveying can only be executed by an official surveyor or a licensed surveyor. However, there are so many 'quacks' in the country purporting to be surveyors. Such people lack the requisite legal backing from the stated law above to prepare plans for clients. These quacks typically conduct dubious and inaccurate surveys and manage to authenticate these plans (conniving with some licensed professionals and officials), adversely affecting professional practice and standards in the country. On the one hand, it is imperative that the relevant laws be enforced, so that licensed surveyors and officials who are found culpable are penalized to serve as a deterrent.

On the other hand, there is the need to adopt innovative ways of engaging these non-professionals in order to formalize their operations and assimilate them, so that they can work well with licensed surveyors. Organizing training programmes for such people and creating a 'special route' through which they can be part of the

Ghana Institution of Surveyors, are some of the approaches worth considering. Moreover, the implementation of a land administration system that allows only recognized practitioners in the registration process could minimize the operations of quacks in the industry. For example, recently, the Lands Commission has rolled out a new online system which grants access to only licensed surveyors. These systems greatly reduce third-party involvement, which usually creates the room for the activities of 'quacks' in cadastral surveying practice. According to Act 127 (1962), 4 (a,b): "Any person contravening the provisions of this Act shall be liable to a fine not exceeding one hundred pounds or to imprisonment for a term not exceeding six months."

A licensed surveyor or official surveyor can, therefore, proceed to undertake this survey for a client. The next step is to schedule a meeting with the client. This is a common practice and a necessary protocol to initiate any business. Discussions on such an assignment to produce a cadastral plan would focus on: All the details that go into a cadastral plan preparation, as captured by LI 1444 Regulation 4, Sub-regulations 1 and 2. Also to appear are the ownership details and other necessary information on the acquisition process, based on LI 1444 Regulation 2. Others are details on the name of family, boundary description, region where the area of interest exists, and the expected size by the client, as stipulated in LI 1444 Regulation 4 Sub-regulation (2):

> 4.(1). Every plan submitted for approval under these Regulations shall be accurately plotted and the scale chosen shall be as specified by the Director of Surveys from time to time or shall be such as will show clearly all the details and specifications required under these Regulations.
>
> 4.(2). Every plan shall have a title which includes the scale, the designation of all the parcels of land shown therein, the region, city, municipality and town in which the land is situated at the time of the survey.

Existing plans are critical for any survey work and so this information would be solicited in tandem with by LI 1444 Regulation

15, sub-Regulation (1):

> 15.(1) A licensed surveyor shall before carrying out any survey of a parcel of land collect all the information relating to any previous survey of such land and of all the adjoining parcels of land.

After all these discussions are made and information sought, it is a common practice to discuss with the client when the site can be visited for a non-official reconnaissance survey. The two parties must deliberate and mutually agree on the cost involved and other courtesies. The site visit is then undertaken to ascertain information already discussed and other field details like vegetation, controls, cultural and artificial features like buildings, roads, and boundary.

Preparation of technical and financial proposal would proceed after the site visit. The details of the contract with client would be well spelt out here. The licensed surveyor must negotiate with the client on some key parameters such as labour, accommodation for survey staff, transportation and other reimbursables in the form of a Terms of Reference (TOR) agreeable to both parties. Here the technical guidelines based on the Procurement Act, 2003 (Act 663) and the Ghana Institution of Surveyors fee schedule would guide the contract negotiation and execution. The cost of cadastral plans varies in Ghana depending on the officer involved, distance to be covered by transport, nature and size of the land. Access to ground controls is no more a serious point of concern, especially in the advent of the Global Navigation Satellite System (GNSS). The contract would be signed, and the schedule of work and payment implemented for the rest of the work to begin. Many clients do not take this part seriously and are very informal in their deliberations. There is a need to ensure both sides fulfil their part of the bargain. The licensed surveyor, by ethical conduct, must faithfully carry out the assignment ensuring that funds are used as agreed, and the client must also honour their contractual obligations after the former executes all deliverables.

After the contract is signed an office reconnaissance is scheduled, the surveyor procures topographic sheets and also applies for a regional number from the Client Services Unit (CSAU) of the SMD, in accordance with Survey Act, 1962 (Act 127) Section 16 (Technical Instruments for Spatial Data Capture).

> 16. A surveyor may, if the boundaries of a land under survey have not already been correctly marked in the prescribed manner by the owner of the land, mark out the boundaries of the landmarks according to the manner of marking prescribed by regulations.

An Ex-Data LI 1444 Reg. 15 Sub-Regulation 2 is obtained:

> 15. (2). The Director of Surveys shall provide a licensed surveyor whom he has instructed to demarcate the boundaries of any parcel of land, all the information in respect of such land as is available to him free of charge.

Field reconnaissance would help obtain controls and other details as Survey and Mapping Division of Lands Commission is visited. This is seen in the Survey Act, 1962 (Act 127), Section 12:

> Any official or licensed surveyor may with his agents, servants, and workmen, enter upon any land which he is appointed to demarcate or survey, and may make all enquiries and do or cause to be done all things necessary for effecting the demarcation of the boundaries and the survey of such land.

Furthermore, differential Global Position System (GPS) technology is then used to execute the work as required in LI 1444 Regulation 5 (1a and 1b). GPS technology is now the most reliable and efficient method in land surveying, as it is capable of withstanding weather conditions, allows intervisibility and meets the accuracy requirement (Laari, 2017; Poku-Gyamfi, 2009; Ziggah, Youjian, Tierra, & Laari, 2019).

> 5.(1) No plan shall be accepted by the Director of Surveys for examination and approval unless–
> (a) it is prepared under the direction of and signed by the official or licensed surveyor who carried out the survey; and
> (b) it conforms to the standards of accuracy and form prescribed by these Regulations or as directed by the Director of Surveys.

Community entry procedures coupled with protocols would be done in the field in line with customary law practices. You walk round the boundary or adjoining boundaries along with the owners

as stipulated in the Survey Act 127 (Section 13, sub-sections 1 and 2):

> 13. (1) A surveyor, demarcating or surveying a land, may cause a notice to be served on any person owning, occupying, or otherwise interested in, any land abutting thereon, or on any person employed on or connected with the management or cultivation of such land, requiring such persons to attend personally, or by agent, before him at such time and place as may be stated in such notice, for the purpose of pointing out the boundaries of such land, or of affording such information as may be needed for the purpose of surveyor demarcation.
>
> (2) The surveyor may issue a notice calling upon any person who in his opinion is able to give any information respecting the boundaries of the land, or in whose possession or power any document relating to such boundaries is alleged to be, to attend before him and give such information or produce such document on the date and at a place specified in the notice.

When all parties agree with the boundary extents, the next step is to clear the land (Survey Act, 1962 (Act 127), Sec 14, sub-sections 1 and 2):

> 14. (1) Any person desiring his land to be either demarcated or surveyed or both may apply to the Chief Survey Officer to have the land demarcated, surveyed or both as the case may be.
>
> (2) The Chief Survey Officer may require a person making an application under sub-section (1) of this Section to clear any boundary or other line for the purpose of the demarcation 01" survey of the land by cutting down and removing any trees, bush, fences, or growing crops.

Demarcating the boundaries is a critical activity that must ensure adjoining plots or extents with other parcels are well delineated; the intervals must also be consistent with the technical guidelines of not more than 300 ft. This would ward off conflicts or litigations as a result of demarcations with long traverse legs or intervals more than 300 ft that makes boundary description far off and subject to dispute.

The Surveying Technical Guidelines recommends the use of Type C boundary posts. Planting of the posts must be at reasonable intervals, in line with the SMD provision of numbering and fixing

points. A field book for the diagram of survey and other field details are to be used in line with LI 1444 Regulation 21, sub-Regulation 1, Paragraph (a):

> 21. (1) Every licensed surveyor shall, when carrying out a survey, keep and maintain a field book in which shall be recorded in respect of that survey.
> (a) the type and other particulars of the theodolites used, the number assigned to each measuring band, the tension applied to the measuring band when taking measurements and, where sag corrections are to be applied, the weight of the respective measuring band.

The field observations then begin using GPS after testing points of departure and determining the reference/base points: Detailing of the cultural and artificial features would be done using a total station. The observations would be downloaded, processed and computations executed. The drafting and cartographic work would be done in line with LI 1444, Regulation 4 sub-Regulations 1 and 2:

> 4. (1) Every plan submitted for approval under these Regulations shall be accurately plotted and the scale chosen shall be as specified by the Director of Surveys from time to time or shall be such as will show clearly all the details and specifications required under these Regulations.
> (2) Every plan shall have a title which includes the scale, the designation of all the parcels of land shown therein, the region, city, municipality and town in which the land is situated at the time of the survey.

The cadastral plan is then plotted and printed at a reasonable scale depending on the size of land but normally 1:2500. The title as well as designation of parcels are herein included subject to LI 1444, Reg 3 sub-Regulation 1, 2. It is required in LI 1444, Regulation 5 (1a) that a licensed surveyor certifies the plan:

> 5.(1) No plan shall be accepted by the Director of Surveys for examination and approval unless – (a) it is prepared under the direction of and signed by the official or licensed surveyor who carried out the survey.

A file containing the required information is prepared to be submitted to the Director of Surveys and Mapping who the law requires in LI 1444, Regulation 9 paragraphs (a) and (b):

> 9. A licensed surveyor shall, where he carries out a survey of any unsurveyed parcel of land, deliver to the Director or Surveys for examination and filing –
> (a) plan showing the boundaries of the parcel of land or in the case of lands where approval of any planning authority is required by virtue of enactment law for the time being in force, the approval of the relevant planning authority; and
> (b) all original records of the survey covering the area of the plan and other information or which the licensed surveyor considers material or which the Director of Surveys may require.

This process of a Licensed Surveyor signing would not apply if it is done by an official surveyor on behalf of the Director of Surveys. Once the financial obligation and other details in the Terms of Reference (TOR) are met, the final cadastral plan can be submitted to the client.

Significance of Laws Governing Cadastral Practice in Ghana

Land law is of crucial relevance to our social, political, and economic life (Bright & Dewar, 1998). For a society to live in harmony and have an orderly process, there is the need for laws to guide and bring sanity (Cardozo & Kaufman, 2010). These laws regulate the conduct of its members by making them abstain from acts that are detrimental to society and enable them fit well in societal norms and practice. Professional practice, apart from its ethical consideration, requires the introduction of laws to regulate and guide surveying.

Reduction of Quacks

When there is no law to guide the surveying practice, it brings about non-professionals who use all sorts of non-prescribed methods in the discharge of work without recourse to any standard. The Survey Act, 1962 (Act 127) can be described as non-responsive or not effective

to current challenges in surveying practice. Coupled with the non-enforcement of relevant surveying laws in Ghana, this has paved the way for quack surveyors and surveying firms to mushroom in the country. In spite of the existing laws, quacks still exist, indicating that the situation could have been bizarre if there were no laws to pin them to a certain standard. Moreover, not only have the activities of quack practitioners deprived qualified and licensed surveyors of revenue and business opportunities, they have also contributed to the chaos in the land documentation and administration process and the numerous land litigation cases which are adversely affecting investments in the country.

