URBAN MANAGEMENT IMPLICATIONS OF PERI URBAN GROWTH IN BAUCHI METROPOLIS

BY

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M.Sc Urban Management

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF URBAN AND REGIONAL PLANNING,

FACULTY OF ENVIROMENTAL DESIGN

AHMADU BELLO UNIVERSITY

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B. Tech. (Hons) U .R.P. (FUT- Yola 2008)

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DECLARATION

I declared that this Dissertation entitled Urban Management Implications of Peri Urban Growth In Bauchi Metropolis**.** Has been performed by me in the Department of Urban and Regional Planning, Faculty of Environmental Design, Under the Supervision of Professor A. Ahmed and Dr. J. S. Oladimeji

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for the award of any other Degree or Diploma at any other University.

………………..................………………………..
Date
Muhammed Magaji SALEH

CERTIFICATION

This Dissertation, Urban Management Implications of Peri Urban Growth in Bauchi Metropolis. By Muhammed Magaji Saleh meets the regulations for the award of Masters of Science Ahmadu Bello University Zaria, and is approved for its contribution to knowledge and literary presentation

……………………………….. ………………………………..

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Chairman Supervisory committee

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Dean Postgraduate School

DEDICATION

This work is dedicated to Allah who his infinite mercies shows me through the entire programme from its beginning to the end and to my late father Malam Saleh Dukawa Kurba for moral support. May his soul rest in peace.

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ABSTRACT

The study examines the pattern and growth process of peri urban areas in Bauchi town with a view to identify implications. The data required for the study are drawn from Primary and secondary sources. Primary data includes, the Physical attributes such as physical site, site layout, location of buildings and available infrastructure were collected to ascertain the pattern and quality of peri urban growth and development. ArcGIS 10.1 was used to analyzed the process of peri urban growth and development. The product of this was used to answer the research questions set out in the study which are, what is the pattern of peri urban growth and development in Bauchi and what are the implications of the peri urban growth pattern of Bauchi? The findings of the study shows, that the total built up area of Bauchi metropolis in year 2000 was established to be 34.5km^2. The peri urban areas in 2010 covered a total of 79.92 km^2. By 2015, this had increased to 109.55km^2. The area with the highest land coverage in 2010 was the South – West at 25.90km2 representing 32.40% of the total land cover of the town. The growth characteristics of the peri urban areas of Bauchi metropolis was determined by using three variables. These are the spatial structure/form, existing infrastructure and housing characteristics. The factors responsible for peri urban growth were, Ineffective planning of the city, ineffective development control, absence of up to date master plan Ineffective development control and Inadequate staffing of the urban development board. The urban management implications of peri urban growth pattern of Bauchi metropolis are, difficulty in supply of infrastructure, Security, loss of revenue to the government and unsanitary condition. Based on the foregoing, the following recommendations are made, Containment of peri urban areas and Regularization of Land ownership, Strengthen planning institutions, Provision of physical infrastructure. Review of the Bauchi Master plan, Provision and upgrading of basic infrastructure and services in peri urban areas, and need to encourage Participatory development.

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CHAPTER ONE

INTRODUCTION

Peri urban growth in sub-Saharan Africa is mainly taking place in an unplanned manner creating low-density development and uneconomic use of environmental resources. Most peri urban areas in the region are faced with deteriorating environmental conditions and a weak public sector unable to provide adequate services (Stren and White, 1989; Nordberg and Winblad, 1994; Peil, 1994). Nigeria is no exception and most residential areas are characterised by poor environmental quality. There is also the perception of peri urban settlement to include all settlements that are marginal to the physical and regulatory boundaries of the formal city. In other words, Local and National governments consider the urban formal sector legitimate, but they do not approve of the peri urban/informal sector settlement (Taylor 2004).

Peri-urban settlements largely develop outside of government control and do not follow strictly formal and traditional urban planning and development processes. It is important to note that, the peri-urban sectors are not monolithic and, more often than informal settlement have developed as a hybrid of formal and informal systems. Peri-urban areas are growing much more rapidly than formal urban districts. In many cities, the peri-urban sectors are already bigger than the formal areas. Their rapid growth and informal status have resulted in uncoordinated urban growth. Whereas the recognition of the significance of the urban challenges posed by informal areas in recent, attempts at regularizing them date back to 1960. Since 1960s a body of laws, decrees and regulations have been enacted covering all aspects of urban development from master plan, land subdivision to building codes and standards for infrastructures.

Urban management involves managing cities, ensuring that all regulations relating to city management are strictly adhered to. This means that citizens must be involved in the planning and implementation of development plans. It also means taking administrative procedures to those that are directly involved. This implies that all stakeholders should be involved and be aware of the effects and consequences of issues relating to planning of urban centers (UNCHS Habitat 1999). Knowing the factors affecting urban development is an important advantage in highlighting the pattern and implication of peri urban development. On the basis of these, different theories have been developed in the early and mid-1950s to explain how cities grow. These are the Chicago school perspective which was formulated in the late "20s mainly by Burgess, considered illegal housing as a result of income level differences of various ethnic groups who competed for urban land. He proposes that present cities shape themselves through struggles for control upon urban space by social groups .These struggle result in areas segregated into zones of protection and/or terror or otherwise zones of legal and illegal activities of all kind.

The neoclassical scheme by Alonso (1968) suggested that illegal housing was as a reaction to the housing needs of the people who cannot affords to pay for the formal housing as a factor influencing the peri urban development.

1.1 STATEMENT OF RESEARCH PROBLEM

Peri-urban areas of Bauchi town have grown rapidly in recent times as receivers of migrant population displaced by insurgency and ethno-religious crisis in the north-east and neighbouring Plateau State. The growth is mainly informal and uncoordinated, and is characterized by uncertain and illegal land tenure, low level of sanitation and minimal or no infrastructure. Most of the areas have also developed on fragile land. Because such growths have occurred outside of Government control, self-imposed and autonomous governing frameworks have taken root. The process of land acquisition and land preparation for development for instance, is determined by informal rules which often contradict formal/institutional planning regulations.

Like many cities, such peri urban areas have grown to constitute not only challenges for the parent city, but as self-governed areas, they also present constrains to sustainable urban development. This study examines the pattern and growth of peri urban areas in Bauchi town and the way such growth constitutes challenge for effective urban management. Previous researches on peri urban settlements have been on land use and land cover change, transportation and environmental problems (Anderson, 2000; Adeniyi, 1999; Graham, 2004; Damina, 2012, Webster, 2002; Taylor, 2004). In a climate of increased insecurity in Nigeria, it is important to establish the pattern of peri urban growth influenced by rapid immigration and the associated urban management consequences. The findings of the study will provide further insight on challenges confronting cities in conflict areas and of urban management strategies to address the problems.

1.2 RESEARCH QUESTIONS

1. What is the pattern of peri-urban growth and development in Bauchi?

2. What are the implications of the evolved pattern of Bauchi in terms of facilities requirement?

1.3 AIM OF THE STUDY

The aim of the study is to examine the pattern and growth process of peri urban areas in Bauchi town with a view to identify implications and make appropriate recommendations.

1.4 OBJECTIVES

1. To examine the concept and urban management implications of peri urban growth.

2. To determine the growth pattern of peri-urban areas of Bauchi town.

3. To establish the urban management implications of the evolved pattern.

4. To identify challenges and make appropriate recommendations.

1.5 SCOPE OF THE STUDY

The study was focused on pattern and characteristics of peri urban growth and development in Bauchi town and the associated implications. The housing forms and actors involved in transaction and transfer of the land ownership in peri urban areas in Bauchi is also covered.

1.6 SIGNIFICANCE OF THE STUDY

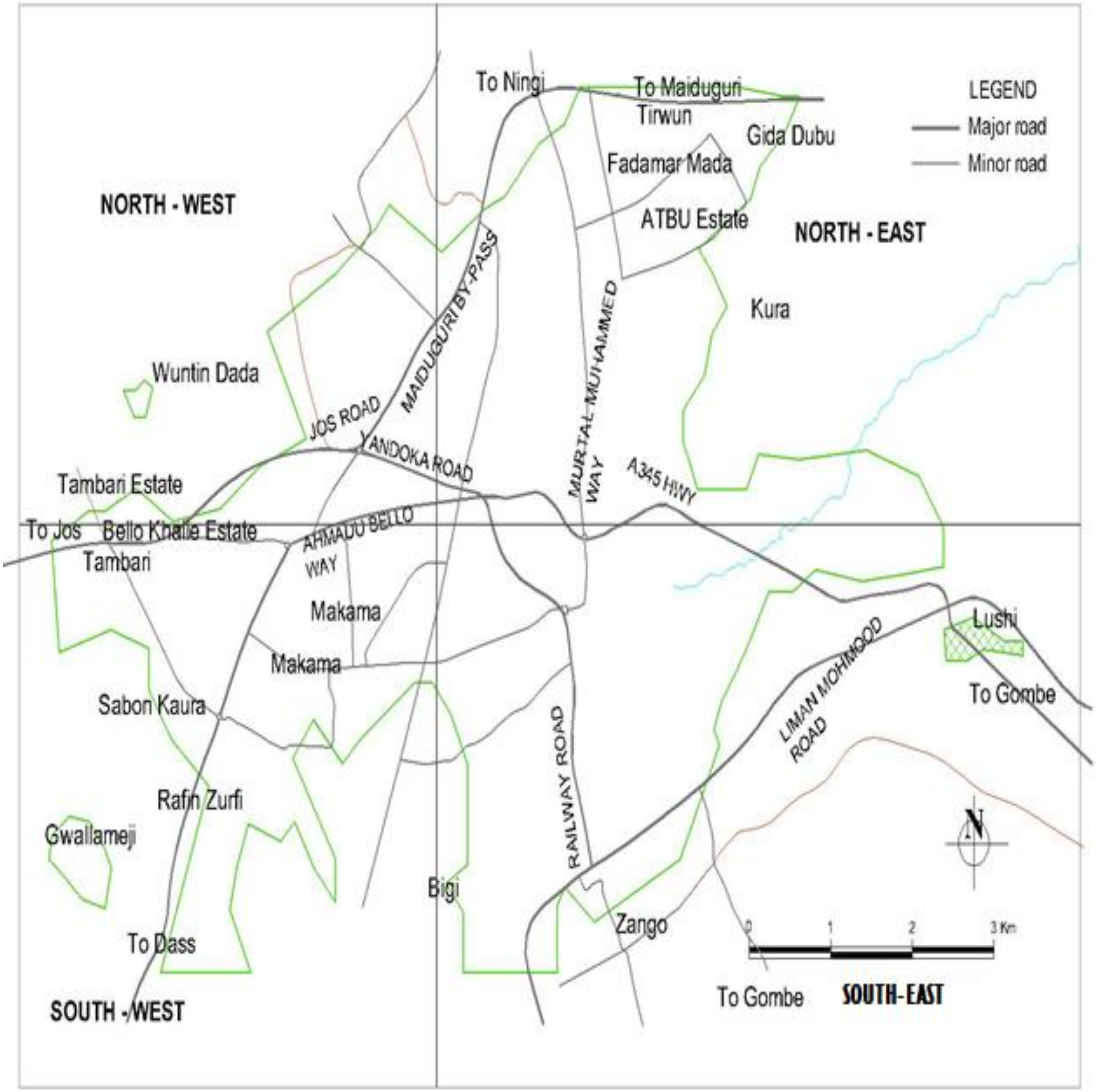
The outcome of the study will enable understanding of the changes and implications of the peri urban development that required intervention by the relevant stakeholders (policy makers, decision makers as well as development team and enforcement agencies

1.7 THE STUDY AREA

Bauchi town is located at latitude 10^0 17^1 North and longitude 9^0 49^1 North. Bauchi is the state capital of Bauchi State. The town enjoys a rainfall of about 1091.4 mm annually, the hottest month is usually April (with 40.56^0C) while the coldest months are December and January with typically 6.11^0C and 7.22^0C respectively. A minimum and maximum annual temperature in the town is 18.33^0C and 32.39^0C respectively.

The city is said to have been founded about the year 1753 by the one Yakubun Bauchi, the first Emir of Bauchi .The name of the town is said to have been derived from a foremost hunter Baushe.

MAP OF BAUCHI METROPOLIS



Bauchi Street guide map; Sources M .O. W & H. (2012.)

1.7.1. Geology and Relief

Bauchi lies generally at an altitude of about 600m above sea level, being part of the central Nigeria highlands and Jos Plateau complex. However, two broad relief zones can be identified, as follows:

Eastern high land area of hill ranges, including the northern edges of the Jos Plateau complex. This is part of the crystalline rock area in central northern Nigeria. The hill ranges are developed on basement complex rocks, in an area which is also characterized by extensive plateau surfaces and volcanic extrusions. The base of the hill ranges is generally at the 600m level, while peaks rise to 700.6m on the hills, and 729.3m on the Bunsil hills.

A central high plain (of the Hausa land) area, belonging to the Kerri Kerri and Gombe sandstone and shale, of Tertiary Age. Isolated hills punctuate the high plain in several places, and reach heights of 798.5m on the Lamurde hill, and 816.4m on the Ligri hill. Indeed, most of the isolated hills in this zone are over 760m. Bauchi town lies within the undifferentiated basement complex with older granites (out-crops) and younger granite out-crops. Now has an eight-like shape, with allotted lower region, with about two-thirds of the land area being south of latitude 11°15[1]

1.7.2. Surface Drainage and Ground water Situation

The town is drained by several river systems. The dominant one is River Gongola which originates in the Jos Plateau area, southwest of Bauchi State. It traverses, in a southwest-north east direction through the southern Local Government Areas of the state including Dass, T/Balewa,

Bogoro, and Kirfi and, thence, to Gombe State. It has numerous headwaters and tributaries within the state.

They include Rivers Surr, Lere, Maijuju, Rafin Bagel, Gangala and Gubi in the southwest part; Rivers Guji, Yuli, Ruhu, Dukut and Panana in the south and south-east parts. Through these tributaries and several other smaller streams and rivulets, the Gongola system provides considerable advantages.

1.7. 3 Climate

Temperatures are, as would be expected, generally high in the town. Mean daily maximum temperatures range from 29.2°C in July and August to 37.6°C in March and April. The mean daily minimum ranges from about 11.7°C in December and January to about 24.7°C in April and May.

1.7.4. The sunshine

Hours range from about 5.1 hours in July to about 8.9 hours in November. Indeed, October to February usually record the longest sunshine hours in the town.

1.7.5. Humidity

Ranges from about twelve per cent in February to about 68 per cent in August.

1.7.5. The rainy season

Months are May to September, when humidity ranges from about 37 per cent to 68 per cent. Monthly rainfall ranges from 0.0mm in December and January, though only traces of less than 0.1mm in February and November, to about 343mm in July. Onset of the rains is often in March while they end virtually by October.

1.7.6. Radiation

is fairly even throughout the year, ranging from about 11.3mm in July to about 18.7mm in April. However, it is relatively highest in March, April and May, when it is generally between 16.1mm and 18.7mm. Similarly, evaporation in the town ranges from 2.4mm in July and August to about 15.7mm in March, the months of January April being the period of greatest evaporation vegetation zones, the town has mainly Sudan savannah which is generally characterized with woodlands particularly mixed acacia

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter reviews the related literature on the concept of the peri urban development, nature of peri urban development, characteristic of peri urban areas, factors responsible for peri urban expansion, the use remote sensing on peri urban formation etc.

2.1 Concept of peri–urban development

The term 'peri-urban' has its roots in the need to transcend the traditional urban-rural dichotomy. There is no universally accepted definition of peri-urban landscapes as a distinct form of urban settlement. All peri-urban areas share the characteristics of change, growth (particularly relative to the urban core) and being located close to large metropolitan regions (UN Habitat 2009). However, they are not homogenous. Peri-urban regions have been defined spatially by their physical structure and form. Alternatively, they have been defined functionally or by a combination of spatial and functional factors. They can be defined in relation to a nearby metropolitan area on their inner boundaries, a rural area on their outer boundaries, or as the land in between. A peri-urban area can be defined simply as land adjacent to the edge of an urban area, that area of land extending from the built up edge of the city to the truly rural hinterland.

Many cities end with a clear boundary, or hard 'edge', which distinguishes between the urban and the rural. Alternatively, the distinction between city and countryside may be less distinct and gradual. It may be equally difficult to identify the outer boundary of the peri-urban zone. A peri-urban area is a distinct settlement pattern, neither urban nor rural but an interface, a transitional Zone. Change is endemic to this interface region with a blurring of uses and urban and rural activities. Change can be regarded as orderly or chaotic, threatening or opportune. The notion of transition may imply either a distinct zone between urban and rural areas, or an area being transformed from rural to urban. A peri-urban area can be an urban land bank awaiting use. Change; particularly from rural to urban uses, in peri-urban regions is usually irreversible. Peri-urban areas are those areas within the sphere of influence of adjacent urban centers. The types of influence exerted on this transition zone may vary greatly, and include the effect of cities on the productivity of land, land prices, habitat and the maintenance of biological diversity, landscapes, and commuting patterns (Webster and Muller 2012). The literature on peri-urban areas refers to the existence of an urban rural continuum, and to other defining characteristics, such as lower population and building densities compared to urban regions, the heterogeneous nature of land uses and rapid rates of change. Many peri-urban areas are undergoing a form of gentrification based on promotion of lifestyle. Such areas can be described on the basis of the wide range of social and economic roles they perform which are as important as the land uses that are found there. Conflict between land uses is also widely regarded as a key characteristic of peri-urban regions. Nevertheless, little attention appears to have been given to the long term planning and management of the land and resource base in these regions on any consistent or integrated basis. Governance arrangements are usually poorly defined.

2.2 Nature of peri-urban land development

The term peri-urban has been widely used, however, there seems to be no specific definition for the term. Rather, most literature use urban and rural information to build hypotheses for this ‘transitional’ zone. According to Birley and Lock (1998), peri-urban areas are areas immediately surrounding cities where farmland is being developed for urban uses and the rural economy is significantly affected by its urban links. The peri-urban concept attempts to move understanding beyond definitions considered solely in terms of geographical location and spatial land use.

Rather it considers the peri-urban interface (PUI) as the meeting of rural and urban activities in effect a process rather than a place (Brook and Davila 2000). As the cities expand, the surrounding peri-urban areas also grow. This means that the nature of the peri-urban interface is one of constant change leading to a variety of livelihood and natural resource problems specific to the PUI. According to Adjekumhene (2002), the 'development' is a multidimensional one which can be viewed from many perspectives. He explained "land development" to mean 'a broad subject encompassing the development of natural areas to redevelopment of occupied land or derelict sites. In his view development in this context means any kind of engineering or building work carried out in, on or over land or any material change of use of land. In support of this definition and for the purposes of this research, 'land development' is considered as any kind of physical developments that changes the original use of the land.

Land is a resource treasured by all who have access to it. Land represents the main form of wealth and the principal source of economic and political power. It is both a natural resource and marketable commodity and therefore should be managed on a sustainable basis. Land also provides a more attractive source of investment. Fobih (2004), argued that, social and cultural organization of the society as reflected in the systems of property ownership, chieftaincy, and lineage are inextricably linked to land. Land thus covers every facet of life in Nigeria. These assertions reveal the importance of land to society. Indeed, the development of a peri-urban area is an inevitable consequence of urbanization. Masika et al, (2002) observe that in the past few decades, urbanization and urban growth have accelerated in many developing countries.

