UNIVERSITY OF CAPE COAST

COMPLIANCE WITH LAND USE REGULATIONS IN THE VICINITY OF FUEL SERVICE STATIONS: A STUDY OF THE CAPE COAST METROPOLITAN AREA

SILAS MAWUENA FIAH

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BY

SILAS MAWUENA FIAH

Thesis submitted to the Institute for Oil and Gas Studies of the Faculty of Social Sciences, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfillment of the requirements for the award of a Master of Philosophy degree in Oil and Gas Resource Management.

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DECLARATIONS

Candidate's Declaration

I hereby declare that this thesis is the result of my original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: …… Date……

Candidate's Name: Silas Mawuena Fiah

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of the thesis laid down by the University of Cape Coast.

Supervisor's Signature: …… Date……

Supervisor's Name: Professor Simon Mariwah

ABSTRACT

Despite the numerous benefits of urban fuel stations, threats are posed to human life and properties when the stations are not well managed. The study assessed compliance with land use regulations in the vicinity of fuel service stations in the Cape Coast Metropolitan area. A total sample size of 371 respondents comprising 352 bonafide land owners or heads of household, 18 fuel service station managers, and one Land Use and Spatial Planning Authority (LUSPA) officer was selected for the study. The study used a descriptive research design with a mixed-method approach and selected respondents based on cluster and purposive sampling techniques. The research found that some of the fuel service stations were identified with hot works (fire-related activities) from the adjoining land use which pose a threat to the environment at large. A land use compliance map was also generated using ArcGIS Pro based on the variations in the land uses from the study. Conditions that accounted for the variations in the statutory and existing land uses were geographic and environmental such as demographic dynamics, global food consumption, energy demands, settlements and infrastructure, and economic activities. The study also revealed that people who are financially stable, socially connected, and can make a great change in society and people's lives influence land use compliance. Regression analysis revealed that demolition of poorly sited structures, withdrawal of permits, effective law enforcement, awareness creation, and financial capacity of land users and developers are significant factors that influence land use compliance in the vicinity of fuel service stations. The study concluded that there is a high level of compliance with land use regulations in the vicinity of the fuel service stations in the Cape Coast Metropolitan area. It is therefore recommended that land use found within proximity to fuel service stations that engage in fire-related activities should be checked, and strictly regulated by the regulating bodies (NPA, EPA, or LUSPA). The LUSPA should also adapt the land use compliance map of this study as reference data to aid in monitoring and tracking land-use activities in the vicinity of the fuel service stations.

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DEDICATION

To my family especially my father Samuel Kudjoe Fiah, and my siblings Michael, Anthony, Christopher, Abigail, Seth, Phyllis, Sharon, Keren, Kristolorm, Akorfa, Addran, Richwells, and Solomon.

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CHAPTER ONE

INTRODUCTION

The Oil and Gas industry is a capital-intensive one and needs careful planning and development of all structures within and around fuel retailing businesses in the downstream sector. Fuel retailing has been a source of livelihood and revenue generation for the oil and gas industry and the communities in which they reside. However, land use and fuel retail activities have affected the environment through fire outbreaks, especially in fuel retail areas in some parts of Ghana as a result of land use non-compliance from land developers.

In Ghana, although, land-use planning and regulations have been practiced and enforced through Cap 84 and the Land Use and Spatial Planning Act 925, 2016, Sections 115, 117, 118, 119, and Sections 94, 95, 96, 97 of Act 936, issues of non-compliance persist. Hence, the goal of this study is to assess the compliance with land use regulation by fuel service stations and adjoining land uses by mapping out the land use pattern around fuel service stations, estimating the level of compliance between the statutory and existing land use, and finally, examining the influencing factors to compliance in the vicinity of fuel service stations and what accounted for such factors.

Background to the Study

Effective land use has been a major issue in the urban space and indeed a global phenomenon that occurs everywhere but it is more pronounced in developing countries due to diverse pressures stemming from persistent population growth, rapid and uncontrolled urbanization, land scarcity for development, and failures in mechanisms for regulating land developments

(Wehrmann, 2008). Inadequate land use planning leads to land use conflicts arising from incompatible neighboring land uses, which can expose individuals to various hazards, vulnerabilities, and significant risks for both society and individuals (Sudmeier-Rieux, 2015).

Land use regulations are vital for managing urban development and ensuring public safety (Sudmeier-Rieux et al., 2015). A site-specific technology that may be intrinsically harmful to both humans and the environment constitutes a risk and must be taken into account to ensure safety. Without mitigation, the risk created by incompatible land uses may manifest into disasters such as technological disasters, when industrial land uses come into conflict with residential areas, or natural disasters where residential areas conflict with sensitive wildlife habitats or hazardous physical environments.

Hiraskar (2007) argues that a harmonious and functional use of space promotes convenience, comfort, and safety as well as sustained economic, and social developments. The achievement of social and economic goals at any level cannot be realized without the harmonious and functional use of space. Regulating the use of space in an urban setting requires the application of various policies and regulatory mechanisms (Williamson, 2010).

Land use planning involves a decision on the use of land to achieve some stated goals and ensure the sustainability of development. Such land-use plans may be realized in the form of a planning scheme for a given geographic area. Zoning with accompanying regulations is often used to execute and enforce land-use plans, which create the conditions required for achieving an environment that is sustainable, required, and viable (GIZ, 2012). Planning is attributed to a goal that should keep future growth and developments under

control, and when this goal is not met, then planning is considered a failure (Loh, 2011).

For the land-use plan to hold and achieve its purpose, land-use regulations must be in place. This land-use regulation may be portrayed in the form of decrees, by-laws, and statutes concerning housing densities, lot sizes, heights, allowable space, and compatibility with adjoining land uses (Kovachev, Slaev & Daskalova, 2016). Countries all over the world enforce land use regulations for the maximization of individual gains and social returns from the usage of land (Tian, 2008). Thus, land-use regulations are necessary for achieving well-matched land development and functioning efficient land uses (Aribigbola, 2008). Legal controls may be included for controlling the land use pattern in urban areas (Harvey & Jowsey 2004) and, the intervention by the public may be of concern and needful to reach an orderly development of efficient land allocation which can be achieved through zoning. The government's major instrument or tool for controlling development and ensuring sustainability is zoning regulation. The environment is protected in a way from conflict use of land through zoning to ensure value for the land. (Yeboah & Obeng-Odoom, 2010). For this, places recognized for residency are protected from the activities that emanate from the manifestations of the industrial and commercial areas.

According to Haughton (2021), lack of recognized rights and social justice contribute to land-use conflicts, which may present significant challenges for planners to seek new techniques or approaches, as well as increasing the ability of actors in the conflict to organize, be in unity, and have their rights protected (Karner & Niemeier, 2013). The welfare economic

features of land-use conflicts which is either way termed as the social welfare theory posit that lands that seem to likely serve the same purposes must be based solely on their effective distribution of economic activities, not on their conversion from one use to another (Cheshire & Vermeulen 2009).

Notwithstanding the availability of numerous development regulatory tools like development plans, there are incidents of total or partial noncompliance in specific places. The essential factors responsible for hindering how effective development control should be according to Kimani and Musungu (2010) are the inability to do inspections and supervision and implement plans for developments, the inability to have a support system that is relevant for effective enforcement, and the local authority's lack of resources for ensuring the wellbeing of developments. Possibly, non-compliance with development regulations may have significant consequences for developers and society as a whole, including the demolition of non-compliant developments, unhealthy environment, lack of aesthetics, and loss of lives and property (AAK 2011a).

In Ghana, certain statutes such as Cap 84 of 1945, the Town and Country Planning Ordinance, (presently known as the Spatial Planning Act) through an amendment by the Town and Country Planning Act, 1958, the Town and Country Planning Regulations, 1959, now the Land Use and Spatial Planning Regulation 2019 (LI 2384), the Building Code (L.I 1630), 1996, the Local Government Act (Act 462), 1993 presently known as the Local Governance (Act 936), 2016 and the numerous by-laws of MMDAs have set the framework for ensuring the compliance to developments through enforcement through a legal means. Also, various land-use regulations in

Ghana seek to promote an orderly manner of development, and a clean-living environment (Memunatu, 2015).

Owing to the rapid growth of fuel stations, the human influence on the environment has increased over recent decades and this has helped to improve the local economy and social life by providing employment opportunities in areas and communities where these fuel retail stations are situated (Mwenda et al., 2017). Despite the numerous benefits of urban fuel stations, threats are posed to human life and properties (Nieminen 2005). Studies on fuel stations in different countries by Baffour et al. (2014), Douti et al. (2019), Onwona (2001), Yirenkyi (2017), and Bakidamteh (2018) have pointed out the impact improperly located fuel stations have on the environment (Baffour et al., 2014). Following a series of mishaps and explosions at gas and petrol stations, there have been several calls on the government, and stakeholders to be active in putting more safety and compliance measures in place to monitor and regulate fuel station activities across the country to protect employees and communities (Tenkorang & Osei-Poku, 2015).

Land use facilities within the vicinity of fuel stations such as restaurants, sawmills, vulcanizing shops, oil depots, auto repair garages, and hot works thus fire related works (Memunatu et al., 2015) that exist around fuel stations may pose a threat to the fuel stations since the reactions between fuel, heat, and oxygen can result in an explosion or fire at the gas station (Li, 2016) depending on activities performed which can influence ignition and hence result in disaster risk. Since fuel stations are capital-intensive businesses involving huge investments, there is a need for land use compliance by adjoining lands in the vicinity of fuel service stations to prevent any form of

misfortune or destruction from adjoining land uses. To achieve this, land use regulations and permits for these facilities in the vicinity of fuel service stations must be checked.

However, there has been an instance in Nigeria where regulatory officials have ignored multiple violations of town planning regulations. Owing to the issues of land use non-compliance, there have been several rapid changes in the landscape, scenery, and character as a result of incompatible development within the whole land use (Aluko, 2011). This is similar in the case of the Northern region of Ghana, in that despite the high level of awareness on compliance with planning regulations, there was still low compliance with planning regulations regardless (Boamah et al., 2012).

It is, therefore, necessary for our Ghanaian context that all developments must be halted immediately in areas identified as planning districts as stipulated in Section 4(1) of Cap 84. On the other hand, with regard to the permit to carry out physical development, Section 91(1) of Act 936 states that unless the planning authorities (District Planning Authority) have given authorization or prior written approval, no form of development shall be carried out in a district by a person. The District Planning Authorities have established bodies in charge of planning in their domain of authority under Sections 91 to 97 of Act 936 and thereby these legislations are geared toward a safe living environment in Ghana and the orderly development of lands.

Moreover, the Town and Country Planning Department's recent rapid assessment of the process involved in permitting in four regions and twenty Metropolitan, Municipal, and District Assemblies (MMDAs) discovered that permitting procedures varied widely across all of these places, making the

process extremely frustrating, particularly for projects that cross regional and district boundaries (TCPD, 2015). Therefore, there is always a need for regulation to maintain control and balance for any system to work as expected (Obabori, 2007). Development controls as regulations provide for control and balance in the built environment and also the development control tools as regulations are meant to offer a strategic framework with policy context for all decisions relating to planning (GOI, 2007). Land use regulations help ensure that fuel service stations are located in safe areas, away from sensitive places like residential areas, schools, hospitals, and high-traffic zones (Harvey et al., 2004).

In the case of fuel service stations, these regulations typically include guidelines for location, zoning, safety measures, environmental considerations, and more. Fuel service stations deal with flammable and hazardous materials, making safety a top priority. Fuel service stations can potentially contribute to soil and groundwater contamination in case of leaks or spills and for that matter, compliance with regulations helps mitigate these risks by enforcing measures to prevent and respond to environmental incidents.

Improperly placed fuel service stations can lead to traffic congestion, which affects nearby businesses and residents. Land use regulations can address this concern by dictating appropriate distances from major roads and intersections (TCPD et al., 2015). Fuel service stations that do not comply with zoning regulations might disrupt the overall aesthetics of an area or interfere with planned urban development. Proper compliance helps maintain a cohesive urban landscape. Land use regulations can also consider the impact

of fuel stations on air quality and public health, ensuring that they adhere to relevant health and environmental standards.

However, the rapid urbanization in Ghana and increasing demand for fuel services have led to the establishment of numerous fuel service stations within metropolitan areas across the globe (Aluko et al., 2011). While these stations play a crucial role in providing essential services to the public, their improper location and non-compliance with land use regulations can pose significant risks to public safety, the environment, and urban planning. The study, therefore, seeks to assess compliance with the land-use regulations in the vicinity of the fuel service stations in the Metropolitan area of Cape Coast. This is to check for the conformity of these land uses against the actual planning scheme in the vicinity of the fuel service station whereby this land uses would ensure that the purpose for claiming lands was used for the exact purpose other than changing its use which could be a great threat to fuel stations based on the activities performed on such lands.

Statement of the Problem

In recent times (between 2007 and 2020), major urban settlements in Ghana experienced industrial fires at fuel service stations which conflicted with housing and other land uses resulting in damages to valuable lives. (Finder, 2017). Thus, preventing land-use conflict through conformance has become a focal point for government policy. Although planning regulations of land use have been practiced in Ghana and enforced through Cap 84, and the Land Use and Spatial Planning Act 925, 2016, issues of non-conformance persist. Urbanization has resulted in the emergence of a slew of new urban areas, most of which have grown without consideration for development

planning or the enforcement of planning standards and rules even in the vicinity of fuel service stations although urbanization gives room for opportunities such as education, knowledge and technology transfer, and employment (Avtar, Tripathi, Aggarwal & Kumar, 2019).

Uncontrolled or unmanaged urbanization has exacerbated social and economic concerns, such as the establishment and the spread of informal settlements, vulnerability to disasters such as fire, and flooding, and the poor state of infrastructures like road transport, drainage, and services related to sanitation (Cobbinah et al., 2017) which may harm fuel service stations. Adjoining land uses can increase their risk levels due to their inability to comply with land use regulations. Non-coordination among institutions participating in the permission process is also on the rise, resulting in overlaps in the permission process, delays, and expensive service costs. All of these fueled projects and developments, which are often unauthorized, haphazard, and poorly controlled, thus endangering lives and property, as well as citizens' economic and social lives (TCPD 2015).

It is important to understand the risk imposed by adjoining land use on fuel stations and the environment due to non-compliance. Yirenkyi (2017) has also highlighted the fuel stations' non-compliance to set standards and regulations. Some fuel stations which are not properly sited may also pose a threat to individuals and the environment. While there are scientific works on non-compliance of fuel service stations in Ghana, as highlighted by Yirenkyi (2017) and Baffour et al (2014), few studies have attempted to assess the compliance with land-use regulations from the perspective of fuel service stations vicinity activities that emanate from adjoining land uses in Ghana. It

is against this background that this study seeks to assess compliance with land use regulations by fuel service stations and adjoining land uses within the Cape Coast Metropolis. This is premised on the fact that non-compliance with land use regulations will lead to land use conflict and industrial disaster risk.

Purpose of the Study

Objectives of the Study

The general objective of the study is to assess compliance with land use regulations by adjoining lands within the fuel service station vicinity of the Cape Coast Metropolis.

The specific objectives are to:

1. Map out the land use pattern in the vicinity of fuel service stations.
2. Assess the level of compliance between existing land use patterns and statutory planning scheme land use plan.
3. Examine the factors that influence land use compliance within the vicinity of the fuel service station.

Research Questions

The research, therefore, seeks to answer the following questions;

1. What are the land use patterns at fuel stations?
2. What are the compliance levels by existing land use patterns relative to statutory land use plans in the vicinity of fuel service stations?
3. What are the factors that influence land use compliance in the vicinity of fuel service stations?

Significance of the Study

The findings from the research will be of worth to the Cape Coast Metropolitan Assembly, the Disaster Management Center in the region, Cape Coast Metro's fire services, and the metro's land use management offices. Descriptive knowledge will be provided by this study hence the Oil and Gas industry businesses in Ghana will have a solid reference to which they can use as a guide for policy-making at various scales to improve sitting practices and know where there are high risks and low risks about fuel stations based on compliance levels on land use planning scheme. The results may also serve as a future research guide or lead to future research by contributing to the literature on compliance and risk in Ghana based on the threat posed by fuel stations and adjoining land uses, and implications for planning. The results from the study could assist Cape Coast Metro in establishing robust fuel station fire prevention and response initiatives, and also routine community engagement programs for people living near fuel service stations. Concerning fuel stations, the study will generate evidence to support effective disaster risk reduction and compliance issues on land use.

Delimitations

The study's scope was limited to only fuel stations within the Cape Coast Metropolitan area (both LPG and gasoline (petrol/diesel fuels) and the adjoining land uses within the specified buffer around these fuel stations. All other land uses outside the specified buffer were not considered in this research work. Samples for the study were derived from only bonafide land users and heads of households, fuel service station managers, and a spatial

planning officer. The only application tools for the data collection and manipulation were SW Maps and ArcGIS Pro respectively for geospatial data.

Limitations

The findings of the study were limited to the Cape Coast metropolitan area. Only the questions that were provided in the questionnaires were to be solely answered by the respondents without making any suggestions whatsoever. In responses on whether the people have permits or not, respondents were reluctant to provide answers to such questions for fear of being reported to authorities responsible for granting development permits. This took more time to explain to them the relevance of the study before answers were given. On the land use maps, raw schemed maps taken from the Assembly were split up, they needed to be georeferenced and digitized using the ArcGIS Pro software before they could be embedded into the SW Map mobile software for field validation with which some manual manipulations had to be done manually on some land use and validated afterward. Because the buffered areas were many, it took months to complete the digitization and field validation to generate the existing land use map. Also, because of time and resources, the bonafide land owners were not interviewed.

Definition of Terms

Land-use planning- "Land-use planning is described as physical and socioeconomic planning that defines the means and assesses the values or limitations of various land-use options, taking into account the corresponding effects on various segments of the population or community interests in resulting decisions" (UNISDR 2009:19).

Land Use Planning is a type of regional and agricultural planning that aims to make use of land greatly, given agreed-upon goals, as well as the opportunities that may be derived environmentally and societally with the requisite limits. This is to determine the potentials that accrued from the land and how it can be transformed (Fresco et al, 1992).

Land-Use Regulation- Land-use regulations serve the objective of limiting development so that urban planning may be implemented. Land-use regulations, often known as urban development regulations or controls, are rules that govern how land may be utilized and developed in certain locations (Goodfellow, 2013).

Land-use zoning: Land-use zoning is a set of rules that divides land into distinct and often solitary purposes including residential, commercial, recreational, and industrial. The most common way to express zoning is through a zoning plan or zoning scheme in which Specific activities are permitted and prohibited within each zone.

Adjoining land: Adjoining land is referred to as a lot or parcel of property that shares all or part of a common lot line with another lot or parcel of land. Adjoining property is any land and/or property bordering the site and every portion thereof, including all conduits, roads, walkways, walls, fences, buildings, and other erections, and all service media and other equipment on, under, or within such land and/or property. (Lawinsider Dictionary).

Organization of the study

The thesis has five organized chapters. This first chapter sets the scene, touching on the background of the study, the problem statement, the objectives of the study, the research questions, and the significance of the study. Chapter

two reviews related literature concerning the study. The third chapter describes the research methodology, methods of data collection and their mode of administration, analysis of data, and procedure. Chapter four presents the results and discussion with existing literature while Chapter five provides the concluding remarks as well as recommendations.

Chapter Summary

This chapter provided an overview of the research. It focused specifically on the study's background, statement of the problem, research objectives and questions, significance, delimitations, and limitations, definition of terms, and study organization.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter reviews the literature on issues related to the study, including definitions and meanings, ideas, concepts, theories land use regulation, land use planning, land use conflict, fuel station, and land use compliance. In addition, empirical literature was done.

Meaning of fuel station in the context of the study

Although there are variations in terms used to describe facilities that sell petrol and gas, the word fuel service station was consistently applied and used in this study. The name fuel service station in this context is used similarly to mean “filling stations”, “distribution stations”, “gasoline stations”, “gas stations”, “petrol stations”, and “service stations”, and therefore any of these names will still be representative of the name fuel stations. The main petroleum products to be looked at in the study consist of gasoline, diesel, kerosene, and LPG. This is because they are the most common ones we find within our vicinity and are sold commercially.

Depending on the part of the world, these facilities can have different names, however, they remain the same in their purpose. According to Mshelia et al. (2015), a fuel station is a place or structure where a motorist or other users go to buy petroleum products. Therefore, the potentially unsafe nature of these facilities demands precautions to prevent fires or injuries in their construction and location (Ahmed et al. 2011). Petrol stations are also vital structures and involve vast amounts of hazardous materials also known as hazmat (Retail Association of Australia (ARA), 2009).

Hanekom (2001), and Spencer and Genovese (2004) believe that any petroleum facility, public garage, service station, or filling station on a highway can be referred to as a petrol station once they supply fuel and petroleum products to motorists and other vendors at a fee. A petrol station as referred to by Mohammed et al. (2014) is a building, or equipment used to sell or dispense petrol into motor vehicles. There are, however, some petrol stations that deal with specialty fuels like liquefied petroleum gas (LPG), natural gas, kerosene, biodiesel, or butane, meanwhile, others aside from their primary business of retailing fuel add shops or convenience stores (Ayodele 2011). However, almost all petrol stations sell diesel and petrol (Ayodele, 2011).

Concept of compliance

According to the OECD (2000), compliance is defined as a target population's conformity with regulatory standards, as well as government policy objectives. Compliance and conformity can be separated advantageously. Compliance refers to submission to expectations, which can take many forms, including, norms, rules, recommendations, entreaties, demands, suggestions, and so on. Conformity, on the other hand, relates to being identified with a specific type of expectation that is a rule, a law, or a social norm, and hence the meaning of conformity is compliance with standards or laws. The concept of conformity typically invokes the idea of shared social standards. There are two forms of compliance: enforced compliance and voluntary compliance (Burby et al., 1998). The compliance that is enforced requires better-trained personnel and greater resources since it has an impact on the work of compliance administering, either in a poor

manner or not at all. Voluntary compliance comprises persuading landowners to comply with norms, rewarding those who do, and disciplining repeat offenders (Burby et al., 1998).

Based on the circumstances in the land use regulations, the degree of compliance varies from place to location. The degree of compliance has a positive relation to income level (Alnsour & Meaton, 2009). For example, it was discovered from research in the United States there are high housing prices for cities that deal with land regulations strictly (Saiz 2010; Kok et al. 2011). Also, countries that are noted to have regulations on urban development loosely enforced have more scattered developments (Brueckner and Selod 2009). Finally, compliance and obedience as termed should not be used interchangeably. Consent and obedience are therefore both examples of compliance.

Land use categories and classification system

Land use is the use of an empty or developed piece of land for a certain purpose at a specific period. Land use is a new socioeconomic activity in which there is a change in the land utility from an area of a primary special purpose to another for a general purpose. The utility value of a piece of land is determined by several geographical considerations. The kind of land use has to determine factors such as the location, the soil and water availability, moisture of soil, fertility, and nearness to other human-related activities.

Land use is categorized into two major groups (Balasubramanian, 2015).

Urban land use: This type of land is for a variety of purposes, including institutional, residential, commercial, transportation, industrial communications, and general utilities.

1. Rural land use: This is a land type that is not urban classified including farmland, agricultural land, forest land, cropland, and rangeland.

Land use classification is attempted at the continental level based on agroclimatic variables, terrain, and soil types. A country's land-use pattern is defined in a manner of its economic structure, physical structure, and institutional structure at any given period (Balasubramanian, 2015). Urban land use is looked at for this study and shown in a built-up class below;

Built-up urban comprising recreational, industrial, residential, public/semi-public utility lands, and commercial.

The purpose of this work is to look at compliance with land use regulations by adjoining lands in the vicinity of the fuel service stations in the Cape Coast Metropolitan Area. The purpose is to assess the various land uses in the planning scheme as compared to what is actually on the ground. Since Cape Coast is an urban area, the focus of this land use will be solely on urban building which is adopted in most countries. Table 1 below shows land use categories and classifications that are relevant to the study by showing the various built-ups with their corresponding make-ups.

Table 1: Land use categories and classification system

Built-up Land-Urban Residential/high-density/medium-density residential/low-density resident	High-rise apartments/ Flats Medium rise apartments Low-rise apartments/ flats Low-rise row houses Low rise Group houses Slums/ Clusters
Commercial	Retail & General Business Community Centre Wholesale & Warehousing Major shopping Centers/ Malls Major Hotels Parking Area Market Yards Exhibition halls Petrol bunks Banks
Industrial	Service Industry Light Industry Extensive Industry Heavy Industry Hazardous Industry
Recreational	Parks/Garden Stadium Playground Gold Course/Race Course Zoo Botanical Garden Historical Monument/Fort Planetarium Major Fountain Hall Swimming Pool Major Cinema Halls/Theatres
Public/and Semi-Public	Major Education Institute Cantonment Major Hospitals Cremation/ Buried Ground Social/Cultural Centre Religious Places Major Government Offices Petrol/Gas Filling Stations Police Station Fire Station Circuit House Electric Substation Jail Water Treatment Plant

Source: Balasubramanian, A. (2015).