Maintenance of Standards

In simple terms, standards are accepted or approved examples of something against which others are judged or measured. Standards are best formulated, adhered to and practised if there is a law guiding such practice. Some of the reasons ascribed to the of problem of surveying in Ghana include the lack of standardization facilities for testing equipment, and difficulty on the part of clients to access accurate and comprehensive maps and plans. However, laws can put these in perspective since the Survey Act, 1962 (Act 127) gives technical guidelines as to how instruments can be tested and the standards to be maintained. The Survey Act contains all the laws necessary for professional practice of land surveyors in Ghana.

When you have no standard, you fall for anything. Currently, in Ghana, there exists all sorts of plans with questionable formats and accuracies. The laws, therefore, guide professional practice to have a baseline in the assessment of these survey products of varying quality. Additionally, GhIS's Code and Ethics serve as a guide for ethical considerations during survey operations.

Reduction of Conflict and Chaos

In the absence of laws to provide guidance in surveying, there arises chaos and the budding of unending conflicts. Where there is no law, processes are not defined, resulting in subjective practices. In the face of cadastral disputes, land guards and litigations show that there is

something fundamentally wrong somewhere. Without laws, most land issues would lead to litigations, thereby increasing conflicts and causing unnecessary chaos.

The long winding land guards menace and improper conduct with more biting laws would sanitize professional surveying practice in Ghana. This would inure to a more peaceful land administration process and a civilized society where people can own properties without inherent conflicts or disputes.

Where there are no laws there are no penalties. The introduction of these laws would bring about penalties as a deterrent to breaking laws and poor professional conduct. These laws guide both moral and ethical conduct needed for efficient and regulated land surveying practice (Maganzani, 2007). Legislation such as the Surveying Act, 1962 (Act 127) gives legal backing to operations in the land management industry and stem the incidence of multiple sale of land, with its attendant violence and protracted conflicts.

Maintenance of Safety and Reliability

Adherence to laws helps ensure safety, reliability and environmental care. It further helps to support government policies and legislation. The ability of devices to work together relies on products and services complying with laws and standards, hence enhancing interoperability.

Survey Act, 1962 (Act 127) and LI 1444

The Survey Act, 1962 (Act 127) is an Act to consolidate with amendment the law relating to geological, soil and land survey. This Act has been in force since 20 June 1962 and has been the main law regulating the lands survey profession in the country.

The law has, among other things, regulated the demarcation and survey of lands by setting out the section for the qualification and registration of surveyors, the system of work and penalties for defaulting practitioners. This law, over the years, has certain critical lapses, which necessitated the Survey Regulations, 1989 (LI 1444).

The LI 1444, which came into effect in 1989, seeks to address

some of these lapses by introducing regulations for producing plans for attachment to an instrument for registration. This has indeed put more credence and enforcement to Act 127. A clear example is LI 1444 Regulation 3(1), which states that no plan of any parcel of land attached to any instrument for the registration of such instrument shall be accepted by the Chief Registrar of Lands or the Registrar appointed pursuant to the provisions of the Land Registry Act, 1962 (Act 122) unless the plan has been approved by the Director of Surveys or any official surveyor authorized in that behalf in accordance with Regulation 2 of this regulation. This Regulation is an enhancement of Act 127 (1962), S (1) to help deal completely with the lapses that was found in the Act.

LI 1444 does not only ensure that the plan is of approved standard, but also ensures that the measuring band used for the survey work is standardized at least once a year under the directions of the Director of Surveys. The instrument used for the survey work influences the level of accuracy of the work, and the state of the machine helps to avoid introducing further errors into the survey work. These instruments can go out of adjustment and when not regularly checked will churn out misleading results.

These two laws have shaped surveying or cadastral practice in Ghana. They have complemented each other as the other additional requirements not catered for in Survey Act, 1962 (Act 127) was cured by LI 1444. This has added additional checks and improved accuracy in the land acquisition process.

The LI 1444 (Section 6 (1)) brought about order as far as registration of instruments is concerned. In the previous Act,1962 (Act 127 3 (1)), an official surveyor, a licensed surveyor or any public officer could go about their duties without any direct supervision of the Director of Surveys. LI 1444, which empowers the Director of Surveys, eliminates all sorts of bias by any of these professionals as they carry out their duties. This would aid in the separation of powers by not giving all rights or authority to a license surveyor to handle such a vital national document. The instance of the approval resting on the Director of Surveys, therefore, mandates the licensed surveyor to lift up his professional work and duties, thus ensuring

higher standards for plans to be approved, in consonance with the laid down framework.

LI 1444 6(1) states that: "No person other than an official surveyor, a licensed surveyor or any public officer making or preparing any plan in the course of his duties as such shall survey any land for the purpose of preparing any plan for attachment of any instrument of conveyance, leases, assignment, charge, or transfer."

Act 127 (1962) 3(1): "No plan of any parcel of land attached to any instrument for the registration of such instrument shall be accepted by the Chief Registrar of Lands or the Registrar appointed pursuant to the provisions of the Land Registry Act, 1962 (Act 122) unless the plan has been approved by the Director of Surveys or any official surveyor authorized in that behalf in accordance with regulation 2 of these Regulations."

The professional would have to be honest and conduct the work with integrity since it would be verified by the Director of Surveys. It is a good thing in surveying to have redundant measurements or at best checks. When a licensed surveyor's work is rechecked, it helps in eliminating errors that might not have been envisaged in the course of the survey. There are instances where the connecting controls to the site are wrongly coordinated or the area on the Insert Map, may have been wrongly placed. Such errors or mistakes could be identified and pointed out by the Director of Surveys during verifications/ validations, for the necessary corrections to be made. This minimizes or eliminates inconsistencies that would have been generated from licensed surveyors if there was no regulator. Consequently, this would bring sanity to the work of surveyors and prevent chaos, as litigations and boundary disputes are minimized or even prevented.

Furthermore, the Director of Surveys, empowered in this regard, would ensure that most survey records by other surveyors are kept for future references and other details needed for subsequent works are made available. Such practice improves the overall land information system or database needed for land surveying. In addition, the submission of plans to the Director of Surveys is a means of income generation for the State. The levies or taxes accrued from each license surveyor could be used in the official running of the Survey and

Mapping Department. The licensed surveyor currently pays 300 Ghana cedis yearly for renewal of license and also pays a fee based on acreage when submitting a plan. Programmes or acquisition of new instruments can all be better borne out of such funds received, since the Director of Surveys has the power to regulate or fix those charges.

From the LI 1444, the Director of Surveys can recommend sanctions and can also blacklist licensed surveyors who do not discharge their work properly. This would have been illusive in Act, Act 127 (1962), but now due diligence would have to be adhered to in the line of duty.

Conclusion

Cadastral survey is the main foundation that satisfies the initial requirements of a land register by defining the parcels and land, which constitute the objects and units of the land record. It is, therefore, the acceptable plan for land registration. It is important that the public avert their mind to Survey Act,1962 (Act 127) and LI 1444 of the Constitution of Ghana, which mandates a plan of registration to have both a licensed surveyor and the Director of Surveys authenticate such plans or singly endorsed by an official surveyor or an assign of the Director of Surveys. Estate agencies and land agents must know the appropriate plan to use at any point in time in land transactions. These legal arrangements undoubtedly have brought order, standards and regulation in cadastral or land surveying practice and must be followed accordingly in the real land surveying practice.

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CHAPTER ELEVEN

The Tourism and Environment Nexus Within the Tourism System

KENNETH PEPRAH

ABSTRACT

The need to explain the linkages between tourism and environment is more revived now than ever before due to the negative impacts exerted by tourism on the natural environment. Students are to understand that tourism and environment nexus occurs within the tourism system. The tourism system comprises the origin or traveller generating region, transportation facilities and intervening opportunities and the tourist destination region. This chapter aims at explaining the activities of tourists within the natural environment. Tourists are travellers journeying from their homes to other places of interest for leisure and recreation but not remunerated jobs and staying for at least one night but less than one consecutive year, in which the natural environment provides locations for their homes (origin), space between home and the places of interest (intervening opportunities) and the leisure and recreational places (destination). A student reading this chapter will grasp the definition of 'tourism' and 'tourist,' the linkages between origin and destination of tourist, the models of intervening opportunities as well as the negative and positive impacts of tourism on the natural environment.

Keywords: Tourism, Environment, Intervening opportunities, Traveller, Tourism system

Introduction

Globally, the tourism industry is one of the fastest growing in terms of demand for and supply of tourism and recreation opportunities. In the wake of its growth, tourism is contributing immensely to both developed and developing countries' economies. The world tourism (overnight stay) increased by +6% in 2017 and 2018 but grew by +4%

in 2019, involving 1.5 billion international tourists. This translated into +8% for the Middle East, +5% for Asia and the Pacific, +4% for Europe and Africa and +2% for the Americas (UNWTO, 2020). It is therefore driving a lot of changes in the natural environment (air, water, biodiversity, soil, land), both in tourist destinations (locally) and on a global scale (Giulietti, Romagosa, Esteve, & Schroder, 2018). However, in 2020 there was a fall in international tourism of 70% due to the impacts of COVID-19 pandemic. In financial terms, about US$730 billion in export revenues have been lost. Asia and the Pacific lost about 79%, Africa and the Middle East 69%, Europe 68% and Americas 65% (UNWTO, 2020).

This chapter is designed to provide the reader with five fundamental relationships that exist between tourism and the environment. Therefore, each of the five parts of the tourism and environment nexus constitutes a section. Three other sections are added to make it a chapter with eight sub-divisions. The introduction is followed by conceptualization of issues regarding the definition of tourism, environment and the interplay of the two which results in the various types of tourism.

In the conceptualization process, philosophy of the social sciences such as tourism studies, is highlighted and a position taken that none of the various philosophical stands treats tourism separately from the environment. Section three of the chapter discusses origin of tourists (the place tourists reside) as a place in the environment. The next section explains intervening opportunities. The models of intervening opportunities are explained. This is followed by a section on destination of tourism, the main reason the tourist leaves his/her origin, embarks on a journey through various tourism destinations (intervening opportunities) to get a particular satisfaction at the destination of choice (the only place which best satisfies this quest of the tourist).

The sixth section explains the negative impact of tourism on the environment (activities, processes and undertakings of tourism that affect the environment). Section seven delves into the positive impacts of tourism on environment. The final section concludes the chapter.

Conceptualization of Issues

According to the United Nations World Tourism Organization (UNWTO), "tourism comprises the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited" (Organization of Economic Co-operation and Development [OECD], 2002, p. 1). This standard tourism definition is concerned with the activities generally undertaken by tourists (the persons) travelling and staying outside the usual environment outside the usual homes of the tourists, for at least one night, but less than one consecutive year, while taking leisure or business or other purpose which cannot include working for pay or seeking employment or remunerated job at the tourism destination. In brief, "tourism is the temporary movement of people to destinations outside their normal places of work and residence, the activities undertaken during their stay in those destinations and the facilities created to cater for their needs" (Mathieson & Wall, 1982, p.1).