The peri urban emerged due to limitation in a dichotomy between rural and urban. Most researchers have identified the inadequacy of this simplistic dichotomy, some authors even suggesting its analytical relevance in a long past. Others have argued more specifically that only the dichotomous construct has outlived its usefulness not the underlying distinction between degrees of ruralness and urbaness (Rambaud, 1973, Pupri 1998) specifically criticizes the dichotomous basis of urban and rural definition, arguing that many of the characteristics that defined rural areas exist along a continuum within which individuals, households, communities and institutions distribute themselves. A key feature of peri urban environments is their dynamic nature, wherein social forms and arrangements are created, modified and discarded. They are areas of social compression or intensification where the density of social forms, types and meanings increases, fomenting conflict and social evolution. Whether we decide to accept a continuum model or a model that employs a "typological set" is less important than the recognition that the spectrum of change from rural to urban is discontinuous, "lumpy", and multidimensional, and that it arises from underlying social processes.

In sociology the first two components are usually taken as the basis for defining urbanization while the third is the core definition of urbanism the social psychological reflection or response to urbanization (Fischer, 1984). The social psychological component essentially refers to those values, attitudes, tastes and behaviors that are seen to be characteristic of urban as opposed to rural dwellers. Earlier notions of this component tended to be associated with "westernization", reflecting the ethnocentric thinking of the time (Holleman, 1964). More recent writers take a more neutral view of the process (Williams, et.al, 1983). Given that the above three components form the basis of the definition of "urban" and given that peri urban includes some level of urbaness, then it follows that some variation of these three components should underlie the definition of peri urban. Holleman underscores this when he directly links peri-urban to the concept of a "change in mental orientation. Importantly, what seems to be not essential to the definition of peri urban is "proximity to the city". The fact that much peri urban "place" is proximate to the city is substantively important and instrumental to a comprehensive understanding of peri urban, but it is incidental to an elemental understanding of peri urban. As we shall elaborate, "proximity to city" represents a further specification, which allows us to distinguish between "types" of peri urban, not to define peri urban in the first place. Additionally, concentration on geographic location as a basis for defining peri urban also undermines a clear understanding of the rural-urban spectrum as dynamic, interactive and transformative.

The social-psychological component is the one most often omitted from peri urban definitions. Yet as some scholars and policy analysts have argued, ignoring this component misses the reality of peri urban, underestimates the prevalence of social change and misclassifies the experiences of numerous people and communities in the real world. Typically, those researchers arguing in support of including this component have also been the most critical of definitions that rely solely on proximity to the city (Groppo and Tosselli, 1997).

2.3 Factors responsible for peri urban expansion

Peri urban or sprawl continue with a combination of demographic, social, economic, and political reasons. Common causes include rapid rural-to-urban migration, poor planning, economic stagnation and depression, poverty, high unemployment, informal economy, colonialism and segregation, politics, natural disasters and social conflicts.

2.3.1 Rural-urban migration

Rural-urban migration is one of the causes attributed to the formation and expansion of peri urban since 1950, world population has increased at a far greater rate than the total amount of arable land, even as agriculture contributes a much smaller percentage of the total economy. For example, in India, agriculture accounted for 52% of its GDP in 1954 and only 19% in 2004; in Brazil, the 2005 GDP contribution of agriculture is one-fifth of its contribution in 1951. Agriculture, meanwhile, has also become higher yielding, less disease prone, less physically harsh and more efficient with tractors and other equipment. The proportion of people working in agriculture has declined by 30% over the last 50 years, while global population has increased by 250% (UN Habitat, 2003).

Many people move to urban areas primarily because cities promise more jobs, better schools for poor's children, and diverse income opportunities than subsistence farming in rural areas. For example, in 1995, 95.8% of migrants to Surabaya, Indonesia reported that jobs were their primary motivation for moving to the city. However, some rural migrants may not find jobs immediately because of their lack of skills and the increasingly competitive job markets, which lead to their financial shortage. Many cities, on the other hand, do not provide enough low-cost housing for a large number of rural-urban migrant workers. Some rural-urban migrant workers cannot afford housing in cities and eventually settle down in only affordable peri urban. Further, rural migrants, mainly lured by higher incomes, continue to flood into cities. They thus expand the existing urban peri urban. According to (Antony, 2005)social networks might also explain rural-urban migration and people's ultimate settlement in peri urban. In addition to migration for jobs, a portion of people migrate to cities because of their connection with relatives or families.

Once their family support in urban areas is in peri urban, those rural migrants intend to live with them in peri urban.

2.3. 2 Urbanization

The formation of peri urban is closely linked to urbanization. In 2008, more than 50% of the world's population lived in urban areas. In China, for example, it is estimated that the population living in urban areas will increase by 10% within a decade according to its current rates of urbanization. The UN-Habitat reports (2003) that 43% of urban population in developing countries and 78% of those in the least developed countries isperi urban dwellers

Some scholars suggest that urbanization creates peri urban because local governments are unable to manage urbanization, and migrant workers without an affordable place to live in, dwell in peri urban. Rapid urbanization drives economic growth and causes people to seek working and investment opportunities in urban areas. However, as evidenced by poor urban infrastructure and insufficient housing, the local governments sometimes are unable to manage this transition. This incapacity can be attributed to insufficient funds and inexperience to handle and organize problems brought by migration and urbanization. In some cases, local governments ignore the flux of immigrants during the process of urbanization. Such examples can be found in many African countries. In the early 1950s, many African governments believed that peri urban would finally disappear with economic growth in urban areas. They neglected rapidly spreading peri urban due to increased rural-urban migration caused by urbanization. Some governments, moreover, mapped the land where slums occupied as undeveloped land.

Another type of urbanization does not involve economic growth but economic stagnation or low growth, mainly contributing to peri urban growth in Sub-Saharan Africa and parts of Asia. This type of urbanization involves a high rate of unemployment, insufficient financial resources and inconsistent urban planning policy. In these areas, an increase of 1% in urban population will result in an increase of 1.84% in peri urban prevalence.

Urbanization might also force some people to live in peri urban when it influences land use by transforming agricultural land into urban areas and increases land value. During the process of urbanization, some agricultural land is used for additional urban activities. More investment will come into these areas, which increases the land value. Before some land is completely urbanized, there is a period when the land can be used for neither urban activities nor agriculture. The income from the land will decline, which decreases the people's incomes in that area. The gap between people's low income and the high land price forces some people to look for and construct cheap informal settlements, which are known as peri urban in urban areas. The transformation of agricultural land also provides surplus labor, as peasants have to seek jobs in urban areas as rural-urban migrant workers.

Many peri urban are part of economies of agglomeration in which there is an emergence of economies of scale at the firm level, transport costs and the mobility of the industrial labour force. The increase in returns of scale will mean that the production of each good will take place in a single location. And even though an agglomerated economy benefits these cities by bringing in specialization and multiple competing suppliers, the conditions of peri urban continue to lag behind in terms of quality and adequate housing. (Alonso-1968) argues that the existence of transport costs implies that the best locations for a firm will be those with easy access to markets, and the best locations for workers, those with easy access to goods. The concentration is the result of a self-reinforcing process of agglomeration. Concentration is a common trend of the distribution of population. Urban growth is dramatically intense in the less developed countries, where a large number of huge cities have started to appear; which means high poverty rates, crime, pollution and congestion.

2.3.3 Poor housing planning

Lack of affordable low cost housing and poor planning encourages the supply side of peri urban The Millennium Development Goals proposes that member nations should make a "significant improvement in the lives of at least 100 million peri urban dwellers" by 2020. If member nations succeed in achieving this goal, 90% of the world total peri urban dwellers may remain in the poorly housed settlements by 2020. (Cohen, 2006) claims that the large number of peri urban dwellers indicates a deficiency of practical housing policy. Whenever there is a significant gap in growing demand for housing and insufficient supply of affordable housing, this gap is typically met in part by peri urban. The Economist summarizes this as, "good housing is obviously better than a slum, but a slum is better than none" Insufficient financial resources, and lack of coordination in government bureaucracy, is the two main causes of poor housing planning. Financial deficiency in some governments may explain the lack of affordable public housing for the poor since any improvement of the tenant in peri urban and expansion of public housing programs involve a great increase in the government expenditure The problem can also lie on the failure in coordination among different departments in charge of economic development, urban planning, and land allocation. In some cities, governments assume that the housing market will adjust the supply of housing with a change in demand. However, with little economic incentive, the housing market is more likely to develop middle-income housing rather than low-cost housing. The urban poor gradually become marginalized in the housing market where few houses are built to sell to them.

2.3.4 Colonialism and segregation

Some of the peri urban in today's world are a product of urbanization brought by colonialism. For instance, the Europeans arrived in Kenya in the nineteenth century and created urban centers such as Nairobi mainly to serve their financial interests. They regarded the Africans as temporary migrants and needed them only for supply of labor. The housing policy aiming to accommodate these workers was not well enforced and the government built settlements in the form of single-occupancy bed spaces. Due to the cost of time and money in their movement back and forth between rural and urban areas, their families gradually migrated to the urban centre. As they could not afford to buy houses, peri urban were thus formed (Jun et- al, 2009).

Others were created because of segregation imposed by the colonialists. For example, Dharavi peri urban of Mumbai – now one of the largest peri urban in India, used to be a village referred to as Koliwadas, and Mumbai used to be referred as Bombay. In 1887, the British colonial government expelled all tanneries, other noxious industry and poor natives who worked in the peninsular part of the city and colonial housing areas; to what was back then the northern fringe of the city – a settlement now called Dharavi. This settlement attracted no colonial supervision or investment in terms of road infrastructure, sanitation, public services or housing. The poor moved into Dharavi, found work as servants in colonial offices and homes and in the foreign owned tanneries and other polluting industries near Dharavi. To live, the poor built shanty towns within easy commute to work. By 1947, the year India became an independent nation of the commonwealth, Dharavi had blossomed into Bombay's largest peri urban.

Similarly, some of the peri urban of Lagos, Nigeria sprouted because of neglect and policies of the colonial era. During apartheid era of South Africa, under the pretext of sanitation and plague epidemic prevention, racial and ethnic group segregation was pursued; people of color were moved to the fringes of the city, policies that created Soweto and other peri urban – officially called townships. Large peri urban started at the fringes of segregation-conscious colonial city centers of Latin America. Marcuse suggests ghettoes in the United States, and elsewhere, has been created and maintained by the segregationist policies of the state and regionally dominant group.

2.3.5 Poor infrastructure, social exclusion and economic stagnation

Social exclusion and poor infrastructure force the poor to adapt to conditions beyond his or her control. Poor families that cannot afford transportation, or those who simply lack any form of affordable public transportation, generally end up in squat settlements within walking distance or close enough to the place of their formal or informal employment. Ben Arimah cites this social exclusion and poor infrastructure as a cause for numerous peri urban in African cities. Poor quality, unpaved streets encourage peri urban; a 1% increase in paved all-season roads, claims Arimah, reduces peri urban incidence rate by about 0.35%. Affordable public transport and economic infrastructure empowers poor people to move and consider housing options other than their current peri urban.

A growing economy that creates jobs at rate faster than population growth, offers people opportunities and incentive to relocate from poor peri urban to more developed neighborhoods. Economic stagnation, in contrast, creates uncertainties and risks for the poor, encouraging people to stay in the peri urban. Economic stagnation in a nation with a growing population reduces per capita disposal income in urban and rural areas, increasing urban and rural poverty. Rising rural poverty also encourages migration to urban areas. A poorly performing economy, in other words, increases poverty and rural-to-urban migration, thereby increasing peri urban.

2.3.6 Informal economy

Many peri urban grow because of growing informal economy which creates demand for workers. Informal economy is that part of an economy that is neither registered as a business nor licensed, one that does not pay taxes and is not monitored by local or state or federal government. Informal economy grows faster than formal economy when government laws and regulations are opaque and excessive, government bureaucracy is corrupt and abusive of entrepreneurs, labor laws are inflexible, or when law enforcement is poor. Urban informal sector is between 20 and 60% of most developing economies' GDP; in Kenya, 78 per cent of non-agricultural employment is in the informal sector making up 42 per cent of GDP. In many cities the informal sector accounts for as much as 60 per cent of employment of the urban population. For example, in Benin, peri urban dwellers comprise 75 per cent of informal sector workers, while in Burkina Faso, the Central African Republic, Chad and Ethiopia; they make up 90 per cent of the informal labour force. Peri urban thus create an informal alternate economic ecosystem, that demands low paid flexible workers, something impoverished residents of peri urban deliver (UN Habitat, 2008). In other words, countries where starting, registering and running a formal business is difficult, tend to encourage informal businesses and peri urban. Without a sustainable formal economy that raise incomes and create opportunities, squalid peri urban are likely to continue.

2.3.7 Poverty

Urban poverty encourages the formation and demand for peri urban. With rapid shift from rural to urban life, poverty migrates to urban areas. The urban poor arrives with hope, and very little of anything else. He or she typically has no access to shelter, basic urban services and social amenities. Peri urban are often the only option for the urban poor (UN Habitat, 2008).

2.3.8 Politics

Many local and national governments have, for political interests, subverted efforts to remove, reduce or upgrade peri urban into better housing options for the poor. Throughout the second half of the 19th century, for example, French political parties relied on votes from peri urban population and had vested interests in maintaining that voting bloc. Removal and replacement of peri urban created a conflict of interest, and politics prevented efforts to remove, relocate or upgrade the peri urban into housing projects that are better than the peri urban. Similar dynamics are cited in favelas of Brazil peri urban of India, and shanty towns of Kenya (UN Habitat, 2008).

Scholars claim politics also drives rural-urban migration and subsequent settlement patterns. Pre-existing patronage networks, sometimes in the form of gangs and other times in the form of political parties or social activists, inside peri urban seek to maintain their economic, social and political power. These social and political groups have vested interests to encourage migration by ethnic groups that will help maintain the peri urban, and reject alternate housing options even if the alternate options are better in every aspect than the peri urban they seek to replace.

2.3.9 Social conflicts

Millions of Lebanese people formed peri urban during the civil war from 1975 to 1990. Similarly, in recent years, numerous peri urban have sprung around Kabul to accommodate rural Afghans escaping Taliban violence.

2.3.10 Natural disasters

Major natural disasters in poor nations often lead to migration of disaster-affected families from areas crippled by the disaster to unaffected areas, the creation of temporary tent city and peri urban, or expansion of existing peri urban. These peri urban tend to become permanent because the residents do not want to leave, as in the case of peri urban near Port-au-Prince after the 2010 Haiti earthquake, and peri urban near Dhaka after 2007 Bangladesh Cyclone Sidr.

2.4. Characteristics of unplanned peri urban areas.

Peri urban areas begin at the outskirt of a city, informality of land tenure is a key characteristic of its formation, substandard housing, lack of infrastructure etc. Below are the key characteristics of peri urban areas.

2.4.1 Location and growth

Peri urban typically begin at the outskirts of a city. Over time, the city may expand past the original peri urban, enclosing the peri urban inside the urban perimeter. New peri urban sprout at the new boundaries of the expanding city, usually on publicly owned lands, thereby creating an urban sprawl mix of formal settlements, industry, retail zones and peri urban, this makes the original peri urban valuable property, densely populated with many conveniences attractive to the poor.

At their start, peri urban are typically located in least desirable lands near the town or city, that are state owned or philanthropic trust owned or religious entity owned or have no clear land title. In cities located over a mountainous terrain, peri urban begin on difficult to reach slopes or start at the bottom of flood prone valleys, often hidden from plain view of city center but close to some natural water source In cities located near lagoons, marshlands and rivers, they start at banks or on stilts above water or the dry river bed; in flat terrain, peri urban begin on lands unsuitable for agriculture, near city trash dumps, next to railway tracks, and other shunned undesirable locations (UN Habitat, 2008).

These strategies shield peri urban from the risk of being noticed and removed when they are small and most vulnerable to local government officials. Initial homes tend to be tents and shacks that are quick to install, but as peri urban grows, becomes established and newcomers pay the informal association or gang for the right to live in the peri urban , the construction materials for the peri urban switches to more lasting materials such as bricks and concrete, suitable for peri urban topography.

The original peri urban over time, get established next to centers of economic activity, schools, hospitals, sources of employment, which the poor rely on. Established old peri urban, surrounded by the formal city infrastructure, cannot expand horizontally; therefore, they grow vertically by stacking additional rooms, sometimes for a growing family and sometimes as a source of rent from new arrivals in peri urban Some slums name themselves after founders of political parties, locally respected historical figures, current politicians or politician’s spouse to garner political backing against eviction UNEP, 2011).

2.4.2 Insecure tenure

Informality of land tenure is a key characteristic of urban peri urban. At their start, peri urban are typically located in least desirable lands near the town or city, that are state owned or philanthropic trust owned or religious entity owned or have no clear land title. Some immigrants regard unoccupied land as land without owners and therefore occupy it. In some cases the local community or the government allots lands to people, which will later develop into peri urban and over which the dwellers don't have property rights (UNEP, 2011). Informal land tenure also includes occupation of land belonging to someone else. According to Flood, 51 percent of peri urban are based on invasion to private land in sub-Saharan Africa, 39 percent in North Africa and West Asia, 10 percent in South Asia, 40 percent in East Asia, and 40 percent in Latin America and the Caribbean. In some cases, once the peri urban has many residents, the early residents form a social group, an informal association or a gang that controls newcomers, charges a fee for the right to live in the peri urban, and dictates where and how new homes get built within the peri urban . The newcomers, having paid for the right, feel they have commercial right to the home in that peri urban. The peri urban dwellings, built earlier or in later period as the peri urban grows, are constructed without checking land ownership rights or building codes, are not registered with the city, and often not recognized by the city or state governments.

Secure land tenure is important for peri urban dwellers as an authentic recognition of their residential status in urban areas. It also encourages them to upgrade their housing facilities, which will give them protection against natural and unnatural hazards. Undocumented ownership with no legal title to the land also prevents peri urban settlers from applying for mortgage, which might worsen their financial situations. In addition, without registration of the land ownership, the government has difficulty in upgrading basic facilities and improving the living environment

Insecure tenure of the peri urban, as well as lack of socially and politically acceptable alternatives to peri urban , also creates difficulty in city-wide infrastructure development such as rapid mass transit, electrical line and sewer pipe layout, highways and roads.

2.4.3 Substandard housing and overcrowding

Peri urban areas are characterized by substandard housing structures. Shanty homes are often built hurriedly, on ad hoc basis, with materials unsuitable for housing. Often the construction quality is inadequate to withstand heavy rains, high winds, or other local climate and location. Paper, plastic, earthen floors, mud-and-wattle walls, wood held together by ropes, straw or torn metal pieces as roofs are some of the materials of construction. In some cases, brick and cement is used, but without attention to proper design and structural engineering requirements. Various space, dwelling placement bylaws and local building codes may also be extensively violated (Bhatta, 2010).

Overcrowding is another characteristic of peri urban; many dwellings are single room units, with high occupancy rates. Each dwelling may be cohabited by multiple families. Five and more persons may share a one-room unit; the room is used for cooking, sleeping and living. Overcrowding is also seen near sources of drinking water, cleaning, and sanitation where one toilet may serve dozens of families. In a peri urban of Kolkata, India, over 10 people sometimes share a 45 m^2 room. In Kibera slum of Nairobi, Kenya, population density is estimated at 2,000 people per hectare — or about 500,000 people in one square mile (Antony, 2005).