Land Use Regulation, Permitting, and Compliance

Regulation of land use in Ghana

Before the Land Use and Spatial Planning Act (Act 925) 2016 was passed, there was a colonial-era law that was in support of the execution of the master plan through regulation and functional use of land from the Town and Country Planning Ordinance of 1945, (Cap 84), (Awuah & Hammond, 2014). The Town and Country Planning Planning Regulations of 1959, the Local Government Act of 1993 (Act 462), and the Building Code (L.I. 1630) of 1996 all endorsed it. By establishing Metropolitan-Municipal-District Assemblies (MMDAs) as planning bodies in their territories, the Local Government Act (Act 462) of 1993 decentralized planning. As a result, the Cape Coast Metropolitan can develop, execute, and enforce municipal plans. That is, while the land is sold to individuals by customary land authorities, the government (MMDAs) is in charge of planning scheme preparation, approval, enforcement, and sanctions.

Land-use zoning regulations in Ghana

It is in the mandate of the Ghanaian zoning guidelines and Building regulations of 2011 through an LI (1630) that all physical developments are governed. As a result, the form of the tenure system and land alienation can have planning repercussions, and certain specifications are needed. Minimum space specifications or essential considerations must be met as part of the required guidelines. The advisory discretionary criteria are influenced by a number of variables. (The Zoning Guidelines and Planning Standards of Ghana). In other words, although customary authority governs access to land, the District Assemblies manage it through planning.

In recent years, the Land Use and Spatial Planning Act 2016 has been the primary tool for land use management in Ghana. Act 925 unifies and updates Ghana's land use and spatial planning legislation. Clause 113 of Act 925 makes it illegal to carry out any development without first obtaining planning authorization from the District Assembly.

Land use regulations and distance requirements for fuel service stations in Ghana

From 2003 to 2010, the Land Administration Project moved Ghana's land use planning ahead because it aimed to simplify the process involved in accessing land and making it more transparent and efficient (TCPD, 2014). While considering the spatial effects in relation to any kind of development, the purpose of the Project was to provide a spatial solution in order to achieve set policies socially, environmentally, and economically. Land information was documented including the location, size, improvements, ownership, and value. Individuals who were interested in using land as real estate were identified and collected information concerning the type and duration of land use and owner rights (Karikari, 2006). The Land Use and Spatial Planning Bill in July 2016, was ratified and aimed to harmonize the land use laws in existence, construction laws, and regulations while giving the Town and Country Planning Department more power to ensure that there is compliance with spatial plans and planning standards at different levels like the national, regional, and district levels, which could trigger a change in land use planning (Parliament of Ghana, 2016).

A collection of guidelines for deciding the size, venue, and specification of sites of various land uses and fuel service facilities are known

as planning standards. Since planning requirements and guidelines may have an impact on the allocation of scarce land and financial resources, they should be used with caution. As a result, certain specifications are needed, while others are suggestions to help the developer. To ensure compliance with land use and reach an effective policy, the National Petroleum Authority (NPA) took a keen look at how fuel service retail activities will be in conformance to land use distance and thereby restructured their permitting statuses on how fuel service stations and Liquefied Petroleum Gas (LPG) refilling stations should be sited. With this, minimum space specifications or essential considerations must be met as part of the required guidelines through which there has been a revised distance requirement for siting fuel station which took effect June 1, 2020.

In the revised distance requirement for siting fuel stations, it is stipulated that the distance from hot works should be 100m for fuel stations and 200m for LPG stations respectively as against the previous 200m distance. Distance from the nearest public institution preferably should be 60m for fuel stations and 500m for LPG from either light or heavy industrial areas just as the previous distance. The distance from areas like dumpsites, wetlands, streams, and rivers is noted for their environmentally sensitive nature, therefore, should be 30m for fuel service stations and 60m for LPG as against the previous 60m. The distance from the next station on the same side of the road is 300m as against the previous 500m for fuel service stations and 1000m(1km) for LPG. The distance between a service station and an LPG refilling plant on the same side of the road should be 500m as against the

previous 1000m and a staggering distance between a service station and an LPG refilling plant is 500m to the previous 1000m (NPA, 2020).

Land use permitting process in Ghana

Development permission is the key device for controlling or managing physical development. Orderliness, ease of movement, public safety, and increased economic development are all benefits of good development management. Permits issued in connection with planning and building applications are referred to as development permits in this context. In human settlements all around the world, planning effectively coupled with proactiveness in development management has been linked to improved environmental sustainability. The Local Governance Act of 2016 (Act 936) recognizes this fact by stating, that no physical development shall be carried out in a district without prior consent of the district council. In acknowledgment of this reality, Act 936 of the Local Governance Act, 2016 provides that without the prior written consent of the District Planning Authority, no physical development is done inside the district, Act 936, Section 91(1). Furthermore, the law stipulates that each individual shall seek permission from the District Planning Authorities, prior to building or undertaking any building or other building, that may contain the conditions deemed required by the district planning authority, Section 106(1) of Act 936.

Planning permit

A planning permit is a legally binding document that encourages adherence to approved zoning restrictions. (i.e., orientation, heights, plot coverage, setbacks, building line, etc.) and planning standards. Planning permits are required for all improvements that are carried out under or above

the property or that produce major changes in the current land use or construction and include land consolidation. The District Planning Authority shall also issue a planning permit for i) A parcel of land change or use, ii) Orientation of physical development, iii) Plot coverage and size, iv) Height of development, v) Building densities, vi) Building lines and setbacks, vii) Colour schemes, viii) Sub-division of land, ix) Consolidation of land, x) Temporary structures, xi) Physical accessibility to facilities, xii) Population threshold, xiii) Facility size threshold, xiv) Minimum facility requirements, xv) Land size requirement, xvi) xvii) Any additional problem of importance to the local government for planning. However, developers may request a modification or rezoning owing to situations where the proposed development does not meet zoning requirements or the approved use.

Development Permit

A Development Permit comprises both a Planning Permission and a Building Permission as prescribed by Regulation 45(3) of LI 2384. A district Planning Authority is the sole authority for the issuance of permits for development. All Physical Developments must require a Planning Permit and or Development Permit per Land Use and Spatial Planning Regulations, 2019 (LI 2384). A development permit shall be required for all physical development involving the erection, structural changes, or any structure transformation and work execution or the putting in place (installation) of any fixture related to any structure. A development authorization is written authorization to develop a person under the parameters mentioned in the authorization. The development permission shall take adequate account of the zoning, planning, and structural characteristics of the planned development.

Development permit activities include activities: i) the putting up of any building or structure except for those exempted by law, ii) renovations in the form of making structural alteration and or transformation to a building, iii) execution of works or installation of any fittings in a building, iv) hoarding of a property (TCPD, 2015). The development permit application shall be accompanied by four sets each of the following:

1. Site plan to the scale of 1:2500 and conforming to the local plan of the area;
2. Block plan to the scale of 1:100 or 1:200 depending on the scale of development;
3. Architectural drawings to the scale of 1:20 or 1:40;
4. Structural drawings to the scale of 1:20 or 1:40;
5. Evidence of a right or authorization to use the land following the laws of Ghana
6. A report on stakeholder consultation where applicable

Enforcement through Institutional mandates and capacities

Compliance with planning standards Reg. 47

A physical development shall comply with the Planning Standards published by the Authority. The Planning Standards shall be reviewed and updated by the Authority periodically. The Authority may issue guidelines and directives to be complied with by persons responsible for considering applications.

Enforcement Provisions-Act 925

Sections 115, 117, 118, and 119 of Act 925 and Sections 94, 95,96,97 of Act 936 provide several enforcement measures.

Section 117 for example stipulates that;

1. No physical development shall be carried out by any person in the country except for permits being issued for such development under the Act.
2. It is an offense to carry out any development without obtaining a permit and hence tantamount to a fine of 500 penalty units or more or 2 years or more in prison and not beyond 1000 penalty units or not beyond 4 years in prison or both.

An enforcement notice may be issued by the District Assembly requiring the immediate halt of any development or construction that is not in accordance with an authorized plan.

A development that does not comply with an authorized or approved plan or where that action is needed to ensure conformity with approved plans may be prohibited, abated, removed, pulled down, or altered for the reason of enforcement by a District Assembly.

Also, for enforcement purposes, a District Assembly may forbid land uses or buildings for or in a manner contrary to planning provision or where there is no compliance with a permit or permit condition to developments revoke the permit, or impose a condition which may be subjected to a penalty of fine payment (Land Use and Spatial Planning Regulations, 2019).

A study by Goodfellow, 2013, indicates that land users react to regulations with low-level adherence due to the implementation process involved in the local plan by stakeholders in charge. These are a result of the weak enforcement mechanisms, limited resources, and qualified staff, as well as how complex and bureaucratic the procedures are. Though it is the mandates and the capacity of authorities responsible for planning to enforce

compliance, some kind of negative outcomes like favoritism, nepotism, and corruption from some individual staff affect compliance negatively. (Alnsour & Meaton, 2009).

Also, enforcement through some mechanisms like fines, structure demolishing, and notice of removal or stop work by the authorities can bring about adherence to regulations (Arimah & Adeagbo, 2000). A study by Arimah & Adeagbo, (2000) shows that compliance with zoning regulations has a positive influence through enforcement. In their study, they reported that during the task force's visit to respondents, they came out with results that they complied by acquiring permits to appropriately use land. The Municipality takes the method of finding problems and getting them remedied. This is the only solution, because current factors in the area of study like the multiple land sales, land conflicts, rising land demand, and rising land values, prevent use right holders from voluntarily obtaining authorization to use land.

According to the report, the landowners barely get permission willingly because the process is convoluted, time-consuming, and costly. The Municipality's monitoring and enforcement actions are hampered by logistical issues. These happenings contribute to non-compliance as a way of creating conditions for which there is a violation of zoning regulations by residents (Burby et al. 1998). Burby et al. 1998 go on to say that planners must either increase their resources and staff to find and correct violations or make way by creating conditions necessary to curb violations or a situation in which there will be an unlikely state for violations occurring. Rukwaro (2009) also points out that landowners can go against the regulations with impunity if the planning authority is incompetent in enforcing them.

Also, Akola, 2007; and Mwangi, 2012, state that urban planning institutions are paid less attention to, this as a result of the shortcomings in relation to the state's regulatory framework design especially the State's management policies that cannot be implemented due to insufficient institutional capacity. Other problems identified by Yakob et al, 2012 as financial resources, the lack of leaders who are committed to managing and implementing the land-use plan, and the unavailability of institutional capacity that could hinder the mandates of institutions responsible for ensuring compliance.

Fuel station siting and associated risk to fuel stations and immediate land use

According to Mahmood et al. (2015), petrol stations should be sited in locations that will be easily accessed and would cause less danger and congestion. This suggests that gas stations should be built in accordance with Disaster Risk Reduction concepts (Sutanta et al. 2012), while also addressing the planning demands of population growth, industrial development, environmental protection, and urban renewal (Britton & Lindsey 1995). There is a strong belief that such an integrated approach espoused by Sutanta et al. (2012) and Britton & Lindsey (1995) would ensure the safety of the public and promote sustainable development when fuel stations are properly laid out as stated by Mahmood et al, 2015.

However, an argument on the view that even when fuel stations are rightly positioned with genuine regulations and the adjoining land uses do not follow land use regulations, they can still pose a threat to fuel service stations.

Petrol stations situated in heavily populated neighborhoods may pose a danger to urban populations, and breach disaster risk reduction and sustainable development values, posing a direct threat to public safety. According to research, an overconcentration of petrol stations in small areas of cities has resulted in health threats, road congestion, accidents, and explosions, as well as disrupted emergency response in some situations (Sur & Sokhi 2006; Sangotola et al. 2015).

There has been a report in the news in Ghana (Myjoyonline 2016) that the Ghanaian government made arguments that it is dangerous to build many fuel service stations in Accra and other major cities. A fuel service station fire in Accra in 2015, for example, killed seven civilians and wounded 132 others (Aljazeera 2017), which may arguably be linked to the city's high concentration of petrol stations near housing projects. As a risk mitigation measure, the National Petroleum Authority of Ghana (NPA) made new establishments relating to regulations on the siting of fuel service stations in the region. The NPA mandated that no LPG refilling stations should be installed within 200 meters of the residence zone (Myjoyonline 2017).

Smith (2004) and Mshelia et al. (2015), argued that in urban settings, facilities such as petrol stations should be situated away from heavily populated areas, hospitals, and schools. There is no specification however by them on how far away these should be since they understand that distance is affected by local context and conditions. In this case, however, the view is that fuel stations render services to people within a particular locality and it is only when they are located close to these people that will suit and satisfy their demands within the shortest time as compared to stations far away.

Furthermore, they point out that there have not been guidelines on requirements for setting distance from a gas station to any developments. Safe distances, according to Mshelia et al. (2015), can be figured out through a scientific risk assessment, in which countries establish their standards based on their legal land-use structure and risk assessment approaches.

Many countries globally do not seem to be adhering to the siting guidelines of fuel stations. In Accra for instance, according to Baffour et al n.d., 60% of petrol stations out of 33 surveyed petrol stations were built less than 200 meters. In Nigeria, petrol stations are profit-making businesses offering motivation to people to breach regulations (Mshelia et al 2015), because of this, research by Arokoyu et al 2015 revealed that, in the Niger Delta Region, approximately 153 petrol stations contacted, only 35 (23%) petrol stations complied to the 400 meters distance guidelines between stations as stipulated by the Department of Petroleum Resources (2007), meanwhile 118 (77%) violated the guideline. Furthermore, only 50 (33%) of petrol stations adhered to the requirement that the closest pumps should be at least 15 meters from the edge of the road; meanwhile, 103 (67%), did not (Arokoyu et al 2015). Various explanations for non-compliance with good standards have been suggested in the literature. In Nigeria's several towns, the Kaduna State Urban Planning Development Agency has discovered a high service demand for land with the inclusion of fuel service stations. (Tah, 2017). This sometimes culminated in a land grab and illegal petrol station building. This has resulted in haphazard construction and the intentional positioning of gas stations in unsuitable, high-risk areas. (Tah, 2017).

Non-compliance around fuel service stations

Non-compliance with planning requirements in order to distribute fuel stations has put the safety of the surrounding environment in jeopardy in Iraq's Baghdad province according to Mahmood et al. (2015). This has culminated in planning problems that have affected the role of fuel service stations in providing services to residents. While Mahmood et al. (2015) do not go into depth on these criteria, they do discuss population density as a consideration to remember when identifying fuel service stations. This does not appear to have been considered in Iraq's Baghdad province since the distribution pattern of petrol stations suggests a geographical disparity (Mahmood et al. 2015). The inability of guidelines to be met puts structural developments around the vicinity of fuel service stations in jeopardy. Institutional capacity for prediction and planning for potential or future emergencies at fuel service stations is needed in this context. The Department of Petroleum Resources in Nigeria mandates that a fuel station be set back from built-up areas by at least 50 meters to provide a buffer zone for non-residential land use.

The views from the perspective of fuel service stations and land use regulation are crucial to this study because when permitting statuses from both land use and fuel stations are not met, haphazard allocations will set in thereby jeopardizing the entire community should there be a disaster that is why land use regulations must be held in high esteem as well as fuel stations checked within these diverse land-use domains.

Factors Influencing Compliance with land-use Regulation

According to research by Offei, Lengoiboni, and Koeva, land rights holders' noncompliance is caused by a lack of understanding of zoning

regulations. The study confirms Fuseini and Kemp's (2015) claim that there is a lack of interaction between the various land-related organizations, such as customary land owners (on land rights allocation), Land Commission on title certificates issuance, and municipal governments (issuing building permits). The absence of contact among the many entities dealing with lands, such as customary land owners, the Land Commission as well as the Municipality contributes to the lack of understanding and awareness.

Non-compliance with the maximum plot coverage is due to a misunderstanding of the rules, and the desire to generate money through rent and household size. The study's participants lacked a clear understanding of the procedure involved in obtaining information on building standards. Respondents were unaware of what steps to follow and from which institution due to a lack of communication between the different authorities. Where opportunities were available e.g., through the Assembly representative, participation in the monthly meetings is optional. To explain the zoning requirements and underline their importance, a coordinated approach with several institutions may be required. This demonstrates that government and traditional institutions do not get along because their systems are not matched (Fekade, 2000).

Another study by Boamah et al (2012) also reveals that individuals learn to claim which institution is most significant or has the most repercussions for them when they interact with multiple institutions for different goals. Respondents place a high value on customary authority (for gaining access to property rights) and the Lands Commission (for obtaining a title certificate to guarantee their tenure), but little attention is given to

planning authority on the standards for building. Boamah et al (2012) suggested that authorities in charge of planning should devise a means through which they can call on the public to participate in ensuring the enforcement of land use planning and zoning regulation and community programs are needed to increase and boost awareness.

People's level of education can be identified as a factor of compliance. A study in Ibadan, Nigeria presented educated people to be more knowledgeable on the awareness of residential standards and are mostly in positions to understand and comply with land-use regulations than the uneducated. Level of education, according to GSS 2012, is defined as a person's highest level of formal education. Compliance is also influenced by aspects of enforcement capabilities like manpower and technological knowledge. Construction sites are difficult to supervise at all stages of construction due to a lack of technical know-how and personnel, as well as insufficient logistics. This minimizes the number of inspections performed on active building projects. As a result, better-trained personnel are needed to boost capacity, not only to discover constructions without permits and properly examine building plans for compliance with standards but also to check with approved plans for construction and detect changes that have occurred to the approved plans. Personnel should therefore be trained to acquire the requisite skills and have the ability to detect developments without permits and this can be a way through which the regulation can be enforced (Boamah et al., 2012).

Social and financial capital are factors contributing to compliance. Putnam et al. in Suharto (2007) stated that social capital is a social resource

that can be manifested in membership in a group, how connected people are in a society, and having networks among greater institutions and individual personalities with mutual benefits. According to Fukuyama (1995), social capital is a reflection of community trust. Lin (1999) is a well-known social network analyst who studies how actors (individuals or organizations) use their social networks to achieve specific goals. Lin sets out to develop a social capital network theory. According to him, social capital is mined from social networks' embedded resources and then invested in social relationships with expected returns. Concern about one's social reputation has long been acknowledged as a key motivator for compliance. (Allingham & Sandmo, 1972).

Financial capital, on the other hand, may include technology, infrastructural-based equipment, and basic production which form the economic resources that necessitate it for people to engage in various livelihood strategies or critical to the success of any livelihood plan (Kollmair & Gamper, 2002).

A study by Alnsour and Meaton (2009), indicates that compliance is influenced by landowners' income, education level, and awareness of zoning and residential regulations, and the presence of these elements may indicate a readiness or intention to comply or not implement regulations. Low income contributes to non-compliance. Low income has two effects on compliance. To begin with, low income can motivate people to expand their homes and use their compounds as a means of earning income through rents, and thus a way of exceeding the maximum requirements; second, the inability to pay for building permits as the cost involved cannot be afforded by people with low

income, as well as the burdensomeness of the building permits negatively impact compliance (Dowall & Clarke, 1996; Fekade, 2000). This study, therefore, looked at some factors that influenced compliance and the current study intends to add up to other factors influencing land use compliance in the vicinity of fuel service stations.

Empirical review on land use pattern and compliance with land use regulation

This section reviews the literature empirically on previous studies conducted on land use regulation, compliance with land use regulation, land use patterns, and land use conflict. The aim is to examine the common issues of interest for researchers regarding compliance to land use with its regulatory process, methodological approaches adopted in analyzing compliance with land use regulations, and the major findings.

Land use pattern

Kleemann, Inkooma, Thiel, Shankard, Lautenbache, and Fürst (2017) conducted a study in Ghana on peri-urban land use patterns and their relationship to land use planning. The research looked into urban growth patterns in Southern Ghana (Takoradi) and Northern Ghana (Bolgatanga), which represent respectively economically vibrant and non-vibrant regions. Employing a mixed-method approach that included expert interviews as well as a bi-temporal change analysis using remote sensing or geo-information systems. The research provided fresh insights into the study locations.

Experts believe land-use planning fails due to a lack of compliance with legal criteria, customary land tenure, and residents' participation in the planning process. Urban development in Takoradi between 2007 and 2013

was faster (7.1%) than in Bolgatanga between 2007 and 2013, (1.1%) increase according to the remote sensing analysis. A conclusion was drawn to indicate that the Bolgatanga region is characterized in dominance by small-scale settlement units only which are different elsewhere with a predominance of both small and large-scale units. However, a potential limitation of the study lies in its short timeframe (2007 to 2013) for analysing urban growth patterns. Incorporating longer-term data might offer a more holistic understanding of the factors influencing land use changes over an extended period.

Additionally, the research did not explicitly investigate the underlying reasons for the differences in urban growth rates between the two regions, leaving room for further exploration. The study's focus on compliance issues with legal criteria and customary land tenure in the context of land-use planning is significant as it sheds light on potential barriers to effective planning. However, the research does not delve into specific challenges and possible solutions to address these issues, presenting an opportunity for further investigation and policy recommendations. Therefore, this current study sought to assess compliance with land use regulations by adjoining lands within the vicinity of fuel service stations which would help understand urban growth patterns and the factors influencing land use decisions can aid in crafting more effective land-use planning policies.

Asamoah (2010) conducted a study on urbanization and changing patterns of urban land use in Ghana: policy and planning implications for residential land use in Kumasi. During the data collection process, the Urban Roads, departments of Town and Country Planning, the Building Inspectorate Division, and the Waste Management Department were consulted. Ghana

Water Company and Ghana Electricity Company were visited and engaged in an in-depth interview. Discovery from the study indicated that the redevelopment of houses is the predominant development tendency in the analyzed region of study. The study area is entirely developed, with only a few pieces of land left to cater for development in the coming years.

Furthermore, the trend of urbanization is generating a shift in architectural styles, from compound residences to multi-story buildings, and from residential to commercial use. The area's layout changed dramatically, with the physical structure dictated mostly by economic activities. As a result, the design or plan was thrown out of whack since growth in the area took its path. The analysis also indicated that the area has been rezoned to allow for both residential and commercial use as a result of the increased business activity. Furthermore, when there is a change in land use, there is more difficulty in delivering public services in the area. People, for example, develop stores without making provisions for water supply lines. It is also difficult to obtain rights-of-way for substations and high-voltage power transmission.

In addition, people intrude on an area designated for trash management. The shift in land use in the study region from mostly residential to commercial and service uses has resulted in increased human and vehicular traffic congestion. Based on the foregoing, it is recommended that the Kumasi Metropolitan Assembly take the required actions to reverse the detrimental effects of rapid urbanization on land use, particularly in the city of Kumasi. The study's scope is limited to the Kumasi area, and the findings may not be generalizable to other cities or regions in Ghana. The study did not delve

deeply into the level of compliance between existing land use patterns and statutory planning scheme land use plans. This current study explored the level of compliance between existing land use patterns and statutory planning scheme land use plans. It would also help map out the land use pattern in the vicinity of fuel service stations of Cape Coast.

Asabere, Acheampong, Ashiagbor, Beckers, Keck, Erasmi, Schanze, and Sauer (2020) researched "Urbanization, land use transformation, and spatio-environmental impacts: Analyses of trends and implications in major metropolitan regions of Ghana". The finding expounded that settlements and land developments have increased in the present-day within the horizon of the urban zones even to the extent of fusing into the urban areas of the regions in the Metropolis.

The research in furtherance discovered a new and dynamic way through which the frequently changing areas observed as public open spaces can be restored from such changes from vegetation to developments or built-ups and in the same vein from developments or built-ups to vegetation. Also, the location of some lands during the old times which were identified with land covers has lost their covers to build-ups. There has therefore been a fragmentation of the Metropolitan area, as the metric-based land use analysis has shown. However, the research did not explicitly discuss the specific spatio-environmental impacts resulting from the observed urbanization and land use changes. Further elaboration on the implications of fragmentation, loss of green spaces, and potential environmental consequences could strengthen the study's overall analysis. This called for the need to map out the land use pattern in the vicinity of fuel service stations in Ghana.

Aguilera, Valenzuela, and Botequilha-Leitão (2011) researched Landscape Metrics in the Analysis of Urban Land-Use Patterns using a case study in a Spanish metropolitan area. The spatial metrics usage in a metropolitan region undergoing significant change and expansion, such as Granada (Spain), has demonstrated its utility in quantifying and analyzing spatial growth features and patterns in urban settings. They modeled three future scenarios that exhibited diverse geographical patterns of urban expansion, according to the study. They were able to trace changes in urban occupancy patterns associated with each scenario by utilizing spatial measurements to measure these processes.

Furthermore, this quantification allowed them to easily analyze the scenarios by separating those with larger urban dispersion or fragmentation of the neighboring rural landscape from those with better compaction and consistent growth patterns stability. The findings showed that spatial metrics are useful in metropolitan land use planning. As a result, changes in urban development patterns may be tracked using geographical data. They may be used to evaluate the spatial implications of urban planning strategies and future scenarios (Van Beusekom, 2003; Franco et al., 2005; Aguilera, 2008), based on the characterization of spatial processes such as linear growth, aggregation, and urban dispersion as well as their major environmental consequences (Galster et al., 2001; Muniz et al., 2008).

The study by Aguilera et al. (2011) focuses on a case study in a Spanish metropolitan area, and it may not directly address the context of the Cape Coast Metropolis in Ghana. The differences in geographical, cultural, and regulatory factors between Spain and Ghana could affect the applicability

of the findings to the Cape Coast Metropolis. While the research highlights the utility of spatial metrics in analyzing urban land-use patterns and planning strategies, it does not explicitly assess compliance with land-use regulations by adjoining lands within the fuel service station vicinity. The study's emphasis on spatial growth features and patterns may not directly address the compliance aspect required in the context of the Cape Coast Metropolis. However, these gaps become the goal of the current research.