Another concept which requires explanation is the term 'tourist.' A temporary visitor or traveller who stays in a tourism destination for more than 24 hours but less than one consecutive year, for leisure, business or other purposes (World Tourism Organization, 1983). There are several types of tourists based on different concepts. In this chapter the discussion focuses on types of tourists based on the natural environment. However, it suffices to mention the other types in passing. Gray used purpose of the trip and divided tourists into 'sunlust' and 'wonderlust' (Huang, 2003). Also, Cohen based the type of tourist on sociological concepts and came up with 'organize mass tourist,' 'individual mass tourist,' 'explorer' and 'drifter' (Huang, 2003). Again, Cohen used another concept, tourist experience to show types of tourists as: 'recreational,' 'diversionary,' 'experiential,' 'experimental' and 'existential' (Huang, 2003). Even though Plog's classification relates more to tourist behaviour and does not directly speak to issues on environment, the described tourist behaviours are related to the natural environments that create the issue of risk,

which is used to differentiate between allocentric and psychocentric tourists (Huang, 2003). The allocentric tourists are travellers visiting and staying in recently discovered tourist destination. Often, allocentric tourists are the first to visit newly discovered tourism destinations. They want to be the ones to see it first, hence, they look for tourist destinations which are exotic, that is, unusual, mysterious, striking, interesting and 'untouched' by other tourists. Allocentric travellers are risk takers. They are not afraid of visiting new and recently discovered places with attendant risk factors (Huang, 2003). Psychocentric travellers are very careful and weigh the risk involved in the new or recently discovered tourist destination. Generally, psychocentric travellers are afraid of risk, therefore, they choose to visit tourist attraction sites which are well known and with good security. Psychocentric travellers are visitors who are not risk takers; they visit only well-established tourist destinations (Huang, 2003). Although these two categories verge on psychographics (lifestyle and life-image), the role played by the environment in psychographics cannot be ruled out. The behaviours exhibited by the allocentric and psychocentric tourists are risks related and these risks are natural environment related (Bukenya & Luostari, 2013). In-between the two extremes are the various pairings, such as near-psychocentric, mid-centric and near-allocentric (Huang, 2003).

"Environment is taken to refer to the sum total of the biological, chemical and physical status and character of the natural world. It is the fabric of the biosphere and, as such, it embraces both living (biotic) and non-living (abiotic) features, along with the processes, cycles and interrelationships which influence these" (Park, 1986, p. 2). Biosphere is a collection of the totality of biome on Earth and biome is the aggregate of all the different ecosystems on Earth. The ecosystems are made up of communities, consisting of population of species, while, population comprises individual organisms.

There are several philosophical viewpoints on knowledge creation and explanation such as rationalism and empiricism as well as the philosophical stances deduced by using ontology and epistemology to explain the natural environment in which tourism occurs (Popper, 1965). Irrespective of the philosophical stance,

tourism and the environment nexus exist. Within epistemological objectivity and its ontological materialism of the empiricist, both tourism and the environment are real entities (physical objects) existing outside the researcher as external reality within the subject-object distinction (Dai & He, 2017). Tourism occurs in the physical or material environment and the various types of tourism are categorized based on the natural environment in which they take place (Sunlu, 2003). For instance, in adventure tourism the examples come from jet boating, caving, glacier walk, forest canopy walks, safari and wildlife tour, etc. Also, in nature tourism, the examples are mountain tourism, coastal tourism, water recreation, etc.

Other types of tourism such as seaside tourism, wilderness tourism, ecotourism, space tourism and farm tourism show an obvious link with the natural environment (Muhanna, 2006). From these illustrations, the natural environment is a physical or material object within which tourism takes place. Even with examples of sports tourism, such as the FIFA World Cup and Olympics Games, the physical host environment represents the tourism destination although the host is not a static place. Other sports tourism like French Open, US Open, Australian Open and Wimbledon are specific physical environment-bound. In the case of business tourism, the conferences, meetings and seminars always have venues in particular physical environments. Again, from the rationalist perspective in which tourism and the environment are sense data (ideas), the two concepts are conceived together (Ardoin, 2006).

It would be extremely difficult to conceive of the idea of tourism without a place (environment) in which the tourism happens. From the social constructionist standpoint, both tourism and the environment are socially constructed (Greider & Garkovick, 1994). Therefore, there is no separation between the constructor and the object of construction, subject-object unison or no distinction. Hence, types of tourism such as social tourism, cultural tourism, pleasure tourism, recreational tourism and active tourism are constructed around certain themes and concepts (Williams, 2002). During these constructions of the various tourism types, the environment in which tourism happens is carefully constructed as well (Ardoin,

2006). For instance, religious tourism which offers pilgrimage to Mecca, Jerusalem, Rome and other places are based on the physical environment in which historic religious events took place. In addition, health tourism is associated with the countries that offer special medical services such as yoga, Ayurveda and others. Wellness centres are specially created in certain geographic environments to achieve certain medical objectives. Therefore, tourism and the environment are intertwined irrespective of the philosophical lens in which the two are viewed. The other epistemological and ontological views such as critical, post-humanist, poststructuralist and postmodernist have pushed the nexus between tourism and the environment even further.

The proliferation of critical, post-humanist, post-structuralist and post-modern perspectives and insights into landscapes of tourism has opened up their study beyond traditional scientific boundaries, and rendered the broader field under study here distinctly more interdisciplinary, multidisciplinary, and transdisciplinary. However, as this chapter continues to argue, intersubjective, embodied, and multisensual tourism performance in the landscape needs to be played out in more complexity and the tourist's encounter with space, generally speaking, developed further (Terkenli, 2014, p. 283).

The emerging tourism types with newness of their products are equally confined to their respective environments. For example, Meetings, Incentives, Conferences and Exhibitions (MICE) come with the physical environment that hosts the tourism product. Also, project CRUMPET, "Creation of User-friendly Mobile Services Personalized for Tourism" is personalized nomadic services for tourism and location-based support which shows that the physical environment is very key to this tourism type (Poslad, Malaka, Laamanen & Zipf, 2001). Even the most expensive type of tourism, space tourism, which is travelling to space via satellite to observe the Earth from outer space is based on an environment (space), which is the final tourism destination of the space tourists.

The following equations summarize tourism and the environment conceptualization. In equation 1, the variables are taken from the UNWTO's standard definition of tourism. Equation

2 shows that the environment in which tourism takes place is the amalgam of land and water within the biosphere and outer space as happens in the emerging space tourism. In equation 3, every tourism type is underlined or underpinned by the environment in which that type of tourism happens.

Tourism = *f*(activities + tourists + travelling + staying + outside usual environment + at least one night + leisure + business + other purposes) – (less than one consecutive year) – (no remunerated job) . . . . (1)

$$Environment = \sum_{water}^{land} Biosphere + Space \quad \text{.....(2)}$$

$$Tourism\ and\ Environment\ Nexus = \Sigma\left(\frac{Tourism}{Environment}\right) \quad \text{.....(3)}$$

In the tourism system, the various components are interlinked and cannot be separated as individual or independent components; just as in systems thinking, the sub-systems and the various systems' elements cooperate to function properly (von Bertalanffy, 1972). In Leiper's tourism system, there are three sub-systems: the tourist, the geographical features and the tourism industry as shown in Fig. 11.1 (Hall & Page, 2010, Leiper, 1990). The traveller generating region can be likened to the origin of the tourist, as explained in this chapter. Also, the tourist destination region is the attraction site the tourist is visiting as described in this chapter as destination. Finally, the transit route region is a geographical region that contains transportation routes and facilities.

In the context of this chapter, the transit route region in addition to transportation infrastructure contains other tourist destinations which do not satisfy the tourist's present need for tourism. Hence, the transit route region can be likened to the concept of intervening opportunities as described in this chapter. The interconnectedness of the three sub-systems works together with six elements of physical, cultural, social, economic, political and technological factors with resource flow in the natural environment (Hall & Page, 2010).

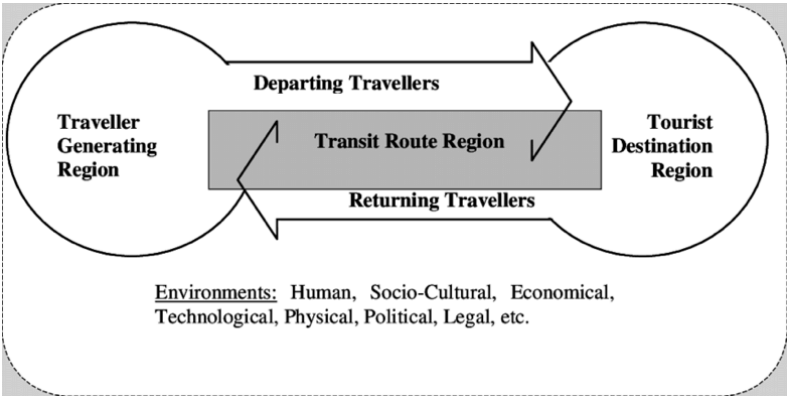

Fig. 11.1. Tourism System Model (Leiper, 1990)

Origin of Tourists

Tourism begins from the origin of the tourist and the origin influences the image the tourist builds on the destination (Lopes, 2011). Origin is the place in the environment where the tourist's journey begins, that is, the place where the tourist is coming from his/her village, town, city, district, region, country and even continent. Origin is the residence of the tourist. The origin of the tourist determines the tourist's travel behaviour and safety perceptions (Sofronov, 2018). Generally, it is a place or location where tourism trip begins. With respect to tourism data collection, the origin is very important, particularly the country the tourist has as his/her normal residence. This country is referred to as country of residence in tourism records keeping. It is not only the tourist who stays in this country of residence but his entire family. Also, it is the country in which the tourist obtains his/her livelihood, that is, works for pay or carries out his/her economic activity or venture that produces the major income. In terms of origin of the tourist, two types are identified: international tourist origin and domestic tourist origin. These are related to long-distance tourism and proximity tourism (Giulietti *et al.,* 2018). A domestic tourist is someone who does tourism within the country of residence. By definition, domestic tourists include citizens and non-

citizens (legal residents of other nationalities) who travel within the country of residence to carry out tourism. Domestic tourist is related to the country of residence, that is, the country in which the tourist has as normal residence with his/her family and does tourism within this country. It has nothing to do with the nationality of the tourist. Hence, domestic tourist's environment is the country of residence, irrespective of the country of nationality of the tourist. This means that domestic tourists are made up of citizens and non-citizens who are legal residents of other nations and all together carry out tourism in the country of residence. For instance, domestic tourists in Ghana include Ghanaians and non-Ghanaians who are legal residents from other countries such as Nigeria, South Africa, Mali, Egypt, Ethiopia, USA, Canada, UK, Europe and Australia, who carry out tourism within the boundaries of Ghana. Therefore the origin and destination of domestic tourists are located in one country. Nonetheless, in-between the origin and destination of the domestic tourist are intervening opportunities. Also, an international tourist is a traveller who journeys from the country of residence (origin) to the country of reference (destination country); and, by so doing an international tourist crosses an international boundary or frontier. In the case of international tourists, the environment is made up of two different countries in which one is the origin and the other is the destination. In-between these two countries are the intervening opportunities.