2.4.4 Inadequate or No infrastructure

One of the identifying characteristics of peri urban is the lack of or inadequate public infrastructure. From safe drinking water to electricity, from basic health care to police services, from affordable public transport to fire/ambulance services, from sanitation sewer to paved roads, new peri urban usually lack all of these. Established, old peri urban sometimes garner official support and get some of these infrastructure such as paved roads and unreliable electricity or water supply.

Peri urban often have very narrow alleys that do not allow vehicles (including emergency vehicles) to pass. The lack of services such as routine garbage collection allows rubbish to accumulate in huge quantities (UN Habitat 2003). The lack of infrastructure is caused by the informal nature of settlement and no planning for the poor by government officials. Fires are often a serious problem.

In many countries, local and national government often refuse to recognize peri urban, because the peri urban are on disputed land, or because of the fear that quick official recognition will encourage more peri urban formation and seizure of land illegally. Recognizing and notifying peri urban often triggers a creation of property rights, and requires that the government provide public services and infrastructure to the peri urban residents. With poverty and informal economy, peri urban do not generate tax revenues for the government and therefore tend to get minimal or slow attention (Antony 2005). In other cases, the narrow and haphazard layout of peri urban streets, houses and substandard shacks, along with persistent threat of crime and violence against infrastructure workers, makes it difficult to layout reliable, safe, cost effective and efficient infrastructure. In yet others, the demand far exceeds the government bureaucracy's ability to deliver.

2.4.5 Low socioeconomic status.

Low socioeconomic status of its residents is another common characteristic attributed to peri urban residents.

2.5 The case study of the Yasore Road Infrastructure Project

Yasore is a small town along the main Kumasi – Mampong road. It is located between Asenua and Fawoade, within the Kwabre district. It is about 9 km from the city centre. Yasore used to be a farming community with most of the community members being subsistence farmers. Demand for residential development in peri-urban areas has however, caused valuable agricultural land in Yasore to be developed in line with urban demands for housing and business (YE 2, pers. comm., 2013).

A customary land administration system is practiced in Yasore under the traditional leadership of the chief of Yasore. The chief, together with the Yasore Development Committee, oversee land delivery in Yasore. All the land in Yasore has been sold for development except for a portion that the chief has instructed his elders not to sell. The chief wants to use that portion for industrial development in the area (YE 3, pers., 2013). Some residents however, insinuate that he has intentionally reserved that portion for future profit once land prices rise further (YE 4; YE 6 and YE 7, pers. Comm., 2013).

A main road connects the Yasore town to the main Kumasi-Mampong road, but there are no access roads to the houses in Yasore. This connection road is in a deplorable state being covered with bushes and potholes. In the rainy seasons, it becomes impassable by car or foot (YE 5, pers. comm., 2013).

The Yasore Road Infrastructure Project In 2012, the Yasore Development Committee appointed a consultant to assess the road and estimate the cost of constructing a hard road surface. An amount of GHC 200 000 (USD 93 023) was estimated for the construction of the main road (YE 2, pers. Comm., 2013). In

2013, the Yasore traditional leadership decided to charge each property owner an amount of GHC 240 (equivalent to USD 111) towards this project (YE 8, pers. Comm., 2013). This amount is to be paid on monthly basis over a period of 2 years (YE 7, pers. Comm., 2013). With about 1000 property owners in Yasore, the traditional leadership is expected to raise a total amount of GHC 240 000 (USD 111 630) for this project.

What divides the community in respect of this project is how the fund will be managed and why the chief did not use some of the money collected from the sale of the land to undertake the construction of the road (YE 4; YE 6; YE 8; pers. comm., 2013). Some think that this is a way of further enriching the chief, to the detriment of the community members

(YE 6 and YE 8, pers. comm., 2013). They are distrustful of the management of the money collected from the community and hence whether the project will come to fruition. Despite this unresolved issue, some property owners have commenced with their monthly payments (YE 5, pers. comm., 2013).

3.3 Analysis of the structures for managing the road development fund The Yasore Development Committee is responsible for managing the road development fund. The Committee is chaired by a member from the royal family. Members of the community have to walk to the palace to make their monthly contributions. This is the reason why some community members allege that this initiative is clandestinely planned to extort money from the already deprived members of the community (YE 6 and YE 8, pers. comm., 203).

The primary problem with the fund management is lack of transparency. The funds are not held in a separate trust account, the Committee has no proper reporting mechanism in place, and there is no mechanism for the community members to track inefficiencies in fund management. Sixteen (16) out of the twenty (20) community members interviewed (Interviews YE 6; YE 8; YE 9 etc., pers. comm., 2013) indicated that they are not aware of how much money has been received so far in respect of the project.

They are aware of the total amount that they have individually contributed since the inception of the programme.

In contrast to the Yasore Road Development Project is the concept of Special Rating Areas that have been established successfully in South Africa.

3.4 Establishment of Special Rating Areas Special Rating Areas (SRAs) are established through formal processes by a consortium of local property owners and the local government. In these areas property owners pay periodic additional property taxes (called property rates in South Africa) towards special development or improvement projects within that area. The contributors generally see direct benefit from this additional tax. These funds are managed by Board of Trustees established by the policy directives of the SRA and thus meet the requirements of good governance (Whittal, 2011).

The processes followed towards the establishment of the Richmond Hill Special Rating Area provide a contrast to the Yasore Road Development Fund. This project was initiated by the Mandela Bay Development Agency, a municipal entity within the Nelson Mandela Bay Metropolitan Municipality in the vicinity of Port Elizabeth, South Africa (RH 1 pers. Comm., 2013).

The municipal entity first developed a policy to guide the establishment of the Special Rating Area. This policy was adopted by the Economic Development Standing Committee (a political oversight committee responsible for economic development in the City of Port Elizabeth, South Africa) (RH1, pers. comm., 2013). The policy indicated the steps to be followed in the establishment of the SRA. Firstly, the municipal entity went through a voting process in securing the consent of all the property owners in Richmond Hill to institute the special rating (RH 1, pers. comm., 2013). A 51% vote in favour of the SRA was a prerequisite for its establishment. All property owners (both home and abroad) were contacted to cast their votes. This took a period of about two years due to the fact that most property owners were not in South Africa and it was important for each owner to have the opportunity to cast a vote (RH 1, pers. comm., 2013; RH 2, pers. Comm. 2014).

After the votes were counted and the required number of votes was secured, a Board of Trustees was established to manage the special rates to be paid by the property owners (RH 3, pers. comm. 2014). The Board is responsible in ensuring the growth of the fund through wise investments (RH 4, pers. Comm., 2014). The Board is also responsible to identify the development needs of the area and to make the resources available to meet those needs. The Board is answerable to the municipal entity which, in turn, reports to the oversight Economic Development Standing Committee (RH 1, pers. comm., 2013).

The voting process followed in the establishment of the SRA, and the fact that an oversight body approved the SRA policy, makes it mandatory for all property owners to pay the required special rate towards the development of Richmond Hill. The Board has the right to charge any property owner who fails to pay the rate (RH 3, pers. Comm., 2014). The formal process followed in the establishment of the SRA in Richmond Hill has contributed greatly to its effectiveness. Property owners understand their responsibilities and are aware of the repercussions, should they default on payment (RH 1, pers. comm., 2013).

Accountability and transparency are ensured through the processes established in the policy directive drawn up at the inception of the SRA (RH 2, pers. Comm., 2014). Monitoring and reporting mechanisms are in place and thus, mismanagement of the fund is less likely and could be easily detected. Trust in the structures and processes leads to greater compliance. This benefits SRA projects and the community (RH 1, pers. comm., 2013).

3.5 Comparison of the Yasore approach to that employed in the SRA There were no initial policy guidelines for the establishment of the Yasore Road Development Fund. It was not established in conjunction with the local authority, the Kwabre District Assembly. Those most affected by its establishment, the paying community members, were not formally consulted and there was no voting process to secure the consent of the members of the community. The use of a loud hailer to inform the community was the extent of the communication effort. This is wholly inadequate as there was no mechanism for community participation or feedback. The satisfaction or otherwise of the community was

Irrelevant to those who had the power to establish the Fund. Furthermore, once funds are received the basic principles of good governance are not adhered to. The fund is managed by the members of the royal family and the Kwabre District Assembly is not involved in this process. The money in the fund is not invested and so fears that the fund will not keep up with expected inflation in construction costs is real. There is no instrument in place to enforce regular payment. This creates a two-fold problem in that equity in contribution cannot be ensured and is unlikely and failure to obtain the necessary funding in the due time is likely to delay the implementation of the road upgrading project.

The structure and processes of the SRA show up the deficiencies in the establishment and operation of the Yasore Road Development Fund. These add weight to the conclusions from that case alone that community participation and other good governance principles are necessary prerequisites for effective and efficient projects which affect and potentially benefit communities.

2.6. Risks of peri urban

Uncoordinated spatial growth in the peri urban areas have brings a lot of risk to its inhabitants as explains below.

2.6.1 Vulnerability to natural and artificial hazards

Peri urban are often placed amongst the places vulnerable to natural disasters such as landslides and floods. In cities located over a mountainous terrain, peri urban begin on slopes difficult to reach or start at the bottom of flood prone valleys, often hidden from plain view of city center but close to some natural water source (Antony 2005). In cities located near lagoons, marshlands and rivers, they start at banks or on stilts above water or the dry river bed; in flat terrain, peri urban begin on lands unsuitable for agriculture, near city trash dumps, next to railway tracks, and other shunned, undesirable locations. These strategies shield peri urban from the risk of being noticed and removed when they are small and most vulnerable to local government officials (Alain D.L2006). However, the ad hoc construction, lack of quality control on building materials used, poor maintenance, and uncoordinated spatial design make them prone to extensive damage during earthquakes as well from decay. Some slums risk man-made hazards such as toxic industries, traffic congestion and collapsing infrastructure. Fires are another major risk to peri urban and its inhabitants, with streets too narrow to allow proper and quick access to fire control trucks.

2.6.2 Unemployment and informal economy

Due to lack of skills and education as well as competitive job markets, many peri urban dwellers face high rates of unemployment. The limit of job opportunities causes many of them to employ themselves in the informal economy, inside the peri urban or in developed urban areas near the peri urban. This can sometimes be licit informal economy or illicit informal economy without working contract or any social security. Some of them are seeking jobs at the same time and some of those will eventually find jobs in formal economies after gaining some professional skills in informal sectors. Examples of licit informal economy include street vending, household enterprises, product assembly and packaging, making garlands and embroideries, domestic work, shoe polishing or repair, driving tuk-tuk or manual rickshaws, construction workers or manually driven logistics, and handicrafts production (UN Habitat 2003). In some peri urban, people sort and recycle trash of different kinds (from household garbage to electronics) for a living – selling either the odd usable goods or stripping broken goods for parts or raw materials. Typically these licit informal economies require the poor to regularly pay a bribe to local police and government officials

Examples of illicit informal economy include illegal substance and weapons trafficking, drug or moonshine/changaa production, prostitution and gambling – all sources of risks to the individual, families and society. Recent reports reflecting illicit informal economies include drug trade and distribution in Brazil's *favelas*, production of fake goods in the colonías of Tijuana, smuggling in katchiabadis and slums of Karachi, or production of synthetic drugs in the townships of Johannesburg. The peri urban -dwellers in informal economies run many risks. The informal sector, by its very nature, means income insecurity and lack of social mobility. There is also absence of legal contracts, protection of labor rights, regulations and bargaining power in informal employments (UNCHS1999).

2.6.3 Violence

Some scholars suggest that crime is one of the main concerns in peri urban. Empirical data suggest crime rates are higher in some peri urban than in non-peri urban , with peri urban homicides alone reducing life expectancy of a resident in a Brazil slum by 7 years than for a resident in nearby non-peri urban . In some countries like Venezuela, officials have sent in the military to control peri urban criminal violenceinvolved with drugs and weapons. Rape is another serious issue related to crime in periu rban. In Nairobi slums, for example, one fourth of all teenage girls are raped each year (UNEP2011).

On the other hand, while (UN-Habitat, 2003) reports some peri urban are more exposed to crimes with higher crime rates (for instance, the traditional inner-city peri urban), crime is not the direct resultant of block layout in many peri urban. Rather crime is one of the symptoms of peri urban dwelling; thus peri urban consist of more victims than criminals. Consequently, peri urban in all do not have consistently high crime rates; peri urban have the worst crime rates in sectors maintaining influence of illicit economy – such as drug trafficking, brewing, prostitutionand gambling –. Often in such circumstance, multiple gangs fight for control over revenue.

Peri urban crime rate correlates with insufficient law enforcement and inadequate public policing. In main cities of developing countries, law enforcement lags behind urban growth and peri urban expansion. Often police cannot reduce crime because, due to ineffective city planning and governance, slums set inefficient crime prevention system. Such problems are not primarily due to community indifference. Leads and information intelligence from peri urban are rare, streets are narrow and a potential death traps to patrol, and many in the peri urban community have an inherent distrust of authorities from fear ranging from eviction to collection on unpaid utility bills to general law and order Lack of formal recognition by the governments also leads to few formal policing and public justice institutions in peri urban (World Bank2012). Women in peri urban are at greater risk of physical and sexual violence. Factors such as unemployment that lead to insufficient resources in the household can increase marital stress and therefore exacerbate domestic violence Peri urban are often non-secured areas and women often risk sexual violence when they walk alone in slums late at night. Violence against women and women's security in slums emerge as recurrent issues.

Another prevalent form of violence in peri urban is armed violence (gun violence), mostly existing in African and Latin American peri urban. It leads to homicide and the emergence of criminal gangs. Typical victims are male peri urban residents (UN2013). Violence often leads to retaliatory and vigilante violence within the peri urban. Gang and drug wars are endemic in some peri urban, predominantly between male residents of peri urban. The police sometimes participate in gender-based violence against men as well by picking up some nmen, beating them and putting them in jail. Domestic violence against men also exists in peri urban, including verbal abuses and even physical violence from households.

Cohen as well as Merton theorized that the cycle of peri urban violence does not mean peri urban are inevitably criminogenic, rather in some cases it is frustration against life in peri urban, and a consequence of denial of opportunity to peri urban residents to leave the peri urban. Further, crime rates are not uniformly high in world's peri urban; the highest crime rates in peri urban are seen where illicit economy - such as drug trafficking, brewing, prostitution and gambling - is strong and multiple gangs are fighting for control.

2.6.4 Disease

Peri urban dwellers usually experiences a high rate of disease: Diseases that have been reported in peri urban include cholera, HIV/AIDS, measles, malaria, dengue, typhoid, drug resistant tuberculosis, and other epidemics (WHO2004). Studies focus on children's health in peri urban address that cholera and diarrhea are especially common among young children. In Haiti (where a majority of the population live in poverty), after the 2010 Earthquake, an outbreak of Cholera spread throughout the country, killing 8321 people. Besides children's vulnerability to diseases, many scholars also focus on high HIV/AID prevalence in peri urban among women. In some peri urban, gender inequality increases women's risk of HIV/AIDS. Mutual monogamy or using condoms are two main ways to prevent HIV/AIDS, but some women might not be able to modify their behaviors due to masculine authority or violence (UN- Habitat 2003). Furthermore, diseases can sometimes lead to high mortality in peri urban. According to a study in Nairobi's peri urban, HIV/AIDS and tuberculosis attributed to about 50% of the mortality burden.

High population densities, poor living conditions, low vaccination rates, insufficient health-related data and inadequate health service engender a higher rate of disease transmission in peri urban than that in non-peri urban areas. Overcrowding leads to faster and wider spread of diseases due to the limited space in peri urban housing. Poor living conditions also make peri urban dwellers more vulnerable to certain diseases. Poor water quality, a manifest example, is a cause of many major illnesses including malaria, diarrhea and trachoma (UNAIDS,2004.) improving living conditions such as introduction of better sanitation and access to basic facilities can ameliorate the effects of diseases.

In addition to poor living conditions, low vaccination rates cause excess cases of disease in peri urban as well. Peri urban children are less likely to be vaccinated mainly because some peri urban dwellers refuse vaccinations without understanding its importance or no one at home is able to take the child to health sectors for vaccinations. Lack of reliable data also has a negative impact on peri urban dwellers' health. A number of peri urban families do not report cases or seek professional medical care, which results in insufficient data (USAID2004). This might prevent appropriate allocation of health care resources in peri urban areas since many countries base their health care plans on data from clinic, hospital, or national mortality registry. Moreover, health service does not exist in most of the world's peri urban. Emergency ambulance service and urgent care is typically unavailable in peri urban. Health service providers avoid servicing peri urban. A study shows that more than half of slum dwellers are prone to visit private practitioners or seek self-medication with medicines available in the home. Private practitioners in peri urban are usually those who are unlicensed or poorly trained and they run clinics and pharmacies mainly for the sake of money. Recent study has shown that there has been substantial improvement in the health awareness of the slum dwellers of Mumbai with regards to HIV/AIDS and Diabetes (UNAIDS2004).

2.6.5 Children's Malnutrition

Child malnutrition is more common in peri urban than in non-peri urban areas. In Mumbai and New Delhi, 47% and 51% of slum children under the age of five are stunted and 35% and 36% of them are underweighted. These children all suffer from third-degree malnutrition, the most severe level, according to (WHO, 2004) standards. A study conducted by (UNAIDS 2004) in Bangkokperi urban illustrates that in terms of weight-forage, 25.4% of the children who participated in the survey suffered from malnutrition, compared to around 8% national malnutrition prevalence in Thailand. In Ethiopia and the Niger, rates of child malnutrition in peri urban are around 40%

The major nutritional problems in peri urban are protein-energy malnutrition (PEM), vitamin A deficiency (VAD), iron deficiency anemia (IDA) and iodine deficiency disorders (IDD). Malnutrition can sometimes lead to death among children. Dr.Abhay Bang's report shows that malnutrition kills 56,000 children annually in urbanperi urban in India.

Widespread child malnutrition in peri urban is closely related to family income, mothers' food practice, mothers' educational level, and maternal employment or housewifery. Poverty may result in inadequate food intake when people cannot afford to buy and store enough food, which leads to malnutrition. Another common cause is mothers' faulty feeding practices, including inadequate breastfeeding and wrongly preparation of food for children. (UN Habitat 2003) study in Bangkok peri urban shows that around 64% of the mothers sometimes fed their children instant food instead of a normal meal. And about 70% of the mothers did not provide their children three meals every day. Mothers' lack of education leads to their faulty feeding practices. Many mothers in peri urban don't have knowledge on food nutrition for children. Maternal employment also influences children's nutritional status. For the mothers who work outside, their children are prone to be malnourished. These children are likely to be neglected by their mothers or sometimes not carefully looked after by their female relatives. Recent study has shown improvements in health awareness in adolescent age group of a peri urban area.

2.6.6 Epidemics

Peri urban have been historically linked to epidemics. This trend has continued in modern times. For example, the peri urban of West African nations such as Liberia were crippled by as well as contributed to the outbreak and spread of Ebola in 2014.Peri urban are considered a major public health concern and potential breeding grounds of drug resistant diseases for the entire city, the nation, as well as the global community.