Abass, Afriyie, and Gyasi (2018) wrote a paper on From Green to Grey: The Dynamics of Land Use/Land Cover Change in Urban Ghana. Changes in the land cover types in the Metropolis, which is a dynamic factor of fast population expansion induced by natural increase and migration net gains, were highlighted in the article. The necessity to address the infrastructure demands of these newcomers has prompted both commercial developers and local governments to rapidly expand both physical and social infrastructure. These include, among other things, residential housing, industrial and commercial centers, roads, and office spaces. Specifically, as a result of most of the developments not being planned and coordinated and because building constructions are done horizontally rather than vertically on the rise and are seen now as the norm, rapid sprawl has been experienced in the Metropolis.

This was partly attributable to the loss of green space in the Kumasi Metropolis. That is, the natural landscape has suffered resulting in the rising demand for land in the Metropolis for residential, industrial, and commercial activities. As a result of a change in spatial demand and increased urbanization, some vegetation was used for reallocation purposes such as

residential, industrial, commercial, and religious interests, and even isolated patches of green along streams were eliminated. The research did not include a comprehensive assessment of the influence of land use compliance within the vicinity of the fuel service station. This could involve analyzing the effects on air and water quality, biodiversity, public health, and community well-being. Hence, this current study sought to explore the influence of land use compliance within the vicinity of the fuel service station.

Hoffman (2014) researched the changing patterns of rural land use and land cover in South Africa and their implications for land reform. His review investigated the vegetation's response to these changing trends in three biomes. The first point that was made was that land use has an impact. Land use has an impact on landscape cover and composition and the ecosystem's on-site and off-site functionality. Alteration can be made to vegetation in relatively short periods in highly dwelled landscapes or landscapes that support a huge number of domestic livestock. Grazing animals drastically reduced the cover of perennial grasses and several shrub species in Riemvasmaak, one of South Africa's earliest land restitution settlements, between 1995 and 2005, after the people had returned to their land. When vegetation is heavily grazed, there is always a shift in the vegetation.

The study primarily focused on the effects of grazing on vegetation cover. It would be beneficial to explore compliance with land use regulations by adjoining lands within the fuel service station vicinity of the Cape Coast Metropolis. Considering a wider range of land use activities could provide a more holistic view of the challenges and opportunities for sustainable land use in Ghana.

Alcamo, Schaldacha, Kocha, Kölkinga, Lapolaa, and Priess (2011) researched on evaluation of an integrated land-use change model including a scenario analysis of land-use change for continental Africa. The model was better at calculating the spatial distribution of cropland suitability and continental average deforestation rates than it was at calculating the spatial distribution of deforestation. The impact of climate on agricultural and grassland productivity was found to be very sensitive to assumptions about future climate change in simulations spanning several decades. In terms of scenario analysis, the model was used to create two scenarios for Africa, each of which included a wide range of future driving factor assumptions. According to the findings, due to rising food demand and expected gains in agricultural yield, farmland acreage may expand significantly up to 2050 (34–40 percent, depending on the scenario).

Even though the average continental deforestation rate predicted from 2000 to 2050 is lower than the rate computed for the 1990s, this rise has primarily come at the expense of forested areas. By combining the effects of driving factors and competition among land uses in a single spatially explicit framework, the model was able to produce consistent scenarios of land-use change on a continental scale. In view of this, the study's strength lies in the model's ability to combine the effects of driving factors and competition among land uses in a spatially explicit framework, enabling the production of consistent scenarios of land-use change at a continental scale. As a result, this current sought to map out the land use pattern in the vicinity of fuel service stations.

Yeboah, Awotwi, Forkuo, and Kumi (2017) worked on the assessment of land use and land cover changes as a result of urban growth in Accra, Ghana. The study's findings clearly showed that observed Land Use and Land Cover classes changed dramatically between 1985 and 2010. With overall classification accuracy of 87.9 percent in 1985 and 96.3 percent in 2010, change detection analysis reveals that built-up area has increased by 59.35 percent, while forest area, an agricultural area, and water bodies have decreased by 33.61 percent, 48.07 percent, and 3.22 percent, respectively. These changes were caused by anthropogenic activities in the study area, but they were not studied. However, the specific anthropogenic activities driving these land use and land cover changes were not thoroughly investigated in the study.

The study identified anthropogenic activities as the driving force behind the observed land use and land cover changes, but it did not delve into specific activities. Examining the factors that influence land use compliance within the vicinity of the fuel service station, would provide a deeper understanding of the underlying factors shaping land use changes in Accra. This served as one of the objectives of the study.

Holden and Otsuka (2014) researched the roles of land tenure reforms and land markets in the context of population growth and land-use intensification in Africa. Their paper looked at the historical and future roles of land tenure reforms and land markets in the process of land-use intensification and livelihood transformation in Sub-Saharan Africa (SSA) in response to population expansion. More secure property rights and the removal of land market restrictions have the potential to increase efficiency

and equality, but there is a risk of elite capture of huge areas of land, leading to inefficient and inequitable outcomes. This applies not just to areas that are abundant in the land, but also to urban and peri-urban areas, where a growing number of people will dwell. Increased population pressure in densely populated rural areas encourages faster rural-urban migration, and offering alternative livelihood possibilities for the moving youth population is vital to attaining economic development while preserving social stability. One significant implication of increased population pressure in densely populated rural areas is the acceleration of rural-urban migration. To achieve economic development while maintaining social stability in Ghana, it is crucial to assess compliance with land use regulations by adjoining lands within the fuel service station vicinity of the Cape Coast Metropolis.

Land use compliance and permitting status

In Kisii town, Kenya, Omollo (2018) investigated conformity assessment to development plan implementation as a tool for development control. Incorporating satellite image epochs from 2005, 2010, and 2017, QGIS software was used to undertake a spatial-temporal analysis guided by Object-Based Image Analysis (OBIA). The findings found that no subsequent land use development patterns followed all approved development zones, indicating nonconformity. The study also discovered a significant difference in land use development between the two paired land development samples. As a result, there was a rejection of the null hypothesis with a 95% confidence level.

The research could delve into the underlying factors contributing to the lack of conformity in land use development. Understanding the consequences

of mismatched land use patterns can help inform policy decisions and development control measures. However, this study sought to assess the level of compliance between existing land use patterns and statutory planning scheme land use plans. This would help know the level of compliance between existing land use patterns and statutory planning scheme land use plans.

Omollo and Opiyo (2020) worked on the appraisal of compliance with land subdivision planning regulations in residential neighborhoods. The target population of 7,430 residential projects from Kisii Town's seven sublocation communities was selected. To achieve a sample size of 364, they used four administrative sublocations as strata, from which proportional random samples were drawn from their respective residential neighborhoods. Data on the degree of compliance was gathered using structured checklists. The findings revealed that the minimum lot size in the Jogoo, Nyamataro, and Nyanchwa neighborhoods as recommended was 0.1 ha, 84 percent, 100 percent, and 88 percent of developers did not comply.

Despite the legal framework that grants Kisii County Government development control, the problem persists. The research could explore the underlying reasons for the high rates of non-compliance among developers, however, understanding the level of compliance between existing land use patterns and statutory planning scheme land use plan is vital for promoting sustainable development. It would also offer a clearer understanding of the implications and the need for improved compliance.

Padeiro (2016) researched the conformance in land-use planning utilizing the determinants of decision, conversion, and transgression. Three logistic regression models were created and used to predict plot development

in three different land-use scenarios. According to the research, previous urban dynamics and distances from Lisbon are the key drivers of all models. Transportation networks impact policy decisions, as well as conforming and transgressive conversions. The political orientations of local administrations have a substantial impact on land-use evolution. Transgression is unaffected by land-conservation policies or municipal choices.

The research could elaborate on the specific land-use scenarios considered in the study and how they relate to the broader regional and national development plans. Understanding the context of these scenarios would provide a clearer picture of the implications for land-use conformance. While the study used logistic regression models for prediction, incorporating qualitative analysis through interviews or surveys with relevant stakeholders could offer a more nuanced understanding of the decision-making processes and the underlying reasons for non-conformance. Therefore, there is a need to assess the level of compliance between existing land use patterns and statutory planning scheme land use plans.

Offei, Lengoiboni, and Koeva (2018) did a study to determine if the set standards for constructing buildings within the protocols laid down by Ghana's land tenure systems were being followed. A case study was employed by the research to ascertain how the traditional land tenure regions ensured that the set residential standards were obeyed. The case study was also used to determine the extent to which these rules or laws affect how entities benefit from their land rights within the context of the usual land tenure. The results of this study showed that there was little consequence metered out on entities that breached these outlined residential policies. Also, it was discovered that

most residents had little or no knowledge about the existence of said policies and boundaries set by zoning written in any documents. To add to the failings, there was a lack of policing to ensure these standards were honored. Using spatial analysis to acquire the final output of the research, it was determined that there existed four major groupings of non-compliance between the local plan and orthophoto. These were outlined as the differences in parcel border orientation, variations within the plot boundary shape, houses erected directly on set plot borders, and variations in the size of plots. In view of this, spatial analysis was utilized to analyze the research data, leading to the identification of four major groupings of non-compliance between the local plan and orthophoto. These non-compliance factors included differences in parcel border orientation, variations within the plot boundary shape, houses erected directly on set plot borders, and variations in plot sizes. That is, the study provided more context on the specific building standards and policies in place within Ghana's land tenure systems, but there is a lack of enough understanding of the level of compliance between existing land use patterns and statutory planning scheme land use plan.

Schmid, Kienast, and Herspergese (2021) researched the compliance of land-use planning with strategic spatial planning insights from Zurich, Switzerland. A quantitative assessment of the compliance of modifications in municipal land-use plans between 1996 and 2016 was conducted using the extracted planning intentions. The general low rate of change was accompanied by a few active land-use planning contradictions. The spatial distribution of new development zones deviated little from the strategic plan. Considering the socioeconomic trends of the region, surprisingly few changes

in authorized building density for mixed-use and residential zones were identified. As a result, they concluded that the Cantonal Structure Plan (1995) was quite effective in quantitatively controlling the spread of building zones. However, it demonstrated that the capacity for active steering is limited in terms of its distribution and construction density regulation. The margin of discretion, according to their study, plays a critical role in multi-level planning systems, balancing flexibility for locally tailored solutions against legislative restrictions to prevent their misuse; as such, they must be included in planning evaluation. This current study sought to enhance planning effectiveness and compliance. The study could explore the level of compliance between existing land use patterns and statutory planning scheme land use plans.

Bonye, Yiridomoh, and Der Bebelleh (2021) researched compliance with land use regulations in peri-urban areas in Ghana. The study focused on the residential areas of Bamahu and Danko in Wa Municipality, Upper West Region. A simple random sample technique and stakeholders purposive sampling processes were used to recruit 199 landowners, with one official from the Wa Municipal Assembly, Lands Commission, and Land Use and Spatial Planning Authority recruited from each.

The descriptive and thematic analytic approaches were used to analyze the data and the findings revealed landowners in the various regions espoused that at the time most of them put up their structures, they had not officially obtained building permits. Economic, institutional, legal, and social factors all played a role in the amount of compliance with land use planning requirements. Compliance with planning requirements also improves tax administration efficiency and prevents disagreements between landlords and

tenants. On the contrary, the study could not explore the level of compliance between existing land use patterns and statutory planning scheme land use plans. This served as a ground for the conduction of this current study.

Dabović, Djordjević, Poledica, Radović, and Jeftić (2020) researched compliance with social requirements for integrated local land use planning in Serbia. Testing results demonstrated that in Serbia, Local Land Use Plans (LLUP) are encouraged in planning legislation, but compliance with LLUP process standards deteriorates from the start to the completion of the process. The comprehensiveness concept is limited to the analysis of some well-known issues. There is also a reluctance to include land users in the process and legitimate their interests. Moving toward institutionalization, the compliance assessment of Local Land use plans (LLUP) requirements in Serbia revealed issues with securing local planning capacities, insufficient land use incentives, regulations, and institutions, and, most notably, a lack of regional-level planning and governance in some parts of the country. During the transition era, the spatial planning system appeared incapable of giving guidance and reasoning for the territorial representation of society's desired aims.

The study did not explore the factors contributing to the deterioration of compliance with LLUP process standards as the planning process progresses. However, this current study assessed the level of compliance between existing land use patterns and statutory planning scheme land use plan

Land use regulations

Boamah, Nelson, and Gyimah (2012) researched the impact of land use regulations on residential land values in the Wa municipality in Ghana. To

determine whether developers are following the municipality's land use regulations and to keep in record the planning authority's state of enforcement, a literature review of the development controls and collating empirical data from land developers was done. Wa municipality's development controls were found to be largely unenforced. Delays in the land use regulation system were observed, and residents' perceptions of the system were reported. The land use ordinance and building code were also found to be incompatible with the socioeconomic status of the residents in the municipality. Conclusions were made that these circumstances have resulted in haphazard development and have had a negative impact on land values in the municipality. This current study will make a comparative analysis of land use regulations and their impact on land values in other municipalities in Ghana or Cape Coast. Comparing different approaches to land use planning and their outcomes would offer valuable lessons for improving the situation in Wa.

Awuah and Hammond (2014) researched the determinants of low land use planning regulation compliance rates in Ghana. This study used empirical data from Kwabenya, a suburb of Accra, Ghana, to test the hypothesis that land use regulation compliance is primarily driven by ignorance of planning requirements and a lack of appreciation for their benefits. The evidence contradicts the hypothesis. The pervasive violations of land use restrictions were discovered to be primarily intentional on the contrary. This was exacerbated by a lack of evidence on the advantages of land use regulations to justify the costs and difficulties of compliance. The elite class was determined to have the highest level of compliance. Due to cronyism and the obligation to produce evidence of compliance for other transactions, such as receiving bank

loans, they have reduced compliance costs. Land use limitations that provide true benefits over costs are more likely to be followed.

The study was conducted in a specific suburb of Accra. To ensure broader applicability and generalizability of the findings, the research could include a more diverse sample that represents different regions and types of urban and rural areas in Ghana. However, this current study will be conducted in Cape Coast as a way to explore the effectiveness of the land use regulations. The study could propose specific policy implications and recommendations to address intentional non-compliance with land use regulations. This could include strategies to enhance awareness, communication, and understanding of the benefits of compliance among residents and property owners.

Phase (2015) reported on urban infrastructure in sub-Saharan Africa harnessing land values, housing, and transport. Each of the 187 papers reviewed was categorized by source types, such as peer-reviewed or non-peer-reviewed journals, organizational viewpoints, book chapters, and conference presentations. A detailed assessment of the legal tools and their spatial consequences revealed a relative scarcity of work. The majority of the literature examined reflects the viewpoints of planners, authorities, and academics who have observed what has gone wrong with the implementation of planning and land-use tools in the region's towns and cities.

Attempts to trace the effects of specific land-use restrictions (or lack thereof) on things like affordable housing opportunities or spatial form are not. This is a flaw in the entire body of literature. This flaw is worsened by the lack of a comparative analysis that looks at how similar (or even identical) legal tools and instruments have impacted other countries and cities. While the

report acknowledges the scarcity of work on the spatial consequences of legal tools, it could specifically identify the key research gaps that need to be addressed in future studies. This would provide a clearer direction for future research endeavors.

Goytia, Dorna, Cohen, and Pasquini (2015) worked on an empirical analysis of land use regulation determinants. To gain a better appreciation of the economics of land regulation and its causes, several alternatives were evaluated to identify the sources of municipal variance in the stringency of the regulatory environment in Argentina. Based on OLS and IV estimates, the findings show that the most prevalent theories about the causes of land-use control, such as those based on externality correction or reflecting the views of the majority of (formal) landowners, have little or no support.

The data support the exclusionary theory, which claims that towns with greater rates of both educational attainment and disadvantaged populations have more restrictive residential zoning policies. It was discovered that as population density increases, the rigor of residential land use regulation becomes less related to welfare economics considerations. It is not influenced by land-based interests, but rather by mild exclusionary goals. When the municipalities were tested spatially, some interesting correlations were discovered. The research conducted by Goytia et al. (2015) presented valuable insights into the determinants of land use regulation in Argentina. However, there are some aspects that could be further addressed or clarified in the study: they did not touch on the effectiveness of land use regulation.

Monkkonen and Ronconi (2013) researched the land Use Regulations, Compliance, and land Markets in Argentina. This study presents an empirical

investigation of the link between land use regulations, compliance, and land prices in three major metropolitan areas of Argentina, the Latin American country with the most stringent land use and urban development regulations. The findings revealed that towns with higher levels of regulation have lower rates of property law compliance, as well as lower land prices for lots sold legally in these municipalities. When developers were questioned about the variables that influence private investment in creating homes for low-income populations, the most significant obstacle in both GBA and Córdoba was acquiring legal authorization to turn a huge rural land into many small urban lots. The importance of infrastructure needs, as well as the intricacy of the bureaucratic process, is highlighted by the fact that they account for a sizable portion of the cost of a housing project. According to the developers polled, acquiring sub-division permissions accounts for 9% of project costs, while infrastructure accounts for 27%. These permit cost estimates do not include the time spent obtaining permits. The study's findings establish correlations between land use regulations, compliance rates, and land prices. However, causality cannot be assumed from the results. This current study examines the influence of land use compliance within the vicinity of the fuel service station in Cape Coast.

Boamah (2013) conducted a study on land use controls and residential land values in Ghana's Offinso South municipality. The article looked into the land use management system in the living standards of the municipality's citizens and its impact on land values. A self-administered questionnaire was used to collect empirical data from physical developers in the municipality. Guided interviews were also used to acquire data from amenity land owners.

The investigations revealed that there are widespread planning rules violations in the municipality. Discoveries were also made that amenity lands are frequently encroached upon, sometimes with the knowledge of planning officials. It recommends that the planning authority engage in communication with developers to ensure voluntary compliance.

Poku-Boansi (2021) wrote a paper on multi-stakeholder involvement in urban land use planning in the Ejisu Municipality, Ghana: An application of the social complexity theory. Semi-structured interviews were used and data from 294 homeowners and some representatives of relevant institutions responsible for land use planning. This paper uses the social complexities theory as a lens to understand the dynamism and complexity of stakeholder involvement in the land use planning process and the implications for sustainable city development in Ghana, using Ejisu Municipality as an example. From the study, the majority of homeowners felt that the land use planning process did not allow for engagement from identifiable groups and that where feedback was sought, it was primarily expert-driven. In addition to the extensively established variables that lead to non-compliance with land use planning in developing countries, the article demonstrated that failing to adhere to the tenets of the social complexity theory also contributed to non-compliance. As a result, land-use planners need to address the limited incorporation of complex tenets in the context in which land-use planning happens.

Dambeebo and Jalloh (2018) researched sustainable urban development and land use management: Wa Municipality in Perspective, Ghana. To acquire primary data, a questionnaire was used. The study in

Wa Municipality considered 173 households. In addition, the chiefs of three institutions in charge of enforcing planning requirements were interrogated. The findings confirmed that even though in the Wa Municipality, there are guidelines for setting up physical developments, it is evident that there are no traces of enforcement to enhance compliance with the set guidelines. Low levels of compliance are also caused by economic and demographic circumstances, as well as a lack of institutional capability. The failure to follow planning criteria adds to haphazard physical growth. This means that clear planning standards are required but not a sufficient prerequisite for successful urban land management.

Cobbinnah, Asibey, and Gyedu-Pensang (2020) researched urban land use planning in Ghana: Navigating complex coalescence of land ownership and administration. According to the findings of a review of relevant land use planning documents in Ghana, as well as interviews with four urban planning agencies and four customary land owners (chiefs/traditional leaders) in Kumasi, the legislative planning framework is unclear, and there is a lack of focus on customary land ownership and administration systems in urban land use planning. Despite the fact that planning laws (such as zoning guidelines) emphasize the separation of ownership and administration, findings show that there is no distinction between customary land ownership and land administration because traditional leaders (the owners) administer the land by determining land use, resolving land disputes, and determining the location of critical community infrastructure and services. The city's low success in sustainable land use planning can be attributed to the repetitious and time-consuming nature of land management by traditional owners and government

planning agencies, as well as a weak agency framework and coordination issues.

Theoretical Approaches to the Study

Land Use Planning Theory

Land use planning theory was developed by the Hoyt model in 1936 (Hollander, 2010). The theory focuses on the systematic process of regulating land use to achieve specific social, economic, and environmental objectives. According to the theory, land use planning involves the control and management of land usage by a central authority with the primary aim of achieving favorable social and environmental outcomes and optimizing resource utilization. The theory holds that land use regulation affects human behavior (Tian, Li, Han, Liu, & Mo, 2020). The second assumption is that the overall benefits of these changes are subject to debate and vary based on specific locations and regulations under consideration (Chen, Long, Liao, Tu & Li, 2020).

The land use planning theory takes into account the systematic process of the land and the social aspects of land use decisions (Chen et al., 2020). It includes the needs and preferences of communities, stakeholders, and various user groups to ensure that land use plans are responsive to local aspirations and create inclusive and vibrant neighborhoods. The theory emphasizes environmental conservation and protection and acknowledges the economic dimension of land use decisions. The theory examines the establishment and organization of land use patterns within a region and analyzes the distribution of various land use categories, such as residential, commercial, industrial,

recreational, and public spaces, to achieve a balanced and functional urban environment (Hollander et al., 2010).

Land Use Planning Theory emphasizes the importance of zoning and regulatory measures to guide land use decisions. Zoning regulations define specific areas for different land uses, ensuring compatibility, safety, and efficient resource allocation. In the view of Goldstein, Caldarone, Duarte, Ennaanay, Hannahs, Mendoza, and Daily (2012), the theory considers the role of human behavior in land use decisions. It assumes that regulating land use can influence human behavior patterns and encourage positive changes in how land is utilized to achieve desired outcomes. Land Use Planning Theory recognizes the need for effective policy implementation and continuous monitoring to ensure that land use plans and regulations are effectively followed and achieve their intended goals. The theory emphasizes the involvement of various stakeholders, including government agencies, local communities, businesses, and environmental organizations, in the land use planning process. Stakeholder engagement fosters collaboration, enhances decision-making, and promotes public ownership of land use decisions.

The study made use of this theory because it provides insights into the reasons behind certain land use decisions and the intended outcomes of the planning scheme. The Land Use Planning Theory can aid in evaluating the level of compliance between the existing land use patterns and the statutory planning scheme's land use plan. Researchers can compare the observed land use categories and their spatial distribution with the planned land use designations. Any discrepancies or non-compliance can be identified and analyzed. Understanding the reasons for non-compliance, if any, can provide

valuable insights into the effectiveness of land use regulations and enforcement. Theory helps identify the key drivers behind land use decisions within the proximity of fuel service stations. Researchers can analyze demographic dynamics, economic activities, geographic and environmental conditions, and regulatory influences that affect land use compliance. Additionally, they can explore the role of stakeholders, such as the Land Use and Spatial Planning Authority (LUSPA), other regulating institutions, and the influence of financially stable individuals in shaping land use decisions.

The land use planning theory relates to the study because the Land Use Planning Theory provides a comprehensive framework to assess the land use patterns in the vicinity of fuel service stations and their alignment with the statutory planning scheme. By understanding the factors that influence land use compliance, the study can offer valuable insights into the reasons behind non-compliance, the role of regulating institutions, and the influence of key stakeholders. The theory will help researchers contextualize the study's findings and make informed recommendations for better land use planning, safety measures, and regulatory enforcement in the area surrounding fuel service stations. By relating the empirical data to the Land Use Planning Theory, the study can contribute to a more holistic understanding of land use dynamics and the overall effectiveness of land use planning policies in ensuring safe and sustainable urban development.

Deterrence Theory

Deterrence is a concept in criminology and sociology that refers to the discouragement of individuals from engaging in criminal behavior due to the perceived negative consequences or punishments associated with committing a

crime (Hirtenlehner & Schulz, 2021). The goal of deterrence is to reduce the occurrence of criminal behavior by creating a perception that the costs or risks of engaging in criminal acts outweigh the potential gains (Siponen, Soliman & Vance, 2022). The deterrence theory was proposed by Cesare Beccaria in 1738-1794 (Tiwari, 2022).

According to Bandaranayake and Kgnu (2020), the Deterrence Theory came into existence to provide an explanatory framework for understanding why individuals choose to obey or disobey the law. Deterrence theory suggests that the certainty, severity, and swiftness of punishment can influence an individual's decision-making process and ultimately deter them from committing crimes (Hirtenlehner & Schulz, 2021). Deterrence theory is a widely recognized criminological concept that suggests individuals make decisions about obeying or disobeying the law based on a rational assessment of potential benefits and consequences.

According to proponents of deterrence, the effectiveness of deterring crime can be challenging to measure, as law enforcement typically becomes aware only of those offenders who are not deterred. Proponents of deterrence claim that individuals determine whether to obey or disobey the law after assessing the advantages and consequences of their actions (Altman, 2021). As a result, understanding the reasons why some individuals choose not to commit offenses remains limited. Verifying the effectiveness of deterrence is difficult since only offenders who are not deterred are brought to the attention of law enforcement. As a result, we may never fully comprehend why others do not offend us. Deterrence can be divided into two categories: general and specific (Hensel & Kacprzak, 2021). General deterrence focuses on preventing

crime by using the punishment of offenders as a cautionary example for the broader public (Hensel et al., 2021). Specific deterrence aims to prevent repeat offenses by making individual offenders less inclined to commit criminal acts again (Altman et al., 2021).