Intervening Opportunities

The concept of intervening opportunities briefly means the various destinations between the origin of the tourist and his/her final tourism destination. The main principle of the intervening opportunity model is that a tourist will want to keep a trip as short as possible. In terms of proximity, the tourist will want to end the trip at the nearest possible destination. However, the purpose of the trip is not the nearest possible destination but to satisfy some touristic needs. So, if the nearest possible destination does not satisfy this need, the next nearest possible destination is considered and so on till a destination that satisfies the touristic need is found. The basic idea behind the

intervening opportunities model is that trip making is not explicitly related to distance but to the relative accessibility of opportunities for satisfying the objective of the trip. This is based on the concept that a trip cannot always go to the nearest destination and stop, it must consider the nearest destination and if that is not acceptable, consideration is made for the next nearest and so on (Indian Institute of Technology [IIT], 2006, p. 59). "The model distributes trips so that the probability of a trip ending at a destination area is equal to the probability that a trip-satisfying destination is located within the destination area times the probability that an acceptable destination has not been found in all other destination areas closer to the trip origin" (Kaltenbach, 1972, p.10):

Tij = Pi[exp(-LA) exp (-L {A + Aj})], where:
Tij = trips between zone i and zone j,
exp = exponential function,
Pi = productions of origin zone i,
Aj = attractions of destination zone j,
A = sum of all attractions of zone closer to i than j, and,
L = probability that a random destination will satisfy the trip purpose.

Hence, between the tourist's origin at point 'i' and the tourist's final destination at point 'j' are so many destinations that could not satisfy the objective of the tourist. So, for origin-to-destination (i-to-j), there are many destinations approximately closer to the origin 'i' than 'j' that could not offer the same satisfaction for the tourist as could be obtained from the final destination 'j'. These destinations are intervening opportunities that influence the tourist choice of destination 'j'. The spatial organization of the origin, the intervening opportunities and tourism destination are significant environmental issues that require careful consideration and choice. For instance, if a tourist from Bamako in Mali decides to do beach tourism in West Africa, there are so many beaches along the Gulf of Guinea that the tourist can choose from such as those located at Dakar (Senegal), Banjul (The Gambia), Bissau (Guinea Bissau), Conakry (Guinea), Freetown (Sierra Leone), Monrovia (Liberia), Abidjan (La Cote

D'Ivoire), Accra (Ghana), Lome (Togo), Cotonou (Benin), Lagos (Nigeria) and Port Harcourt (Nigeria) (Example 1). If the tourist from Bamako (Mali) settles on visiting Accra (Ghana), all the other cities along the coast of West Africa including those mentioned and not mentioned, become alternative beach tourism destinations referred to in this section as intervening opportunities. When the tourist from Bamako (Mali) with the need of beach tourism arrives at Kotoka International Airport in Accra, he/she can visit La Beach Resort, Tema Mighty Beach, Kokrobite Beach, Winneba St George Beach, Cape Castle Beach, Elmina Beach or Busua Beach in Sekondi Takoradi area (Example 2). If the tourist from Bamako (Mali) decides to visit Busua Beach, all the other beach resorts along the coast of Ghana become intervening opportunities. Upon arriving in Accra, if the tourist from Bamako (Mali) can get the same or equal or similar satisfaction at La Beach Resort just as can be obtained from Busua Beach, there would not be the need to visit Busua Beach. Considering the distance between Kotoka International Airport and Busua Beach and the close proximity to La Beach, he/she will choose La Beach over Busua Beach. Distance will not place any hindrance if the satisfaction derives from beach tourism at Busua Beach is different from that of La Beach and if it offers higher satisfaction. Therefore, distance is not a determining factor in choosing tourism destination from the many opportunities offered. Rather, satisfaction provided by the destination is the underlying factor in deciding on which tourism destination to visit, among the lot.

The intervening opportunities offer an alternative spatial organization theory just like the gravity model (Indian Institute of Technology [IIT], 2006). The intervening opportunities theory was first put forward by Stouffer (1940 p. 846): "the number of persons going in a given distance is proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities." In other words, the number of persons going in a given distance is directly proportional to the number of intervening opportunities.

According to Akkoyunlu (2012, p. 156), the number of trips from an origin zone to a destination zone is directly proportional to

the number of opportunities at the destination zone and inversely proportional to the number of intervening opportunities. This hypothesis may be expressed as:

tij = (k.aj/vj)

where:

aj = the total number of destination opportunities in zone j

vj = the number of intervening destination opportunities between zones i and j

k = a proportionality constant to ensure that all trips with origins at zone i are distributed to destination opportunities' ` ` (IIT, 2006, p. 56).

From the first example given, using the beach tourist from Bamako (Mali), his/her origin is Bamako (Mali) and his/her destination is Accra (Ghana). So, the travel is Bamako–Accra; the total number of beach opportunities in Accra; the number of intervening beach opportunities between Bamako and Accra, that is, from Dakar to Accra; and a constant 'k'. Therefore:

$$\text{Travel}_{\text{Bamako-Accra}} = \left(k \frac{\text{the total number of beach opportunities in Accra}}{\text{the number of intervening beach opportunities between Bamako and Accra}}\right)$$

From the second example provided, using the same beach tourist from Bamako (Mali), his/her origin is Bamako (Mali) and his/her destination is Busua Beach (Ghana). So, the travel is Bamako–Busua Beach; the number of beach opportunities at Busua Beach; the number of intervening beach opportunities between Bamako and Busua Beach; and a constant 'k'. Therefore:

$$\text{Travel}_{\text{Bamako-Busua Beach}} = \left(k \frac{\text{the total number of beach opportunities at Busua Beach}}{\text{the number of intervening beach opportunities between Bamako and Busua Beach}}\right)$$

"In the intervening opportunity approach, the probability of commuting between two units i and j is proportional to the origin population mi and to the conditional probability that a commuter

living in unit i with population mi is attracted to unit j with population mj, given that there are sij job opportunities in between. The conditional probability P(1jmi; mj; sij) needs to be normalized to ensure that all the trips end in the region of interest" (Lenormand, Bassolas & Ramasco, 2016. p. 4).

Schneider (1959) has proposed the following modification of the Stouffer hypothesis. The Schneider hypothesis states that the probability that a trip will terminate in some volume of destination points is equal to the probability that this volume contains an acceptable destination times the probability that an acceptable destination closer to the origin of the trips has not been found (IIT, 2006, p. 57). Therefore, intervening opportunities are important environmental issues between a tourist's origin and destination. They represent opportunities, in other words, destinations which could not offer the same tourism satisfaction as could be found in the destination of choice (final destination).

Destination of Tourists

Destination is the place or location within the environment that hosts tourist attraction sites; it is the image of the destination that is transmitted to the tourist through marketing and advertisement; and it is the destination image that is branded (Lopes, 2011). Hence, destination is a place where the tourist visits and then goes back to the origin or home (Sofronov, 2018). Therefore, tourists visit or travel to tourism destinations. A destination is the place or location where the tourist will visit for pleasure or for other purpose. A classic definition by Burkart and Medlik (1974, p. 46) is that "tourism destination is a geographical unit visited by tourists being a self-contained centre" (Zemla, 2016, p. 2). A tourism destination is defined as the geographic centre from where tourism is generated.

A tourist destination is then simply described as a "geographical location to which a person is travelling" (Metelka, 1990). Buhalis (2000) broadens this definition by stating that the geographical location "is understood by its visitors as a unique entity, with a political and legislative framework for tourism marketing and

planning." Lynch and Tinsley (2001) state that most studies tend to look at the tourist destination as a "system containing a number of components such as attractions, accommodation, transport, and other services and infrastructure." Each of these components is "dependent upon other parts for success in attracting, servicing, and satisfying the tourist" (Mill & Morrison, 1985; Manhas, Manrai, & Manrai, 2016, p. 26).

A tourism destination is a place where tourism products are delivered. Tourism products cannot be sent to the tourist at his/her home or place of convenience. The tourist product is fixed in the environment, so the tourist has to journey to the tourist product in order to enjoy it. The place of the tourist product is called tourism destination. It is a place where tourism is experienced by tourists. Tourism destination is a place where tourism planning and management take place. Destination is a fundamental unit on which all the many complex dimensions of tourism are based. It is a basic unit of analysis in tourism. Destination is a focal point in the development and delivery of tourism products and the implementation of tourism policy. Destination has physical and administrative boundaries defining its management, images and perceptions (Cooper, 2012). Tourism destination is affected by the weather and climate of the specific geographic or environmental area; hence, a destination's seasonality created by environmental factors affects the influx of tourists to the destination (Sunlu, 2003).

With respect to tourism data or records keeping, the country where the tourist is travelling to is called country of reference. It is the country which has the tourist attraction site. So, tourism data are collected at the country of reference. In tourism research, the country of reference is the study area. Tourism destination can be viewed severally. It is seen as urban tourism, rural tourism, coastal tourism and mountain tourism destinations (Giulietti *et al.,* 2018). In all the types of destination, the type of environment is the key distinguishing characteristic. Another important factor is the scale of the destination environment as "along a continuum from a developed region/country to a developing region/country" (Pender & Sharpley, 2005). On this scale, there are destinations within

destinations; that is, with destinations in a continent such as Africa, there are other destinations in terms of regions such West Africa, East Africa, North Africa, Central Africa and Southern Africa. Also, within these regional destinations are country destinations such as South Africa, Kenya, Egypt, Ethiopia and Senegal. Within these countries there are care destinations in the country's administrative regions, districts, cities, towns and specific tourist attraction sites. At the destination, environment multiplier refers to the environment as setting for action (functionality of the environment as support to tourism activities); environment as a social system (a place for social interactions); environment as emotional territory (emotional role); and environment as self (identity role) (Pender & Sharpley, 2005).

Tourism destination is an amalgamation of four important components, consisting of attractions (both natural and human-made pull of visitors to the destination), amenities (involving accommodation, food and beverage outlets, entertainment, retailing and other services), access to destinations (entails all forms of transport by air, land and sea) and ancillary services (local organizations) (Cooper, 2012). Destinations are used not just by tourists but also by many other groups. There are destinations for tourists only, destinations for normal residents only, destinations for both tourists and normal residents. In all cases, destinations are put to multiple uses.