2.7. Remote sensing and urban growth assessment

Many scientists, resource managers, and planners agree that, the future development and management of urban areas entail comprehensive knowledge about the on-going processes and patterns. As a result, understanding the urban growth patterns, dynamic processes, and their relationships and interactions is a key objective in the contemporary urban studies(e.g. Bhatta, 2009 -2010; Deng et al., 2009).Remote sensing is helpful tool to better understand the spatiotemporal trends of urbanization and monitor the spatial pattern of urban landscape compared to traditional socioeconomic indicators such as population growth, employment shifts, etc. (Jun et al., 2009).However, the availability of multi - temporal data is important to analyse the dynamics of land cover change over time and space. The common approach to the study is to consider the behavior of the built up areas over the spatio- temporal changes taking place, by visual interpretations. In order to detect the changes and patterns of different spatial phenomenon, it is important to make sure that the available images are acquired in the same season. This will help to avoid data inaccuracy generated due to seasonal variations. Nonetheless, it is difficult to find multi-date data taken at the same time of different years, particularly in tropical regions where cloud cover is prevalent (Mas, 1999). As a result the selection of temporal dimension is mostly dependent on the availability of good quality data at that particular time of interest. Particularly, this is true for developing countries. Although challenged by different factors such as spatial and spectral heterogeneity of urban environments, remote sensing is an appropriate source of data for urban studies (Roberts &Herold, 2004. Now days, the physical expansions and patterns of urban growth on landscapes can be distinguished, mapped, and analysed by using remote sensing data (Bhatta, 2010). Medium resolution Landsat images play the key role in the analysis of urban change at different spatial scale (e.g. Buyantuyev et al., 2010; Ding et al., 2007; Huang; et al., 2008).

Shi et al. (2012) used three sets of Landsat Thematic Mapper (TM) images to characterize the growth types and analyse the growth density distribution in response to urban growth patterns in peri-urban areas of Lianyungang City. The result of this research depicted that, substantial arable lands were lost by urban growth in peri-urban & the pre-dominant growth types were edge-expansion and infilling growth respectively with important evidence of urbanization from a city‘s central core. Deka et al. (2012) showed that the integration of remote sensing (RS) and Geographical Information System (GIS) technique to effectively detect urban growth, emphasizing on the potential applicability of Landsat TM data in the urban studies at both regional as well as local level. This study also considers the pattern of medium resolution Landsat images for analysis of urban growth at metropolitan scale of Bauchi.

2.8 Image classification methods

Classification in remote sensing involves clustering the pixels of an image to a relatively small set of classes, such that pixels in the same class are having similar properties. The majority of image classification is based on the detection of the spectral response patterns of land cover classes (Brito& Quintanilha, 2012). In order to utilize remote sensed images effectively, several image classification methods have been suggested and developed over the past decades. But there is no single ideal classification method for each and every remote sensing image (Tso& Mather, 2009). The choice of image classification method mostly depends on the objectives of the research, the nature of the image and the level of detail or accuracy required for specific application (Lillesand et al., 2008).

There are two broads of classification procedures: supervised classification unsupervised classification. Supervised classification is the process of assigning objects of unknown identity to one or more known features using training data. Maximum likelihood (ML) classification algorithm assumes that the statistics for each class in each band are normally distributed and calculates the probability that a given pixel belongs to a specific class. Each pixel is assigned to the class that has the highest probability (i.e., the maximum likelihood). Better results can be achieved in supervised classification technique by taking more features and training samples from the study area. Training data are objects selected as representative samples of known features.

In supervised classification prior knowledge of the ground cover is important to select training samples. The advantage of the ML classification algorithm is that it takes the variability of the classes into account by using the covariance matrix. However, the disadvantage of maximum Likelihoods classification arises from the time and effort required to prepare the training samples (Al-Ahmadi & Hames, 2009).

In unsupervised classification technique, an algorithm is chosen that will take a remotely sensed data set and find a pre-specified number of statistical clusters in multispectral or hyper-spectral space. Although these clusters are not always equivalent to actual classes of land cover, this method can be used without having prior knowledge of the ground cover in the study site (Mohd Hasmadi I et al., 2009). Contrary to the a priori use of analyst- provided information in supervised classification; unsupervised is a clustering of the data space without any information provided by any analyst. Analyst information is used only to attach information class (e.g.ground cover type) labels to the segments established by clustering. Clearly this is an advantage of the approach. However, the result of clustering is simply the identification of spectrally distinct classes in image data. These classes do not necessarily relate to the informational categories that are of interest to analyst. Hence, proper interpretation of these classes is required along with reference data that requires understanding of the concepts behind the classifier and familiarity with the area under analysis (Lillesand et al., 2008).

Maximum Likelihood classifier is one of the most popular and widely used types of image classification technique in remote sensing (Brito & Quintanilha, 2012). Several researchers have demonstrated the importance of supervised maximum likelihood classification technique for land cover change analysis. For example, Tang et al. (2008) analysed the spatio-temporal landscape dynamics of two petroleum - based cities: Houston, Texas in the United States and Daqing, Heilongjiang province in China. They used the conventional Maximum Likelihood Classification method to classify six multi- temporal satellite images. Yuan et al. (2005) used supervised maximum classification method to map and monitor land cover change using multi temporal Landsat Thematic Mapper (TM) data in the seven- county Twin Cities Metropolitan Area of Minnesota for 1986, 1991, 1998, and 2002. Zhou and Wang (2011) used maximum likelihood classifier to characterize the changing patterns and intensities of green space in Kunming, China from 1992 to 2009.

2.9 Remote sensing and change detection techniques

Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times (Singh, 1989, p. 989). Different change detection methods have been developed and documented over the past decades can be found in (D. Lu et al., 2004). All have their own advantage and disadvantage. Some of the most commonly used change detection methods have been discussed below.

2.9.1 Image differencing

Image differencing is one of the most widely used to determine changes between images, and has been used in a variety of geographical environments. The difference between two images is calculated by subtracting the imagery of one date from that of another, and generating an image based on the result. The subtraction results in large positive or negative values in areas of radiance change, and values close to zero in areas of no change. A critical challenge of this method is deciding where to place the threshold boundaries between change and no change pixels. This method is also sensitive to mis -registration and mixed pixels. To obtain good result, the two images must first be aligned so that corresponding points coincide. The complexity of image pre-processing needed before differencing varies with the type of image used.

2.9.2 Principal component analysis (PCA)

Principal component analysis is a technique used extensively in remote sensing images analysis in application well beyond that of change detection. PCA has been used for determining the intrinsic dimensionality of multi spectral imagery, data enhancement for geological application, and land cover change detection. This method is often used to reduce the dimensionality of the data without reducing its overall information content. However, estimation of the PCA projection from data has its own limitations. Its computational complexity makes it difficult to deal directly with high dimensional data, like satellite images. Second, the number of examples available for the estimation of the PCA projection is typically much smaller than the ambient dimension of the data and this can lead to over fitting of the projection.

2.9.3 Post classification comparison

Post classification comparison is the most intuitive methods of change detection, is GIS overlay of two independently produced classified images. The post-classification comparison can be used to identify not only the amount and location of change, but also the nature of change. The method can produce from-to information (D. Lu et al., 2004). However, the accuracy of the change detection is highly dependent on the accuracy of the classification result. The method reduces the need to perform geometric and atmospheric corrections (Jensen, 2005; Y. Liu et al., 2004) Post-classification comparison is made on classified images. Mas (1999)suggested that post classification is often considered a priory to be the superior change detection method and is, therefore, used as the standard for evaluating the results of other methods. However, every inaccuracy in the individual data classification map will also be propagated in the final change detection map. Therefore, it is imperative that the individual classification maps used in the post-classification change detection methods be as accurate as possible. In addition to these the image classification stage of this method takes a long time because the accuracy of the classification needs to be high to get a good change detection result (D. Lu et al., 2004). The advantage of post-classification comparison is that it can provide from-to information which helpful to differentiate which land cove or land use class is changed to another class.

2.9.4 Change Vector Analysis (CVA)

Change vector analysis technique is an empirical method of detecting radiometric changes between multitudes of satellite images in any number of spectral bands. This method yields information about the degree and type of spectral changes by calculating a vector magnitude and direction in multispectral change space for each pixel (Balcik & Goksel, 2012). Like image differencing, at threshold indicating change and no change area also needs to be determined in this method (Lambin & Strahler, 1994). A particular advantage of the change vector analysis method is the potential capability to process any number of spectral bands desired. This is important because not all changes are easily identified in any single band or spectral feature. Nevertheless, since no effective method has been developed to handle more than two spectral bands (Kontoes, 2008).

2.9.5 Image Rationing

Image rationing is another method for change detection in which two images from two dates are divided band by band and pixel by pixel. If the ratio of two images is equal to 1, then no change has occurred, but if the ratio is greater than or less than one that means change has occurred. A threshold needs to be decided. The common way for deciding this has been to set a threshold value and then evaluating the change detection. Image rationing produces images with a non-Gaussian distribution of pixel values and if a threshold is decided based on standard deviations from the mean, the change will not be equal on both sides. This feature of image rationing has been criticized (D. Lu et al., 2004; Singh, 1989).One of the most common ratio is called Normalized Difference Vegetation Index (NDVI) is: (NIR-RED)/ (NIR+RED) or simplified as NIR /RED. The advantage of image rationing is that the effect of different Sun angles, shadows and topography is reduced, the disadvantage is the non-Gaussian distribution of the ratio image making threshold selection difficult (D. Lu et al., 2004).

Recently, numerous studies have indicated the use of post-classification comparison change detection technique for land cover change analysis in urban studies. Yin et al. (2011) post-classification comparison to detect changes of Shanghai metropolitan area, China based on Landsat MSS, TM and ETM+ images from 1979, 1990, 2000 and 2009. By overlaying the classified images over each other they were able to compare the changes in pixels of the layers pixel – by - pixel. Alphan et al. (2009) used post - classification comparison change detection method to assess the land cover changes in Kahramanmaraş (K.Maraş) and its environs from multi temporal Landsat and ASTER imagery, respectively belong to 1989, 2000 and 2004 . J. Liu et al. (2005) also used post-classification comparison to analyse and map the magnitude and pattern of China‘s changing landscape during the 1990s from Landsat TM images covering the entire county. They classified the images in to different land cover class identified. Then the classified images were compared using some statistical measurements.

2.10 Remote sensing and spatial metrics

Metrics as discussed above, the main strength of remote sensing technique lays on its capability to deliver spatially consistent data set that cover a wide range of spatial extent with both high and detailed spatio-temporal resolution, including historical time series data (Herold et al., 2005). Yet, it cannot provide full description of the underlying processes that are responsible for the changing patterns of urban landscape. To bridge this gap spatial metrics are used. The thematic land cover maps obtained from the analysis of Landsat TM and ETM+ images will used to further quantify and describe urban landscape pattern. The interest to quantify landscape patterns are often driven by the premise that patterns are linked to ecological processes (Gustafson, 1998). Spatial metrics are expedient tools for quantifying spatial heterogeneity and to have better insight on how spatial structures impact the system interaction in a heterogeneous landscape. Heterogeneous landscape or spatial heterogeneity refers to the complexity and unevenness of a system property in time and space, spatial heterogeneity is considered synonymous of spatial pattern. A system property is any measurable entity, for instance the configuration of the landscape mosaic. Spatial structure is a major subset of the concept of spatial heterogeneity; usually referring to the spatial configuration of the system property (Turner Spatial metrics can provide rich numerical description of the landscape structure at patch, patch class or the whole landscape level (Herold et al., 2003).

Spatial metrics can be categorized into three broad classes: patch, class, and spatial metrics (Bhatta, 2010). Patch is a relatively homogeneous area that differs from its surroundings (McGarigal & Marks., 1995). Patch metrics are computed for every patch in the landscape, class metrics are computed for every class in the landscape, and spatial metrics are computed for the entire landscape (Bhatta, 2010).

However, most spatial metrics are scale dependent and they are determined by the extent of spatial domain, the spatial resolution and the thematic definition of the map categories (Šímová & Gdulová, 2012). It is up to the user to define the landscape, including its thematic content and resolution, spatial grain and extent, and the boundary of the study area, based on the phenomenon under consideration before conducting any kind of metrics computation (McGarigal et al., 2012). Attention should be paid while comparing the value of metrics computed from landscapes that have been defined and scaled differently.

2.11 Analysing urban growth pattern using remote sensing & spatial metrics

Patterns are distinguished by spatial relationships among component parts in landscape metrics. A landscape pattern can be characterized by both its composition and configuration of its component parts (McGarigal & Marks., 1995). These two characteristics of a landscape can individually or in combination affect ecological processes. A variety of metrics have been developed to quantify categorical map patterns in the past studies (see, for example McGarigal et al., 2002). Despite the availability of plenty of metrics, offered by different literature, to describe landscape structure, they are still categorized under the two major components, namely, composition and configuration of a landscape (Gustafson, 1998). Composition metrics is easy to quantify and can be defined as features related to the presence, proportion and the variety and richness of patch types within the landscape mosaic. Nevertheless, composition metrics does not consider the spatial character, arrangement, or location of patches within the mosaic. A variety of quantitative descriptors of landscape composition are available, but the principal measure of composition includes; the proportional abundance of each class in the entire landscape, patches richness, patches evenness, and patch diversity (McGarigal et al., 2002). Shannon‘s diversity index (SHDI), Shannon‘s evenness index (SHEI), dominance (DOM) and patch richness density

(PRD) are some of the examples of commonly used composition metrics. Conversely, configuration metrics is relatively more challenging to quantify. It refers to the spatial arrangement, character and position of patches within the class of patches or entire landscape (McGarigal & Marks., 1995). The principal aspects of configuration metrics includes: patch area and edge, patch shape complexity, core area, contrast, aggregation, subdivision, and isolation. Some of the most frequently used configuration metrics includes: number of patches (NP), percentage of landscape (PLAND), edge density (ED), landscape shape index (LSI), mean patch size (MPS) and number of patches (NP), largest patch index(LPI), total edge (TE), mean shape index (MSI), area-weighted mean fractal dimension (AWMFD), total core area (TCA), mean Euclidean nearest neighbour index (MNN), contagion (CONTAG),effective mesh size (MESH), aggregation index (AI). Urban growth and land cover change has been the major topic concerning remote sensing applications (Masser, 2001). The spatial and temporal dimensions are major concerns of remote sensing using urban studies. To better understand the complexity of urban systems and its spatial and temporal dimensions, et al., 1989).Urban growth analysis needs to be linked with land cover change model.

Currently, there has been an increasing interest in applying remote sensing and spatial metrics techniques (see for example FRAGSTATS McGarigal et al., 2012)to analyse urban environment. For instance, Kuffer and Barrosb (2011) used spatial metrics in a VHR remotely sensed images to analyse the morphology of unplanned urban settlements in Dar es Salaam and New Delhi. In this study, different sets of metrics were used for two case studies. After eliminating several highly correlating metrics, the authors selected a set of four metrics , i.e. is mean area, patch density, aggregation index and Shannon‘s diversity index for Dar es Salaam and aset of six metrics, i.e. effective mesh size, landscape division index, patch density, contagion, aggregation and Simpson‘s evenness index for Delhi. Both sets of metrics measure size, pattern and density. Finally, the sets of spatial metrics were combined using spatial multi - criteria evaluation to produce a composite index indicating areas of high likelihood of‗unplannedness‘ in the study area. Jain et al. (2011) applied spatial metrics and gradient analysis method for quantifying and capturing changes in urban landscape using LISS III imagery of Gurgaon, India. The combination of landscape metrics, i.e. percentage of landscape, mean patch size, number of patches, landscape shape index and largest patch index have been used to quantify the patterns of urban growth in different directions of the city in terms of size, shape and complexity of development. Finally, they were able to demonstrate the potential of spatial metrics and gradient analysis to quantify the impact of regional factors on the growth pattern. Pham and Yamaguchi (2011) showed the potential application of spatial metrics as secondary sources of information for supporting remotely sensed data and their use to characterize urban growth patterns of Hanoi, Vietnam. The study used the percentage of like adjacency (PLADJ) metric on the urban growth maps generated using maximum likelihood image classification technique to illustrate the changes in the urban structure in the study area. Six class-level landscape metrics, i.e. class area, number of patch, edge density, largest patch index, mean nearest neighbour distance and area weighted mean patch fractal dimension, were selected to characterize the peri- urban. The urban composition parameters of Hanoi,Seto and Fragkias (2005) effectively compared the spatio-temporal pattern of urban land use changes in four Chinese cities, using three concentric zones and a set of landscape metrics. This study used a group of six spatial pattern metrics analysis indices namely: total urban area (UA), number of urban patches (NUMP),mean urban patch size (MPS), urban patch size coefficient of variation (PSCOV), urban edge density (ED) and area, weighted mean patch fractal dimension (AWMPFD). The results of the study indicate that urban form can be flexible over relatively short periods of time. Despite different economic development and policy background, the four cities exhibit common patterns in their shape, size, and growth rates, suggesting a convergence toward a standard urban form. X. J. Yu and Ng (2007) used a combination of remote sensing images, spatial metrics and gradient analysis to analyse the spatial and temporal dynamics of urban sprawl in Guangzhou, China. The results of the study indicates that landscape change in Guangzhou exhibits distinctive spatial differences from the urban centre to rural areas, with higher fragmentation at peri urban or in new urbanizing areas.

Population growth and rapid economic development were the two major driving forces of urban expansion in the study area. The authors were also able to demonstrate the importance of temporal data to reveal the complexity of landscape pattern and to capture the spatio-temporal dynamics of landscape changes. Herold et al. (2005) explored the importance of spatial metrics in the study and modelling of urban land use change in Santa Barbara urban area, California, USA. Percentage of landscape (built up)(PLAND), patch size standard deviation (PSSD), contagion index(CONTAG), patch density (PD), edge density(ED), area weighted mean patch fractal dimension(AWMPFD)are the spatial metric growth signatures used in the study. According to the study, the growth of Santa Barbara develops outward from the original downtown core. Generally the study shows that spatial metrics can be utilized for the detailed mapping of urban land use change at different geographic scales and can help understand a number of socioeconomic characteristics from remote sensing data.

Schneider et al. (2005) used remotely sensed data to map changes in land cover in the greater Chengdu area and to investigate the spatial distribution of urban development by using spatial metrics along seven urban-to-rural transects corridors of growth. Pham et al. (2011) explored and approach for combining remote sensing and spatial metrics to monitor urbanization, and investigate the relationship between urbanization and urban land use plans. The study explained the pattern in four cities of Asia namely: Hanoi, Hartford, Nagoya and Shanghai, using Landsat and ASTER data. The results indicates that the combined approach of remote sensing and spatial metrics provides local city planners with valuable information that can be used to better understand the impact of urban planning policies in urban areas. Herold et al. (2005)stated that spatial metrics Combined with, time -series of high spatial resolution remote sensing data has the potential to characterize the dynamics of urban growth processes as well as it can reveal the spatial component in urban structure underlying the growth process (Herold et al., 2002). In this context, remote sensing and spatial metrics are used in a complementary way to better understand the urban growth processes and patterns. Jianguo Wu et al. (2011) analysed the spatio-temporal patterns of urbanization in two fast growing metropolitan regions in the United States using: Phoenix and LasVegas. Based on historical land use data and landscape pattern metrics at multiple spatial resolutions they were able to characterize the temporal patterns of urbanization in the metropolitan regions. The results of the research showed that, two urban landscapes exhibited strikingly similar temporal patterns of urbanization with an increasingly faster increase in the patch density, edge density, and structural complexity of the landscape. That is, as urbanization continued to unfold, both landscapes became increasingly more diverse in land use, more fragmented in structure, and more complex in shape .Finally, the authors conclude that a small set of spatial metrics is able to capture the main spatio -temporal signatures of urbanization, and that the general patterns of urbanization do not seem to be significantly affected by changing grain sizes of land use maps when the spatial extent is fixed. There are several approached to analyse and quantify the dynamics of urban growth patterns and processes.