The goal of general deterrence is to keep the general public safe from crime (Maimon, Howell & Burruss, 2021). As a result, the punishment of offenders in society acts as a model for others in the general community who have not yet been involved in criminal activity. The theory has been selected because by applying deterrence theory to the study of compliance with land use regulations in the vicinity of fuel service stations, researchers could gain insights into the behavioral motivations of individuals and builders in adhering to or violating these regulations. This could contribute to a deeper understanding of the factors that influence compliance with urban planning and zoning laws in the specific context of fuel service station areas in the Cape Coast Metropolitan Area. Deterrence theory, in the context of mapping land use patterns, could involve investigating whether the spatial arrangement of various land uses surrounding fuel service stations is influenced by the fear of legal consequences or penalties.

Moreover, applying deterrence theory to compliance assessment could involve evaluating whether land use patterns near fuel service stations conform to statutory planning schemes due to the perceived deterrence of penalties for non-compliance. The study might explore whether areas exhibiting higher compliance rates align with the principles of deterrence, where individuals or entities are more likely to adhere to land use regulations to avoid potential negative outcomes. In the examination of factors influencing

land use compliance, deterrence theory could offer insights into how individuals and stakeholders make decisions regarding land use in proximity to fuel service stations.

Conceptual Framework

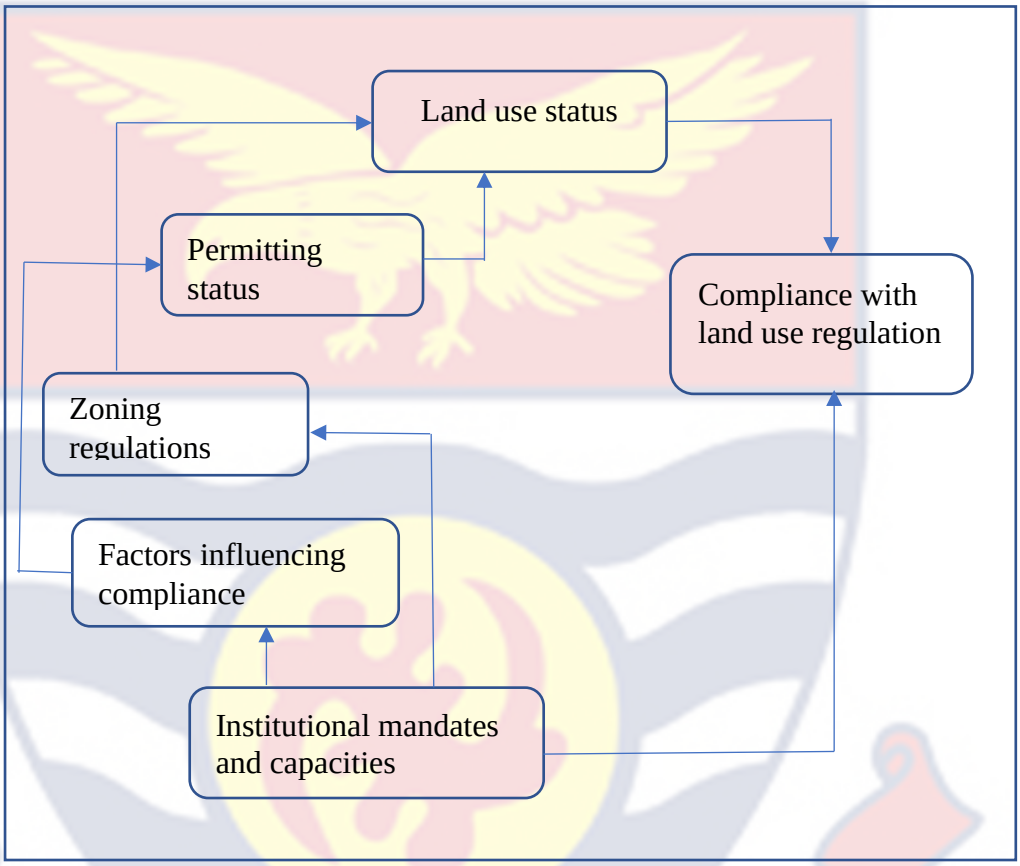

Figure 1: Conceptual framework: Authors construct (2021), based on Wehrmann 2008; Giz 2012; Yeboah & Obeng-Odoom (2010) and Lengoiboni et al. (2018).

A conceptual framework is a grouping of general views and propositions derived from various studies that are used to organize a future presentation (Díaz et al., 2015). When well described, a conceptual framework has the potential to be useful as a tool to assist a researcher in making sense of later findings. (Kyaka, 2012). As Díaz et al., (2015) noted, a well-developed conceptual framework is not merely a theoretical construct, but a practical tool that aids researchers in navigating the intricate terrain of their study

(Muchanga & Chalawila, 2022). It draws upon a compilation of theoretical perspectives, existing literature, and empirical studies to form a coherent and structured framework for investigating a particular research problem (Peruchi, de Jesus Pacheco, Todeschini & Ten Caten, 2022).

Regarding this study, the conceptual framework shows the association between institutional mandates and capacities, zoning regulations, permitting status, and land use status. As part of the conceptual framework, land use status refers to the actual use or activity taking place on a particular piece of land (Hansis, Davis & Pongratz, 2015). It includes residential, commercial, industrial, or other uses (Brandão & Canals, 2013). Land use status can be compliant or non-compliant with zoning regulations and permitting requirements (Iban, 2020). For instance, if a piece of land is designated for residential use in the zoning plan but is being used for industrial purposes, it represents non-compliance.

Permitting status relates to whether individuals or entities have obtained the necessary permits and approvals for their land use activities (Allard & Curran, 2023). Obtaining permits signifies adherence to regulatory requirements (Peterson, 2013). The absence of required permits indicates non-compliance. The permitting process serves as a formal mechanism to ensure that proposed developments align with established regulations (Allard et al., 2023). Zoning regulations involve the division of land into different zones or areas with specific permitted land uses (Carruthers & Tretter, 2022). These regulations outline what types of activities or developments are allowed in each zone. Zoning regulations directly influence land use patterns and the types of activities that can take place in specific areas (Allard et al., 2023).

Non-compliance with zoning regulations can lead to unauthorized land uses, impacting overall compliance (Liang, Jiayu, De & Xin, 2022).

Institutional Mandates and Capacities refer to the roles, responsibilities, and capabilities of the institutions involved in land use regulation and enforcement (Ariti, van Vliet & Verburg, 2019). These institutions might include local government bodies, planning authorities, and regulatory agencies (Syaban & Bisri, 2022). The capacity of these institutions to effectively implement and enforce regulations can impact compliance rates. For example, strong institutional mandates and well-trained personnel might lead to better monitoring and enforcement, which could enhance compliance.

The conceptual framework was established based on the concepts of Deterrence Theory and Land Use Planning Theory has been employed to construct the conceptual framework. Deterrence Theory adds a layer of deterrence, suggesting that strict enforcement and perceived consequences influence compliance decisions. By examining factors such as regulatory mechanisms, economic incentives, stakeholder involvement, and contextual variables, the study explores how these elements interact to either encourage or discourage compliance with land use regulations. The Land Use Planning Theory provides a comprehensive framework for making informed decisions about how land should be used, developed, and managed in a way that aligns with social, economic, and environmental goals (Reed et al., 2016). It plays a crucial role in shaping the physical and social fabric of communities and cities while striving for sustainable and balanced growth (Löbmann et al., 2022).

As shown by Figure 1, institutional mandates and capacities, zoning regulations, permitting status, and land use status are all geared towards

compliance with land use regulations. A compliance factor such as awareness creation on obtaining a building permit can influence the permitting status of the individual that is to say that if people are aware of acquiring building permits, and through enforcement, they will not hesitate to acquire the permits because no developments would be allowed without it. The permitting status of the individual also determines the land-use status. The individual having or not having a permit can tell whether they are to engage in certain developments or not. Some individuals may have a permit to build but such buildings may not be in line with the zoning regulations. Others may not have a permit but would build according to the zoning scheme and all these will determine how compliant a person is with such permitting status.

The institutional mandates and capacities do not only lead to compliance but influence the factors leading to compliance and determine the zoning regulations on how implementations are done through the institutions in charge and the zoning further leads to land use status. Thus, through zoning, the land-use status can be determined whether the purpose for which an area was zoned is actually in line with the zoning regulation standards or has deviated totally, and then compliance can be achieved when the land use is based on these factors. Zoning with accompanying regulations is often used to execute and enforce land-use plans, which create the conditions required for achieving an environment that is sustainable, required, and viable economically for land use and the type of ownership (GIZ, 2012) and the purpose for land use planning according to Smith (2004) is resolving conflicts and reducing the risks that are associated with the location of dangerous land use facilities.

Chapter Summary

A literature review has been associated with the study. This study was underpinned by the concept of compliance, and other related theories as major themes due to how they are related to the study's objectives. It was noticed that there has been extensive research on land use. Most of these works are linked to land use patterns, land use regulation, and compliance haven conducted empirical reviews. The literature identified empirically that most of these works on compliance with land use regulations were not done in relation to the vicinity of the fuel service stations. Only a few of the literature reviewed showed studies that have attempted to assess compliance with land use regulations within the vicinity of fuel service stations by adjoining land uses in Ghana. It is however in this sense that this gap in literature seeks to reveal some aspect of land-use regulation in the vicinity of the fuel service stations, thus showing how land-use regulations could influence the activities of these fuel service stations and how fuel retail activities could be regulated to enhance compliance.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter explains the research methodology and describes the approaches that were used to fulfill the study's goals and objectives. The chapter covers the study area, study design, population, and target population, the procedure for sampling, data collection procedure of the study, data collection instruments, data processing and analysis, ethical considerations, and the summary of the chapter.

Study Area

Description of the study area, Cape Coast Metropolitan area.

The Cape Coast Metropolitan Area is known to be one of Ghana's oldest districts, having been elevated to municipality status in the year 1987 by Legislative Instrument (LI 1373) and later moved to the metropolitan assembly by Legislative Instrument (LI 1927) in the year 2007. The Cape Coast Metropolis in the region is bordered to the West by Komenda Edina Eguafo Abrem Municipality at Iture bridge and to the East by Abura Asebu Kwamankese District (see Figure 2). The Metropolis is bordered to the northern part by the Heman Lower Denkyira District and the South is the Atlantic Ocean. The location of the metropolis geographically is at longitude 1° 15'W and latitude 5°06'N. The Metropolis covers a land size of 122 square kilometers and serves as a business and trade community with the farthest point at Brabedze located about 17 kilometers from Cape Coast, the Central Regional capital. According to the 2021 Population and Housing Census, the population of the Metropolis stands at 189,925 with 92,790 males indicating

(48.9%) and 97,135 females indicating (51.1%). The majority of the population (189,925) live in urban areas since the metropolitan area is urban-centered.

The Cape Coast Metropolis has been the centre for education, drawing students from all over the country to the many second cycles and tertiary institutions, including the Mfantsipim School, Adisadel College, St. Augustine College, Wesley Girls High School, Holy Child School, University Practice Senior High School, Cape Coast Technical Institute, Cape Coast Technical University and the University of Cape Coast (GSS 2010). The great number of these students residing in the communities has led to the construction of new housing structures by private individuals, social facilities, recreational facilities, and commercial facilities. However, the Cape Coast Metropolis has the largest remaining historic centre of pre-1900 structures, as well as the greatest potential for revitalization and economic growth through the repair, renovation, and where possible, reconstruction of existing building blocks.

The Cape Coast Metropolitan Area is experiencing rapid urbanization and development, making it an important location to study land use regulations and their impact. As urban areas expand, there is a need to ensure that land use regulations are followed to maintain orderly and sustainable development. The presence of fuel service stations in the metropolitan area introduces potential land use conflicts and safety concerns. These stations are critical infrastructure for urban mobility but can also pose risks to surrounding areas. Studying land use compliance in their vicinity can provide valuable insights into the effectiveness of regulations in managing such sites. Conducting the study in the Cape Coast Metropolis ensures that the research is

locally relevant and applicable to the specific challenges and dynamics of this urban area. The findings can be used to address the unique land use issues faced by the metropolitan area and tailor solutions accordingly.

Also, unlike the severe fuel service station disasters that have occurred in some parts of Ghana like Accra, Kumasi, and Takoradi for example, the June 3rd disaster at Circle, Accra, Trade Fair gas explosion, Bole gas explosion, and Atomic gas explosion, which claimed many lives and properties, the Cape Coast Metropolitan has not experienced this severe fuel service station risks in recent times and therefore the area is selected for the study to inform planning to prevent any future occurrences in the Metropolis.

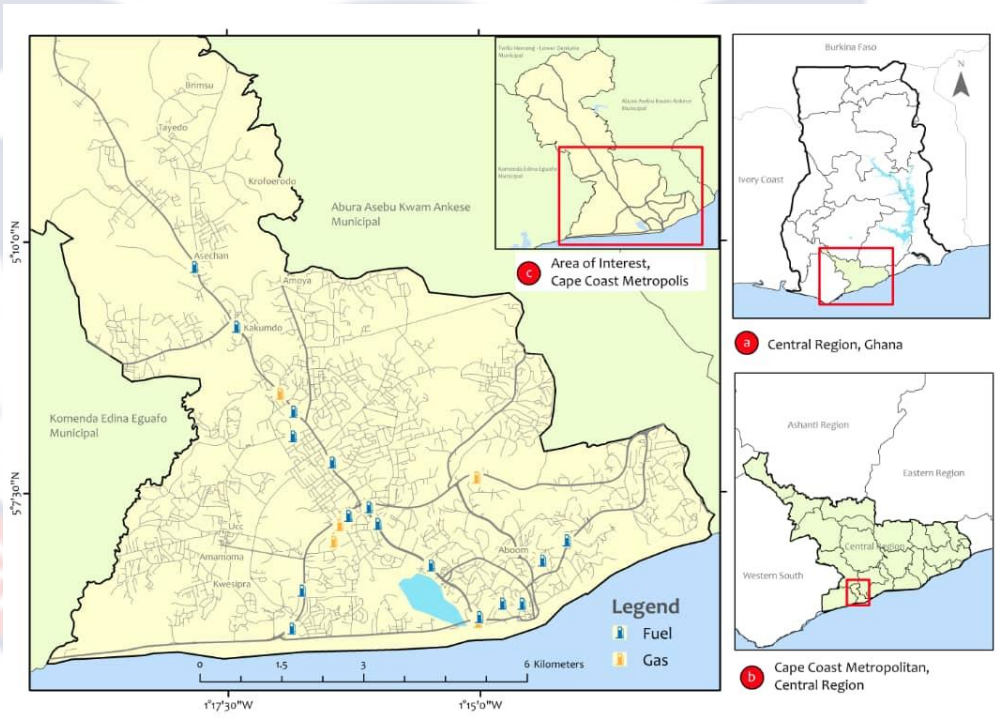

Figure 2: The study area showing Fuel Service Stations
Source: Field data, (2021)

Research Philosophy

The philosophy underpinning this study is pragmatism, involving a combination of interpretivism and positivist approaches. Tashakkori and

Teddlie (2010) argue that "One of the central ideas in pragmatism is that engagement in philosophical activity should be done to address problems, not to build systems" (p. 97). Positivism shares a correlation with foundationalism, which refers to a belief in a reality that does not rely on human knowledge. To someone who is a staunch believer in positivism, the physical world as we see it is also tagged as the genesis of our knowledge.

The positivist viewpoint holds that there is the possibility to gain knowledge about the world without the use of intermediaries. This helps to eliminate any bias when performing research (Poetschke, 2003). Some qualitative methodological characteristics identified with the interpretive research model are in-depth interviews and observation. The interpretive paradigm focuses on meanings, interpretations, and experiences that help researchers in reporting from a variety of perspectives and descriptions, as well as being able to delve into the processes of subjective interpretation, acknowledging the participants' beliefs, interests, motivations, intentions, values and reasons, meaning-making and the self-understanding (Henning et al., 2004). Therefore, for this study, a pragmatic philosophy with positivist and interpretive approaches was used.

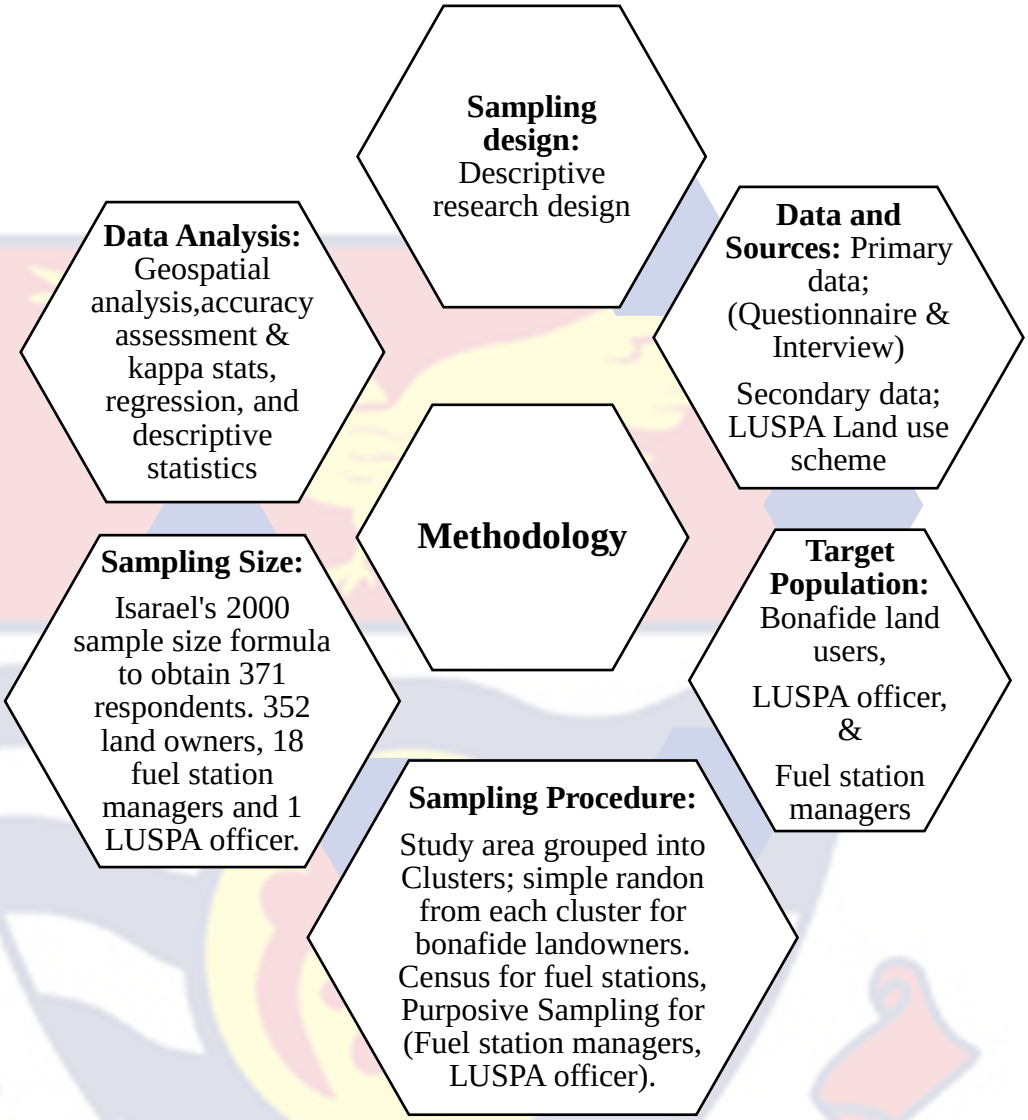

Figure 3: A diagram showing the Methodological steps used to execute the research.

Research Design

The research approach used in this study is mixed-method. Tashakkori, Teddlie, and Creswell (as cited in Ivankova et al., 2006) defined mixed methods as a procedure for collecting, analyzing, and mixing or integrating both quantitative and qualitative data within a single study to gain a better understanding of the research problem as neither method alone is sufficient to capture both the trends and details of a situation. The study would make use of

the mixed method design because it allows researchers to analyze data from both qualitative and quantitative viewpoints. Moreover, the mixed-method research design allows the researcher to move beyond surface-level insights and delve into the underlying factors influencing land use compliance. By integrating quantitative analysis and qualitative exploration, this approach ensures a comprehensive understanding of the subject matter, thereby contributing to a more robust and holistic examination of land use dynamics in the study area. The mixed-method approach enhances the validity, reliability, and depth of the study's findings, ultimately enriching the overall quality of research outcomes.

The researcher employs qualitative research to gather large-scale data on land-use planning schemes, identifying broader land-use trends. Qualitative research, as articulated by Yilmaz et al., (2013), seeks to understand individual interpretations within a specific context and time frame. Qualitative design allows for in-depth discussions, explaining the details of the issues. By combining these data streams, a more comprehensive perspective of land use compliance patterns within the fuel service station setting is achieved.

Quantitative research, as emphasized by Creswell & Clark (2017), necessitates a substantial sample size that is representative of the target population for findings to be applicable at a broader level. A qualitative research design, particularly a descriptive design would be used for the study. A descriptive research design is “aimed at casting light on current issues or problems through a process of data collection that enables them to describe the situation more completely than was possible without employing this method” (Fox & Bayat, 2007:8). The use of statistical analysis and ArcGIS Pro tools

further enhances the reliability and objectivity of the results, reducing the likelihood of interpretation errors. (Creswell & Clark, 2017; Wahyuni, 2012). This approach is particularly apt for understanding spatial patterns of land use in the Cape Coast Metropolitan area, as it allows for unbiased and systematic analysis.

Data and Sources

Primary and secondary sources of data were used in the study to reach the goals of the study. News articles, journals, and acquisition of Land-use data from the Cape Coast Metropolitan Assembly (Land Use and Spatial Planning Authority), covering the location of fuel stations and adjoining land-use schemes served as the secondary source of data (statutory land use scheme). The primary data were in three-fold. The first was derived based on the land use planning scheme to pick land use geographic location data in the fuel service station vicinity. The second aspect of data was gathered from bonafide structure/landowners and heads of household in fuel station adjoining vicinities through the administering of questionnaires and lastly, an interview guide was used to solicit information from fuel station managers and the office of the Land Use and Spatial Planning Authority.

Population

A study population, according to Taherdoost (2016), is the collection of elements from which a sample is drawn. Also, according to Devi (2017), population refers to the total number of units of a phenomenon that exists in the study region that is being investigated. The study was limited to Cape Coast in the Central Region. The study population comprises adjoining land users i.e. (bonafide structure/landowners and heads of household), fuel station

managers in the Cape Coast Metropolitan area, and a Land Use and Spatial Planning Authority officer from the Metropolis.

According to the Population and Housing Census (2021), the population of the Metropolis stood at 189,925**,** and based on the ArcMap Pro land use scheme population determiner, the total size of the metropolis within the zoned scheme land use was 5,194. Therefore, the target population for the study included the bonafide structure/landowners and heads of households around the fuel service stations. These groups of people were included to give information on the kind of work done on the facility they belong if such works were fire-related that may pose threats to fuel stations or not as well as knowledge on development compliance and building permits employing questionnaires. Fuel station managers within the Metropolitan area were also targeted for the study and they provided information on how the activities of adjoining land use were going to have an impact on the fuel stations and ways by which they can cater for their business in times of disaster. Finally, the Land Use and Spatial Planning Authority gave spatial information on areas within the Metropolis allocated for building fuel stations as well as other land-use purposes and their mandates on compliance with land-use regulations in the area using an interview guide.

Sampling Procedure and Techniques

Sampling can be defined as the procedure for selecting the target population's research units for inclusion in the study. In this study, an appropriate sample was chosen from the population to be able to achieve the objectives of the research. The appropriate sample size for the study was derived using Israel's 2000 sample size formula to obtain 371.

$$n = \frac{\text{Population Size}}{1 + [\text{Population Size} \times (\text{Margin of Error})^2]}$$

Probability and non-probability sampling strategies were employed to pick the 371 respondents. Census, cluster, and purposive sampling techniques were used specifically. The following is a breakdown of how the study's various respondents were chosen.

a) Bonafide structure/landowners and heads of household

In selecting these respondents to provide responses to the questionnaires, a cluster sampling technique was used to sample adjoining land users within the Cape Coast Metropolitan Area. The cluster sampling method involves dividing the population into smaller, more manageable groups called clusters. This was done based on the geographical zones, neighborhoods, or administrative areas of data collection. The clusters were randomly selected and determined based on the sample size required for the study and the practicality of data collection.

A survey was conducted within each cluster. Depending on the size of the clusters, all fuel service stations and adjoining lands within the selected clusters were surveyed. The questionnaire was administered to the selected adjoining lands (e.g., developers, and residents) within the sampled clusters with the aim that at each cluster a simple random technique would be employed to obtain data. This was so because of how similar the population is in nature. In view of the fact that a large sample size was used and how easy it is to get access to respondents, this sampling strategy was chosen. Nonetheless, cluster sampling has the advantage of being feasible, as it can take into account a vast population.

b) Other Respondents

Twenty-one fuel service stations within the Metropolis were involved using a census approach and purposive sampling to select eighteen (18) fuel station managers and one officer from the Land Use and Spatial Planning Authority. Purposive sampling was the best choice for these respondents because it allowed the study's goal to be achieved by including individuals who could provide the information needed to meet the study's objectives through the use of an interview guide. Purposive sampling is also used to take advantage of the different qualitative research designs accessible while gathering information from regulators such as LUSPA.