The Negative Impact of Tourism on the Environment

Often the negative impacts of tourism on the environment are seen from the point of the old argument of population and environment/natural resource relationship; when tourist use of the natural environment is greater than the ability of the natural environment to regenerate itself (Sunlu, 2003). Traditionally, tourism sometimes can result in negative environmental consequences (Muhanna, 2006). This old argument is based on a premise of optimal relationship between population and the environment. The word, 'optimal' means the 'best' or the 'ideal' relationship. If this best/ideal relationship is offset by overpopulation (more population than natural resources),

then environmental degradation is the result. In this context, tourism can adversely affect the very natural environment on which it depends, thereby destroying both the natural environment and tourism (Rabbany, Afrin, Rahman, Islam & Hoque, 2013). Contrariwise, if there is under-population (less population than natural resources), the result is under-utilization of natural resources' leading to under-development. Therefore, there is the optimal carrying capacity, optimal threshold and climax environment in which population and natural resources of the environment are proportionately equated. This kind of analysis between tourism and the environment is based on an equilibrium analysis which advocates for a balance of nature, a state of stasis and equilibrium between population growth, population numbers and natural resource utilization. Often, environmental protection, conservation and restoration of degraded environments are the prescriptions to adhere to the balance of nature. When these fail, the environment suffers serious malaise or becomes ill, often described as 'degraded.' In tourism, the negative environmental impacts receive a lot more publicity (Semenova, 2013).

There is another drive of environmental degradation which is not related to population numbers versus environment relationship. It is the culture of development of the people or country implementing tourism. In some cultures, nothing from the natural environment is considered as waste. Everything from the natural environment is considered as a natural resource. Therefore, in such cultures, painstaking efforts are made to harvest all such resources, which are then kept for both immediate and future use. Ghana does the opposite as heavy-duty machines are used to clear the land of vegetation and top soil and get it ready for whatever constructional project to kick start. By doing so, the compost is lost inadvertently. In better cultural practices, the vegetation is gathered and added to the top soil to create compost for tree planting, afforestation, parks and gardens. Some species are uprooted and replanted elsewhere. In Ghana, there is limited attempt at the national, regional, district, town or village level to salvage these resources. After taking the resource that is of interest such as gravel, sand, timber and bamboo, no effort is made to rejuvenate or restore the environment, as required by national

legislation. Interestingly, nature is expected to replenish itself. So, in the quest to develop tourism infrastructure, sometimes the natural environment which has created the natural attraction, is destroyed. This the reason why efforts are made to add canopy walk to waterfalls, develop infrastructure at the beach for the tourist, enhance natural wildlife sanctuaries and so forth. Oftentimes, these other resources are of no immediate need.

Other studies discuss the negative use of resources, resulting in increased pollution, discharges into the sea, natural habitat loss, increased pressure on endangered species and heightened vulnerability to forest fires (Faraji rad & Aghajani, 2010, Asadzadeh & Mousavi, 2017). The generation and accumulation of waste in mountain and coastal tourism as well as scattering of waste in lakes, rivers, fountains, parks and open spaces are some of the ills of tourism in the environment (Asadzadeh & Mousavi, 2017). Others include:

> potential threats to natural environments due to high concentration of tourist activities, such as soil erosion, increased air emissions and noises from vehicles, crowding, improper disposal of solid waste and littering, release of sewage, architectural/visual pollution, loss of biodiversity, alteration in ecosystems (damage of flora and fauna) and climatic changes due to high construction activities . . . In some cases, the negative impacts of tourism development can gradually destroy the environmental resources on which tourism depends for survival (Gill, 2014. p. 72)).

The Positive Impact of Tourism on the Environment

The nature, scale, and geographical characteristics of landscapes of tourism are situated in traditional tourism environments (Terkenli, 2014). The major concerns are found in environmental innovation, environmental management, environmental responsibility, environmental performance and environmental sustainability (Işık *et al.,* 2019). Some environments are country-specific but others are seen as global due to their enormous contribution to atmospheric processes as well as land and water regulation. Tourism depends on the natural

environment for survival. Hence, the care tourism takes of the natural environment is to ensure tourism's own survival. For instance, in the Wechiau Community Hippo Sanctuary, zero land degradation is adopted to save both the natural environment, the people and hippos. About 40 km stretch of the Black Volta River serves as habitat for hippos and about 5 km landwards is reserved and preserved as feeding ground for the hippos (Peprah, 2018). In this form, tourism contributes to environmental protection, conservation, restoration of biological diversity and sustainable use of resources (Faraji rad & Aghajani, 2010). Tourism offers environmental education and sensitization, thereby raising awareness about the environment (Gill, 2014). In ecotourism, both awareness about the environment in addition to environmental protection and conservation are addressed. Similarly, green tourism or sustainable tourism seeks to achieve the same ends. In the following nine studies, tourism development had the following environmental benefits:

> protection of a Howler Monkey population, Belize, reduction of poaching in the Khao Yai National Park, Thailand, conservation of land and wildlife surrounding Maasai village communities in Tanzania, conservation of the Komodo National Park, conservation of a hippo population in KwaZulu Province, South Africa, conservation of coral reefs offshore from the village of Desa Jungut Batu, Indonesia, and protection and conservation of wildlife surrounding the village of Masoka, Zimbabwe (Pujar, 2014, p. 14).

Conclusion

Tourism is a global industry with both local and global benefits to the tourists, host community of tourism destination, tourism industry investors, the public sector and a host of other stakeholders. Generally, tourism involves travelling for pleasure, visiting places away from home, organization of visits for people travelling and provision of infrastructure to satisfy the needs of tourists. The environment is basically the natural environment (ecosystem) which supports the tourism industry. The relationship between tourism and the environment is first seen on the types of tourism which

are classified after the type of natural environment, for example, adventure tourism (caving), nature tourism (mountain tourism, coastal tourism) and wellness tourism such as yoga and Ayurveda, are associated with certain natural environments in some countries. Also, categorization of tourists is based on their experiences in the environment as allocentric and pyschocentric tourists.

The origin of tourists, that is, the country of residence of the tourists is location-specific in the natural environment. The two types of touristic origin, which is domestic tourism (proximity) and international tourism (long-distance) are based on origin and destination of the tourism activity. If tourism takes place in the country of residence it is considered as domestic tourism. In this case, both the origin and destination of tourism take place in the country of residence. Whenever the tourism destination is located in a different country (international tourism), crossing an international border is a must-do activity. In-between the tourist's origin and destination are a number of destinations that offer tourism. However, these various or alternative destinations do not offer adequate satisfaction to the tourist, so they are referred to as intervening opportunities. This concept presents another relationship between tourism and the environment. It is the concept of intervening opportunities that helps the tourist to decide on the final tourism destination. Hence, in selecting a final tourism destination, intervening opportunities are used — not distance.

Destination of tourism is the place where the tourism product is consumed. Tourism is enjoyed at the destination since the product is not transportable. The tourist has to transport himself/herself to the tourism destination to take part in tourism. The destination is located in the natural environment. The destination presents ownership of the natural environment, its management, performance and sustainability. In this process, sometimes the intended outcomes are achieved leading to benefits to the natural environment. These include conservation of wildlife, biota, historical and cultural artefacts. The unintended outcomes result in environmental pollution and degradation of the very natural environment on which tourism is supported. Tourism and the natural environment are inseparable

and mutually linked together. The use of the natural environment to develop tourism will lead to some unavoidable negative consequences. These consequences should be in the minimum by application of proper prior planning. The major concern is the deliberate and avoidable adverse impact that threatens the sustainability of the natural environment. These consequences require total elimination and not just reduction. The benefits of tourism and the environment nexus need to be sustained and multiplied. In summary, this chapter has established that conceptually, tourism and environment are inseparable. It is extremely difficult to do tourism without the natural environment.

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CHAPTER TWELVE

Socio-Demographic Determinants of Food Insecurity in Ghana

ANTHONY MWINILANAA TAMPAH-NAAH

ABSTRACT

Food insecurity in the urban setting stems from the inability of people in such areas to access food due to inadequate funds or insufficient food supplies. This study describes food insecurity experiences among urban folks in Wa, Ghana. The study would be informative for researchers and students who are interested in food (in)security issues at the local and national levels. The study was conducted in Wa, an urban setting in the Upper West Region of Ghana. And 321 individuals were conveniently sampled. Controlling for other socio-demographic variables, ordinal logistic regression was used to analyze the data. Respondents who attained senior high school education were less likely to be moderately food insecure rather than low food insecure, compared to respondents without education. Those who were not working had higher odds of being moderately food insecure rather than being low food insured, compared to those working. Those aged 50 years or more, married and had primary education or more were less likely to be associated with low, medium, or high food insecurity. Females and those not working had higher odds of experiencing high food insecurity rather than low food insecurity, compared to males and those working, respectively. There is a high prevalence of food insecurity among the urban population in the Wa township. To mitigate the high prevalence of food insecurity among the population, the local government authorities such as the Wa Municipal Assembly would need to provide more agricultural-related skills education and training for individuals at risk of being food insecure. This would place them on a better position to acquire the needed food on daily basis.

Keywords: Food security; Food insecurity; Food availability; Food accessibility; Food utilization

Introduction

Food forms an essential element in the growth and development of individuals. However, the availability of food is not at the disposal of all households mainly due to economic related issues (Szabo, 2015). The scarcity of food exposes numerous individuals, especially within urban households, to adverse growth and development conditions such malnutrition. These undesirable outcomes of food scarcity can predispose household members to less economic activities (FAO, 2018); hence, diminishing their purchasing power and eventually pushing them into the cycle of vicious poverty (Ruel, Garrett & Yosef, 2017). The scarcity of food, therefore, could have intergenerational adverse effects on household members.

Food insecurity is defined as the disruption of food intake or eating patterns because of lack of money and other resources (Nord, Andrews & Carlson, 2005). In other words, food insecurity describes a household's inability to provide enough food for every individual to attain and maintain an active and healthy life (Feeding America, 2020). The occurrence of food insecurity may be long-term or temporary and this could be linked to a number of issues including income level, employment status, educational level, number of household members, and place of residence or ecological zone (Riddle, Niles & Nickerson, 2020; Chinnakali *et al.,* 2014). Persons who experience food insecurity are prone to undesirable health or social outcomes such as diabetes, anemia, cognitive problems (inability to learn), aggression, depression, anxiety, and malnutrition (Afulani, Herman, Coleman-Jensen & Harrison, 2015; Gregory & Coleman-Jensen, 2017; Jones, 2017).

Globally, there were about 130 million people who did not have enough food to eat in 1990 and this figure increased to approximately 870 million people in 2008. About 98% of these food insecure people lived in developing countries, where 15% of them were malnourished, and about 37 countries were identified as in urgent need of food (FAO, 2008; FAO, 2012). In sub-Saharan Africa, the proportion of hungry people increased from 175 million in 1990 to 239 million in 2000, with approximately 20 million added in the past four years (FAO,

2012). In 2016, approximately 27.4% of the population of Africa was categorized as severely food insecure (FAO, 2017). Generally, about 65 million of populations on the continent were acutely food insecure (World Vision, 2020). These alarming food insecure situations are attributed to unfavourable environmental conditions, poverty, and conflicts.