However the selection of approaches depends on the objectives and the problem on hand and understanding of the different tools and techniques used for analysing urban environment. Several studies reviewed in this section indicate the value of medium resolution remote sensed satellite images and spatial metrics for the analysis of urban change.

2.12 Urban growth modelling

Rapid urban growth accompanied by land cover change, has become a global phenomenon observed all over the world. Several studies have endeavoured to understand the spatio-temporal pattern of land cover change and its driving forces (Allen & Lu, 2003; Veldkamp & Lambin, 2001). There are two broad categories of land change models developed over the past several decades (Hu & Lo, 2007).These are dynamic simulation based models and statistical estimation models. Simulation-based models such as Cellular Automata (CA) attempts to capture the spatio-temporal pattern of urban change by incorporating spatial interaction effect in to the model. However, the poor explanatory capacity of simulation models has limited the detail understanding and interpretability of urban growth dynamics with its potential driving forces (Luo & Kanala, 2008).Moreover, most dynamic simulation models are not capable of incorporating adequate socio- economic variables(Hu & Lo, 2007).Empirical models use statistical analysis to reveal the interaction between land cover change and explanatory variables and have much better interpretability than simulation models. For example, regression analysis can help to identify the driving factors of urban growth and quantify the contributions of individual variables and their level of significance (B. Huang et al., 2009; Luo & Kanala, 2008; Nong & Du, 2011). Binomial (or binary) logistic regression is a form of regression, which is used to model the relationship between a binary variable and one or more explanatory variables yielding dichotomous outcome (Hosmer & Lemeshow, 2004).Logistic regression is based on the concepts of binomial probability theory, which does not assume linearity of relationship between the independent and the dependent variables, does not require normally distributed variables, and in general has no strict requirements. In the context of urban growth modelling, logistic regression model was used to study the relationship between urban growth and biophysical driving forces (B. uang et al., 2009).The conversion of non-urban to urban land use is considered as state 1, while the no conversion is indicated as state 0 in the same period of time. A set of independent variables are selected to explain the probability of non-urban land use conversion to urban. The main purpose of urban growth modelling is to understand the dynamic processes responsible for the changing pattern of urban landscape, and therefore interpretability of models is the most important aspect the modelling process. The advantage of statistical models is their simplicity for construction and interpretation or their capacity to correlate spatial patterns of urban growth with driving forces mathematically. However, statistical models lack theoretical foundation as they do not attempt to simulate the processes that actually drive the change (Koomen & Stillwell, 2007).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

The chapter explains the data required and sources, data collection tools, and data collection procedure for the study. It also covers the statistical procedures employed in data analysis.

3.1 Data required and sources

The data required for the study are drawn from primary and secondary sources. The primary included physical attributes such as change of the site, including site layout, location of buildings and available infrastructure. These were collected to ascertain the pattern and quality of peri urban growth and development. These categories of data are sourced from the field survey using questionnaire supported with interviews with staff of the Urban Developments Board, the Ministry of Lands Housing and Urban Development and the ward Heads. Data collected and sources are shown in table 3.1

Table 3.1 Data required and sources

Data type	Data required	Data sources
Peri urban settlements characteristics	, physical site, site layout, location of building space for installing infrastructures.	Field survey, map.
Process of peri urban growth and development	, percentage rate of peri urban growth, characteristic of development intern of infrastructure, physical location of housing conditions.	Satellites imageries, Field survey.
Process of development	, access to land (formal and informal) available roads spaces, and drainages, materials use for measuring plots and size of plots	Field survey.
Determinant of peri urban growth.	Strength and weaknesses of the ministry, master plan review, development control issues	Interview , field survey
Infrastructures and facilities development	That are available for public uses such as recreational facilities, educational facilities, health facilities, water supply and drainages facilities.	Field survey.
Physical development characteristic	Approval of building permit, adherence to development control, planning status, physical setting of building.	Ministry of lands Housing and Urban Development, Bauchi Local Government Department of Works and Housing.
Conceptual frame work	Concepts , Models and pattern of peri urban development	Publish and Unpublished materials
	Map of Bauchi, Landuses and peri urban areas of Bauchi town.	The use of Google map to capture peri urban areas
	Details of peri urban development from 2004, 2009 and 2014	The use of Google earth to capture the imageries and the extents of developments.

Source (Author 2015)

3.2.1 DATA COLLECTION INSTRUMENTS

The tools used in this study included questionnaires. Interview guide and remote sensing technologies. A set of questions were organised in a systematic way for the purpose of eliciting data from respondents. An interview was conducted using an interview guide. The Geographic Information System was used to compliment the process. It shows the images of growth process.

3.2.2 DATA COLLECTION PROCEDURE

(a) Sample frame

The sampling frame consist of fourteen peri urban areas from which samples were be drawn from a total of 493810 people (NPC2006) and projected to 2015 at a growth rate of 3.4 to 667,183 people

(b) Sample size

Using a sample frame of 41491 of households, drawn from fourteen peri urban areas of Bauchi town, the sample questionnaires as 383.This represents 0.0915% of the projected population of Bauchi peri urban areas. This gives a true representation of the total population size of the study area without bias. The below formula were used to calculate the sample questionnaires for each of the fourteen peri urban areas taken the standard error of the mean as (3.25%), as describes in the Table 3.3.

$$\mathbf{N}= \frac{\boldsymbol{p}(\mathbf{100}\%-\boldsymbol{p})}{(SE)^2}$$

Where

N = the required sample size

SD = the standard Deviation

SE = the standard error of the mean

Table 3.2Samplepopulation size

s/ no	peri urban settlements	Population size	Sample size
1.	Wuntin Dada	5608	52
2.	Tambari	1849	17
3.	SabonKaura	2716	25
4.	RafinZurfi	2310	21
5.	Gwallameji	2416	22
6.	Bigi	4501	42
7.	Lushi	2349	22
8.	Zango	5349	50
9.	Dumi	2416	22
10.	Inkil	2520	23
11.	Gida Dubu	2510	23
12.	Tirwun	4417	41
13.	SabonLayi	1404	13
14.	Kura	1126	10
TOTAL		41491	383

Sources: (Author 2015).

(c) Sampling procedure

Systematic random sampling will be adopted for questionnaire administration where the first household head will be chosen at random and the next head of household at interval of ten houses.

3.4. Interview

An interview was conducted using an interview guide. The interview was done with different stakeholders that included the officials of the Ministry of Land Housing and Urban Development, Urban Development Board, Bauchi Local Government Works and Housing

Department, Wards heads (Masu Unguwanni) and Lands agents (see table 3.4). The interview will elicit verbal responses which will help to obtain reliable and valid information from the respondents.

Table 3.3 sample for interview

Ministry/departments	Frequency	
Land Housing and Urban Development	3	Town planner, Surveyor, BAGIS.
Urban Development Board	2	Head development control. Head physical planning
Local Govt Works and Housing	1	Head land section
Ward Heads (MasuUnguwanni)	14	14 wards Heads
District Heads (Hakimai)	3	Dawaki ,Makama,Nasarawa.
Land Agents (Dillalai)	2	2 land agents
TOTAL	25	

Source: (Author 2015)

3.4.2 Field mapping

The Geographic Information System was used to compliment the process. It shows the images of growth process. The LANDSAT ETM-9 satellite images of Bauchi metropolis as of 2005, 2010 and 2015 with a spatial resolution of 30m.

Direct observation was used in the study area using a checklist; these methods examine the existing situation with regard to character and process of growth. The data captured include characteristics of the study area relating to physical form, water supply, electricity, road network, drainages and garbage collections, sanitation. Photographs were used to show the nature of development and the state of infrastructure provided clear records of the situation at hand.

3.4.3 Image registration

The image was scanned and imported into Arc GIS 10.1 for registration, the image reader extension (Tiff images) was activated to allow the software to read Tiff image files. The images were then Geo referenced in Arc GIS due to its flexibility. Subsequently the study area was cut from the whole image for the three time period. The images were broken into subsets in Arc View as Tiff image.

3.4.4 Image overlay

The images generated for the analysis were then overlaid , so as to obtain a visual representations of the peri urban development of Bauchi town that occur in each period that is 2005, 2010 and 2015. In overlay operation, the exact location, the amount of peri urban development was determined.

3.4.5 Data Processing

The coordinates of all peri urban areas of Bauchi metropolis from the Global Positioning System (GPS) was transferred into Microsoft Excel worksheet and stored for easy transfer into ArcGIS environment. Google imageries of peri urban areas for 2005, 2010 and 2015 were used for the analysis. Pre-processing operations were carried out on the images. Pre-processing functions involve those operations that are normally required prior to the main data analysis and extraction of information, and are generally grouped as geometric corrections. The geometric corrections were carried out to correct the data for sensor irregularities and unwanted sensor and converting the data so they accurately represent the reflected sensor. Geometric corrections were carried out to correct for geometric distortions due to sensor-Earth geometry variations.

After importing the images, each of them was georeferenced in order to define its existence in physical space, that is, establishing its location in terms of map projections or coordinate systems. This is the process of registering the images to a common coordinate system to establish the relationship between page coordinates on a planar map and real-world coordinates. The coordinates from the GPS was used to georeference the images.

3.5 Data analysis

The data analysis consisted of examining and coding the key data into database the purpose is to describe the data collected from the sample survey, questionnaire, an interview, and performing an analysis on descriptive responses using frequency tables, and descriptive statistics to display result with respect to each of the research objectives. The Arc GIS 10.1 was used to analyze the process of peri urban growth and development.

The data collected was analyzed using computer programme of Statistical Package for Social Scientists (SPSS). Frequencies and percentages for different levels of variables like; sex, age, economic activities, types of social services in the area were generated. The descriptive approaches were used for qualitative forms of data. Data analyzed are presented using tables and other appropriate statistical diagrams as well as photographs. The purpose of the analysis is to establish the survey attributes of household as it relates to form of physical development.

In order to assess the pattern and process of peri urban growth, thematic mapper (TM) and Enhence Thematic Mapper Plus (ETM+) were used. Land Sat images taken from 2005,2010 and 2015 were accessed from NASA, Global Land Cover Facility (GLCF) which detected the change process that occur, identifying the nature of the change, measuring the area extend of the change, and assessing the spatial process of the change.

CHAPTER FOUR

4.0 PRESENTATION OF RESULTS

This chapter provides explanations on the growth pattern of peri urban areas of Bauchi town based on the field and secondary data collected and analysed. The product of this is used to answer the research questions set out in the study which are; what is the pattern of peri urban growth and development in Bauchi and what are the implications of the peri urban growth pattern of Bauchi?. The chapter is organised into three (3) the first explains peri urban growth based on time series analysis. The second shows the characteristic of peri urban development within each time series, and the third explains the urban management challenges and implications of the growth pattern.

4.1 PERI URBAN GROWTH PATTERN

4.1.1 Growth pattern 2000 – 2005

The total built up area of Bauchi metropolis in year 2000 was established to be 34.5km^2. In the year 2005, this had increased to 55.95km^2.The pattern was further analysed within the four quadrants of the city. These are the North – East, North – West, South – East, and South – West. The quadrant with the fastest growth is South-West with a total growth area of 32.19%.The factors responsible for such growth are nearness to major Institutions including the Abubakar Tafawa Balewa University, School of Agriculture (Animals Science), Federal Polytechnic, and the Police Training School. This sector generally has become active growth point due to increased demand for off campus staff and student housing. New settlements that have emerged within this quadrant these are Rafin, Zurfi, Sabon Kaura, and Gwallameji. The quadrant with the least growth is the South – East quadrant which grew by 26.30%. In 2000 the South - East covered only 5.25km^2 as shown table 4.1. Its grew to 9.08%. Absent of basic infrastructure and absence of institutions is the major explanation. The few settlements that emerged within these areas during the period are Bigi, Dumi, upward to Lushi as shown in the Table 4.1 Figure 4.1a. The South – East and North – West quadrant grew moderately by 25.18% and 22.69% respectively.

Table 4.1 Proportion of Peri Urban Growth Areas 2000 – 2005

Quadrant	Growth Area in kilometres square (km2)				Difference of
	2000	% Growth	2005	% Growth	Growth Km^2
North – West	5.25	15.20	10.70	22.69	5.45
North – East	7.02	20.30	12.15	19.92	5.13
South – East	9.08	26.30	14.09	25.18	5.01
South – West	13.10	37.90	18.01	32.19	4.91
Total	34.45	100	54.95	100	20.50

Sources; (Field survey 2015)

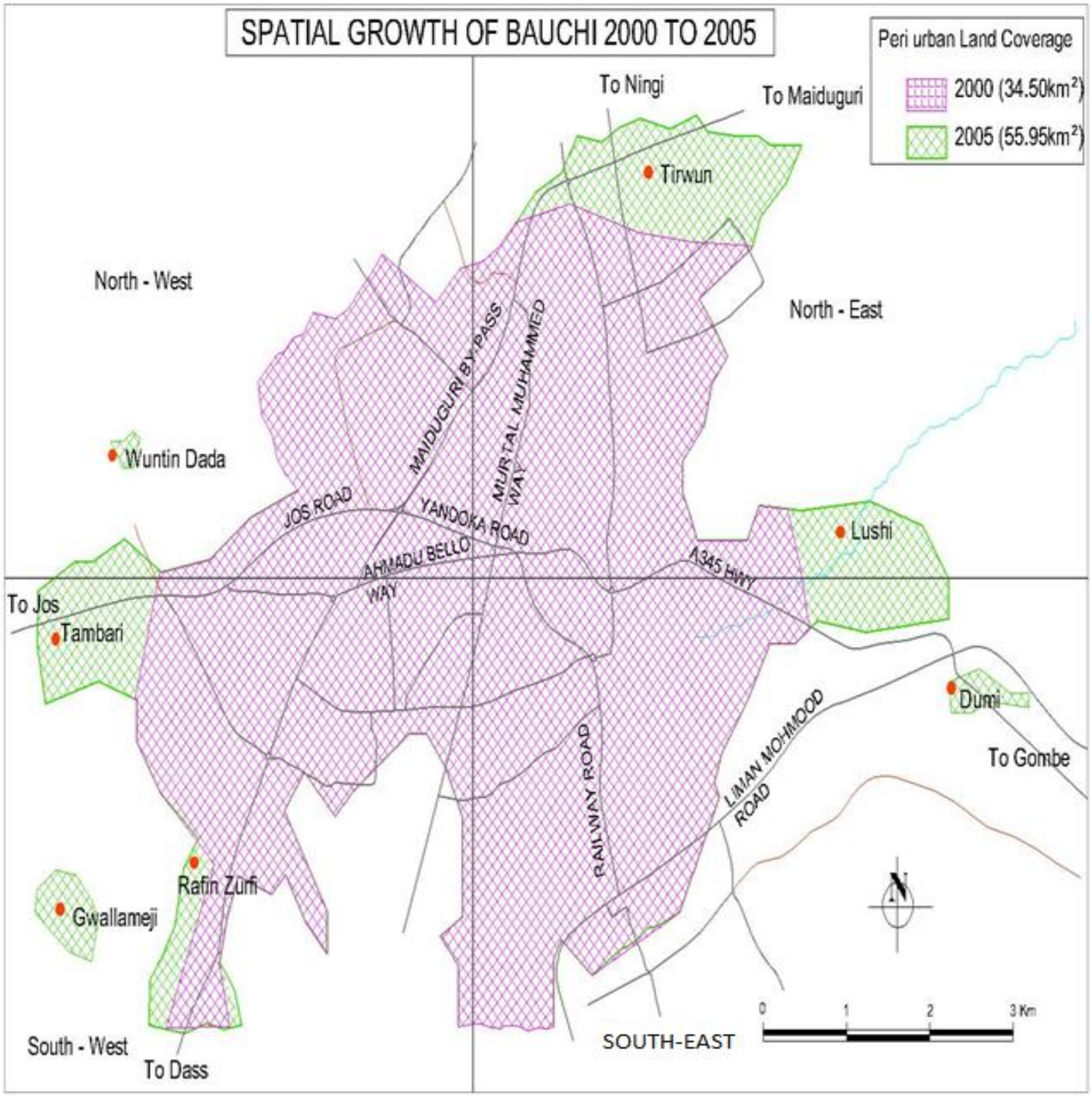


Figure 4.1 spatial growth of Bauchi town 2005

4.1.2 Growth pattern (2005– 2010)

The highest growth within this period like the previous (2005 – 2010) is recorded in the South – East quadrant with a difference of 8.05km^2 as shown on table 4.2. The growth can be explained by the relatively good provision of infrastructure and services and nearness to major institutions and including the Abubakar Tatari Ali Polytechnic (School of Engineering) and Tambari housing estates with 8.05 km^2. New settlements that grew within this quadrant included Wuntin Dada, Tambari and Mechanic village. The areas with the least growth are the North – West quadrant. Growth in this direction has been constrained by difficult terrain and nearness to the Military Barrack. The second and third fastest growth is recorded in the North – East and the South – East quadrants respectively as shown in Table 4.2 and Figure 4.2a.

Table 4.2 Proportion of Peri Urban Growth Areas 2005 – 2010

Quadrant	Growth Area in kilometre square (km^2)				Difference
	2005	**% Growth**	2010	**%Growth**	Km^2
North – West	10.70	22.69	16.90	20.94	6.2
North – East	11.15	19.92	19.10	23.84	7.95
South – East	14.09	25.18	22.45	3.95	8.05
South – West	18.01	32.19	25.90	32.79	7.89
Total	55.95	100	75.92	100	**30.09**

Sources; (Field survey 2015).