Data Collection Instruments

Data was collected using a mixed-method approach with two research tools. Structured questionnaires and interview guides were developed and used as the research instrument for the primary data from the field of the study.

A questionnaire, in the form of hard or soft copy, is a tool for collecting quantitative data that is extensively used for research because it is an effective research tool for gathering standardized data and drawing generalizations. It is an instrument that contains structured questions to which respondents provide answers. Questionnaires provided quick responses and therefore adequate care was taken when developing questionnaires, to ensure that received responses were not influenced. The design of the questionnaire however reflected the research aims and objectives. Because of the large number of bonafide structure owners/household heads, the questionnaire was useful. Though the usage of the questionnaires had numerous benefits, low response rates, clarity of issues, and possible literacy issues were some of the

disadvantages of using questionnaires. The questionnaire was designed on a 1-5 scale and divided into two (2) sections with section (A) asking respondents for demographic information such as their gender, age, and educational level, among other things. Section (B) gathered data from respondents in order to fulfill the research's third objective. Items in these sections were graded on a 5-point scale, with 1 indicating Strongly disagree, 2 indicating disagree, 3 indicating Neutral, 4 indicating agree, and 5 indicating strongly agree.

Specifically, section B contained items concerning the third objective on the factors that influence land use compliance within the fuel station vicinity. With objective one on the pattern of land use, and objective two on compliance levels between existing land use and official land use plans and the permitting statuses of land uses within the fuel stations vicinity, an observation checklist in the SW Map was used to compare what is on the ground to the statutory scheme and in addition with the ArcGIS-Pro application software to make Spatial analysis comparison from the planning scheme obtained from the Land Use and Spatial Planning Authority to determine the level of compliance between the existing land use and the statutory land use scheme.

An interview guide on the other hand was used to collect qualitative data from two categories of respondents, and thus fuel station managers and an official from the Land Use and Spatial Planning Authority based on objective three on the mandates and capacities of the LUSPA to regulate developments within the vicinity of fuel service stations. According to Kallio et al., (2016), an essential feature of the use of semi-structured interviews includes their flexibility in nature which enhances the investigation of ideas. To put it

another way, this instrument gave the interviewer some leeway to ask for more relevant information through supplementary questions, which were frequently highlighted when the instrument prompted the interviewer.

Data Collection Procedure

To commence the gathering of all necessary information or variables, a support letter was endorsed by the University of Cape Coast's Institute for Oil and Gas Studies. Also, a clearance letter was issued by the University of Cape Coast's Institutional Review Board. This was done to ensure the data gathering process's integrity and to acquire access to institutions and respondents. Based on acquiring the primary data, field mapping of the location of the station was undertaken. Based on the classification derived from the Planning Scheme of Cape Coast Metropolitan Assembly, Arc map software was used to digitize the Land use planning scheme and grouped them into segments which were further embedded into SW Map for actual field validation of the land use. Two field assistants helped in picking the points of various land use with the SW Map android application as geospatial data. The goal of the geospatial data gathering was to figure out where fuel stations were located and how they were distributed throughout Cape Coast. The location of these fuel stations was compared to adjoining land use developments such as residential apartments, educational, recreational, agriculture, industrial, etc. using the SW Map checklist. The geographic location of fuel stations in the study area was determined using Google Earth and validated with a mobile GPS handset within the SW Map application during visits to each station.

With data collected from the land users themselves, structured questionnaires were prepared to aid in the data collection that took vital

information on the permitting status of land users as well as some factors that influence compliance. This informed the number of land users complying and those not complying with the land use regulation within the fuel service station vicinity. The questionnaires to be used were administered to selected land users within the vicinity of fuel stations as part of the study. The selected land uses were visited and households found within such land uses were issued a questionnaire to fill out. Fuel stations and the LUSPA office were also visited respectively and their concerns were taken before the interview began.

Data Processing and Analysis

Data analysis, according to Adèr (2008), is the act of editing, cleansing, transforming, and modeling data in order to emphasize relevant information, suggestions, conclusions, and decision-making support. The data collected to map out and show the pattern of land use went through several processes. In mapping out the fuel service station pattern, coordinates were picked at each fuel service station using the SW Map embedded GPS during the validation on the field. An Excel sheet was used to enter the names of fuel service stations and coordinates then saved as a comma-separated value file (CSV file) since the CSV file format aids easy processing within the ArcGIS work domain and, easy displaying of coordinates spatially.

A spatial analysis and accuracy assessment was adapted. For the land use pattern to be spelled out, that is to know how each existing land corresponds or relates to the other, an accuracy assessment was done. A descriptive statistic was used to present the frequencies and percentages of land uses. The Kappa statistic below was then used to analyze the Producer Accuracy, User Accuracy, Error of Omission, and Error of Commission to

determine the various percentages that came out from the land uses. With this, the output from the Kappa statistics showed clearly the level of compliance with land use within the fuel service stations in the metropolis. The Kappa statistic refers to the proportion of the existing and the statutory land uses which are correlated and are significantly different from chance. The kappa value is lower than the Percentage Correctly Classified (PCC) because the Kappa takes into consideration type 1 and type 2 errors. The Type 1 errors (commission i.e. Over estimation) are the false positives while the Type 2 errors (omission i.e. Under estimation) are the false negatives. The non-compliance can be seen by examining the Type 1 and Type 2 errors with respect to the various land uses.

Also, the output of the Kappa statistic is calculated using the expected values and observed. The Kappa is a statistical measure that assesses the level of agreement between two raters or classifiers when dealing with categorical data. It quantifies the extent to which the observed agreement between the raters or classifiers exceeds the agreement expected due to chance. Kappa values can range from -1 to +1. Kappa with +1 indicates perfect agreement between raters or classifiers, and Kappa > 0 connotes good to moderate agreement beyond chance. Kappa with 0 value indicates an agreement equivalent to chance, while Kappa < 0 indicates an agreement worse than chance.

+1 >0	Perfect Agreement/Moderate Agreement
=0 <0	Agreement equivalent to chance/worse than chance

The various errors that are associated with the various land uses are explained.

1. **User Accuracy:** refers to the probability that a reference class (ground truth) has been correctly classified. This means that if a land cover sample is taken from the field and compared to the classified image, the chances of that land cover being correctly classified on the image is the value of the user's accuracy.
2. **Error of commission:** It is an error of overestimation of the samples in a class which means that some pixels have been falsely classified as belonging to a particular class when in fact they do not belong to that class. Such pixels represent false positives or a type I error. It is the opposite of user accuracy.
3. **Producer Accuracy:** refers to the probability that a sampled point on the classified image belongs to its stipulated class. This means that it is the chance of a sampled class on the image being a true representation of itself.
4. **Error of omission:** It is an underestimation error. It represents the percentage of land cover samples on an image that have been put into another class instead of their correct class. They represent false negatives. It is the opposite of producer accuracy.

$$\hat{k} = \frac{N\sum_{i=1}^{r} x_{ii} - \sum_{i=1}^{r} (x_{i+} \cdot x_{+i})}{N^2 - \sum_{i=1}^{r} (x_{i+} \cdot x_{+i})}$$

The Kappa computation Where;

1. r = number of rows in the error matrix
2. xii= number of observations in row i and column i (on the major diagonal)
3. xi+ = total of observations in row i (shown as marginal total to right of the matrix)
4. X+i = total of observations in column i (shown as marginal total at bottom of the matrix)
5. N = total number of observations included in the matrix.

The data collected to map out land-use patterns and assess the level of compliance between the statutory land use scheme and the existing land use also went through several processes. A spatial comparison analysis was made using the ArcGIS Pro after the SW Map field inputs were called into the ArcGIS Pro. These comparisons showed the level of compliance that existed between the statutory land use scheme on paper and the existing land use on the ground.

The quantitative data was modified to look for variations and consistency in respondents' data. This was to remove any errors, missing values, or outliers that could skew the results and impact the validity of the findings. Moreover, it helped ensure that the dataset is accurate and reliable for analysis. After modifying and cleaning the data, researchers can conduct various statistical analyses to explore relationships, patterns, and trends in the respondents' data. To attain its corresponding descriptive statistics, SPSS was employed. The ascertained statistics (including frequencies) were utilized in the analysis and review of the field data.

Regression analysis, specifically linear regression was used to determine the factors that influence land use compliance within the vicinity of the fuel service station. Regarding this analysis, “Land Use Compliance” was the dependent variable, while independent variables were the factors that influenced “Land Use Compliance”. An alpha value of 0.05 was used, indicating a 95% confidence level. The coefficients associated with each predictor will indicate the direction and strength of their influence. For instance, a positive coefficient might suggest that as proximity to the fuel service station increases, compliance decreases. This analysis was conducted to help determine the factors that influence land use compliance for policy recommendations and strategies to enhance land use compliance near fuel service stations.

Qualitative data on the other hand was analyzed manually. The researcher commenced the data collection through insightful interviews to access the participants' perspectives and experiences about the research topic. The qualitative data was meticulously transcribed, converting spoken expressions into written narratives, ensuring a tangible foundation for analysis. Following transcription, the researcher immersed into a thorough manual analysis, meticulously scrutinizing the transcribed data to unearth recurring thematic patterns, underlying concepts, and noteworthy elements that surface from the dataset. These discerned themes form the bedrock upon which both qualitative and quantitative analyses stand. Through thematic analysis or narrative scrutiny, the researcher analysed the textual landscape and made meanings from the collected data.

Ethical Considerations

Ethical clearance with an identification number (UCCIRB/CHLS/ 2022/21) was granted by the Institutional Review Board (IRB) at the University of Cape Coast before data collection began. Participating organizations and Institutions as well as the selected respondents of the Cape Coast Metropolitan area were consulted and permissions were obtained before the data collection began. However, participants were briefly introduced to the purpose of the study and were allowed to decide whether to partake in the study in order not to introduce coercion but rather the respondents' willingness to respond to the questionnaire. Equally, fuel station managers, bonafide landowners, and institutions were taken through the goal behind the study briefly during the interview and questionnaire sections. The study conducted was a non-invasive one and there was no likeliness for physical harm to be caused. Secrecy and confidentiality of participants' information and data gathered during this work was a top priority. Notwithstanding, all prominent and credible individuals and sources that are cited in this work were given due recognition to ensure that this study is not flagged for cribbing.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

The purpose of the study is to assess compliance with land use regulations by adjoining lands within the vicinity of fuel service stations in the Cape Coast Metropolitan area. This core objective forms the bedrock for subsequent distinct objectives. This chapter entails findings and analyses/reviews that are reliant on the prior set of study objectives.

Background Information of Respondents

The demographic information of respondents was obtained from the first section of the questionnaire by analyzing the respondent's specific characteristics. Information obtained here included the respondent's gender, age, education status, employment status, occupational status, residential status, ownership status of the residential facility, duration of stay, and indigeneity of the respondents (Table 2).

Table 2: Background Information of respondents (N=352)

	Frequency	Percent (%)
Respondent's gender		
Male	188	53.4
Female	164	46.6
Age of respondent (years)		
18-29	23	6.5
30-39	114	32.4
40-49	142	40.3
50-59	60	17.0
60 and above	13	3.7
Education status		
No formal education	18	5.1
Basic education	68	19.3
Secondary education	193	54.8
Tertiary education	73	20.7

Table 2: Cont'd.

Employment status		
Self-employed	222	63.1
Employed (Private)	54	15.4
Employed (Government)	41	11.6
Unemployed	35	9.9
If employed, what is your Occupation.		
Trading	233	66.2
Public servant	64	18.2
No occupation	35	9.9
Manufacturing and repairs	15	4.3
Farming	5	1.4
Residential facility closer to the fuel station.		
Home	173	49.1
Shop/kiosk	150	42.6
Church	15	4.3
Health facility	10	2.8
Mosque	3	0.9
The ownership type of facility		
Owned	170	48.3
Rented	89	25.3
Family property	69	19.6
Caretaker	24	6.8
Duration of operation or living On land use type.		
Less than a year	35	9.9
2 to 4 years	150	42.6
5 to 9 years	100	28.4
Beyond 10 years	67	19.0
Are you an indigene of Cape Coast?		
Yes	226	75.6
No	86	24.4
Permitting status of land users/bonafide landowners		
Yes	267	75.9
No	85	24.1
Total	352	100.0

Source: Field data, Fiah (2022)

Table 2 indicates that 188 (53.4%) respondents were males while 164 (46.6%) were females indicating the dominance of males in the siting of fuel stations in the study area. In relation to respondents' age, the results show that most respondents (40.3%) fall within 40-49 years, followed by 30- 39 years with a percentage of 32.4%. About 17% of respondents were between the ages of 50-59, and only 3.7% of the respondents were 60 years and above. These findings indicate that adults of 40 to 49 years dominate the entire populace and fuel stations in the study area are owned by older people.

Also, Table 2 revealed that, out of the total of 352 respondents, the majority of the respondents 193 (54.8%) had attained their secondary education. This, however, can imply that most of the respondents are not qualified to acquire higher positions as government-employed workers in the Metropolis.

The results in Table 2 again indicate the employment status of respondents. Most of the respondents (63.1%) were self-employed. This shows that the majority of the respondents had jobs or businesses that they make a living out of without so much dependence on other governmental or private institutions within the Metropolitan area.

Similarly, out of the total 352 respondents, 317 of them had an occupation. The majority of respondents 233 (66.2%) engaged in trading while 64 (18.2%) of the respondents were public servants, with 15 (4.3%) and 5(1.4%) representing manufacturing and repairs, and farming respectively.

Furthermore, Table 2 demonstrates the proximity of the residential facility of the respondents to fuel service stations. A larger portion of respondents resided in houses as compared to other residential facilities. Out

of a total of (352) respondents, 173 (49.1%) resided in houses while 150 (42.6%) of the respondents resided in shops/kiosks. 15 (4.3%) of them resided in a church mission house. Nonetheless, the ownership status of the facility, the duration of stay of respondents, as well as the period of operation on land use type were also looked at as seen in Table 2. The results indicate that the majority of the adjoining land users have been operating or living on the land type for not less than a year in the vicinity of fuel service stations.

In addition, the study looked at whether respondents were indigenes of the Cape Coast Metropolitan area or not. The majority 266 (75.6%) of the respondents reported that they were indigenes of Cape Coast while 86 (24.4%) were not indigenes of Cape Coast. This means that many of the respondents were born and bred in the Cape Coast metropolitan area implying that they have adequate knowledge of the development of land use and land use patterns in the vicinity of fuel service stations over the years.

Finally, the permitting status of land users was looked at. Out of the 352 respondents, 267 (75.9%) respondents have permits or site plans for their facility whereas 85 respondents representing 24.1% do not have site plans or permits. This result indicated that the majority of respondents in the Metropolis are very aware of the need to acquire building permits for their structures.

Objective One: ***What are the land use patterns within the vicinity of fuel service stations in the Cape Coast Metropolis?***

This section presents the results based on objective one of the studies which was to map out the land use pattern in the vicinity of the fuel service station. The land use was classified using the land use classification scheme.

The classifications were done using twelve land-use types of the Land Use and Spatial Planning classification as presented in Table 3 and the Balasubramanian (2015) Land use categories and classification system as shown in Table 1. This classification was done to help show the land use pattern around the vicinity of fuel service stations in the Cape Coast Metropolitan area using the Statutory and the existing scheme, and the fuel service stations themselves as land use based on the National Petroleum Authority (NPA) distance standards. Though NPA stipulates several distance requirements, distances from stations, distances from adjoining facilities, and distances from hot works are of interest to this study to identify places likely to be vulnerable in terms of disaster. The statutory scheme was the actual planning scheme derived from the LUSPA, then grouped into segments and digitized using an ArcGIS Pro and embedded into a mobile software known as SW map to be validated on the field to get the schemed map that is what is supposed to be, whereas the existing scheme focuses on what exactly is on the ground during the visit to the field.

Table 3: Land use patterns near fuel service stations

LAND USE	Existing Land Use		Statutory Land Use	
	Frequency	Percent (%)	Frequency	Percent (%)
Agriculture	30	0.6	13	0.3
Civil and Culture	144	2.8	113	2.2
Commercial	267	5.1	118	2.3
Educational	129	2.5	151	2.9
Fisheries	7	0.1	6	0.1
Industrial	70	1.3	38	0.7
Mixed-use	234	4.5	163	3.1
Public open space	1877	36.1	556	10.9
Recreational	33	0.6	28	0.5
Residential	2264	43.6	3786	72.9
Transport	112	2.3	118	3.6
Utilities	17	0.3	24	0.5
Total	5194	100.0	5194	100.0

Source: Fieldwork, Fiah (2022)

From Table 3, a total of 5194 (100%) land uses were validated from both planning schemes. The frequencies showed the number of land use that were digitized based on the planning scheme derived from the LUSPA. An ArcGIS Pro was used to map out the land uses found within the vicinity of fuel service stations. Figures 4 and 5 show the mapped-out land use patterns in their defining color schemes respectively.

Residential land use has the most significant representation in the existing land use, accounting for 43.6% of the area. However, in the statutory land use plan, the percentage of residential land use increases substantially to 72.9%. This suggests that there is an emphasis on residential development in the planned land use, which might indicate a vision for increased urbanization or population growth in the study area. The existing land use includes a substantial percentage of public open space (36.1%), which might signify a focus on preserving green areas or natural spaces in the current land use. However, in the statutory land use plan, the percentage of public open space decreases to 10.9%. This change may indicate a shift in planning priorities, potentially allowing for more development or urban expansion.

Commercial land use constitutes 5.1% of the existing land use but decreases to 2.3% in the statutory land use. Similarly, industrial land use decreases from 1.3% in the existing land use to 0.7% in the statutory land use. This reduction could indicate efforts to limit or control commercial and industrial development in the study area. The statutory land use plan allocates a significant portion of the land for residential (72.9%) and educational (2.9%) purposes. This suggests a focus on accommodating housing needs and providing space for educational facilities in the future. Agricultural land use is

relatively small in both the existing land use (0.6%) and statutory land use (0.3%). This may indicate a diminishing emphasis on agricultural activities in the area, possibly due to urbanization and land-use conversion.

A study by Asabere et al., (2020) on urbanization, land use transformation, and spatio-environmental impacts: Analyses of trends and implications in major metropolitan regions of Ghana confirms these findings as the research discovered a new and dynamic way through which the frequently changing areas observed as public open spaces can be restored from such changes from vegetation to developments or built-ups and in the same vein from developments or built-ups to vegetation. Also, the location of some lands during the old times which were identified with land covers has lost their covers to build-ups. To add up, a study by Aguilera et al,. (2011) on landscape metrics in the analysis of urban land-use patterns using a case study in a Spanish metropolitan area confirms the study in the Cape Coast Metropolitan area as the spatial metrics usage in a metropolitan region undergoing significant change and expansion, such as Granada (Spain) has demonstrated its utility in quantifying and analyzing spatial growth features and patterns in urban settings. The statutory land use map and existing land use maps below were generated to show the pictorial pattern of land use within the Metropolitan area.

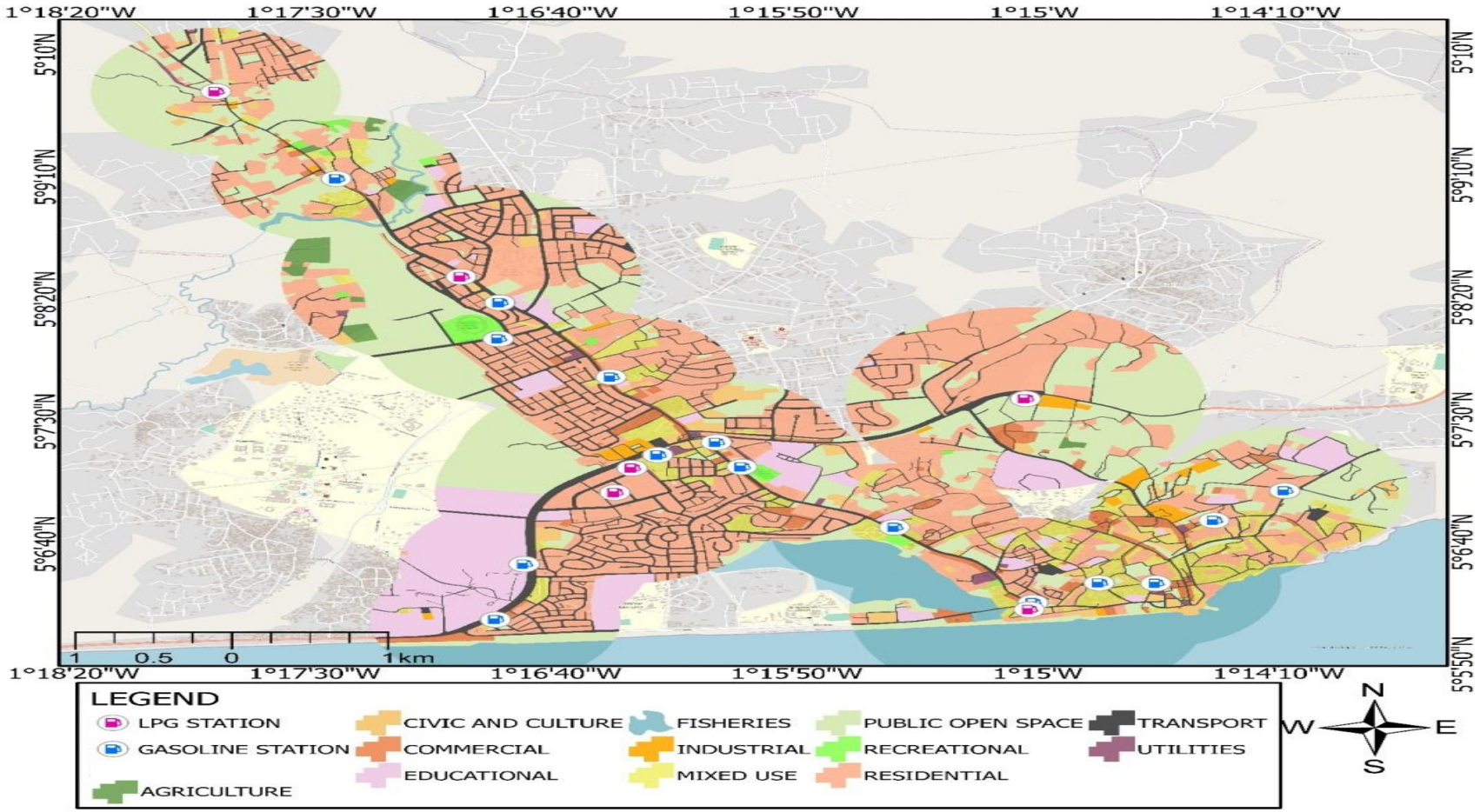

Figure 4: Statutory land use map in the vicinity of the fuel service station

Source: Fieldwork, Fiah (2021)

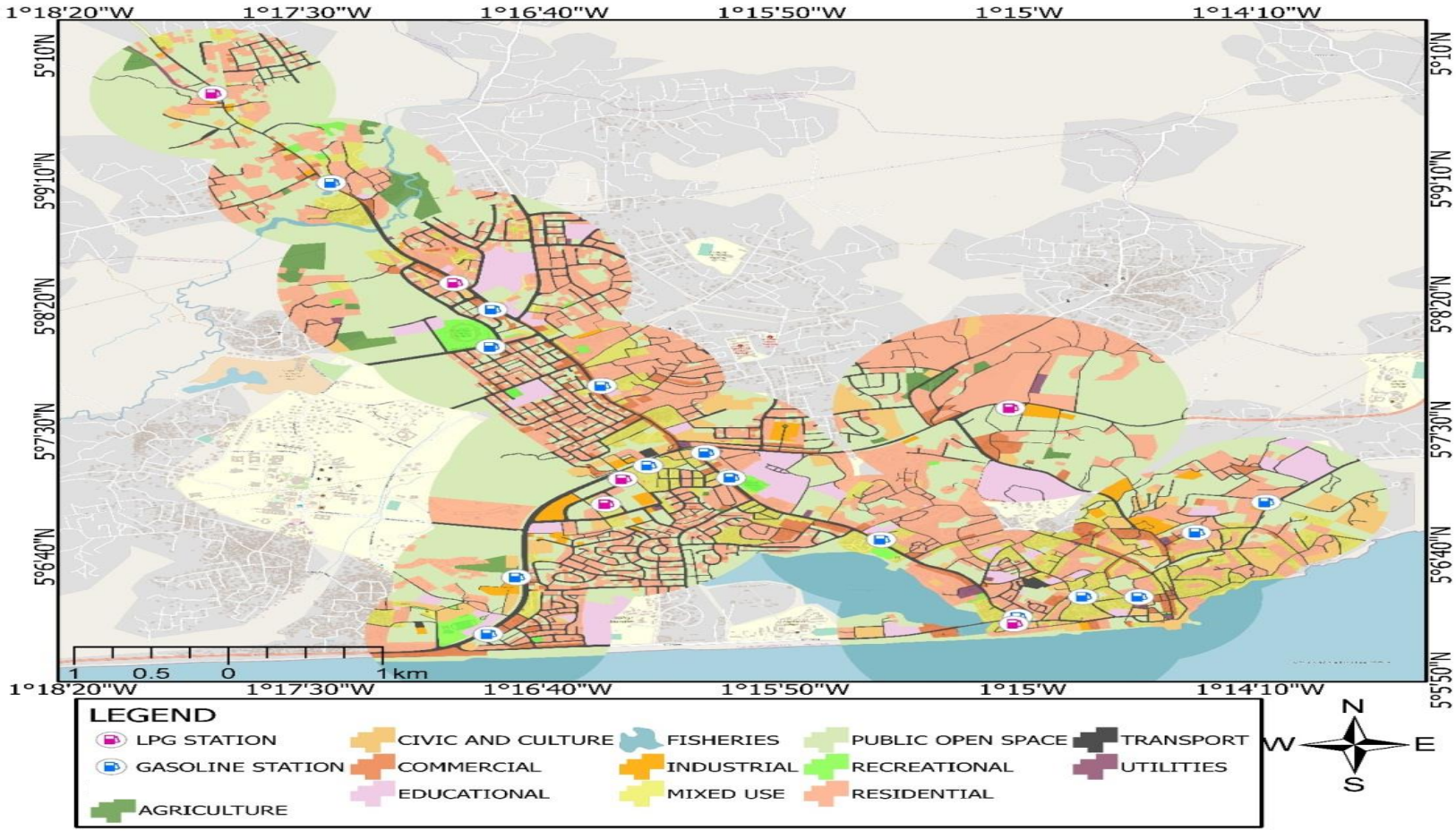

Figure 5: Existing land use map in the vicinity of the fuel service station

Source: Fieldwork, Fiah (2021).