Some related studies have been conducted on food security issues in Ghana. For example, a survey was conducted by the World Food Programme (2012) to understand the state of national food insecurity, its underlying causes, and possible ways of addressing them. In another study, Quaye (2008) looked at the food security situation in three regions in northern Ghana. The study further examined some coping strategies during food insecure seasons among farmers in these regions. Osei-Bonsu *et al.* (2009) studied food insecurity and hunger as core indicators of nutrition, for future programme planning and implementation at Nzema East District of Ghana. Even though these studies assessed food security conditions extensively in these regions, not much emphasis was on how socio-demographic aspects, especially urban household variables are linked to food insecurity. Hence, the present study would contribute to filling this gap by examining how such variables are associated with food insecurity in the Wa Municipality of Upper West Region.

Firstly, the findings of this study in the Wa Municipality of Upper West Region would further inform the local authorities about the state of food security in the Municipality. Secondly, other non-governmental organizations can use conclusions and recommendations of the study to update their programmes on food insecurity. Thirdly, the findings would be of interest to scholars and other groups who are concerned about issues of food (in)security, especially in Upper West Region, Ghana.

Study Context

Ghana faces imminent food insecurity as the average yield of food has not been growing (Darfour & Rosentrater, 2016). Importation of food into the country is enormous. On the average, US$ 2.4 billion is

used to import food annually (Adombila, 2018). These foods include rice, sorghum, frozen chicken, and meat for domestic and industrial consumption. In the country, food production and availability per year largely depend on rainfall during and between growing seasons. This creates food insecurity at household levels, making households poor and chronically distressed. Ghana is generally food secure, but there are pockets of food insecurity existing in all regions as a result of acutely limited resources and limited alternative livelihood chances for most people to meet their dietary needs. Adverse weather conditions and bushfires have had severe effects on smallholder farm enterprises (Ministry of Food and Agriculture, 2007; Darfour & Rosentrater, 2018).

In 2012, the Ministry of Food and Agriculture in Ghana initiated some strategic plans to mitigate the occurrence of food insecurity. These included the modernization of agriculture, maintaining National Food Buffer Stocks (NFBS), prioritizing nutrition education, minimizing post-harvest losses, and reducing or preventing diseases or pest infestations. Nonetheless, about 1.2 million people, representing five percent of the country's population, are food insecure. Food security in the northern part of the country remains a major concern for the government and other stakeholders. Out of this food insecure population, 34% of them are in the Upper West Region, 15 percent in the Upper East Region, and 10 percent in the Northern Region [now split into three regions Savannah, North-East and Northern regions] (WFP, 2009).

Theoretical Model

The study adapted a food security model by the WFP as a guide to selecting variables (Fig. 12.1). The model has four main dimensions, namely, food availability, accessibility, utilization and stability. This model dictates that, first, there should be the availability of food. This is the extent to which sufficient quantity and quality of food are physically present in an area. It includes food found in markets, food produced on local farms or home gardens, and food provided as food aid or gifts. Second, is access to food. Even when food is

available, some people may not always be able to access it. Food access is ensured when communities, households, and all individuals have enough resources to obtain sufficient food for a nutritious diet through a combination of home production, stocks, purchase, barter, gifts, borrowing, or through food aid programmes.

Third, the utilization of food is a requirement for food security. Utilization refers to an individual's ability to obtain energy and nutrients from food to live a healthy life. Proper child care practices, a diet with sufficient energy and nutritional value, safe drinking water, adequate sanitation, knowledge of food storage and processing, general health, and basic nutrition are essential to achieving adequate food utilization. The fourth component of food security, referring to both food availability and accessibility is stability. For households to be food secure they need to have access to food at all times and should not be at risk of becoming food insecure as a consequence of shocks or cyclical events, such as seasonal food shortages. Even if a household has adequate food consumption at one point in time, the household can still be food insecure if continuous availability or accessibility to food is limited.

In this study, the variables used to assess food insecurity in relation to the chosen adapted model were financial resources to purchase food, food prices, and markets (underlined and italized in Fig. 12.1). The choice of these variables was informed by the adapted questionnaire on Food Insecurity Experience and Scale (Further details on this questionnaire are presented under the dependent variable section). Socio-demographic characteristic of a person can predispose him or her to a certain level of food insecurity. The ability, therefore, to purchase food is largely influenced by the availability of adequate financial resources to pay for the food.

Methods

Study Area

The study area was Wa Township and it is the capital town of the Wa Municipality in the Upper West Region (Fig. 12.2). The Municipality is positioned in the north-western part of Ghana. The population of

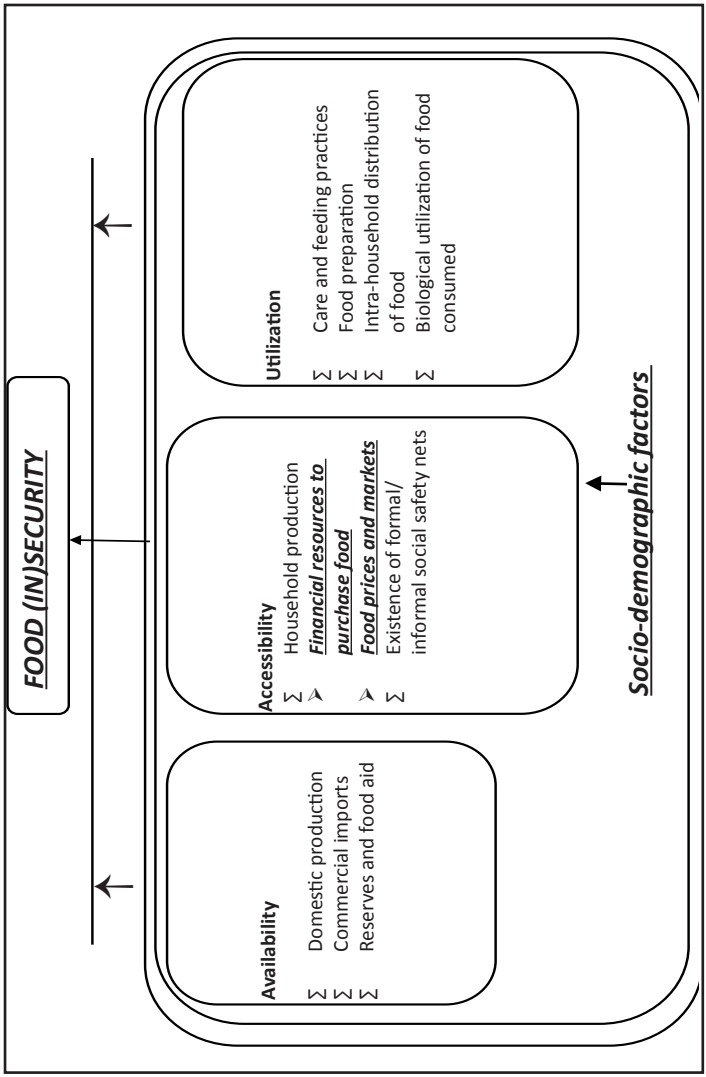

Fig. 12.1 Model of Factors Determining Food Insecurity (Adapted from FAO,1996)

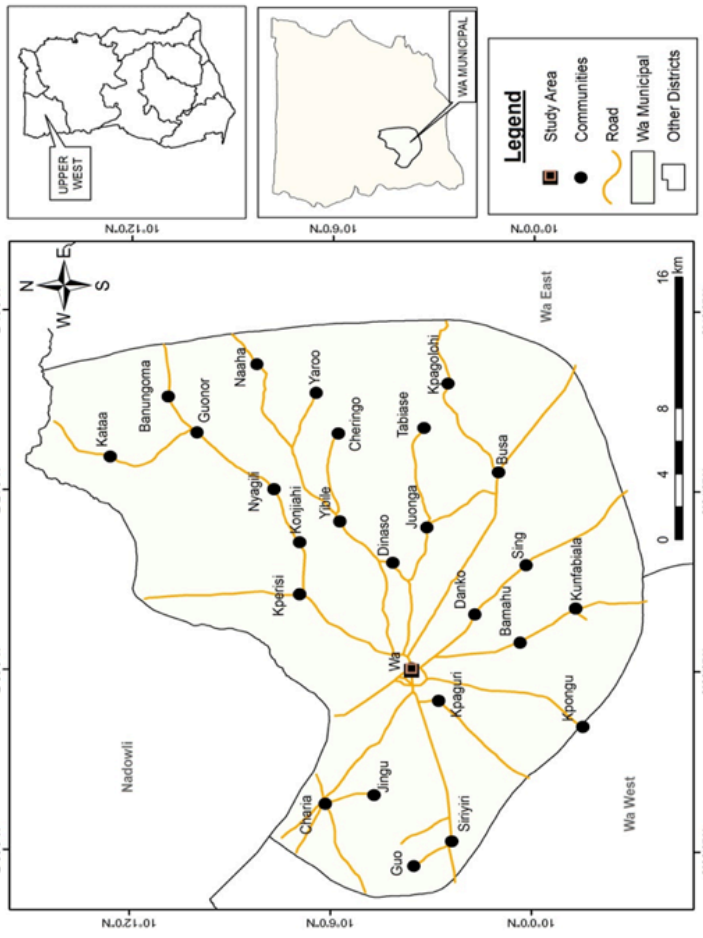

Fig 12.2 Map of Wa Municipality showing the study area

the municipality is approximately 129,689, representing 15.3 percent of the region's total population (GSS, 2019). The male population is estimated to be 49.7 percent as against 50.3 percent female. The Municipality serves as the administrative and business hub of the Region and the private or informal sector is the largest employer in the Municipality, employing about 80 percent of the population (GSS, 2014).

The residents of Wa township tend to purchase food items more than they cultivate, thus making it suitable for the study, to assess its urban population and food insecurity status. The Municipality lies in the Guinea Savannah vegetation belt commonly populated with shea (*Vitellaria paradoxa*), baobab (*Adansonia*), dawadawa (*Parkia biglobosa*), and neem (*Azadirachta indica*) trees. The main economic activities are agricultural-related and key crops grown are maize, millet, peanuts, okra, and rice. Animal husbandry (e.g. sheep, goats, pigs, and cattle) is also common in the region. *Tuo-zafi* (made from maize or millet) accompanied with soup made from green vegetable leaves is the commonest food among households in the Region.

Study Design and Sample Size

The study applied a cross-sectional design. The respondents consisted of both male and female who were adults aged 20 years and more. A sample size of 381 of the urban population was considered for the study. The sample size was obtained using the following parameters: population of Wa township = 51,737. This was a projected population based on the year 2010 for ages 20 years or more (Ghana Statistical Service, 2014); confidence level of 95 percent; and confidence interval of 5. The calculation was done using a sample size calculator from Creative Research Systems (2012).