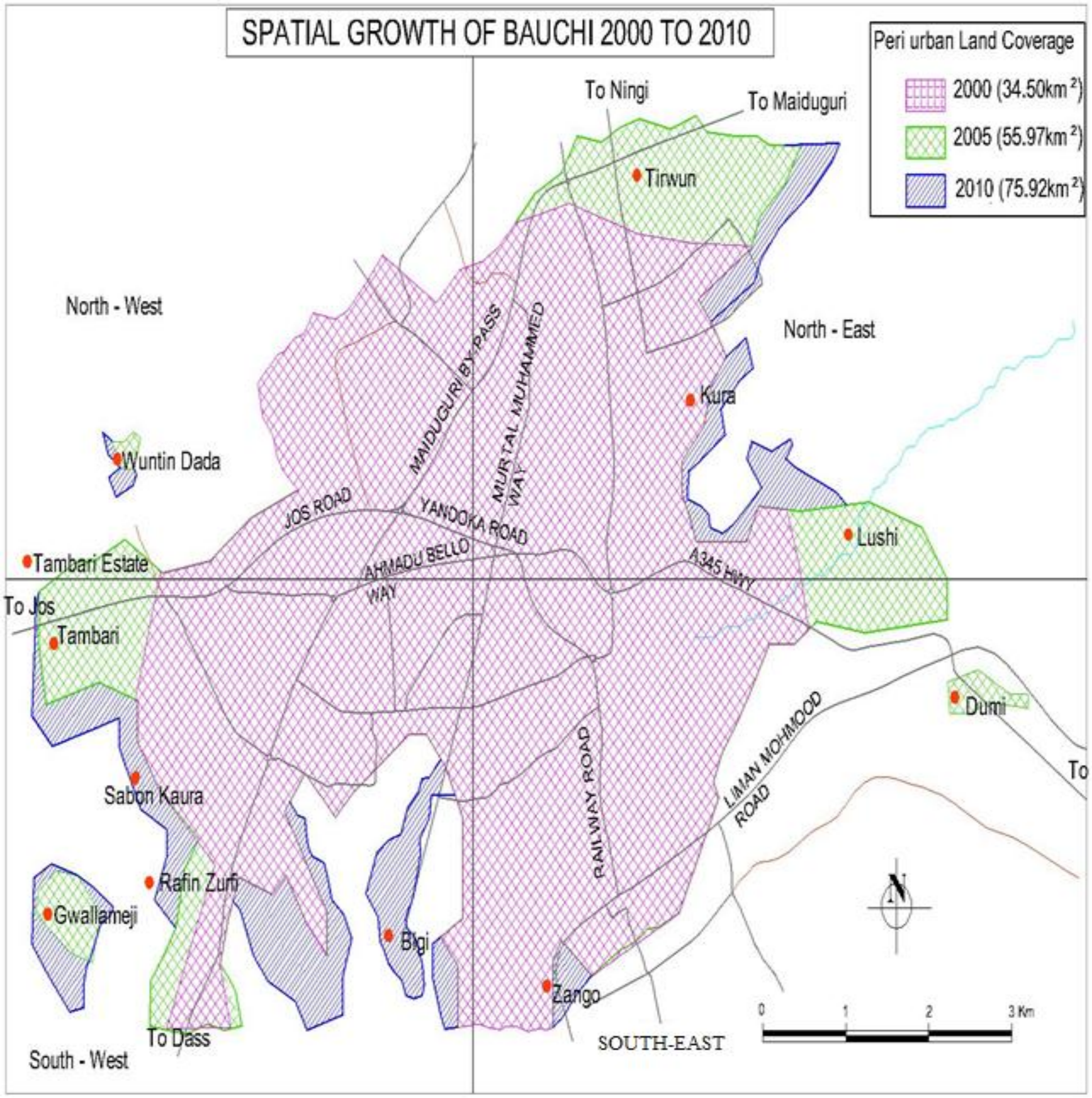


Figure 4.2. Spatial growth of Bauchi town 2010

4.1.3 Growth pattern (2010 – 2015)

Table 4.3 shows the Proportion of Peri Urban growth areas in year 2010 to cover a total of 79.92 km^2. By 2015, this have increased to 109.55km^2 in 2015. The area with the highest land coverage in 2010 was the South – West at 25.90km2 representing 32.40% of the total land cover of the town, and the least is in the North – West at 20.94%. This remained simultaneously the case in 2015 with the South - West accounting for 34.91% and the North – West at 17 .36%as shown in Table 4.3 and Figure 4.3. The highest increase is in the South – West with a difference of 12.35km^2 and the North – West at 2.12km^2 the lowest change was in the North – East with the difference of 6.00km^2

Table 4.3 Proportion of Peri Urban Growth Areas 2010 – 2015

Quadrant	Growth	Area in 66Kilometre square (km^2)			Differences
	2010	%Growth	2015 Growth	%	Km^2
North – West	16.90	20.94	19.02	17.36	2.12
North – East	19.10	23.89	25.10	22.91	6.00
South – East	18.04	22.57	27.18	24.81	9.14
South – West	25.90	32.40	38.25	34.91	12.35
Total	79.92	100	109.55	100	29.61

Sources; (Field survey 2015)

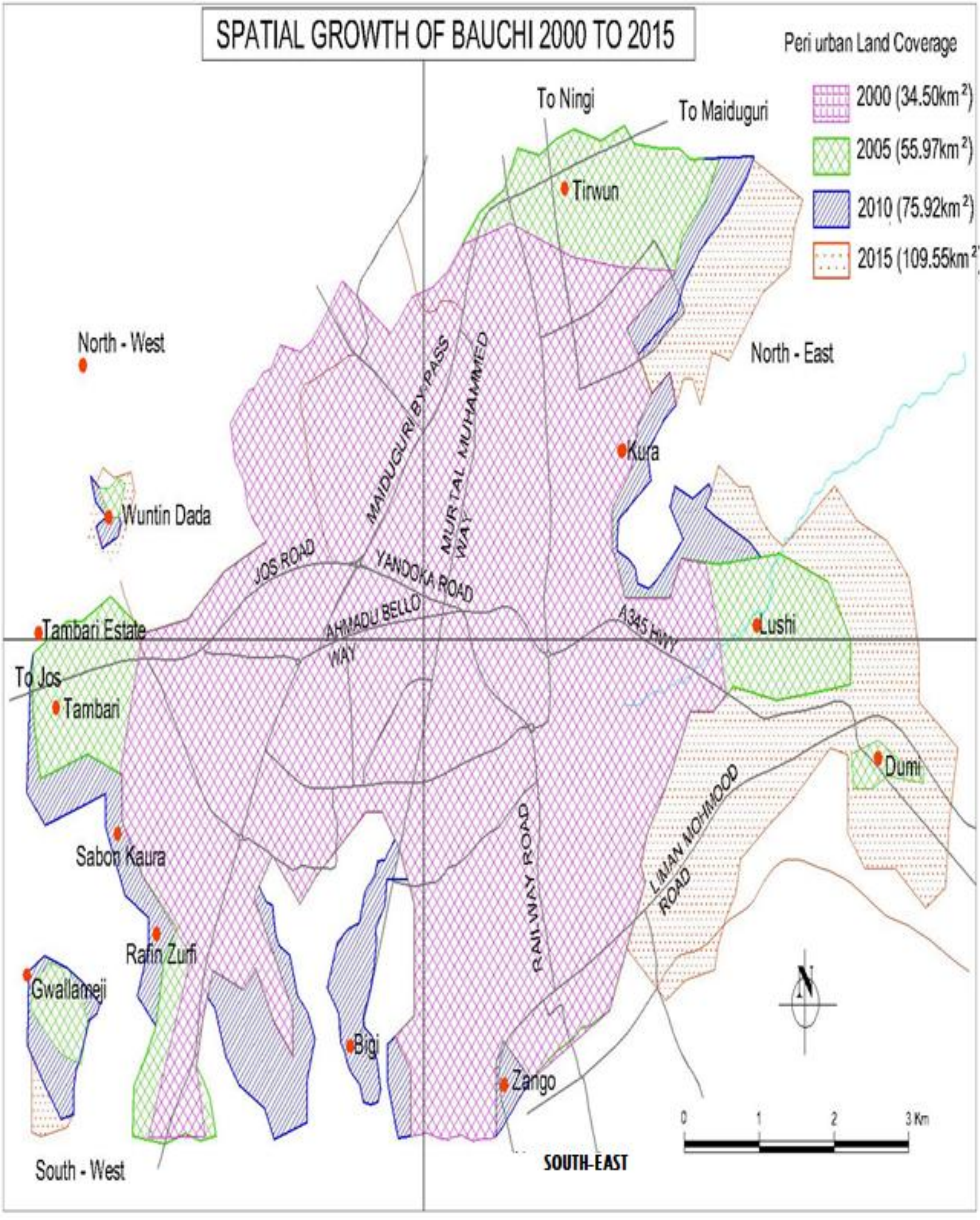


Figure 4.3 spatial growth of Bauchi town (2015).

4.2 DEVELOPMENT CHARACTERISTICS OF PERI URBAN GROWTH AREAS

The growth characteristics of the peri urban areas of Bauchi metropolis was determined by using three variables. These are the spatial structure/form, existing infrastructure and housing characteristics.

4.2.1 Spatial Structure and form

The spatial growth pattern and form of the peri urban areas is generally unplanned irregular and disorderly. There is general irregularity in layout and building arrangement. Houses are arranged in chaotic manner with little or no space for roads and without drainages infrastructure (plate i). Residents tend to build almost 100% of their plot which makes it almost impossible to provide access and circulation. The most visible disorderliness occurs at Bigi, Dumi, Lushi, Gwallameji, and Sabon Kaura (plate ii). Areas that are fairly orderly are those originally planned and layout. These are Gida Dubu, Abubakar Tafawa Balewa University housing estate and Tambari housing estate. Figure 4.4 shows the areas that are planned and those that are unplanned.

Plate i. Part of building that collapse at Tirwun. (Source field survey 2015)

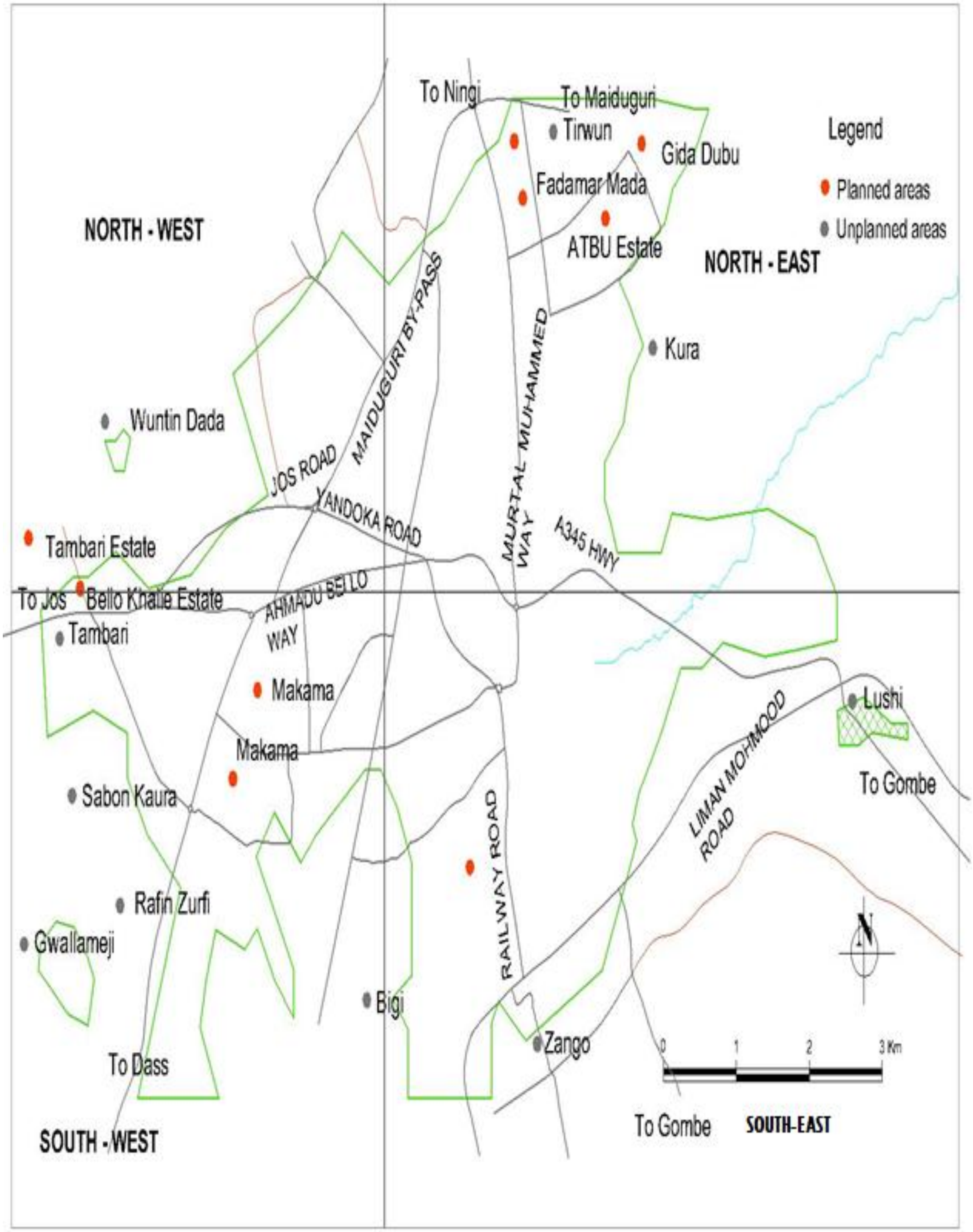


Figure 4.4; Planned and Unplanned growth areas (Source field survey 2015).

Plate ii. Low quality building material on the poor location of building. (Source field survey 2015)

4.2.2 Physical Infrastructure

4.2.2.1 Road network

Most of the peri- urban growth areas have no roads and where the roads are available, they are narrow and in poor condition. The North – West quadrant around Wuntin dada and the Tambari housing Estate has fairly well laid and maintained roads. Most of the peri urban growth areas are located along the major high ways that link Bauchi to other parts of the country in many directions (table 4.4). To the North – West of the metropolis is the Federal trunk 'A' high way linking Bauchi to Jos to the east a high way links Bauchi to Maiduguri and to the North - West to Kano.To the South -East another highway links Bauchi to Gombe, and to the South – West connecting Bauchi to Dass. Generally, the growth of the city along the roads has not been directed by any planning input. The most significant examples are the built up areas at Tirwun, along Maiduguri road, Wuntin Dada along Jos road, Inkil along Gombe road and Rafin Zurfi along Dass road. According to the field survey, all the peri urban settlements are not properly laidout, as shown in table 4.4 and figure 4.5

Table 4.4 Area covered by roads/circulation system in peri urban areas.

Road type	Land area(ha)	Nature of road	Land area(ha)
Vehicular Road	9.6	Tarred	5.5
Foot path	1.08	Untarred	8.9
Total	10.68	Total	14.4

Source; (field survey 2015).

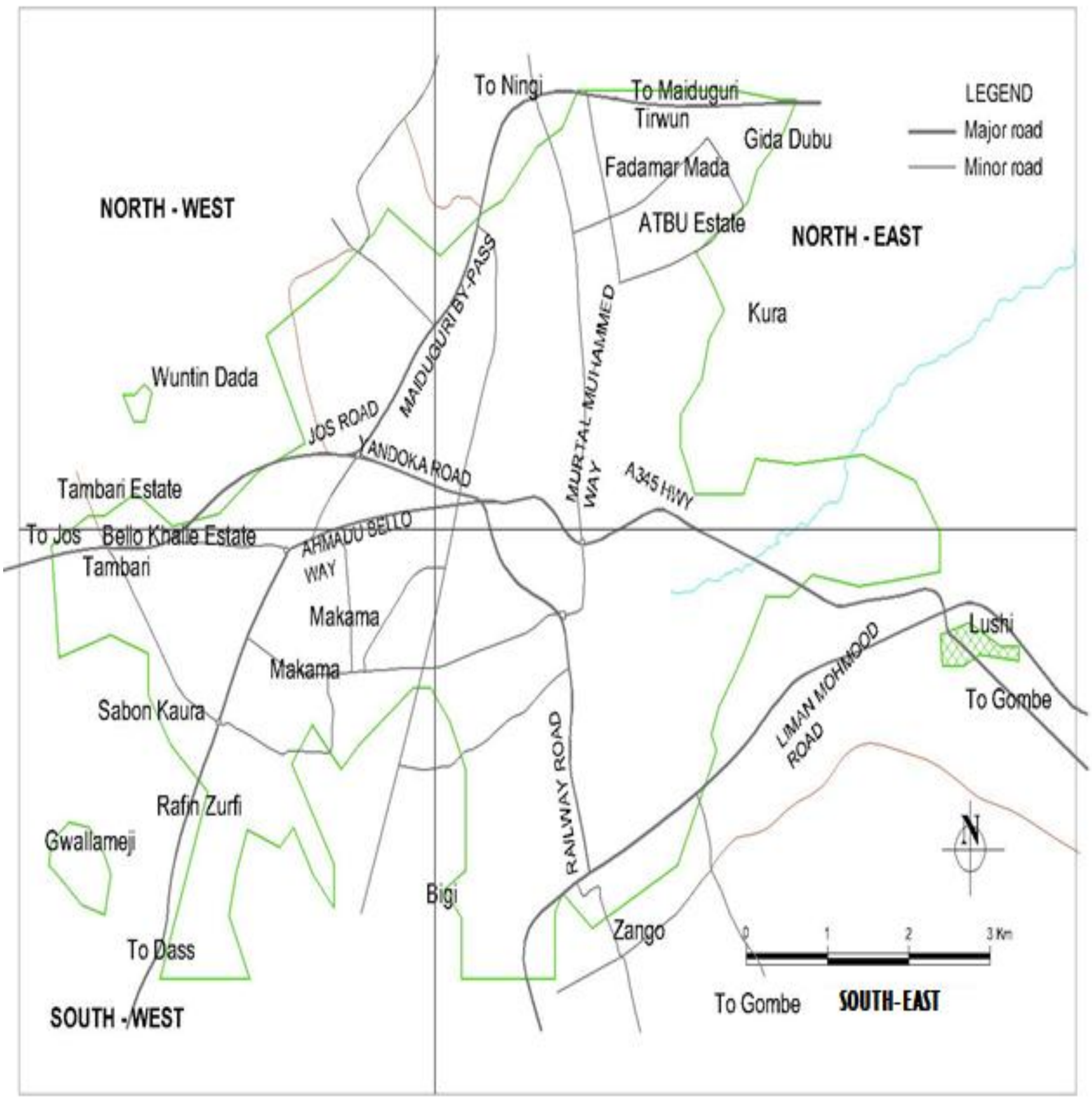


Figure 4.5 Bauchi metropolis road network. (Source field survey 2015).

Plate .iii. Poor road network without drainage. (Source field survey 2015).

4.2.2.2 Drainage system

The drainage system is unplanned and poorly developed. It was observed during the physical survey that almost all the drainages are narrow and shallow. The present storm water drainage infrastructure is not integrated. Existing drainages consist of mainly open earth concrete trenches and a few box drains along the main roads. It was also established during the physical survey that almost all the drainages are narrow and shallow of approximately 0.5 × 0.6 and 0.75 × 0.85 meters. The drains are easily filled by refuse and other sediments as a result of size. The result is that waste water is always over flowing onto the surface being used by pedestrians. Also due to inadequate drainages houses and streets often become flooded during the rainy season. In Lushi and Sabon Kaura, rain water regularly drives people out of their houses during the rainy season. The exception are Gida Dubu, Tambari Housing Estate, and some parts of Gwallameji where adequate drain exist, ensuring that water is easily drained. Figure 4.6 shows the areas that have adequate and inadequate drainage.