Furthermore, Figures 4 and 5 show all the land use identified in the vicinity of fuel service stations in the Cape Coast metropolis presented by the various color schemes. Table 1 gives a brief description or characterizes the twelve land use classifications. The land use pattern on the map spatially ranges from the northwest through to the southeast of the study area. This map, therefore, represents what is supposed to be on the ground as per the original raw scheme map derived from the office of the Land Use and Spatial Planning Authority. Similarly, just as Figure 4 described, Figure 5 presents the existing land use. That is what was found on the ground.

The various land use types are not evenly distributed within the vicinity of the fuel station as shown in Figure 5 thus the existing land use map. Some of the fuel service stations were identified to have more residential use and public open space close to them while others have mixed-use and commercial land use around them.

Spatial location and distribution pattern of Fuel service stations as land use in the Cape Coast Metropolitan area.

Within an area of 20.71km², twenty-one fuel service stations were identified and these fuel stations are spatially not equally distributed. Exploration was done solely to identify the various fuel service stations within the Metropolis. Six LPG stations out of the twenty-one fuel service stations were identified and the remaining fifteen were identified to be gasoline stations as shown in Figure 6. Also, none of the fuel service stations were identified to combine both LPG and Gasoline in their operation.

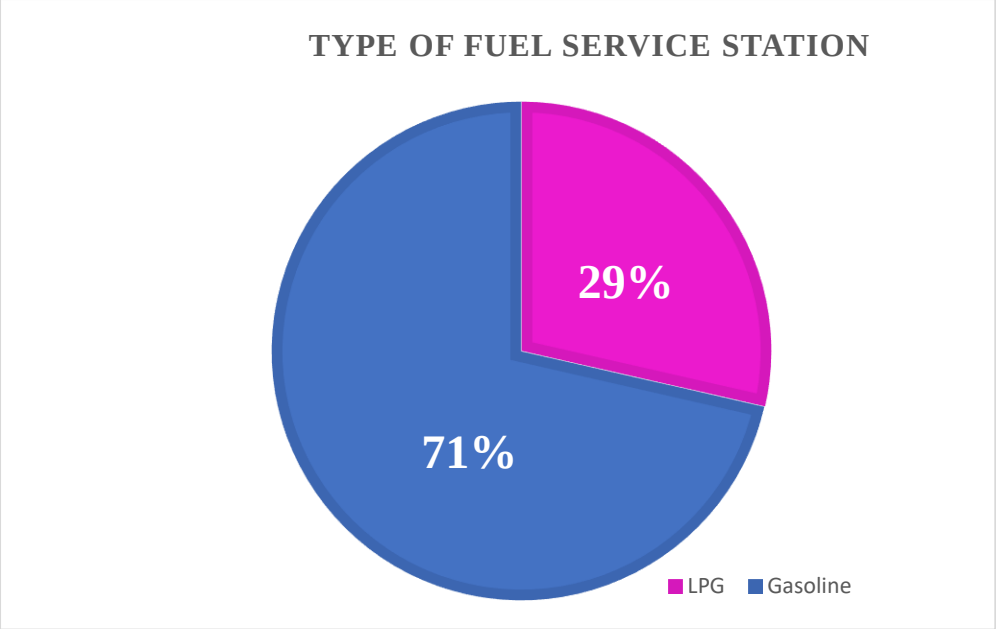

Figure 6: Types of fuel service stations in the Metropolis
Source: Fieldwork, Fiah (2021)

In Ghana, the National Petroleum Authority (NPA) is the institution responsible for regulating and determining the distance of fuel service stations from one another and from adjoining facilities. According to the NPA, the distance from one station to the next station on the same side of the road should be 300 meters and the distance between a Service Station (gasoline) and an LPG Refilling Plant on the same side of the road be 500 meters. From Figure 7, the longest distance between the nearest neighboring fuel service station was approximately 0.73km (730.0 meters) between stations (**G**) and (**H**) along the Accra-Takoradi highway. The shortest distance was found between **Station C** and **Q**, along the Bakaano-Kingsway Road with a distance of approximately 0.06km (55.04 meters).

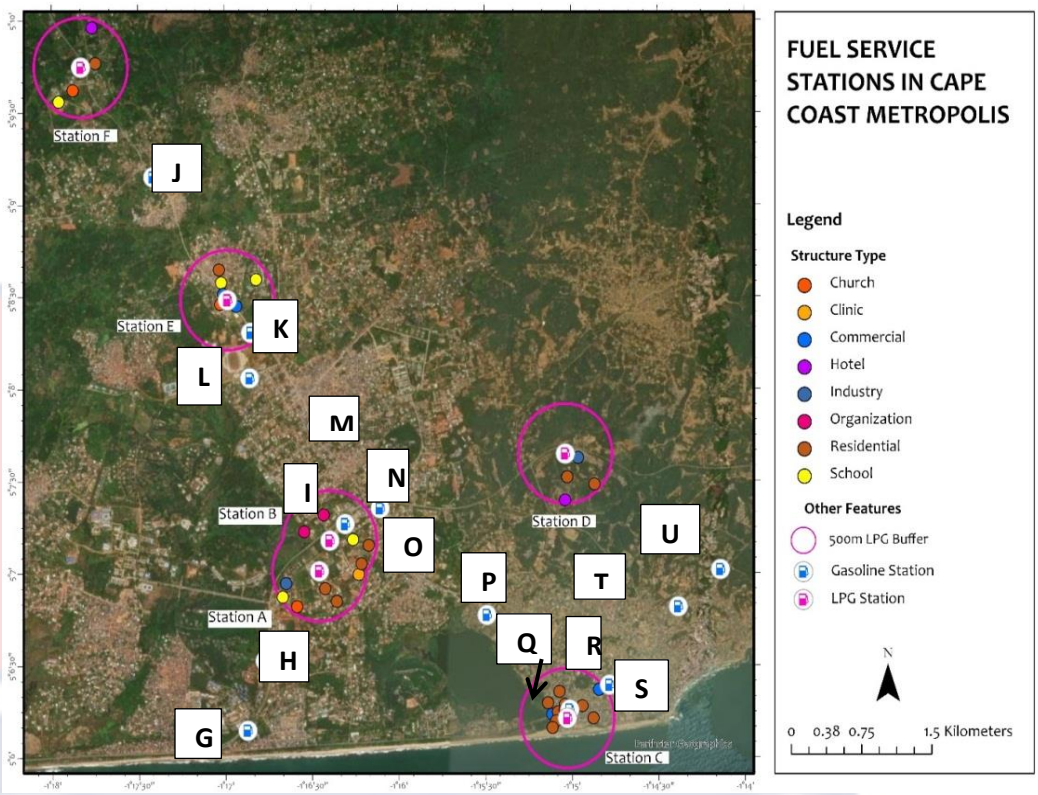

Figure 7: Location of fuel service stations in the Cape Coast Metropolitan area
Source: Fieldwork, Fiah (2021)

The findings based on the NPA distance requirement showed that the majority of the fuel service stations were found in compliance with the set distance requirement. Thus, the regulatory framework is generally effective in ensuring appropriate spacing between fuel stations and LPG refilling plants. This helps reduce potential safety risks associated with facilities too close to each other, in terms of fire hazards or traffic congestion

However, some stations identified as (A, B, I), (E, K), and (C, Q) are not within the specified distance requirement of the NPA, meaning that the distance between them was less than 500 meters for a service Station and LPG Refilling Plant on the same side of the road. This indicates that the fuel service stations and LPG refilling plants that do not meet the required distance indicate potential non-compliance with the NPA's regulations. Therefore, there

are safety concerns and there could be an increased risk of accidents, fires, and explosions in the fuel service stations and LPG refilling plants (Bariha, Ojha, Srivastava & Mishra, 2023). However, many jurisdictions have zoning regulations that define where fuel stations can be located in relation to residential, commercial, and industrial areas as stipulated by the NPA. These regulations are designed to balance the need for fuel access with safety and community well-being and when this is disregarded then the likelihood of imprint conditions including congestion and accessibility issues, affecting both vehicular and pedestrian traffic in the area would manifest (Terzioglu & Iskender, 2021).

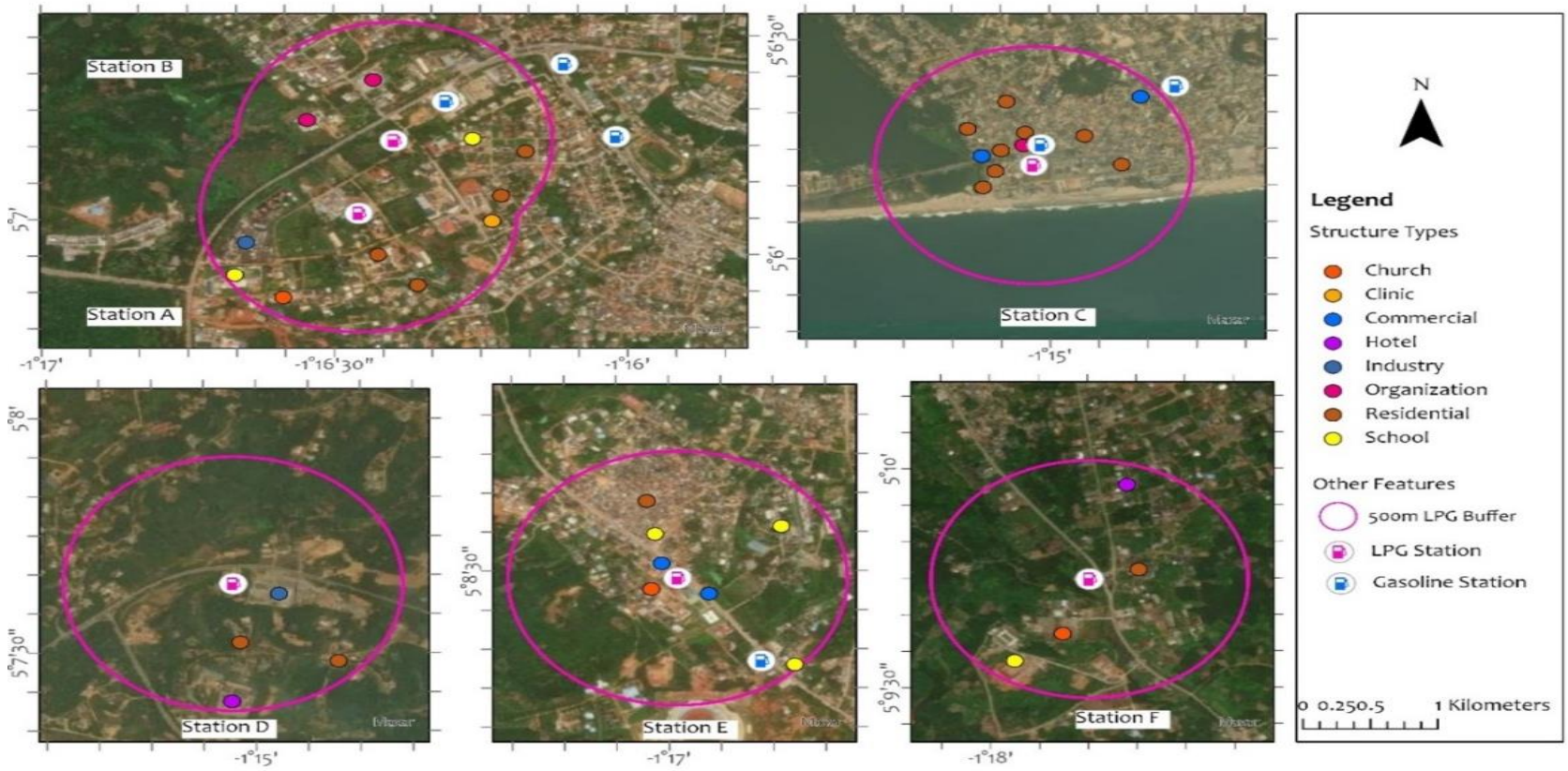

Figure 8: Distance from nearest public institutions per NPA 2021 distance standard

Source: Field data, Fiah (2021)

The NPA states that the distance from the nearest public institution to fuel service stations should be 60 meters for gasoline and 500 meters for LPG (see Figure 8). However, it was identified that several adjoining facilities such as schools, clinics, and churches were close to the gasoline and LPG stations which is against the distance standard stipulated by the NPA. This is in relation to a study by Mshelia et al. (2015) who argued that in urban settings, facilities such as petrol stations should be situated away from heavily populated areas, hospitals, and schools. There is no specification however by them on distance. In this case, however, the view that fuel stations render services to people within a particular locality and it is only when they are located close to these people that will suit and satisfy their demands within the shortest time as compared to it being far away though that could be dangerous. Though Mshelia et al (2015) did not specify any distance, this study has a specified distance to check for distance compliance even though fuel service stations are of help, they need to be far away from these adjoining land uses or facilities as specified by NPA to ensure safety as well.

Hot works identified on land use within the vicinity of the fuel service station

Hot works are fire-related works like the use of open flames, welding, and soldering, using bitumen and tar boilers, thawing pipes, the use of hot air blowers and lead heaters that may be found in the vicinity of fuel service stations which may pose a great threat to these stations in the Metropolitan area. Some specific areas were identified with many hot work activities in the vicinity of fuel service stations as shown in Figure 9. The National Petroleum Authority (NPA) however stipulates that the distance from hot works should

be 100 metres apart from gasoline stations and 200 meters apart from LPG stations.

Nevertheless, the findings from Figure 9 showed several hot works that were identified within the stipulated distance within fuel service station settings. The distribution of these hot works around fuel service stations can have significant safety implications. The most immediate risk is the potential for explosion. Hot work activities like welding, cutting, grinding, and soldering produce sparks and open flames that can easily ignite fuel vapors in the air leading to a catastrophic event. Gasoline and other fuels release flammable vapors that can travel a considerable distance from the source. Even if the hot works activity is not directly adjacent to the fuel stations, vapors can reach the work area and create a hazardous situation. However, workers who are involved in hot works and individuals in the vicinity of these stations could be injured or killed in a fire or explosion as well as harming the general public due to life and property damages. Despite these, the NPA also has strict regulations and guidelines regarding hot works near furl service stations and failure to comply with these regulations can lead to legal penalties and liabilities from these defaulters.

According to NEBOSH (2016), any manifestation or outcome that provides heat serves as a source for causing fires once there is the presence of oxygen and fuel. Besides, in the case of a technologically induced accident, there has to be a human intervention (whether directly or indirectly). A study by Ahmed et al (2011) affirms that human errors and negligence are the most common causes of fuel service station accidents. Therefore, negligence from these identified land use with hot works can bring about disaster in such areas

and even beyond depending on the petroleum product. Therefore, it is important for people dealing with hot works to be farther away from these fuel service stations or best be halted from such fire related activities.

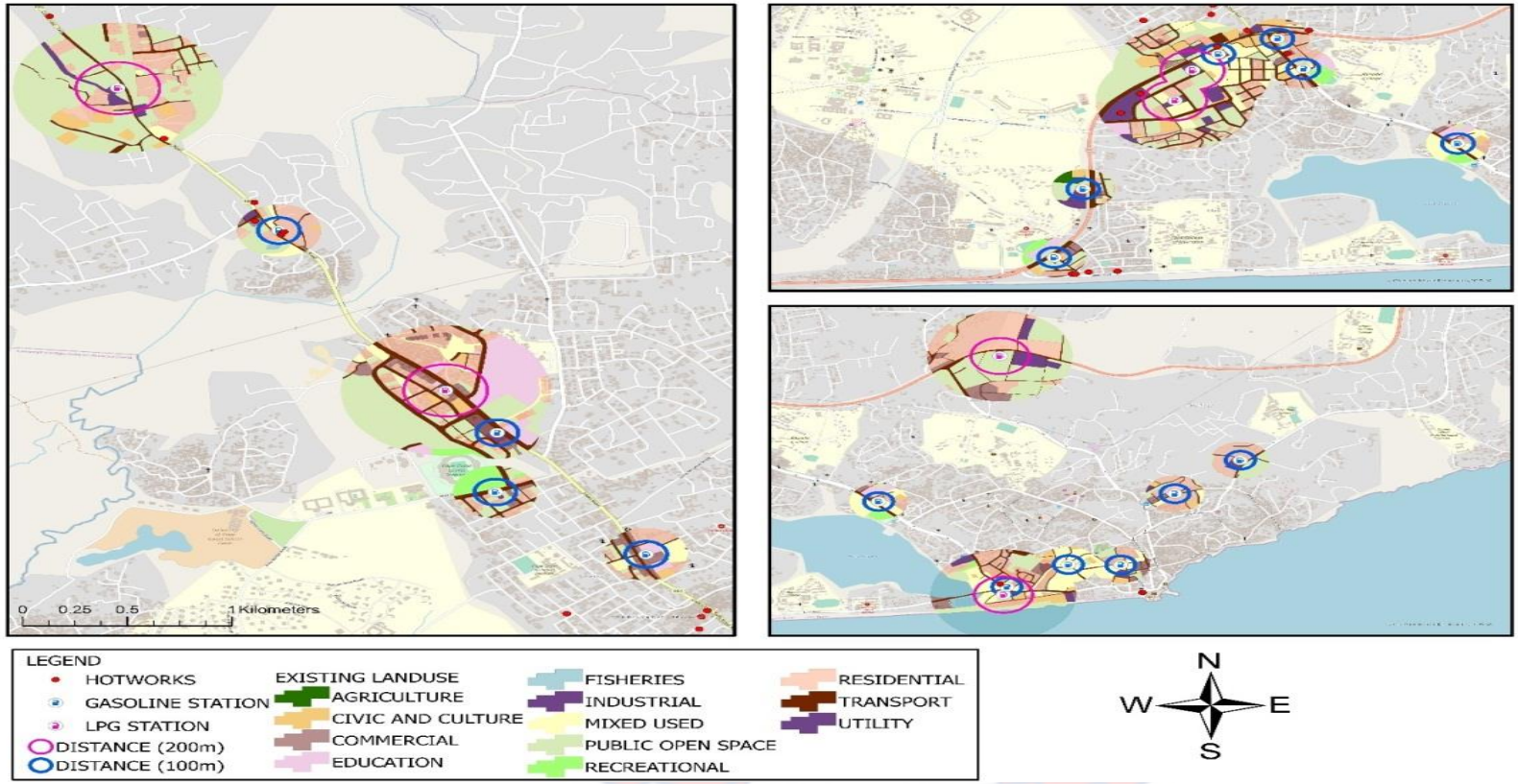

Figure 9: A land use map showing areas identified with hot works within the vicinity of fuel service stations

Source: Field data, Fiah (2021)

Efforts by fuel station managers in reducing disaster risks

Notwithstanding the likelihood of fire risk and disaster at the fuel stations, this study found that fuel service station managers have put in place ways to control their dealings to make sure adjoining land uses are also safe. In an interview with the fuel service station managers, respondents indicated how they performed and managed their retail outfits in order not to jeopardize the environment based on the location, distance from one station to the other, and hot works.

First of all, the socio-demographic information of the fuel station managers showed that all managers were males at the time of data collection. Also, all managers have had formal education with 15 managers having attained tertiary education, and only 3 managers having attained secondary education. Furthermore, all stations have been in their locations for more than six years. The majority of the stations were established in the community as a result of the increased demand for petroleum products in the metropolis as the population kept on rising. All fuel stations were purposely built for retailing as specified by the managers.

Six LPG managers remarked that based on a question posed to them about the safety standards they considered looking at the variety of works from adjoining lands and their retail outfit that could cause disaster. The response from one LPG manager was as follows:

> *Before the start of work each day, we inspect the vicinity ourselves to make sure there are no hot works close to our tank.*

A follow-up question was posed about how they ensured compliance in their work and one LPG manager's remark was that:

> *Initially, inspections were made once a year but in present times, monitoring and inspections are done about three times a year. The Ghana National Fire Service do routine checking of fire extinguishers and check for possible fire source around to ensure safety. They are also always available anytime LPG (as termed as load) is to be discharged into the storage tank. The load would not be discharged until the fire service is present with their firefighting gadgets should there be a fire outbreak. One thing they also offer pump attendants is fire training to be well-versed in dealing with safety about fire. Other bodies like the NPA and EPA do their specified checks as well to ensure safety.*

The responses indicated a routine check on the adjoining surroundings to look out for any possible fire source. A manager at an LPG station remarked that:

> *We put other measures in place ourselves to ensure the safety of the environment at large. Some measures are that we talk to people around the station to be cautious of fire-related activities. This is because there can be leakage where nothing can happen at all but once it's caught up by the fire, disaster will occur. Thus, we ask the people around us to be conscious-minded of themselves as well. We also*

have a gadget we put on the exhaust of any car that comes to refill its tank. This is to prevent the heat from the exhaust from reaching the pumping valve. We also have sand in buckets just as the gasoline stations have sand in buckets and fire extinguishers hanging around.

Similarly, responses from the gasoline (petrol/diesel) managers were not far different from the LPG managers even though they do not go around to check for likely hot works. During the interview, one of them remarked:

We always have sand in buckets close to the pumps so, in case of any spillage at the dispensing pump, we pour the sand on it to prevent any combustion. We also have fire extinguishers readily hanging around, some at the forecourt, and various rooms at the station as backup systems to ensure safety should there be any fire outbreak. We also have an assembly point where all workers must gather should there be a fire to ensure their safety. One common thing we do to ensure compliance from drivers is to ask them to turn off their ignition any time they refill their tanks, and this has been seen to be a common practice. We are also not bothered by any adjoining facility since the distance is reasonable and so far, we have not encountered any issue of fire outbreak.

The station managers also indicated the fact that the Ghana National Petroleum Authority, the National Fire Service, and the Environmental

Protection Agency perform their routine checks to ensure compliance with their outfits. One of them remarked:

> *The GNFS, EPA, and NPA come every two months for auditing, and through that, they do other checks in and around the stations. Also, these institutions give us certificates that are renewed every year, and before the certificates are renewed, they come back to check on how compliant our work has been within such periods. Moreover, the GNFS offers fire training to workers through which they are awarded certificates to ensure they are equipped with the requisite skills on how to combat fire when the need arises. Another body that also comes for inspection is the Factory Inspectorate Department. Their mandate is to check out the availability of sand in buckets readily available at dispensing pumps. They also check for fire extinguishers and first aid kits to ensure the station is safe and the adjoining environment is safe as well.*

The final question was posed as to how they foresee the future of their safety as fuel service station managers and compliance from adjoining land users within the community in which they are located. Responses from all eighteen managers were similar and the following excerpts are illustrative of the consensus:

> *Once these inspectorate bodies perform their tasks well by routinely checking up on their activities and we as managers ensure we abide by these regulations, there is a*

possibility of safety all time round. The adherence from drivers by turning off their ignitions when refilling their tanks has been progressive over time and we are glad and hope no fatal disasters occur through that we would all be safe and the future safer. One final thing that we believe will ensure better safety is a safety practice from adjoining land users. Once they show concern about the safety of all and perform their work not out of negligence to affect our work too, then we believe we are all safe.

Research has indicated that an excessive number of fuel service stations in a compact region of a city has led to issues like overcrowding of traffic, explosions, and health concerns in other circumstances, which have made it more difficult to respond to emergencies (Sangotola et al. 2015). According to the Ghanaian government, the construction and establishment of more fuel filling stations in Accra and other densely populated Urban cities in the nation are going to be risk-prone. Within the Cape Coast Metropolis, this study has revealed that no area has been verified to be over-concentrated with fuel service stations. However, only some areas have been identified to be near these fuel stations as depicted in Figure 8.

Objective Two: ***What are the levels of compliance with the existing land use patterns relative to the statutory land use plan in the vicinity of fuel service stations?***

This section presents the results in relation to objective two which sought to assess the level of compliance between the statutory and existing land use in the vicinity of fuel service stations within the Cape Coast

metropolitan area. The purpose is to know what exists between statutory and existing land use schemed patterns as displayed in Table 4. Land use has changed over the years due to numerous factors. This has resulted in land uses complying with a set regulation or not.

After mapping out the pattern of land use in the vicinity of the fuel service stations, a spatial analysis and accuracy assessment were done to show the relationships that existed between the various land uses and the level of compliance that existed between the existing and statutory land use.