Dependent Variable

The dependent variable was an index generated using the Food Insecurity Experience Scale (FIES). See Table 12.1 (FAO, 2014). The FIES is an experienced-based metric of the severity of food insecurity that relies on people's direct responses to a series of

questions regarding their access to adequate food. The FIES contains eight questions for adults, including two questions for children under five years on food insecurity. The present study only considered the first eight sets of questions for adults to examine the individual experiences concerning food insecurity among an urban population.

Table 12.1: Dependent Variable Components

QUESTION	VARIABLE
Q1. Were you worried you would run out of food because of a lack of money or other resources?	No food
Q2. Were you unable to eat healthy and nutritious food because of a lack of money or other resources?	Healthy food
Q3. Did you eat only a few kinds of foods because of a lack of money or other resources?	Food type
Q4. Did you have to skip a meal because there was not enough money or other resources to get food?	Skip meal
Q5. Did you eat less than you thought you should because of a lack of money or other resources?	Ate less
Q6. Did your household run out of food because of a lack of money or other resources?	Household food
Q7. Were you hungry but did not eat because there was not enough money or other resources for food?	Hungry
Q8. Did you go without eating for a whole day because of a lack of money or other resources?	Not eating

Source: Questions on FIES (FAO, 2014)

Independent Variables

A variable was struck from each of the eight itemized questions on the data collection instrument based on FIES. The study used specific names under the variable column in Table 12.1 to represent the questions. It should be noted that the variables are operationalized as captured by the FIES to enable comparison of results with studies that adapted the scale. These variables were then combined to generate a food insecurity index.

The independent variables consisted of individual level socio-

demographic variables. These included ages 20-30; 31-40; 41-50; 51-60; 61 or more years; sex (male, female), marital status (never married, married, ever married); education (no formal education, primary, Junior High School [JHS], Senior High School [SHS], Tertiary); and employment status (not employed, employed). Each of these variables was carefully chosen based on informed related literature.

Data Collection

Convenience sampling technique was applied to select respondents within Wa township and to solicit their responses. This technique was considered due to the ease at which it allowed the researcher to select respondents. Hence, healthy and physically abled individuals who were 20 years and above and willing to take part in the research were interviewed. During the data collection, questions were asked with regard to the immediate past 12 months whether a respondent at any time was food insecure, answering each of the eight questions with responses 'yes', 'no' or 'don't know.' Trained research assistants were tasked to collect the data from 12 June to 26 July 2019. Out of 381 of the questionnaires that were allocated for the data collection, 321 of them had complete responses, translating to an 84 percent response rate.

Data Analysis

An index for food insecurity was generated using a scale of nine (0-8): food secure (0); low food insecurity (1-3); moderate food insecurity (4-6); and high food insecurity (7-8). Controlling for other relevant socio-demographic variables, ordinal logistic regression was used to analyze the data to identify which categories of the population were more at risk of being food insecure. Ordinal logistic regression was applied to analyze the data. The findings were primarily presented with odds ratios (OR) and adjusted odds ratios (AOR), including their respective 95 percent confident intervals and two distinct p-values (0.05 and 0.10) were used to ascertain statistical significance of variables.

Results

Table 12.2 shows the distribution of socio-demographic characteristics of respondents. Most of them were aged 20-30 years and few were aged 61 years and above. Slightly more than half of them were males. Five in ten of the respondents were married. With education, about four in ten of the respondents had tertiary education while a few (9%) had primary education. On employment status in the past 12 months, 60 percent of them were engaged in a paid job.

In the study, respondents were questioned to ascertain how they experienced food insecurity. When respondents were asked as to whether they were worried about food running out, the majority (59%) of them affirmatively responded (Table 12.3). Approximately, six in ten (60%) of them indicated that they were able to eat healthy and nutritious food. A little above half (52%) of them confirmed that they ate only a few kinds of foods and that they did not skip a meal within a day. Fifty percent indicated that they did not eat less than they thought. Most (54%) of them also responded that the household did not run out of food. On whether they were hungry but did not eat, 66 percent responded no. About eight in ten (80%) ate at least a meal per day.

Fig. 12.3 shows that most of the respondents were food insecure (68%). With those who were food insecure, about three in ten (30%) of them were moderately food insecure while close to two in ten (20%) experienced high food insecurity. The study further examined associations between socio-demographic characteristics of respondents and a food insecurity index (food secured, low insecure, medium insecure, and high insecure) (Table 12.4). All the socio-demographic characteristics selected for this study were significantly associated with food insecurity. A higher proportion (47%) of respondents aged 20-30 years were associated with high food insecurity. Females (37%) were more linked to food insecurity. With marital status, those who had never been married were more (50%) allied to food insecurity. Proportionally, 52 percent of the respondent with primary education experienced food insecurity. And a higher proportion (27%) of those who were not employed 12

months preceding the study experienced food insecurity.

Table 12.5 shows the results of bivariate and multivariate ordinal logistic regression results on food insecurity experiences of respondents. The odds ratios in ordinal logistic regression are interpreted as the odds of one level of an ordinal dependent variable occurring in comparison with the other levels of the dependent variable under study (Orme & Combs-Orme, 2009). In this study, an odds ratio greater than one shows an increased possibility of respondents being among the high food insecure category compared to those who are moderate, low, or food secure category.

Table 12.2: Socio-Demographic Characteristics of Respondents

Variables	Category	Frequency	Percentage
Age	20-30	113	35.20
	31-40	96	29.91
	41-50	55	17.13
	51-60	37	11.53
	61+	20	6.23
Sex	Male	186	57.94
	Female	135	42.06
Marital Status	Never Married	97	30.22
	Married	163	50.78
	Ever married	61	19.00
Education	No formal education	39	12.15
	Primary	29	9.03
	JHS	39	12.15
	SHS	58	18.07
	Tertiary	156	48.60
Employed for the past 12 months	Not employed	127	39.56
	Employed	194	60.44

N = 321

Table 12.3: Food Insecurity Experiences of Respondents

Variables	Category	Frequency	Percentage
Worried about food running out	No	124	38.75
	Yes	188	58.75
	Don't know	8	2.50
You were unable to eat healthy and nutritious food	No	188	58.57
	Yes	126	39.25
	Don't know	7	2.18
You ate only few kinds of food	No	151	47.34
	Yes	166	52.04
	Don't know	2	0.63
You skip a meal	No	165	51.40
	Yes	150	46.73
	Don't know	6	1.87
You ate less than you thought	No	163	50.78
	Yes	149	46.42
	Don't know	9	2.80
Your household ran out of food	No	174	54.21
	Yes	137	42.68
	Don't know	10	3.12
You were hungry but did not eat	No	211	65.73
	Yes	97	30.22
	Don't know	13	4.05
You went without eating for a whole day	No	256	80.76
	Yes	47	14.83
	Don't know	14	4.42

N = 321

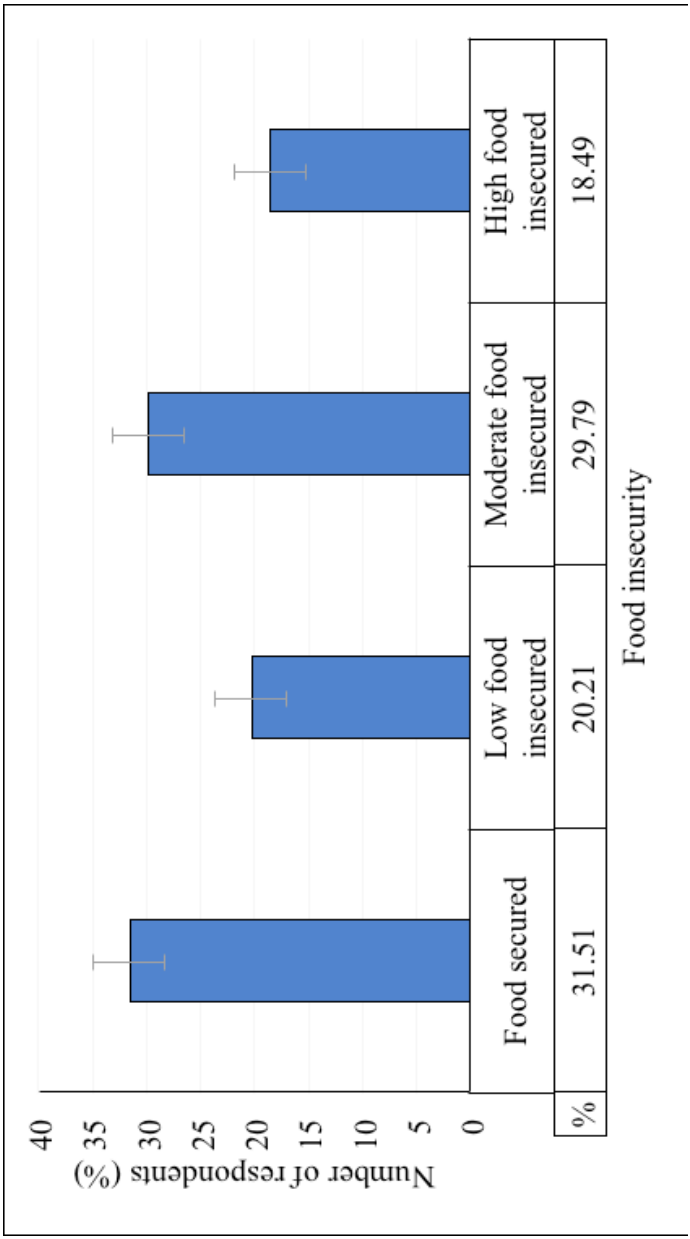

Fig. 12.3: Prevalence of Food Insecurity

The other scenario is that with the odds greater than one, it means that respondents have an increased likelihood of being categorized as high, moderate, or low food insecure compared to the food secure category.