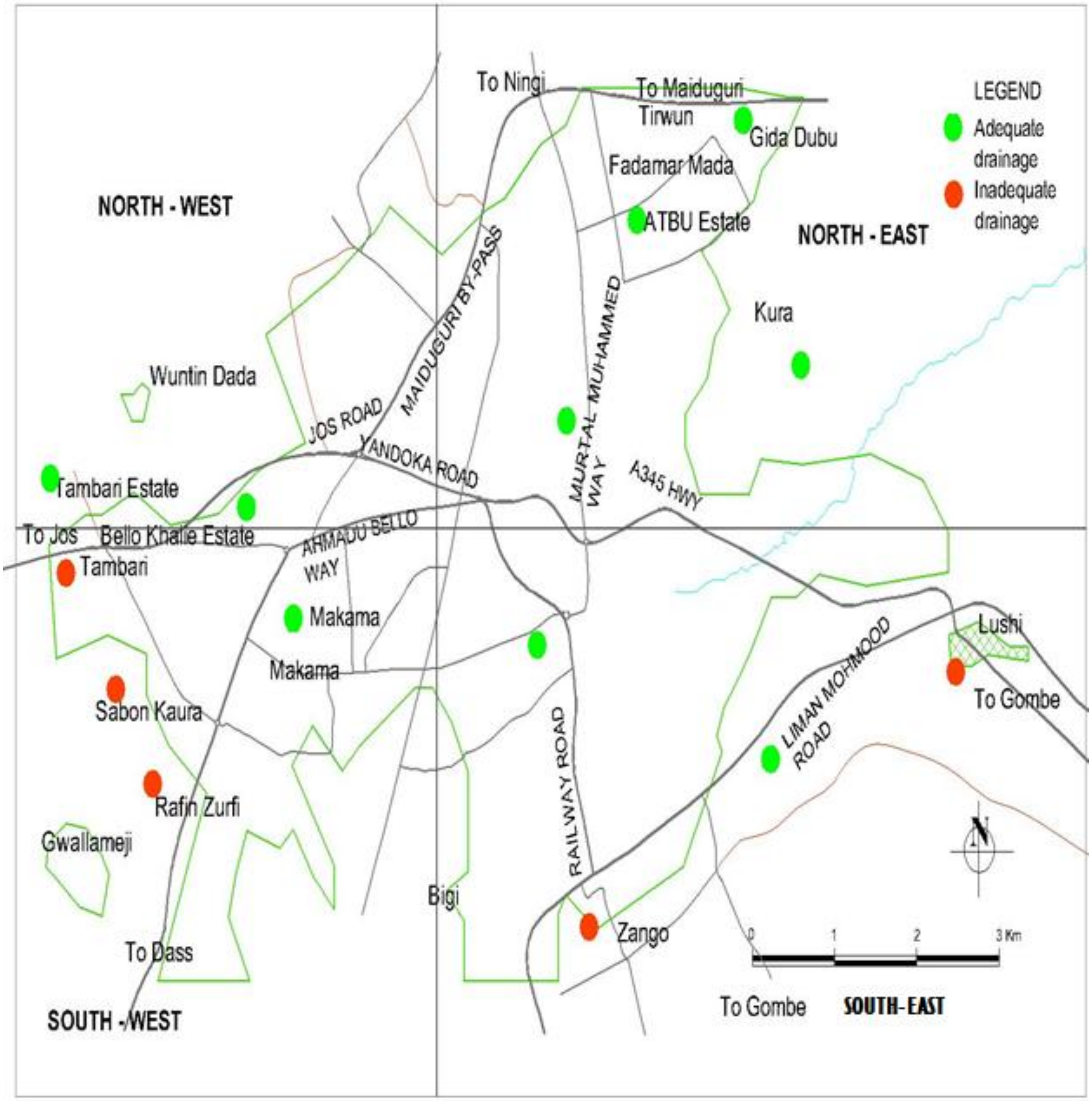


Figure 4.6 Peri urban areas of Bauchi showing areas with adequate and inadequate drainage, (Source field survey 2015).

Plat iv. Poor road without drainage (source field survey 2015).

4.2.2.3 Water supply

Water supply infrastructure like road is mostly under developed. The public supply system is generally absent or where available like in Tambari Housing Estate, Tirwun, and Gwallameji has not kept pace with demand. The areas with or nearly no public supply system are Bigi, Dumi, and Lushi. In these areas supply pipes do not exist, but rather motorized boreholes and wells are the main sources of supply. In the areas around Tirwun, Sabon layi, and Gida Dubu housing estate, public supply source is periodic and intermittent. As such, residents depend on alternative sources such as motorized boreholes and wells. Figure 4.8 indicates that majority of the residents i.e. 43% depend on water vendors to survive, 23% depend on private wells, 14% depend on boreholes outside places, while 20% depend on public water supply. Figure 4.7 shows the areas that have adequate and inadequate access to water supply.

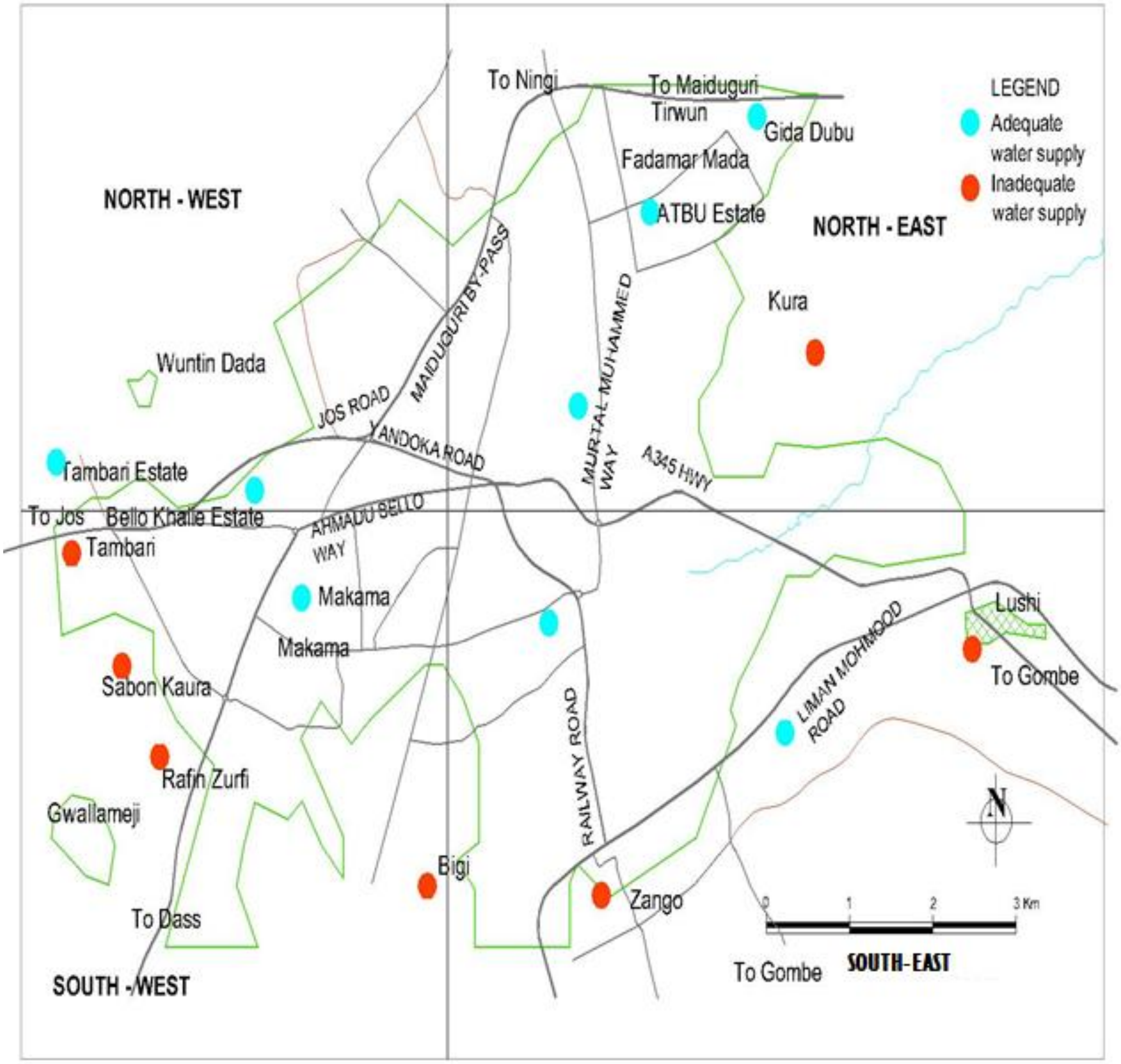


Figure 4.7 Peri urban areas Bauchi showing access to water supply (Source field survey 2015).

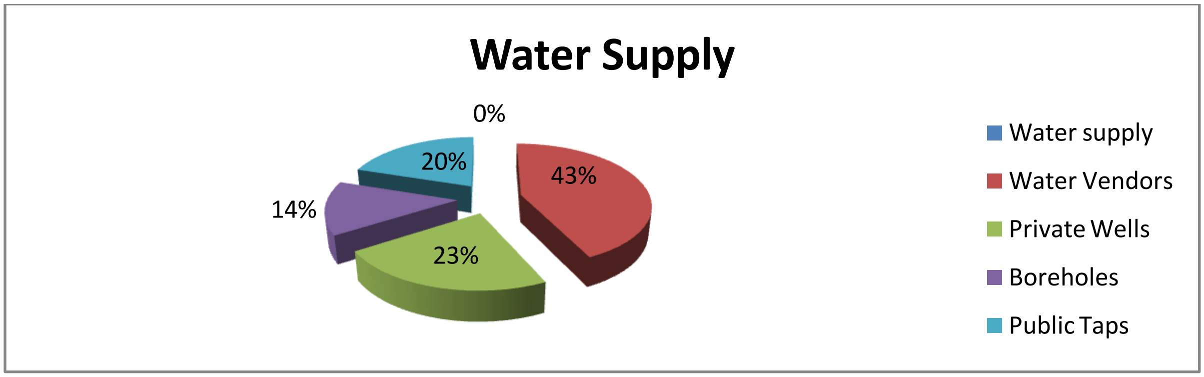


Figure 4.8 Source; (Field survey, 2015).

Plate v. Source of water supply. (Source Field survey, 2015)

4.2.2.4 Electricity supply

Electricity supply is characterized by formal and informal connections. Most houses in the South – West quadrant around Tambari and Wuntin Dada are mostly formally connected. These areas are the planned growth areas. Unlike the North – West quadrant around Bigi, and Dumi, the chaotic manner of peri urban growth has generally hindered formal and planned delivery of electricity. Houses in this segment therefore, are illegally connected as shown in figure 4.9. The

South – East and the North – East growth areas are as well very chaotic. As expected therefore these areas also, generally lack organized supply of electricity hence, majority of the residents have improvised and are illegally connected to neighboring houses. The arrangement in this circumstance involves illegal connectors paying certain amount to the head of households they tap from who then remits to PHCN monthly out of the amount collected.

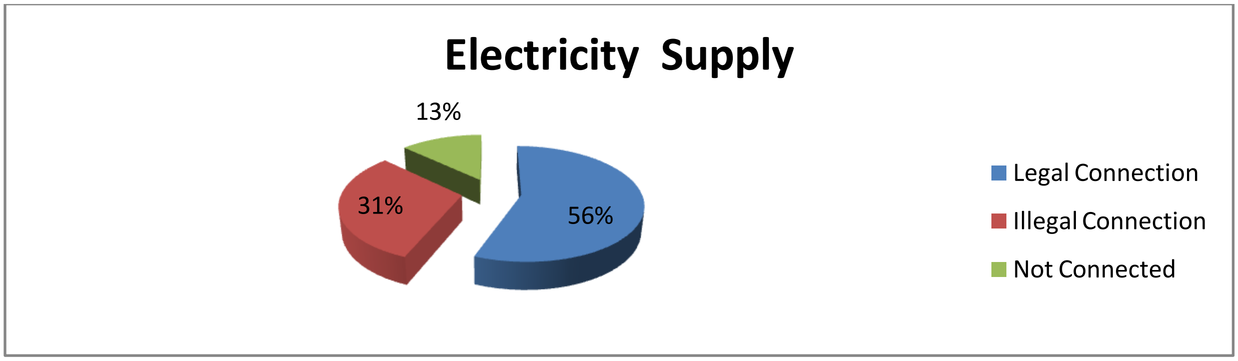


Figure 4.9Source (Field survey 2015).

Plate vi: poor road, electric supply and drainage. (Source field survey 2015)

4.2.3 Social infrastructure

The peri urban growth areas generally are poorly serviced. Social services considered in the survey are schools, hospitals, and law enforcement. Only dispensaries and pharmacy stores for instance exist at Lushi,Tiwun and Gwallameji. Most families therefore are compelled to treck a long distance to obtain health care service in the city core. Schools are also generally poorly distributed. Areas totally lacking of schools are Sabon Kaura, Zango, Kura, Bigi, and Rafin Zurfi. Places like Tambari, Gwallameji and Lushi have Primary and Junior Secondary Schools but considered insufficient by all standard. Police out posts and fire fighting stations are also unavailable. The total number of primary and secondary schools in all the growth areas is fifteen (15). These are inadequate to accommodate the growing populations. In the absence of police outposts, most of the peri urban are prone to insecurity. The total number of police out posts is three (3) located at Rafin zurfi, Gwallameji and Tirwun. (Table 4.5).

Table 4.5 Distribution of social infrastructure.

S/No	Areas	Educational Institutions			Health Institution			Security Services
		Pri sch	Sec Sch	Tertiary	Medicine Store	Dispensary	Hospital	Police Force
1	Wuntin Dada	1	1	1	2	0	0	0
2	Tambari	0	0	1	0	0	0	0
3	Sabon Kaura	1	1	2	1	0	0	0
4	Rafin Zurfi	0	0	2	1	0	0	1
5	Gwallameji	1	1	2	4	1	0	1
6	Tirwun	1	1	0	3	1	0	1
7	Zango	1	0	0	0	0	0	0
8	Dumi	1	0	0	0	0	0	0
9	Sabon Layi	0	0	0	0	0	0	0
10	Kura	0	0	0	0	0	0	0
11	Bigi	0	0	0	0	0	0	0
12	Gida Dubu	0	0	0	0	0	0	0
13	Lushi	1	1	**0**	1	1	0	0
14	Inkil	1	1	0	1	1	0	0
	Total	**8**	**7**	**8**	**13**	**4**	**0**	**3**

Source (field survey 2015).

4.2.4 Housing characteristics

The disorderliness of the peri urban areas has already been established in the previous sections. Buildings in the growth areas similarly exhibit caotic characteristics. Houses are generally traditionally built with local materials. Three housing types are identified within the peri urban areas. They are flats, compounds and bungalows. The compound forms are mostly arranged in groups, and can be classified as either standard or substandard forms. One group comprise of concrete walls with corrugated iron roofing with no dilapidation. These types can be seen in Tambari, Gida Dubu, Abubakar Tafawa Balewa University Housing estates, Sabon Kaura, and Gwallameji. While the other category comprises of dilapidated houses of mud walls and thatch or corrugated iron roofing seen mostly in Bigi, Dumi, and Lushi. From the survey it was discovered that 58% of houses are built with traditional materials. Purely mud block 25%, mud with cement 15% in Bigi,Dumi, and Lushi, while the remaining 42% are built of modern materials cement with iron sheet roofing which take into account the design, floor space and arrangement of rooms these can be seen in the Tambari, Gida Dubu, Abubakar Tafawa Balewa University Housing estates, Sabon Kaura, and Gwallameji. The table below show the material use for constructing houses in peri urban areas of Bauchi metropolis which directly related to quality of houses in the areas plate vii.viii, and ix.

Table 4.6 Building type Materials

S/no	Building Type	Building Materials	Frequency	Percentage
1.	Traditional	Mud	59	18
		Mud/Block	82	25
		Mud/Cement	49	15
2	Modern	Cement/Iron	138	42
	Total		**328**	**100**

Source; Field survey 2015

Plate vii. Low quality building material on the poor location of building (. Source field survey 2015).

Plate .viii. Building types , (Source field survey 2015.

Plate ix: Poor location of building. (Source field survey 2015).

4.3. FACTORS RESPONSIBLE FOR PERI URBAN GROWTH

The factors responsible for peri urban growth are explained in the following sections. Three factors are considered such as ineffective planning of the city, ineffective development control and absence of up to date master plan etc.

4.3.1 Ineffective planning of the city

Failure to control growth is primarily responsible for chaotic development of the peri urban areas. The process of land development and land preparation for development for instance, are determined by informal rules which often contradict formal planning regulations or guidelines. That is, most of the growth has occurred outside government control. This condition encourages people to take over greater control of their development in a manner that impinges the accepted urban planning standard. It is common to see houses built within passages which obstruct pedestrian and vehicular movement. This has occurred because the planning authorities are ineffective.

.4.3.2 Absence of up to date master plan

The situation is compounded with the absence of an up to date Master plan. Bauchi metropolis for instance has an old master plan prepared by Max Luck in 1976. Since then a lot of attempt have been made to review the master plan, which is supposed to be reviewed in every five years. The absence of up to date Master plan to guide and regulate the urban development has hindered the effective and efficient growth of the city. The city also needs to be viewed in its wider regional context as it grows, both of which require the guidance of a plan as shown in plate, x, and xi .

Plate x: Process of uncontrolled land conversion, (Source field survey 2015).

Plate xi: The process of uncontrolled land development. (Source field survey 2015).

4.3.3 Ineffective development control and inadequate staffing of the Urban Development Board

The grant of development or building permits is the main pre requisite for carrying out any physical development as provided in the town and country planning laws and Nigerian Urban and Regional Planning Laws. The permit is given to regulate the type, nature and characteristics of housing or physical development carried out on any piece of land. But the study shows that, only 21% of the houses acquired development permits while 79% have not. This implies that housing development in peri urban Bauchi have generally not been authorized. When interviewed the Development Control Department attributed lack of control to inadequate personnel to effectively and efficiently monitor development. The planning authority has only one qualified town planner in the Urban Development Board. Anything from this, the development process does not meet planning standard for right of ways, access roads and provision of public spaces. Further to this, the process of acquiring land is mostly traditional as shown in Table 4. 9and figure4.11. In addition, houses are built without registration of the land ownership with government. As a result, the government has difficulties in upgrading basic facilities and improving the living environment of the peri urban dwellers as show in Table 4.9.Consequently, people and service movement in these areas is very restricted and residents have to walk long distance to obtain services like health care, education, transport and the like.

Table 4.7 Mode of acquiring land

S/N	Mode of acquiring land	Frequency	Percentage
1	Traditional	190	58
2	Inheritance	95	29
3	Government	39	12
4	Other	36	11
	Total	**360**	**100**

Source; Field survey 2015.

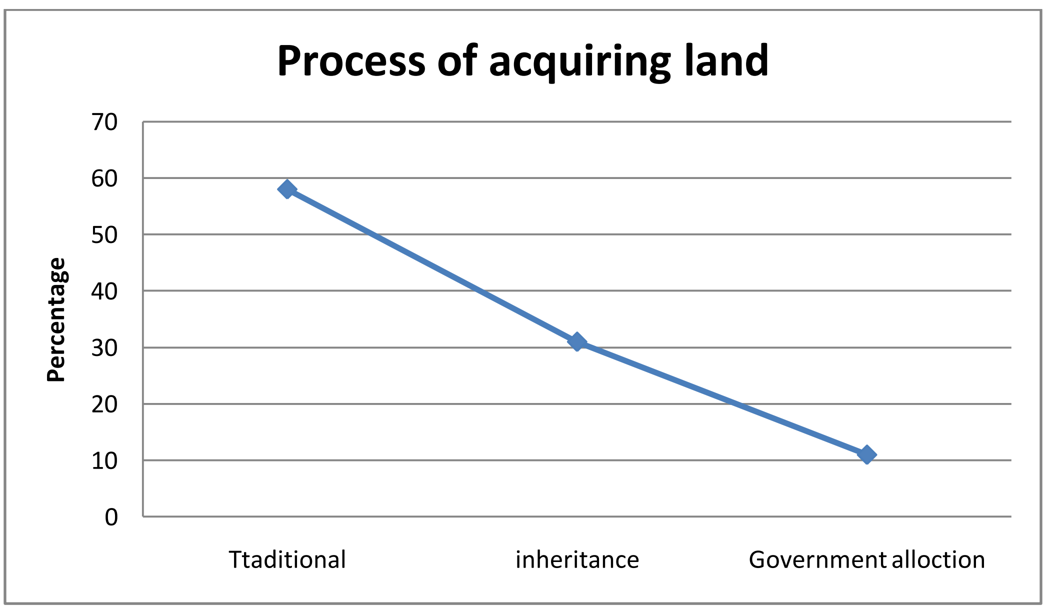


Figure 4.11 Process of acquiring land. (Source field survey 2015).