Table 4 shows the output of the Kappa statistic calculated using the expected values and observed. The Kappa assessed the level of agreement between two raters or classifiers when dealing with categorical data. It quantifies the extent to which the observed agreement between the raters or classifiers exceeds the agreement expected due to chance. Kappa values can range from -1 to +1, with different interpretations based on the magnitude of the value: Kappa with +1 indicates perfect agreement between raters or classifiers, and Kappa > 0 connotes good to moderate agreement beyond chance. Kappa with 0 value indicates an agreement equivalent to chance, while Kappa < 0 indicates an agreement worse than chance.

Table 4: Relationship between the existing land use and statutory land use scheme

	STATUTORY LANDUSE SCHEME														
EXISTING LANDUSE	AGRIC	CIVIC	COM	EDU	FISH	INDUS	MXD	POS	REC	RES	TSP	UT	Total	ERROR OF COMMISSION	USER ACCURACY
AGRIC	12	0	0	1	0	0	0	11	0	5	1	0	30	60.0	40.0
CIVIC	0	106	0	2	0	2	0	5	0	27	1	1	144	26.4	73.6
COM	0	1	109	1	0	0	0	1	0	146	5	4	267	59.2	40.8
EDU	0	0	0	117	0	0	0	3	0	9	0	0	129	9.3	90.7
FISH	0	0	0	0	6	0	0	1	0	0	0	0	7	14.3	85.7
INDUS	0	0	1	0	0	32	0	1	0	36	0	0	70	54.3	45.7
MXD	0	0	5	3	0	0	160	5	0	51	8	2	234	31.6	68.4
POS	1	5	1	15	0	2	2	443	2	1365	40	1	1877	76.4	23.6
REC	0	0	0	1	0	0	0	2	26	4	0	0	33	21.2	78.8
RES	0	1	2	11	0	2	1	85	0	2136	22	4	2264	5.7	94.3
TSP	0	0	0	0	0	0	0	8	0	3	111	0	122	9.0	91.0
UT	0	0	0	0	0	0	0	1	0	4	0	12	17	29.4	70.6
TOTAL	13	113	118	151	6	38	163	566	28	3786	188	24	5194		
ERROR OF OMISSION	7.7	6.2	7.6	22.5	0.0	15.8	1.8	21.7	7.1	43.6	41.0	50.0	PERCENTAGE CORRECTLY CLASSIFIED		Kappa statistic
PRODUCER ACCURACY	92.3	93.8	92.4	77.5	100.0	84.2	98.2	78.3	92.9	56.4	59.0	50.0	63%		41.9%

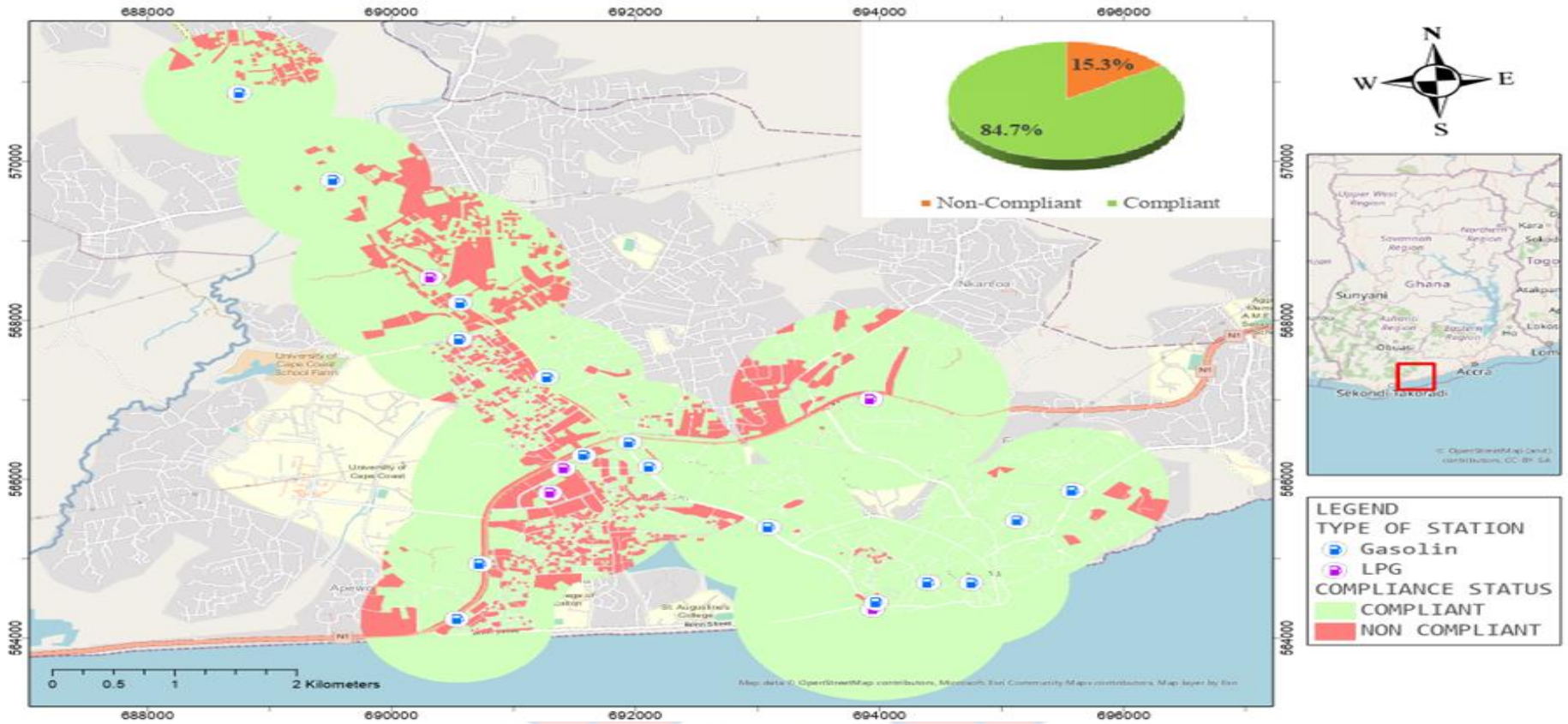

Figure 10: Map showing the level of compliance between existing and statutory land use within the vicinity of the fuel service station

Source: Field data, Fiah (2021)

In the case of the study, the kappa statistic was 0.419 and thus 41.9% and this suggests that there is a moderate level of agreement between the classifications (moderate agreement beyond chance). This is because the kappa is positive and greater than 0. Also, a Kappa of 41.9% means that less than half of the existing land uses near filling stations comply with the statutory land use plan. The overall accuracy or Percentage Correctly Classified (PCC) are existing land uses that match their statutory land use. This is to imply that the majority of the existing land use matched their statutory thus what is supposed to be as planned on the scheme. It is therefore noted that the level of compliance with the existing land use patterns relative to their statutory land use plan in the vicinity of fuel service stations is high as 63% of the land uses matched their statutory and 41.9% of Kappa statistics of the land use indicated good to moderate beyond chance on the land uses as represented in Table 4. However, the ArcGIS Pro was also used to determine and confirm the compliance status and it indicated a high level of land use compliance between the statutory and existing land uses as 84.7% of land use was compliant and only 15. 3% were not compliant as shown in Figure 10.

Furthermore, Over 60% (Error of commission) of land currently under agricultural use was not originally zoned for agricultural use. Only 40% (user accuracy) of agricultural land meant for agricultural purposes is being used for agriculture. It was observed that 7.7% (error of omission) of land meant for agriculture was lying fallow as a public open space while 92.3% (Producer accuracy) of land depicts a true representation of what the land is meant for as shown in Table 4. This result indicates that the agricultural land use according to the statutory scheme is less than that of the existing land use scheme

indicating more or an excess in agricultural use of land was identified on the ground as against agriculture use per the original scheme. This is to say for example that most land users engaged themselves in other land use such as public open space and even educational land use as seen in the case of the University of Cape Coast from the field where portions of land lying fallow for future developments by the University are being used by encroachers for farming and other related agriculture purposes.

Similarly, for the Commercial use of land, it was found that 59.2% of land under Commercial use was not zoned for such purposes. It was however observed that 7.6% of omission was used for other land use purposes such as Industrial, Mixed-use, public open space, and residential purposes while 92.4% (Producer Accuracy) of land for Commercial purposes was truly used for its purpose. This result indicates that the commercial land use according to the existing scheme is more than that of the statutory land use scheme. A study by Asamoah (2010) affirms that to the finding of the Cape Coast Metropolis that the trend of urbanization is generating a shift in architectural styles from compound residences to multi-story buildings, and from residential to commercial use as a redevelopment of houses is the predominant development tendency in the analyzed study area. This is not different in the case of the Cape Coast Metropolis as people have expanded their dwelling places to commercial purposes as indicated by the majority of respondents engaged in trading.

Again, 9.3% of land committed to education was not originally zoned for educational use. Only 90.7% of educational land was accurately meant for educational purposes and is being used for education. It was observed that

22.5% error of omission of land meant for education was lying fallow as the majority was in residential zones and 75.5% Producer accuracy of land depicts a true output of what the land is meant for based on the statutory scheme on education. This result indicated that educational land use according to the existing scheme is less than that of the statutory land use scheme and this was accounted for by encroachment from other land users. The University of Cape Coast for instance has had several issues from adjoining land users on encroachment for residential usage like hostels.

Furthermore, over 5.7% of land currently under residential use was not originally zoned for that purpose. It was observed that 43.6% of land meant for residential use was lying fallow while 56.4% of land depicts a producer accuracy of the land. This result means that the majority of land zoned for residential purposes has been shifted to other uses. That is, many have turned their residential place of dwelling into other profitable ventures, especially as educational centers and recreational grounds. According to the LUSPA, the area zoned for residential purposes happens to be the largest in the Metropolis but due to some reasons by land owners, this has shifted as people have rented their residential dwellings for other profit-making ventures.

Literature has also shown that changes in land use indicate to what extent and how humans respond to changing requirements or adapt to the environment, and they are both the back-and-forth results of human efforts to secure essential resources. For example, a study by Masore (2011) indicated that in the Masingini forest in Zanzibar, the forest experienced some drastic changes unlike what used to be in that plants and animals were lost due to urban growth. These were identified due to problems like infrastructural,

commercial, and residential developments that were noticed to take the positions of surrounding lands. The tremendous changes in the forest have insightfully been identified with certain conditions that are economic, social, and environmental in nature.

A study in line with these findings by Abass, Afriyie, and Gyasi (2018) in "From Green to Grey: The Dynamics of Land Use/Land Cover Change in Urban Ghana" underlined changes that occur within the Metropolis pertaining to land cover types that have experienced massive changes leading to population increase through natural increase and migration. This finding is in line with the findings from the Cape Coast metropolitan area as there have been alterations in land usage observed in the nearby areas of fuel service stations. Some exceeded their allocated land use into other categories of land use while others did not reach their usage limit which is conflicting in nature. These conflicting land uses can be a threat to these fuel service stations. The conflicting nature of land use affirms a study by Asamoah (2010) which found that there is more difficulty in delivering public services in the area where there has been a significant change in land use. People, for example, develop stores without making provisions for water supply. It is also difficult to obtain rights-of-way for power transmission. In addition, areas designated for managing waste are being invaded by people causing residential to commercial shift in land use and that has resulted in heavy motor and human traffics.

Again, according to Abass, Afriyie, and Gyasi (2008), the ability to provide the infrastructure needs for newcomers has led to an increase in the rate at which physical and social infrastructure are being put up by developers

in both the private and public sectors. They include but are not limited to, roads or highways, trading centers, corporate spaces, as well as residences. Abass et al., (2008), explicitly highlighted that due to an increase in the construction of poorly planned and haphazard buildings, usually leaning towards horizontal structures (which appear to be the trend of the day), there has been a significant increase in the infrastructure of all sizes and purposes being put up to cover extensive areas within the Metropolis over the past few years. It was therefore unsurprising that this increase in demand for space for all manner of purposes, as well as the haphazard building culture, was heavily linked to the destruction of the natural environment. To ensure that the growing need for land does not lead to the total annihilation of the natural ecosystems found within the metropolis, some portions of the lush natural lands were set aside for urban purposes. This need for more space for various purposes did not spare even the sporadically spread-out patches of vegetation that were situated along waterways.

An official of LUSPA, during an interview, explained some of the contributing reasons that accounted for the land-use change in the Cape Coast Metropolis as revealed in the quote below:

> *These include reviews from institutions such as NPA, EPA, and Fire Service that they work hand in hand with when it comes to issues on compliance from both adjoining land users and fuel service stations. Revisions in their policies especially with the NPA would affect compliance.*

An example is the previous distance requirement or interval for filling stations was 500 meters and is currently reduced to 300 meters. Accordingly, we have the mandate to review the local plan every five years, and based on that some land uses will change and that will bring differences in the schemes. For example, within a layout, we can zone a place for open space, but with time, and the increasing number of people, changes will set in since we have the mandate to review the local plan every five years.

Several other factors accounted for some land use types being re-purposed for other uses. These include geographic and environmental conditions such as demographic dynamics, global food consumption, energy demands, settlements and infrastructure, economic activities (trade and industry), land systems and zoning, land policy and development programs (conservation policies, financial investment), and weak regional planning.

The pattern of land use and the relationship between the existing and statutory schemes have been represented using Figure 10, a spatial analysis that was done using ArcMap Pro. It was observed that 84.7% of the land use in the vicinity of the fuel service stations complied with the land use regulation within the metropolis while 15.3% of them did not comply with the regulations.

Objective Three: ***What are the factors that influence land use compliance in the vicinity of fuel service stations in the Cape Coast Metropolitan area?***

This section presents the results of the study in relation to objective three. Being conversant with elements that exert some level of control on land use compliance is paramount. This is because obeying set rules for the usage of land ensures that a conducive environment is created and maintained for long-term physical development in a municipal area (GIZ 2012). Perspectives of residents in the vicinity of fuel service stations in the metropolitan area were sought to examine the conditions that may influence land use regulation compliance.

Table 5: Factors that influence land use compliance within the vicinity of fuel stations

Statement	SD F(%)	D F(%)	N F(%)	A F(%)	SA F(%)
The Assembly creates awareness of requiring or obtaining a building permit.	6(1.7)	46(13.1)	86(24.4)	164(46.6)	50(14.2)
The Assembly makes known to the public the basic requirements for obtaining a permit (evidence of land ownership, building permit application, 4 copies of the building plan)	24(6.8)	55(15.6)	76(21.6)	150(42.6)	47(13.4)
Most land users fail to acquire building permits before developing the lands	4(1.1)	30(8.5)	135(38.4)	154(43.8)	29(8.2)
Most people inherited the lands and the structures on them	2(0.6)	29(8.2)	124(35.2)	112(31.8)	85(24.1)
Land users and developers lack the necessary education on land use compliance	6(1.7)	57(16.2)	71(20.2)	175(49.7)	43(12.2)
Many land developers do not have and use site plans	5(1.4)	37(10.5)	146(41.5)	132(37.5)	32(9.1)
Demolishing poorly sited structures can influence compliance	53(15.1)	119(33.8)	25(7.1)	62(17.6)	93(26.4)
Inadequate qualified personnel can influence the level of land use regulation compliance	4(1.1)	57(16.2)	52(14.8)	196(55.7)	43(12.2)
Land-use regulation compliance is higher in neighborhoods of elite classes	14(4.0)	26(7.4)	27(7.7)	161(45.7)	124(35.2)
Law enforcement agencies responsible for land use regulation compliance are performing their tasks as expected	14(4.0)	48(13.6)	93(26.4)	170(48.3)	27(7.7)
Deterrence through withdrawal of permit can influence land-use compliance	24(6.8)	42(11.9)	32(9.1)	141(40.1)	113(32.1)
Punitive measures are likely to compel people to comply with land-use regulations.	41(11.6)	26(7.4)	26(7.4)	129(36.6)	130(36.9)

Table 5: Cont'd.

Some land developers and users encourage noncompliance with land use regulations by bribing responsible law enforcement agencies.	4(1.1)	24(6.8)	39(11.1)	194(56.0)	88(25.0)
People who have been part of the management/organizing committees and communal projects for a long are likely to have control over land-use compliance.	6(1.7)	63(17.9)	44(12.5)	200(56.8)	39(11.1)
People, who have the power to impact and make important decisions that change the course of your life can be influencers on land-use compliance.	6(1.7)	46(13.1)	36(10.2)	226(64.2)	38(10.8)
Having a leadership position in your area can highly influence decision-making/land-use regulation compliance	5(1.4)	32(9.1)	30(8.5)	229(65.1)	56(15.9)
The financial capacity of land users and developers influences land-use regulation compliance.	8(2.3)	24(6.8)	33(9.4)	132(37.5)	155(44.0)

Strongly Disagree=SD, Disagree=D, Neutral=N, Agree=A, and Strongly Agree= SA

Source: Fieldwork (2022)

Table 5 shows by representation in frequencies and percentages of responses from adjoining land users on the contributing factors to land use compliance in the vicinity of fuel service stations;

The "assembly creates awareness requiring obtaining a building permit" was to seek respondents' knowledge on awareness of the institution responsible for issuing development permits. The responses showed that the Assembly performed its task as expected of them by letting developers know about obtaining building permits before they started with their developments. From Table 5, 214 (60.8%) respondents agreed, and 52 (14.8%) respondents disagreed that the Assembly created awareness for obtaining permits. To confirm the rate of agreement from adjoining land users, an interview conducted with an official of LUPSA confirmed that the Assembly created awareness through the dissemination of information to land users.

> *Normally what we do is we do radio programs to educate the public on land use. We educate Chiefs, especially on lands, and tell them that they cannot just sell land without any proper local plan. We educate them on the usage of the land and that lands have diverse purposes so they should sell lands based on the land use purpose based on land details and its location. There is a need for landowners to take permits and ensure that lands are not to be sold to them where there are no local plans. (An official of LUSPA 2022)*

The view from the respondents is important because Alnsour and Meaton (2009) indicated that compliance is influenced by landowners' awareness of

zoning and residential regulations, and this may indicate a readiness or intention to comply or not with regulations.

Also, a revelation from the study showed that 183 respondents (52.0%) agreed with the statement that most land users fail to acquire building permits before developing the lands while 34 (9.6%) disagreed with the statement. These results showed that, in spite of the awareness creation, most people set up, build, or develop their lands before obtaining permits for reasons that, the document processing is lengthy and costly. This is in line with a study by Arimah and Adeagbo (2000), who found that landowners barely get permission out of their free wills because the process is convoluted, and takes more time with cost. Also, non-coordination among institutions participating in the permitting process is on the rise, resulting in overlaps in the permission process, delays, and expensive service costs. These happenings contribute to non-compliance as a way of creating conditions for which there is a violation of zoning regulations by residents. Another study by Bonye, Yiridomoh, and Der Bebelleh (2021) confirmed that at the time most respondents put up their structures, they had not officially obtained building permits. However, Section 91(1) of Act 936 states that no physical development by a person shall be undertaken except for first an endorsed written permit being issued for such development by the District Planning Authority. However, responses showed that people set up their structure without obtaining permits which is in contravention of the Act.

Furthermore, on whether demolishing poorly sited structures can influence compliance or not, the responses showed that 172 (48.9%) respondents disagreed with the statement while 155 respondents (44%) agreed

with it. This result indicated that there is no consensus as to whether demolishing poorly sited structures can influence land use compliance in the vicinity of fuel service stations. This is contrary to the findings of Arimah and Adeagbo (2000) that enforcement through some mechanisms like fines, structure demolishing, and notice of removal or stop work by the authorities can bring about adherence to regulations.

The enforcement mandate as stipulated per the Land Use and Spatial Planning Act, 2016, Act 925, Section 121 reveals that:

> *"An authorized officer without notice may carry out instant prohibition, demolition or removal of an unauthorized development if that breach is causing an environmental nuisance as expounded in an enactment that is related to the environment or seen as interference with public right of space usage* and the Local Governance Act 2016, Section 106(5 and 6) *where the owner, occupier or developer responsible for the construction, or development has failed to show enough cause why the building, structure, work or physical development should not be removed, altered or pulled down, the District Assembly shall, by notice, order the owner, occupier or developer to remove, alter or pull down the building, structure, physical development or other work within one month at the expense of the owner, occupier or developer. However, where the person responsible for the building, work, or development fails to comply with the order within the specified time, the district*

planning authority may carry out the removal, alteration, or pulling down, and recover the expense from the person, as if it were a debt from that person to the District Assembly". This means that the Spatial Planning Authority has the authority to carry out demolishing of developments that are not in compliance with the set land-use regulations and by so doing will enhance compliance with land-use regulations.

It was also noticed that, of the 352 respondents, the majority 239 (67.9%) 'Agree' that inadequate qualified personnel of the Planning Authority influence the level of land use regulation compliance. This is affirmed by Boamah et al (2012) recommend that construction sites are difficult to supervise at all stages of construction with the absence of requisite technological skills, and personnel, as well as insufficient logistics. This minimizes the number of inspections performed on active building projects. As a result, better-trained personnel are needed to boost capacity, not only to discover constructions without permits and properly examine building plans for compliance with standards but also to check constructions that are with approved plans and detect changes to plans that have already been approved. In order to enforce the regulations properly, it is expedient to get personnel vested by providing them with the necessary equipment that will help them to point out developments that are without permits.

In this regard, an official of the Spatial Planning Authority was asked if they had enough resources or the required capacities such as funds, personnel, logistics, and technology to enforce compliance on land use. He

remarked that though they have a task force in place as trained personnel who are in charge of inspecting developments frequently to ensure compliance, he admitted that funds and other logistics to aid their work were a challenge:

> *There are a number of our men (personnel) in terms of a task force that go around to monitor works on the grounds and report to the office. Often, we go around to check or inspect ongoing projects or projects that have commenced and are yet to commence. We have a task force in place who go every day and report after the day's work. The engineer and I go around to check twice a week to ascertain that what they came to report is just as it is. For a resource on technology, the introduction of the digital address system helps to come out with more local plans so places can be monitored and bring such places under compliance to set standards. Funds were initially given to run the office to meet the necessary resources needed and come out with local plans and review them every five years but as it stands now, for the past ten years, we have not received any of those funds to support us. However, we try to push through our budget to have little given to support our people in performing daily checks on land uses in the vicinity of fuel service stations. (Official of LUSPA, 2022).*

A study by Kimani and Musungu (2010) confirms the pressing conditions hindering how effective a development regulation could be including the inability to have the capacity to do inspections and supervision

and implement plans for developments, the inability to possess a system that supports enforcement, and the local authority's lack of resources for ensuring the wellbeing of developments. Arimah and Adeagbo, (2000) also confirmed that Municipality's monitoring and enforcement actions are hampered by logistical issues, which contribute to non-compliance with zoning regulations. Other challenges identified by Yakob et al (2012) to hinder the mandates of institutions responsible for ensuring compliance are financial resources, the lack of leaders who are committed to managing and implementing land-use plans, and the unavailability of institutional capacity.

Amidst these challenges, the study asked whether the law enforcement agencies responsible for land use regulation compliance are performing their tasks as expected. It was found that 194 (56.0%) agreed that indeed there is a performance from law enforcement agencies that influenced people to comply with set regulations. It is expected from the planning institution that they perform their task well as part of their mandates to make sure land users comply with the set standards in the vicinity of fuel service stations. These mandates are stipulated in the Land Use and Spatial Planning Act, 2016, Local Governance Act 2016, and Act 936.

Moreover, the majority 254 (72.2%) agreed that for land use regulation compliance to be possible, then withdrawal of permits from people who violate the land use regulations will serve as a measure to deter others. This is linked to the specific deterrence of the two main categories of the deterrence theory, Onwudiwe et al (2005). The goal of specific deterrence is to make offenders less likely to re-offend in the future. The prescribed sanctions are designed to deter only the individual offender from committing the offense

again in the future and because of the painful experience of being arrested or having one's building license revoked, a builder, for example, would be discouraged from building in an unlawful area.

An interview conducted with the LUSPA officer reveals as following:

> *On issues of warnings and sanctions, the new Act 925 explains that selling land without a local plan is against the law. A person can be imprisoned for selling land without a local plan and will serve in prison for a maximum of five years. A buyer of such land without checking for a local plan can also be imprisoned for a minimum of two years. That is why we educate people now and then warn them about lands sold and bought without any proper local plan. We also have sanctions for people who do not take permits but put up structures. We use the Local Governance Act 936, where there are portions that give details of sanctions to persons who develop land without a permit and even to those who develop with permits but without going by the local plans.*

A follow-up question was posed based on the response given by the LUSPA officer; What criteria do you adopt to deter people who violate the regulation, and what are the outcomes of these sanctions and warnings? The response was:

> *The use of a task force for daily checks is one main criterion to deter people not complying and a legislative instrument we depend on gives us the will to terminate*

permits and revoke permits from people who don't take heed to the warnings.

Act 925 stipulates that the District Assembly, in performing its tasks, should make it known by giving or issuing notices to persons in written form who are without permits but undertaking developments or have construction works ongoing or have completed developments. This is to say irrespective of the stage of physical development, the LUSPA has the mandate to perform its necessary task.

The LUSPA officer further remarked that;

Act 925, Section (115) gives us the power as a planning authority to even revoke a building permit that has already been granted. The planning authority may revoke a permit where the development does not comply with the conditions of the permit and revocation or modification of a permit is subject to the payment of a penalty determined by the Authority on receipt of a claim. These criteria help to make the work of the Assembly feasible and there is a great belief that there are positive outcomes from these sanctions and warnings once land-use regulations are present.