Table 12.4 : Socio-Demographic Characteristics by Food Insecurity

Characteristics	Level of food insecurity				p-value
	Food secured n (%)	Low insecure n (%)	Medium insecure n (%)	High insecure n (%)	
Age †					0.000*
20-30	20 (19.80)	18 (17.82)	30 (29.70)	33 (32.67)	
31-40	39 (43.33)	19 (21.11)	22 (24.44)	10 (11.11)	
41-50	8 (16.67)	13 (27.08)	18 (37.50)	9 (18.75)	
51-60	15 (42.86)	7 (20.00)	11 (31.43)	2 (5.71)	
61+	10 (55.56)	2 (11.11)	6 (33.33)	0 (0.00)	
Sex ‡					0.049*
Male	63 (38.18)	30 (18.18)	44 (26.67)	28 (16.97)	
Female	29 (22.83)	29 (22.83)	43 (33.86)	26 (20.47)	
Marital status ‡					0.000*
Never Married	19 (22.09)	12 (13.95)	26 (30.23)	29 (33.72)	
Married	54 (35.29)	39 (25.49)	40 (26.14)	20 (13.07)	
Ever married	19 (35.85)	8 (15.09)	21 (39.62)	5 (9.43)	
Education †					0.000*
No formal education	5 (13.51)	6 (16.22)	22 (59.46)	4 (10.81)	
Primary	2 (8.00)	4 (16.00)	8 (32.00)	11 (44.00)	
JHS	9 (31.03)	6 (20.69)	8 (27.59)	6 (20.69)	
SHS	13 (22.81)	11 (19.30)	23 (40.35)	10 (17.54)	
Tertiary	63 (43.75)	32 (22.22)	26 (18.06)	23 (15.97)	
Employed (last 12 months) ‡					0.000*
Not employed	21 (18.75)	18 (16.07)	43 (38.39)	30 (26.79)	
Employed	71 (39.44)	41 (22.78)	44 (24.44)	24 (13.33)	

*N = 292 (due to the removal or 'don't know' options with food insecurity experiences); ‡ Applied Chi-square Test; † Applied Fisher's Exact Test; *Significant at p < 0.05*

The bivariate ordinal logistic regression results revealed that 31-40 year (OR = 0.278, p = 0.00), 51-60 years (OR = 0.279, p = 0.000) and 60 or more years(OR = 0.182, p = 0.001), females (OR = 1.621, p = 0.023), married (OR = 0.365, p = 0.000), ever married (OR = 0.402, p = 0.005), tertiary education (OR = 0.365, p = 0.002), and employed in the last 12 months (OR = 0.358, p = 0.000) were significantly associated with increased likelihoods of experiencing a certain level of food insecurity (low, moderate, or high). Among all the variables that were found to be significantly associated with food insecurity, females were identified to be approximately two times more likely of experiencing high food insecurity. All the variables, since they had significant categories associated with food insecurity were therefore considered for the multivariate logistic regression analysis (Table 12.5).

This model was accurately predictive with statistically significant outcomes (Prob > Chi 2 = 0.000 and Pseudo R2 = 0.106). Within the multivariate model, 51-60 years (AOR = 0.360, p = 0.043), 61 or more years (AOR = 0.178, p = 0.006), tertiary education (AOR = 0.173, p = 0.000) and those employed in the last 12 months (AOR = 0.529, p = 0.040) were found still to be predictive of a certain level of food insecurity among the respondents at a statistical significant level of $p < 0.05$. The rest of the categories including females (AOR = 1.548, p = 0.061), never married (AOR = 0.526, p = 0.067), JHS education (AOR = 0.416, p = 0.089) and SHS education (AOR = 0.447, p = 0.076) were significant at $p < 0.10$. In the multivariate model, the odds of females experiencing low, moderate or high food insecurity were still high although it slightly reduced. The second batch of significant categories at $p < 0.10$ are equally important at predicting levels of food insecurity among respondents since they were identified as protective factors in the bivariate model.

Discussion

The study was conducted among an urban population of Wa township in Ghana. This was achieved with the usage of a well-designed FIES research instrument for assessing an individual's food insecurity experiences. In this study, approximately seven in 10 (70%) adults

were food insecure. In a test of associations, at least a category in each covariate considered for the study was associated with food insecurity experiences (low, medium, and high). These factors were further subjected to a binomial ordered inferential test and again all of the covariates had significant groups linked with food insecurity. However, it emerged that females were much burdened with food insecurity experiences. The rest of the covariate groups (51-60 years, 61 or more years, married, ever married, tertiary education, and those employed in the last 12 months) exhibited lower odds of food insecurity. Holding all covariates constant, predictive effects of the food insecurity were ascertained. All the statistically significant factors among age (51-60 years and 61 or more years), sex (females), marital status (married), education (JHS, and SHS), and employment status (employed) still showed likelihoods of experiencing certain levels of food insecurity (low, medium, or high).

In this study, it was a bit intriguing to observe that older adult populations (51 or more years) were found to have a lesser likelihood of experiencing food insecurity. However, researchers have shown that older people generally are more prone to experience food insecurity compared to younger populations due to decline in productivity translating to decrease in earnings (Fernandes *et al.*, 2018). In a study conducted in Eastern Region, Ghana, old people were offered the needed care, especially provision of food (van der Geest, 2016). To the present study's finding, could it be that older people are better catered for in all societies in the country?

More extensive studies are needed to understand the dynamics of food insecurity and old age in urban areas to better inform policy formulation. The study showed that females were more associated with experiencing food insecurity compared to their male counterparts. In the cross-examination of the female group about education and employment status in the last 12 months, they were less educated and most of them were not employed in 12 months preceding the study. This probably could have implications for them being able to have the needed financial support to purchase food, hence, leading to food insecurity experiences.

Table 12.5: Ordinal Logistic Regression Analysis of Experiences of Food Insecurity

Character-istics	FOOD INSECURITY					
	Bivariate			Multivariate		
	OR	95% CI	p-value	AOR	95% CI	p-value
Age						
20-30	1			1		
31-40	0.287*	0.167, 0.491	0.000	0.599	0.287-1.250	0.173
41-50	0.711	0.386-1.309	0.274	1.039	0.456-2.369	0.926
51-60	0.279*	0.137-0.560	0.000	0.360*	0.134-0.966	0.043
61+	0.182*	0.069-0.480	0.001	0.178*	0.052-0.602	0.006
Sex						
Male	1			1		
Female	1.621*	1.068-2.460	0.023	1.548**	0.979-2.447	0.061
Marital status						
Never Married	1			1		
Married	0.365	0.222-0.600	0.000	0.526**	0.264-1.046	0.067
Ever married	0.402	0.215-0.754	0.005	0.502	0.204-1.230	0.132
Education						
No education	1			1		
Primary	2.329	0.941-5.762	0.067	1.315	0.477-3.628	0.596
JHS	0.644	0.273-1.519	0.316	0.416**	0.151-1.141	0.089
SHS	0.820	0.405-1.660	0.582	0.447**	0.184-1.086	0.076
Tertiary	0.365*	0.195-0.683	0.002	0.173*	0.077-0.389	0.000
Employed (last 12 months)						
Not employed	1			1		
Employed	0.358*	0.231-0.554	0.000	0.529*	0.288-0.972	0.040
Cut 1	—	—	—	-3.106 (-4.061, -2.151)		
Cut 2	—	—	—	-2.034 (-2.943, -1.126)		
Cut 3	—	—	—	-0.329 (-1.215, 0.556)		
Number of observations	—	—	—	292		
LR Chi2	—	—	—	84.26		
Prob > Chi2	—	—	—	0.000		
Pseudo R2	—	—	—	0.106		

*Significant at $p < 0.05$; **Significant at $p < 0.10$

In contrast to this finding, Pandey and Fusaro (2020) in their study in Nepal found no significant association between sex of respondent and food insecurity. However, a study conducted by Bowen *et al.* (2016), females were found more likely to experience food insecurity. These authors argued that this was reflective because of lower mean income measures among females compared to their male counterparts. They further observed females being more linked to food insecurity due to homelessness or marginally housed with lower incomes. At the locality where the present study was conducted, the issue of homelessness was minimal. However, the presence of females having lower or marginal incomes could be present; and this phenomenon has been observed in populations where females possess less purchasing power for essential food items both in variety and quantity (FAO, 2009).

Marriage life in most societal circumstances tends to be a protective avenue to shield individuals from adverse eating deficiencies. Married individuals in the study were less likely to be associated with any of the three levels of food insecurity. In a related study, singles (those unmarried, separate, divorced, and widowed) were found to have much higher odds of been food insecure compared to married couples (Tantu *et al.,* 2017). Married persons find themselves in a complex environment due to the individual couple's characteristics. These characteristics such as education and income could serve as a buffer against food insecurity. And this study did not examine the interrelations of these external characteristics of married couples with food insecurity. Further assessment of the identified issues with marital status and food insecurity could further be examined to determine mediating factors.

Another significant finding of the study was that individuals with JHS, SHS, and tertiary education had a lower likelihood of experiencing food insecurity. Among these individuals, those who attained tertiary education were much less linked to low, medium, or high food insecurity. This, therefore, suggests that the attainment of higher educational levels could be a shielding factor to experiencing low instances of food insecurity as compared to those who attain lower or no formal education. Similar studies on food insecurity in various

contexts have also noted that higher educational acquisition was a pathway to securing needed quantities of food for daily consumption (Esturk & Oren, 2014; Mutisya *et al.,* 2016).

In most urban environments, being employed is a sure measure of satisfying an individual's dietary needs. Having employment is of essence in these situations since residents largely purchase food displayed in the markets. The situation is not much different in the area where the present study was conducted. Wa is the administrative capital of the region and most economic activities are in areas of retailing goods and providing services, and most foods available in the town are cultivated by rural farmers. Therefore, individuals who do not have daily incomes or constant source of income to acquire food items are more likely to be food insecure. This research found that individuals who were employed in the last 12 months preceding the study were less likely to experience a particular category of food insecurity compared to those who were not employed. This finding concurs with a study conducted in Ethiopia on unemployment and food insecurity which revealed that individuals who were employed had higher likelihood of been food secure. The number of insufficient and reliable income sources significantly contributes both moderately and severely to food insecurity (Etana & Tolossa, 2017). Other studies conducted in Iran (Jafari-Koshki & Arefhosseini, 2019) and India (Chinnakali *et al.*, 2014) equally found employment status as an important determinant of food insecurity. Unemployment does not independently contribute to persons being food insecure but rather underlying issues such as skills, talent, and education are key to getting employed. This is expected of those who are unemployed to be food insecure. However, it would be worthwhile to further investigate which segment of unemployed individuals are more prone to food insecurity in urban settings.

Conclusion and Recommendations

There is a high prevalence of food insecurity among the urban population in the Wa township. Experiencing food insecurity is most likely to be associated with an individual's socio-demographic

characteristics that predispose one to one's ability or inability to afford food. Largely, individuals who were aged 30 years or more, females, those never married, those without education, and persons without employment are more vulnerable to having food insecurity. It would, therefore, be prudent for authorities and organizations such as the Municipal Assembly, and, NGOs to provide more skills education and training for the youth. This would mitigate food insecurity among populations at risk.

Strengths and Limitations of the Study

The study has some strengths and limitations. The usage of the FIES instrument enabled the study to potentially identify populations at risk of being food insecure. Such measures are important to mitigate the onset of malnutrition among vulnerable populations. This was done by considering some important socio-demographic variables of the respondents. Simplicity of the research instrument enabled the study to measure food insecurity among an urban population. The clear presentation of the findings obtained from the data would facilitate easy understanding by decision-makers about food security, especially in urban areas. Despite all the outlined strengths, the study was unable to specifically assess actual food consumed, diet quality, and food expenditures of the urban population. The period for reporting an individual's food affordability and availability could result in recall bias where respondents either over-estimated or under-estimated their food insecurity experiences. Most of these limitations could be mitigated with a longitudinal study design. Such a design would elicit the responses (both quantitative and qualitative) over a period of time to better inform policy-makers to appropriately formulate social intervention programmes by targeting populations at risk.

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