4. 4 URBAN MANAGEMENT IMPLICATIONS OF PERI - URBAN GROWTH

The urban management implications of peri urban growth pattern of Bauchi metropolis are drawn from the previous section of the research. These are outlined in the section below.

4.4.1 Difficulties in supply of infrastructure

One of the identifying implications of peri urban growth areas is lack or inadequate public infrastructure. The lack of infrastructure is caused by the informal nature of development in the growth areas. The narrow and haphazard layout of peri urban streets and houses makes it difficult to layout reliable and efficient infrastructure. Irregularity of street pattern makes provision of infrastructure difficult. As observes this has happened because there are no plans and planning regulations as shown in plate xii. As a result it is not possible to provide new infrastructure within the existing peri urban areas. Also chaotic manner of peri urban growth generally hindered formal and planned delivery of electricity to this segment, therefore illegally connected. From the above scenario the provision of infrastructure is mostly restricted, but additional cost in term of its provision and demolition is the alternative for planned delivery of infrastructure.

Plate .xii. Poor road network without drainage.(Source field survey 2015).

4.4.2 Security implications.

Since the peri urban areas are growing haphazardly without proper planning, it sometimes serves as a hide out for criminals. The prevalence of crime and juvenile delinquency, political violence public ignorance are predominant in the peri urban areas. The “Sara – Suka” are mostly located in the peri urban areas of Dumi, Tirwun, Gwallameji and Lushi. This is so, because both the planning authority and law enforcement agents are not actually effective in these areas. Often police cannot reduce crime because of ineffective planning of the city and governance. Fire is another major risk to the peri urban areas and its inhabitants, with streets too narrow to allow proper and efficient access to fire control trucks. Absence of police out post, fire services stations, and ineffective planning of the areas are the major security problems.

4.4.3 Loss of revenue to the government

Payment of ground rent, planning permit, land registration fees, titling etc, are means of financing urban infrastructure development. These fees are mostly generated from formal land supply. Where informal actors dominate as the case with the peri urban areas of Bauchi, it is clearly a serious case of revenue lost. Informal settlements are the vital elements of the informal economy as characterised by plate xiii. Housing and land in these areas are traded without registration in the cadastre and required payments of state taxes and fees. Houses generally cannot be used as collateral for other business purposes. Since there is no tenure security in most of the cases, this income is constantly under threat of being lost ('dead capital'). Because the peri urban areas do not generate tax revenue for the government, they tend to get minimal or slow attention.

Plate xiii: Housing condition in Bauchi town. (Source field survey 2015).

4.4.4 Implications of unsanitary conditions

Caotic growth and development of the peri urban areas is directly related to poor sanitation as shown in plate xiv. Random construction of houses has obstructed many natural water ways leading to flooding during the rainy season. Flooding also is directly related to over spill of pit latrines and septic tanks which pollute water sources. As shown from the study, all the peri urban areas do not have adequate sanitation facilities with the exception of Tambari, Gida Dubu, Abubakar Tafawa Balewa University housing estates. The toilet facilities are predominantly pit latrines, and most houses do not flush toilets that empty into septic tanks. In the peri urban areas, sullage waste from domestic sources is either channelled into roadside ditch or forms its own access pool. Absences of drainages generate big ponds that become breeding places for mosquitoes, bthat cause malaria and diarrhea. This is the most common implication related to water and sanitation.

The expansion of peri urban asks for a continued expansion of water network. If the network is not sufficiently maintained, leakages lead to loss of valuable resources. Rapid peri urban growth is seriously outstripping the capacity of the city to provide adequate service for their citizens. In peri urban areas where there is no planning for facilities, the number of residents living without access to basic water is still increasing.

Peri urban settlements at city fringes and lower-quality buildings are critical challenge to overcome for Bauchi metropolis. Their low construction standards and poor drainage systems are critical constraints. Another major threat is that Peri urban settlements are commonly built on low-lying areas subject to floods, as well as sites that are vulnerable to collapse of buildings as shown on plate xv. This situation leaves those social groups that are already very vulnerable most exposed to disaster risk.

Moreover health services do not exist in most of the peri urban areas. Ambulance services and urgent care is typically unavailable. The study shows, that more than half of the peri urban dwellers are prone to visit private health practitioners.

Plat xiv. Uncollected solid waste dumps on the vacant undeveloped plots (Source field survey 2015).

Plate xv: poor road without drainage. Source field survey 2015.

CHAPTER FIVE

5.0 SUMMMARY, CONCLUSION AND RECOMMENDATION

5.2 SUMMARY

Based on the research findings, peri urban areas of Bauchi metropolis have expanded from 34.50 km^2 in 2005 to 55.95 km^2 in 2010. The growth was further anlysed using four quadrants of the city, North – East, North – West, South – East and South – West. Between 2005 to 2010, the highest growth was recorded in South – West quadrant with total growth areas of 32.19 %. Factors responsible for such growth are nearness to major institutions. This sector has become active growth point due to increased demand for off campus staff and student housing. The areas with the least growth is the North - West quadrant. The growth in this direction has been constrained by difficult terrain and nearness to the military barrack. The peri urban areas in 2010 covered a total land area of 79.92km^2. By 2015 this has increased to 109.55 km^2.

The growth is mainly informal and uncoordinated, and it is characterized by uncertain and illegal land tenure, low level of sanitation, and minimal or no infrastructure. The process of land acquisition and land preparation for development for instance, are determined by informal rules which contradict planning regulations. Absence of social infrastructures has made the peri urban residents to treck long distance to obtain the social services like schools, hospitals etc. The determinant of peri urban growth also covered ineffective development control, absences of up to date Master plan and inadequate staffing of the Urban Development Board. The urban management implications of peri urban development includes difficulties in supply of infrastructure, security, loss of revenue to the government, traffic and circulation problems and poor Health care and sanitations.

5.2. CONCLUSION

The study revealed that peri urban areas of Bauchi metropolis have witnessed remarkable growth between 2000 –2015. In recent time, the growth has been due to migrant population displaced by insurgency and ethno – religious crisis in the North – East and neighbouring Plateau State. Most of the areas have also developed on fragile land, which constitutes not only challenges to the parent city, but also presents constrains to sustainable urban development The study has also shown that, the process of land development and land preparation for development for instance are determined by informal rules which contradict formal planning regulations or guidelines. This condition encourages people to take over greater control of their development in a manner that impinges the accepted urban planning standard. It has also shown that the pattern of development has impacted negatively on the town generally through irregular construction of houses and caotic supply of infrastructure and services. In many areas there is no space left for social services like schools, hospitals, and children's playground. There is uncollected refuse heaps over flow on the roads, streets, and drainages. Therefore this study will be of value, in a climate of increased insurgency in Nigeria, to establish the pattern of peri urban growth influenced by rapid immigration and the associated urban management consequences, which will provide further insight on challenges confronting cities in conflict areas and of urban management strategies to address the problems.

5.3. RECOMMENDATIONS

Urban Management implications of peri urban growth are many. Thus there is no universal solution on how to improve peri urban growth. Rather, solutions and policies must be tailored based on the needs and characteristics of the peri urban areas. Based on these, the following recommendations are made.

a. Containment of peri urban areas and Regularization of Land ownership

It has been suggested that land title should be regularized by granting of Certificate of Occupancy (C of O). This legal recognition by the government will make land developers to follow planning rules and regulations. Also all vacant land should be acquired by the Ministry of Lands. Where open spaces exist, these can be used for the provision of community facilities.

The Certificate of Occupancy per plot on these peri urban areas can be processed with minimum cost and time. Government should survey the perimeters and register the layout. This can then be used as the individual plot tittle deed plan attached to each plot C of O. Trained professional staff should be given the full legal support to implement the necessary land transfers or revocations.

b. Strengthen planning institutions

The State Urban Development Board designed as to fit for purpose, proactive planning and investment. The manpower needed of the Urban Development Board should be considered, because shortage of manpower of the Urban Development Board, with lack of coordination between developments agencies resulted has in weak enforcement of the development control. Workshops and seminars including funds and necessary logistic should also be planned on the basis of priority.

c. Provision of physical infrastructure

The study has shown that Peri urban areas of Bauchi metropolis lack adequate infrastructure. Addressing this shortcoming therefore should be a primary consideration. First the existing roads network would need to be upgraded and as well integrated. In doing this storm water drainages should simultaneously be considered. Domestic waste water should be made to flow directly into the drainages along the roads. These can be achieved by encouraging the residents to use concrete block or pipes in channelling the waste water into the drainages.

The second important need is provision of adequate public water supply networks to ensure water reaches all residents. For settlement that lack piped networks, pipes should be laid as close as possible to the compounds in order to facilitate private connection. This proposal should also be the case for electricity supply. There is a need to enhance individual house connections. It is also been suggested that streets lighting should be provided at strategic locations.

d. Preparation of urban upgrading plans for the peri urban areas

Based on the study, out of the fourteen peri urban settlements, Tirwun, Gwallameji, Sabon Kaura, Rafin Zurfi, Bigi, Dumi, Lushi, and Kura, require immediate attention through upgrading to improve basic infrastructure. The upgrading should include the provision of water supply, drainages and electricity. This intervention would contribute toward improving living conditions. Social services as well are also necessary for overall sustainability of these communities. That is attention should be focused on the provision of complimentary facilities like Schools, Primary Health Care Centres, and Fire Fighting Stations.

e. Review of the Bauchi Master plan

There is urgent need for the review of the master plan to address the general development challenges of the entire city considering infrastructure, services and land administration. Revised master plan will present as well a positive and dynamic vision of the demographic and economic growth of the city. In the revised Master plan, the city needs should be viewed in the wider and regional contexts with attention on land required for the surrounding catchment areas. This will enhance land allocation, social structure and economic activities. Formal review process is recommended along with monitoring on the basis of policies indicators and when necessary within 10 years period. The Master Plan should assign responsibilities of overall implementation with respect to issues such as development control, land administration, housing and transportation etc. There should also be Preparation of local plans with good coordination with the Master Plan. Mixed land uses should be promoted to accommodate residential and local employment elements, in terms of basic services and infrastructure.

f. Participatory development

Community participation is an essential element for managing development and ensure successful implementation of urban master plans. In particular appropriate participatory development are recommended to bridge the skills and resources gap in the State government to ensure the provisioning of basic utilities and services in the newly developed areas and upgrading the existing under serviced areas. Community sensitization on the importance and benefits of physical planning toward sustainable development and attainment of improved living conditions is essential. This recommendation requires developing policy frame work that carries along poor and marginalized groups and also contribute to knowledge on pattern and implication of peri urban growth through the following stages.

i. Awareness

Create a relationship between NGO^s, Government, public/private sectors. This can be achieved through Capital Improvement Programme.

ii. Assessment

Conduct an assessment based on the need and characteristics of the peri urban areas. This will include the planning institutions to identify community strength and needs.

iii. Planning

Develop an action plan on the contentment of peri urban land ownership, infrastructures, peri urban upgrading, and review of master plan and adopt a specific strategy to monitor the processes for measuring progress.

iv. Monitoring

Monitor to regulate the type, nature and characteristic of housing or physical development carried out on any piece of land. The process of development have to meet the planning standard for right of ways, access roads, and provision of public spaces.

v. Implementation

Implement strategies identified in the action plan to address issues.

vi. Evaluation

Identified a critical challenges and the change observed in the peri urban areas, on the basis of priorities.

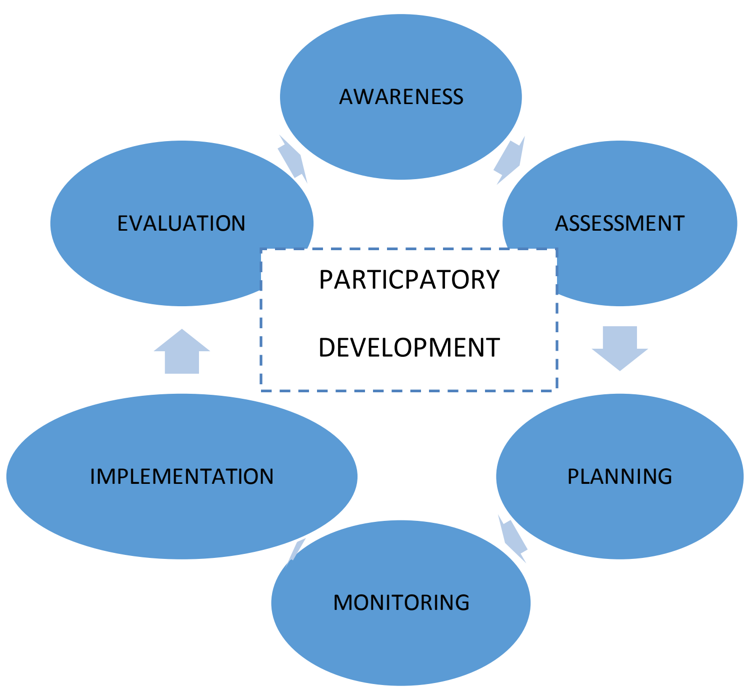


Figure 5 .1. Participatory development model.

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Department of Urban and Regional Planning.

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Msc URBAN MANAGEMENT RESEARCH QUESTIONAIRE

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QUESTIONAIRE

Name of the respondent …………………………………………..

Age 18 – 23 { } 24 -28 { } 29 – 34 { } 35 above { }

Sex. Male { } Female { }

Marital status Married { } Not married { }

Household size ……………………………………………………..

Number of adult in the house ………………………………………

Number of children's in the house…………………………………..

How long you have been living in this place? ………………………

Are living in your personal apartment Yes { } (B) No { }

If yes for how long……………………………………….

If no how did you rent the house?

(A) Through friends { } (B) Ward head { } (C) land agent { }

How much rent do you pay for the house per month (A) #2000{ }

(B) #3000{ } (C) #4000{ }

Did you relocate from another place?

(A) Yes{ } (B) No{ }

If yes why did you chose to relocate?

(A) Security { } (B) Opportunities { } (C) Others{ }

How did you finance your family?

(A)Government work { } (B) Business { } (C) paid job { }

Where have disposed your waste?

(A) Government refuse bin { } (B) Vacant land { } (C) Front of house { } (D) Drainage { }

Do you have any land sales agreement or any documents?

(A) Yes { } (B) No { }

Did government recognizes it

(A) Yes{ } (B) No { }

Did you receive building permission before putting up this building?

(A) Yes{ } (B)No { }

If yes from whom?

(A) Traditional leader { } (B) Development control department { }

If no how did you set out the building……………………………………...?

From whom did you acquire the land?

(A) Government { } (B) Market { } (C) Friends/Relatives { } (C) Others{ }

What kind of title did you hold?

(A) C of O { } (B) Sales agreement{ } (C) Others { }

How many households are occupying these building?

(A) 1 -3 { } (B) 4 -6{ } (C) 7 Above { }

Why did you chose to put your building in this area

(A) Access to land { } (B) Close to place of work { } (C) Others { }

Are there any regulations controlling development in this area?

(A) Yes { } (B) No { }

If yes by whom………………………………………………………………….?

Is there any police post in this area?

(A)Yes { } (B) No { }

What are your sources of water supply?

(A) Tap { }(B) Borehole { } (C) Dug well { } (D) Others { }

Is your house connected to water supply?

(A) Yes { } (B) No { }

Is the area depends on services from water vendor?

(A) Yes { } (B) No { }

If no where are you getting domestic water…………………….?

Is the public school adequate to accommodate demand?

Yes { } (No) No { }

Department of Urban and Regional Planning.

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Msc URBAN MANAGEMENT RESEARCH QUESTIONAIRE

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1. Name of Respondent………………………………….
2. Position in the Ministry ……………………………………………

3. Number of staff in the ministry……………………………………

4. Qualifications

(A) Bsc URP { } (B) Bsc Geography { } (C) Others { }

5. Are there any regulation controlling the growth in this areas?

(A) Yes { } (B) No { }

6. If yes how…………………………………………………………….?

7. Are people adhering to regulations regarding growth in this area?

(A)Yes { } (B) No { }

9. If no why……………………………………………………………?

10. Did the department have enough staff to control development?

(A) Yes{ } (B)No { }

11. If no how many staff do you have……………………………………..?

12 When was the last Master plan of Bauchi metropolis produce…………………?

13 When was it review last………………………………………………………?

14 Which company produces it……………………………………………………..?

15. How many offices do you have in Bauchi Metropolis?

(A) 1- 2{ } (B) 3- 5 { } (C) None { }

16. If no why…………………………………………………………………….?

17 How many development permit application do you received yearly from the selected areas?

18. How many approvals are you able to grant in a year………………………………..?

19. Is the developers received permit before putting their structures…………………………..?

(A) Yes{ } (B) No{ }

20. If no why……………………………………………………………………..?

21. Did the developers normally keep to the specification of the permit…………………..?

(A) Yes{ } (B) No{ }

22. How many health services did you have in these areas…………………………………?

(A) 1 -4 { } (B) 5 -7 { } (C) None { }

23. What is the health services coverage…………………………………………………..?

(A) Adequate { } (B) Not adequate { }

24. What are the other problems are you facing (A) Security { } (B) Transportation { } (C) Health { }

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WARD HEADS

Location of settlement ………………………………………..

Mode of plot acquisition {A} land holders { } {B} government { }

{C} Friends { }

What is your role on acquisition of land {A} Witness { } {B} Agent { } {C} Seller { }

What materials are you using for plot demarcation and measurement?

{A}Tape { } {B} Footsteps { } {C} Rope { }

Negotiation and land transaction process {A} Bargain { }

{B} fixed amount { }

Plot demarcation and documentations process {A} Beacon { }

{B} Plants { } {C} Stones

Criteria for acquiring the land

(A) Gender selective { } (B) Money{   } (C) Indigene {   }

When have you move into this area…………………………………………………?

CHECK LIST FOR OBSERVATIONS

Housing characteristics

Spatial form

Arrangements of buildings Linear { } caotic { }

Relationship of one building to other Good { } No relation { }

The circulation pattern within the neighborhood radial { } No drainage { }

Design of the buildings Traditional { } Modern { }

Road network characteristics

Size of the roads …………………………m^2

Space roads occupied……………………. m^2

Layout of roads and circulations………………

Roads width………………………………. m^2

Drainages

Characteristics of drainages

Is it narrow? Yes { } No { }

Is it shallow? Yes { } No { }

Other sediment and refuse Yes { } No { }

Water supply

Adequate to content the population growth Yes {   } No {   }

Inadequate to content population growth Yes {   } No {   }

In house connection Yes {   } No {   }

Stand pipe outside Yes {   } No {   }

Locations of boreholes in-house or outside connections Yes { }   No {   }

Location of dug wells in-house or outside Yes {   } No {   }

Electric supply

Formal connections Yes {   } No {   }

Informal connections Yes {   } No {   }

Not connected Yes {   } No {   }

Health services

Dispensaries available Yes {   } No {   }

Hospitals available or not available

Pharmacies available Yes {   } No {   }

Total Distance covered …………………………………….

Housing types

Traditional mud, thatch, Yes { } No { }

Modern cement iron Yes { } No { }

Compound, { } flat, { } bungalow

Where have you living before coming to this place……………………………………?