On other factors, 282 (81%) respondents agree that some land developers bribe law enforcement agencies which encourages some developers to carry out their developments even without permits or put up developments that are not in line with the planning scheme. Bribery is a form of negative manifestation of land use compliance which will result in haphazard developments and pose a great threat to these fuel service stations

in the long run. A study by Alnsour & Meaton (2009) argues that in most developing countries the enforcement of regulations is backed by some form of negative manifestations like corruption, nepotism, and favoritism. When these negative manifestations are identified with individuals responsible for promoting compliance then it can be said that some individual staff are also responsible for affecting compliance negatively.

The social capital of an individual is a social resource that can be manifested in membership in a group, how connected people are in a society, and networks among greater institutions and individual personalities have a great influence on land use compliance. That is people who have been part of the management/organizing committees and communal projects, people who have the power to impact and make major decisions in societal make-up and organizations for a long period and people who have leadership positions are likely to influence land-use compliance. In this regard, 239 (67.9%), 264 (75.0%), and 285 (81.0%) of the respondents agreed with these three statements respectively. Lin (1999) is a well-known social network analyst who studies how actors (individuals or organizations) use their social networks to achieve specific goals. Lin sets out to develop a social capital network theory. According to him, social capital is mined from social networks' embedded resources and then invested in social relationships with expected returns. Concern about one's social reputation has long been acknowledged as a key motivator for compliance.

Finally, the financial capacity of land users and developers influences land-use regulation compliance. From Table 5, the results indicated that the majority of respondents, 287 (81.5%) strongly agreed that the financial

capacity of land users and developers influences land-use regulation compliance. That is people who have supported societal well-being through financial resources are likely to influence land use compliance. The financial capital may be portrayed in cash forms, savings, credit, or debit forms also known as basic resources. However, there are other means by which financial capital can be presented. Some include technology, infrastructural-based equipment, and basic production which form the economic resources that necessitate people to engage in various livelihood strategies. (Kollmair & Gamper, 2002). It was drawn from these results that people's financial capacity influences compliance with land use regulations

Table 6: Linear regression model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.352a	0.124	0.122	0.978	0.124	49.414	1	349	0
2	.407b	0.165	0.161	0.956	0.041	17.29	1	348	0
3	.437c	0.191	0.184	0.943	0.025	10.895	1	347	0.001
4	.452d	0.204	0.195	0.936	0.013	5.86	1	346	0.016
5	.465e	0.217	0.205	0.93	0.012	5.392	1	345	0.021
6	.475f	0.225	0.212	0.926	0.009	3.896	1	344	0.049

Table 6 presents the linear regression analysis of the factors that influence land use regulation in the study area. From Table 6, model performance determinants such as the r-squared or adjusted r-square of the regression model demonstrated a strong performance. This indicates that the output from the regression analysis is fairly reliable. Regarding the factors that influence land use compliance, demolishing poorly sited structures, deterrence through withdrawal of permit, law enforcement agencies responsible for land use regulation performed their tasks as expected, the assembly creates awareness requiring or obtaining a building permit, the financial capacity of land users and developers and most people inherited the lands and structures on them were found to influence land use regulations in the vicinity of fuel service stations.

Out of the seventeen factors regressed against land use regulation in the study area, six of the factors were found significant. As shown in Table 6, this influence is statistically significant (P-Value < Alpha-value). Notwithstanding, (a) demolishing of poorly sited structures was found to be significant because poorly sited structures can influence compliance and thus regulations may play a role in promoting land-use compliance (Revington & Wray, 2022). Stricter enforcement and removal of non-compliant structures can deter others from violating land-use regulations. The Land Use and Spatial Planning Act 2016, Act 925, Section 121 states that an authorized officer may carry out instant demolishing of poorly sited structures if that breach is causing an environmental nuisance.

The regression of (b) deterrence through withdrawal of permit against land-use compliance was significant. This suggests that the fear of losing a building permit due to non-compliance might act as a deterrent, encouraging individuals to adhere to land-use regulations. (c) Law enforcement demonstrative significance influence on land use regulation compliance. This implies that when law enforcement agencies effectively carry out their duties, it could positively impact land-use compliance. Adequate enforcement might discourage individuals from violating regulations. The regression of the (d) Assembly creates awareness requiring or obtaining building permits against land-use compliance was statistically significant. According to Kollmair et al. (2002), increasing awareness of land use issues makes people comply with land use procedures or regulations.

The financial capacity of land users and developers (e) and developers influences land-use regulation compliance indicating that individuals' financial capabilities can influence their willingness and ability to comply with land-use regulations. This could mean that economic constraints may contribute to violations of land use regulations. This finding affirms a study by Kollmair et al. (2002) who found that the financial capacity of land users and developers influences land-use regulation compliance. They further explained that the huge financial capacity of some of the land users influences the purchasing of technology and infrastructural-based equipment, thus influencing compliance with land use regulations.

Moreover, the regression analysis showed that (f) people who inherit lands and the structures on them influence land use regulation compliance. This suggests that the inheritance of lands and structures might influence

compliance behavior. This could imply that people who inherit properties might have different motivations and levels of commitment to adhering to regulations. This finding showed that the process of inheriting properties, encompassing both land and the built structures upon it, could potentially exert a distinct impact on individuals' attitudes and behaviors toward adhering to regulatory guidelines. Such an influence might stem from a multitude of factors, ranging from the emotional attachment to inherited properties to the inherent responsibilities that come with owning a property due to inheritance. Heikkila and Harten (2023) explained that individuals who have inherited lands and structures might display varying motivations and levels of commitment when it comes to complying with land use regulations. Moreover, reasons such as preserving family legacies, safeguarding sentimental value, or managing the financial aspects associated with inherited properties influence land use compliance.

Chapter Summary

Information concerning the socio-demographic characteristics of respondents was presented in this chapter. It also mapped out the pattern of land use in the vicinity of fuel service stations as well as the distribution of fuel service stations in the Cape Coast Metropolitan area. Subsequently, the chapter highlighted the level of compliance between the statutory and the existing land use. The last section of the chapter discusses the factors that influence land use compliance The next chapter focuses on the summary, conclusions, and recommendations of the study.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This chapter presents the summary, conclusions, and recommendations based on the objectives of the study. Conclusions drawn from the findings and recommendations to improve land use regulation compliance in the vicinity of fuel service stations in the Cape Coast Metropolitan area and elsewhere were presented also. The chapter ended with the study's contribution to knowledge.

Summary

The study's goal was to assess land-use regulation compliance in the vicinity of fuel service stations within the Cape Coast Metropolitan area. More specifically, the research was carried out with the following specific objectives:

1. Map out the land use pattern around fuel service stations
2. Assess the level of compliance between existing land use patterns and statutory planning scheme land use plans within the vicinity of fuel service stations.
3. Examine the factors that influence land use compliance within the vicinity of the fuel service station.

The philosophy underpinning this study is pragmatism, involving a combination of interpretivism and positivist approaches. The mixed-method research design was adopted as well. In all, 371 respondents were sampled for the study. The study used structured questionnaires to solicit information from bonafide land users/heads of households with a sample of 352 respondents which were derived by use of systematic random sampling. Additionally,

interviews were conducted with 18 fuel service station managers and one representative from the Land Use and Spatial Planning Authority. An observation checklist embedded in the SW Map was used to compare what is on the ground to the statutory scheme and in addition with the ArcGIS-Pro application software to make a Spatial analysis comparison from the planning scheme obtained from the Land Use and Spatial Planning Authority to determine the level of compliance between the existing land use and the statutory land use scheme. The data collected were analyzed and presented in frequencies, percentages, and maps.

Summary of Key Findings

The key findings of the study were as follows:

On the first objective, it was found that the majority of the fuel service stations were in line with NPA's distance requirement of 300 meters from stations on the same side of the road. Many public institutions have also been identified to fall within the distance of 500 meters from LPG stations as against the NPA standard requiring that public institutions must be 500 meters away from LPG stations. It was also revealed that a number of the fuel stations were identified with hot works from adjoining land use.

Again, it was found that fuel service station managers have in place measures to ensure compliance with their outfits. Their workers undergo fire-safety training to be readily vested against any fire outbreak. Institutions such as the NPA, GNFS, and EPA performed their routine checks as well at the fuel service stations.

For the second objective, the study revealed that there have been variations in the land use scheme, thus the difference between the statutory and the existing land use scheme. One factor identified by LUSPA to cause this variation in land use was the fact that reviews are done by some regulating institutions like the EPA, NPA the Fire service, and even the LUSPA as part of their duties in ensuring compliance since they work hand-in-hand on land use as confirmed by the LUSPA. In general, geographic and environmental conditions such as demographic dynamics, global food consumption, energy demands, settlements and infrastructure, economic activities (trade and industry), land systems and zoning, land policy, and development programs were identified for accounting for the variation in land use.

Also, it was found that the majority of the land use exceeded their use limits while only a few were within their use limit as zoned by the LUSPA. Also, the study revealed that land use compliance in the metropolitan area is very good as 84.7% of the users within the vicinity of fuel service stations complied with the regulations and from which a land use compliance map was generated.

The study found that the majority of the respondents in the Metropolis are very aware of acquiring building permits but relatively fewer of them had permits for their structures.

The third research objective finally focused on the factors that influence land use compliance in the vicinity of fuel service stations in the Cape Coast Metropolitan area. The study revealed that the Land Use and Spatial Planning Authority performed their tasks as expected of them to ensure compliance with land-use regulations. However, they do not have enough

resources in terms of funds, logistics, and technology to aid in implementing more strict measures to enhance full compliance with land use regulations.

The study also revealed that people who are financially stable, socially connected, and can make a great change in society and people's lives influence land use compliance. This is because they can use these capabilities to influence policymakers and stakeholders responsible for ensuring land use compliance.

However, based on the regression of the responses from respondents, it was found that some of these factors as responded to by respondents indicate that most of them are not statistically significant. The statistically proven factors identified include demolishing poorly sited structures, deterrence through withdrawal of permit, law enforcement agencies responsible for land use regulation performing their tasks as expected, the assembly creating awareness requiring or obtaining a building permit, the financial capacity of land users and developers and most people inherited the lands and structures on them were found to influence land use compliance in the vicinity of fuel service stations.

One interesting revelation from the study indicated that there has been a high disagreement among respondents that demolishing poorly sited structures can influence compliance. This is to say, they discourage the demolishing of poorly sited structures by the LUSPA as many structures on the land use were identified not in very close proximity to fuel service stations but most on waterways which could be a great threat should there be a heavy downpour and in the long run, might affect fuel service stations.

Conclusions

The following conclusions were made from the findings of the study:

1. On objective one, the majority of fuel service stations in the study area are in line with the National Petroleum Authority's (NPA) distance requirement of 300 meters from stations on the same side of the road. However, several public institutions were found to be within a distance of 500 meters from LPG stations, violating the NPA standard. This suggests a need for better adherence to safety regulations, especially concerning the location of public institutions near potentially hazardous facilities like LPG stations. The study concluded that land uses found very close to fuel service stations that engage in fire-related activities are likely to be more vulnerable than other land uses farther apart. This is to say that should there be a disaster, the land uses in the closest vicinity would face severe impact as compared to those outside the stipulated distances.
2. With respect to objective two, there are variations between the statutory and existing land use schemes, and the study identifies several factors contributing to these differences. The involvement of multiple regulating institutions, such as the EPA, NPA, Fire service, and LUSPA, in land use reviews plays a role in shaping land use decisions. Additionally, various geographic, environmental, demographic, and economic factors account for the variations in land use. Addressing these variations requires effective coordination and monitoring among regulatory bodies to ensure better alignment with the statutory land use scheme. While the majority of land use within

the vicinity of fuel service stations complies with regulations, there are instances where land use exceeds its use limits as zoned by the Land Use and Spatial Planning Authority (LUSPA). This points to the importance of stricter enforcement of zoning regulations to ensure that land use adheres to the designated use limits and supports sustainable development. It is concluded that there was a high level of land use compliance in the vicinity of fuel service stations in the Cape Coast Metropolis.

3. Among the factors that influence land use compliance, regression analysis revealed that demolition of poorly sited structures, withdrawal of permits, effective law enforcement, awareness creation, and financial capacity of land users and developers are significant factors that influence land use compliance in the vicinity of fuel service stations. Financially stable individuals, permit seizure and influential stakeholders can play a role in shaping land use decisions and ensuring adherence to regulations. However, it is crucial to balance the influence of powerful stakeholders with the need to maintain safety and compliance with land use regulations. It is concluded that people who are financially stable influence land use compliance by violating land use regulations without punishment.

Recommendations

The following recommendations were made from the conclusions of the study:

1. Land use found within proximity to fuel service stations that engage in fire-related activities should be checked, and regulated by the regulating bodies (NPA, EPA, or LUSPA) and if possible, should be halted from performing such activities since they have the power to do so. Inspections from these regulating bodies should continue and the GNFS should continue with the regular simulation exercise which would keep fuel station workers active and ready should a disaster occur.
2. There was a high level of land use compliance in the Cape Coast Metropolis based on the generated land use map. It is recommended that the LUSPA adopt the mapped-out land-use maps generated in this study to track land-use activities in the vicinity of the fuel service station since the map showed compliant and non-compliant areas.
3. It is recommended that to ensure land use compliance at all levels, stakeholders responsible for land use compliance should deal equally with people who would violate the land use regulation standard irrespective of their wealth and status without nepotism or favoritism. The LUSPA should be in its capacity by taking a bold step in dealing with defaulters of land use regulations by prosecution since they have the power to do so and this will deter others from siting in unauthorized places.

Contribution to Knowledge

This study came out with a land-use map for the Cape Coast Metropolitan area to inform stakeholders and other researchers about areas that have changed over time, areas that comply, and areas that do not comply with land-use regulations. Also, areas likely to have high risk were identified which will inform policymakers, especially those in the Oil and Gas industry about siting fuel dispensing stations.

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APPENDICES

APPENDIX A

INTERVIEW GUIDE FOR LANDUSE AND SPATIAL PLANNING AUTHORITY (LAND USE AND SPATIAL PLANNER)

Interview date:

Interviewee Position:

Educational background:

Introduction

This is a guide meant to purposely obtain information on the **level of compliance between existing land use patterns and statutory planning scheme land use plan and analyze their permitting status within the vicinity of the fuel service stations, and the factors that influence the land use compliance within the vicinity of the fuel service station.** This information is purely for academic purposes. The discussion will be taking your experiences and roles as a Land Use and Spatial Planner who deals with issues of compliance on land use within the Cape Coast Metropolitan area and providing answers to spatially related questions on fuel service station sites within the Metropolis, as well as other land-uses. You are highly assured of the confidentiality of whatever responses you may provide.

Questions on the level of compliance between statutory and existing land use scheme

1. Could there be some driving forces that would bring variance in the level of compliance between the statutory and the existing land use scheme?

(Probe: How do you intend to deal with such forces as a land-use regulatory body to promote compliance? Do you think people who build do so according to the statutory land use scheme as desired by your outfit and What is your reason for thinking so?)

Questions on conditions affecting compliance in the vicinity of the fuel service station.

2. How do you get compliance and zoning regulation awareness to landowners/developers around fuel service stations in the Cape Coast Metropolitan area?

   (Probe: On what basis do you attest that land owners are aware of compliance and zoning regulations around fuel service stations? How often do you carry out awareness programs to educate landowners on compliance regulations? Do you think the land-use regulations are properly formulated and implemented?)

3. Do you have enough resources (funds, personnel, logistics, and technology) to improve compliance on land use?

   (Probe: How often do you go around to inspect ongoing construction works and buildings of fuel service stations and adjoining developments? How do you deal with issues of the statutory planning scheme and existing land use differences i.e., permits taken to build say residential facilities on paper but used for a different purpose?)

4. Are there some warnings and sanctions placed on landowners who do not implement standards according to the Cape Coast regulations?

   (Probe: what criteria do you adopt to deter people from not complying? What are the outcomes or effects of these warnings and sanctions?)

5. How are landowners motivated to ensure permitted uses, especially for residential standards?
6. How are landowners concerned with respect to ensuring residential standards and ways of addressing such concerns?
7. What do you think by estimation is the percentage of landowners that have complied with land use regulations since the implementation of the local plan? How do you foresee the future of land use compliance within fuel service stations in the Cape Coast Metropolitan area?

APPENDIX B

INTERVIEW GUIDE FOR FUEL SERVICE MANAGERS

Interview date:

Interviewee Position:

Educational background:

Introduction

This is a guide meant to purposely obtain information on the **factors that influence land use compliance within the vicinity of the fuel service station.** This information is purely for academic purposes. The discussion will be sought from you (fuel service station managers) only to know your views on how the activities of adjoining land use are going to have an impact on the fuel stations and ways by which you can cater for your business in times of disaster. You are highly assured of the confidentiality of whatever responses you may provide

Thank you.

1. The number of years the fuel station has been in the location

a) less than 1 year b). 1-5yrs c). 6-10yrs d). 11-15yrs e). 16-20yrs f). Over 20yrs'.

2. How did your fuel retailing business come to this community?

   (Probe: Was it an already building that was transformed into that? Was it in operation before adjoining land uses came into existence? Based on the permit from the Land Use and Spatial Planning Authority, is your retail setup supposed to be in this current location?)

3. What are the safety standards you consider looking at the variety of works from adjoining lands and your outfit that could cause disaster?

(Probe: How likely are you to be fearful because of adjoining land use fire-related activities close to fuel service stations? Looking at the position of your fuel retail business, is the distance from adjoining infrastructure going to disturb your fuel retail services? What measures are in place to ensure compliance from adjoining land use so that your fuel service retail business is not compromised and how your outfit is to ensure compliance so that adjoining lands are not affected as well? If an accident/ disaster occurs from adjoining land, what backup systems are in place to contain the situation from your outfit).

4. How do you foresee the future of your safety and compliance with adjoining land use within the community in which your business lies?

APPENDIX C

QUESTIONNAIRES FOR HEADS OF HOUSEHOLDS/ BONAFIDE LANDOWNERS/LAND USERS.

Introduction

This is a questionnaire meant to purposely obtain information on **factors that influence land use compliance within the vicinity of the fuel service station.** This information is purely for academic purposes. The answers will be sought from you (bonafide landowners) only to know your views on how compliant you are or not, thus your permitting status, the kind of land you are operating on with its associated activities near fuel service stations, and how they are going to have an impact on the fuel stations. You are highly assured of the confidentiality of whatever responses you may provide

Thank you.

Instruction

Please tick where appropriate

SECTION A: SOCIO-DEMOGRAPHIC DATA OF RESPONDENT

1. Respondent's gender

(a) Male [ ] (b) Female [ ]

2. Age of respondent

a). 18- 29 [ ] b). 30- 39 [ ]

c). 40- 49 [ ]

d). 50- 59 [ ] e). 60yrs and above [ ]

3. Education status

a) no formal education [ ] b). basic education [ ]

c). secondary education [ ] d). tertiary education [ ]

4. Employment status

a). Unemployed [ ] b). Self-employed [ ]

c). Employed (Government) [ ] d). Employed (Private) [ ]

5. If employed, what is your main occupation?

a). Farming [ ] b). Trading [ ]

c). Public servant [ ]

d). Manufacturing and repairs [ ]

6. What kind of residential facility closer to the fuel service stations do you reside in?

a). House [ ] b) Church [ ] c) Mosque [ ]

d). School [ ] e) Health facility [ ] f) Shop/kiosk

7. What is the ownership status of the facility

a). Rented b). Owned

c). Family property d). Caretaker

8. Duration of operation or living on land use type.

a). Less than a year b) 2 to 4 years c) 5 to 9 years

d). Beyond 10 years

9. Do you have a permit or a site plan for your facility?

a). Yes [ ] b). No [ ] c) Don't [ ]

10. Are you an indigene of Cape Coast?

a). Yes [ ] b). No [ ]

SECTION B: Factors affecting land use compliance regulations within the vicinity of the fuel service station in the Cape Coast Metropolitan area.

Instruction: Please tick (**'√'**) your degree of agreement or disagreement (Strongly Agree=SA, Agree=A, Neutral=N, Strongly Disagree=SD, Disagree=D) with the statements

	Statement	SA (1)	A (2)	N (3)	SD (4)	D (5)
11	The Assembly creates awareness of requiring or obtaining a building permit.					
12	The Assembly makes known to the public the basic requirements for obtaining a permit (evidence of land ownership, building permit application, 4 copies of the building plan)					
13	Most land users fail to acquire building permits before developing the lands					
14	Most people inherited the lands and the structures on them					
15	Land users and developers lack the necessary education on land use compliance					
16	Many land developers do not have and use site plans					
17	Demolishing of poorly sited structures can influence compliance					
18	Inadequate qualified personnel can influence the level of land use regulation compliance					
19	Land-use regulation compliance is much higher in neighborhoods of elite classes					

20	Law enforcement agencies responsible for land use regulation compliance are performing their tasks as expected.					
21	Deterrence through withdrawal of permit can influence land-use compliance					
22	Punitive measures are likely to compel people to comply with land-use regulations.					
23	Some land developers and users encourage noncompliance with land-use regulations by bribing the responsible law enforcement agencies.					
24	People who have been part of the management/organizing committees and communal projects for a long are likely to have control over land-use compliance.					
25	People who have the power to impact and make important decisions that change the course of your life can be influencers on land-use compliance.					
26	Having a leadership position in your area can highly influence decision-making/land-use regulation compliance					
27	The financial capacity of land users and developers influences land-use regulation compliance.					

Thanks for participating in this survey

APPENDIX D

AMENDMENTS TO THE GUIDELINES FOR SITING PETROLEUM PRODUCT RETAIL OUTLETS

NATIONAL PETROLEUM AUTHORITY
No. 6 George Walker Bush Highway, Dzorwulu, Accra
C.P.M.B
Cantonments, Accra
Tel: +233 302 766 195/6
Email: info@npa.gov.gh
Website: www.npa.gov.gh

NPA/IML/OMC/01/12

10th June, 2020

To: All OMCs and LPGMCs

Amendments to the Guidelines for Siting Petroleum Product Retail Outlets

The Authority wishes to inform you of amendments to the Guidelines for Siting Petroleum Products Retail Outlets (PPROs) which had been under implementation since January 2016.

The existing Guidelines were reviewed in 2017 based on feedback received from stakeholders. Additional concerns received following the last review necessitated the need for the current review to accommodate and incorporate current industry standards and norms to make it relevant and up to date for use.

Please find attached a summary of the revised distance requirements for siting PPROs as **Appendix 1**. Also attached is the complete and detailed Guidelines for Siting PPROs as for your information and necessary action.

Kindly note that the Guidelines are effective, ***1st June, 2020*** and shall not apply to any retail outlet retrospectively.

In light of the above, please be informed that all applications that were previously refused for not meeting the minimum distance requirements may be re-submitted anew with accompanying processing fee for consideration. Appeals of previous applications will not be accepted.

Please take note and be guided accordingly.

Alhassan S. Tampuli
Chief Executive

Cc:

1. *The Honorable Minister, Ministry of Energy, Accra.*
2. *The Industry Coordinator, AOMCs, Accra.*
3. *The Executive Director, Environmental Protection Agency, Accra.*
4. *The Chief Fire Officer, Ghana National Fire Service, Accra.*
5. *Land Use and Spatial Planning Authority, Accra.*
6. *The Chief Inspector, Department of Factories Inspectorate, Accra.*
7. *Office of the Head of Local Government Service, Attn: Dr. Nana Ato Arthur*

Revised Distance Requirements for Siting PPROs

No.	Parameter	Previous Requirement	New Requirement
1	Distance From Next Station on same side of road	500m (FS/SS) / 1000m (1km) (LPG)	**300m**
2	Staggered Distance from Next station (across road)	500m (FS/SS) / 1000m (1km) (LPG)	**300m**
3	Distance between a Service Station and an LPG Refilling Plant on the same side of the road	1000m	**500m**
4	Staggered distance between a Service Station and an LPG Refilling Plant	1000m	**500m**
5	Distance from 11KV – 33KV Line	10m from the centre of the Transmission Lines	**10m from the centre of the Transmission Lines to the boundary of the proposed site (facility).**
6	Distance from 69KV – 161KV Line	15m from the centre of the Transmission Lines	**15m from the centre of the Transmission Lines to the boundary of the proposed site (facility).**
7	Distance from 225KV – 330KV Line	20m from the centre of the Transmission Lines	**20m from the centre of the Transmission Lines to the boundary of the proposed site (facility)**
8	Distance from nearest public institution	60m (FS/SS) / 500m [(LPG)(Light or Heavy industrial Area)]	**Preferred is 60m (FS/SS) / 500m [(LPG)(Light or Heavy industrial Area)]** **Where the recorded distance is less than the preferred, applications will be reviewed further by the Authority on a case by case basis**
9	Distance from hot works	200m	**100m for FS/SS and 200m for LPG**
10	Road bend	60m	**60m**
11	Distance from Environmentally Sensitive Areas such as Wetlands, Dumpsites Streams, Rivers	60m	**30m for FS/SS and 60m for LPG**

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

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OMB NO: 0990-0279
IORG #: IORG0009096

6TH JUNE, 2022

Mr. Silas Mawuena Fiah
Institute for Oil and Gas Studies
University of Cape Coast

Dear Mr. Fiah,

ETHICAL CLEARANCE – ID (UCCIRB/CHLS/2022/21)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your research **Compliance with Land use Regulations in the Vicinity of Fuel Service Stations: A Study of the Cape Coast Metropolitan Area.** This approval is valid from 6th June, 2022 to 5th June, 2023. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD

UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST