



*Your complimentary
use period has ended.
Thank you for using
PDF Complete.*

[Click Here to upgrade to
Unlimited Pages and Expanded Features](#)

UNIVERSITY OF NAIROBI

IMPACTS OF URBAN AGRICULTURE ON PHYSICAL INFRASTRUCTURE IN THE INFORMAL SETTLEMENTS CASE STUDY OF KIBERA, NAIROBI

By

GABRIEL MULI MBUSYA

B42/82145/2012

A research project submitted in partial fulfillment for the requirements of Post Graduate Diploma
in Housing Administration in the Department of Real Estate and Construction, University of
Nairobi

October 2013



PDF Complete

Your complimentary use period has ended.
Thank you for using PDF Complete.

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

Declaration

I, the undersigned, declare that this research project is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted for any other degree at any other university before.

Signed: í í í í í í í í ...

Date: í í í í í í í í í í

MR. GABRIEL MULI MBUSYA

DECLARATION BY SUPERVISORS

This Research Project has been submitted for examination with our approval as the university supervisors in the Department of Real Estate and Construction Management

Supervisor (Sign): í í í í í í í í í í .

Date: í í í í í í í í .

DR. MARY KIMANI

Supervisor (Sign): í í í í í í í í í í .

Date: í í í í í í í í .

MR. DENIS MBUGUA MUTHAMA

Table of contents

	ii
Table of contents	iii
Figures	ii
Tables	iii
List of Abbreviations	iv
Abstract.....	v
Acknowledgment	vi
Dedication.....	vii
Chapter One	1
INTRODUCTION.....	1
1.1 Introduction	1
1.2 Problem statement.....	2
1.3 Research Objectives	4
1.3.1 Main objective.....	4
1.3.2 Specific objectives.....	4
1.4 Research questions	4
1.5 Significance of the study	4
1.6 Scope of the study	5
1.7 Definition of key terms.....	6
Chapter Two	8
2 LITERATURE REVIEW.....	8
2.1 Introduction	8
2.2 Informal settlements.....	8
2.2.1 Characteristics of Kenyan informal settlements.....	9
2.2.2 Nairobi Informal settlements.....	9
2.3 Urban Agriculture	11
2.4 Physical housing infrastructural services	12

	structure in the informal settlements	13
	Informal settlement Housing Infrastructure.....	14
2.5	Integration of UA and human settlement experiences	15
2.5.1	Urban Agriculture in developed Countries	15
2.5.2	Urban Agriculture in developing countries.....	16
2.5.3	Differences between UA in developed and developing countries.....	17
2.6	UA and the Urban environment health.....	19
2.7	Institutional framework	20
2.7.1	What have been the urban policy responses to urban agriculture in Kenya.....	20
2.8	Policy, Legal and Regulatory Framework.....	21
2.9	Conceptual and Analytical framework.....	24
Chapter Three.....		28
3	RESEARCH METHODOLOGY	28
3.1	Study Area Background	28
3.2	Study area	29
3.2.1	Geographic Location	29
3.2.2	Population	29
3.2.3	Climate.....	30
3.2.4	Socio-economic.....	30
3.3	Research Design.....	32
3.3.1	Research Design.....	32
3.4	Sampling Design.....	33
3.4.1	Stratified random sampling.....	33
3.4.2	Purposive sampling	33
3.5	Sample population.....	34
3.5.1	Data collection method.....	34
3.6	Data analysis and Data presentation.....	35



Your complimentary
use period has ended.
Thank you for using
PDF Complete.

[Click Here to upgrade to
Unlimited Pages and Expanded Features](#)

.....	36
.....	36
.....	36
4.2 Results finding	36
Chapter Five.....	50
5 CONCLUSIONS AND RECOMMENDATIONS.....	50
5.1 Introduction	50
5.2 Summary of the Findings/Results	50
5.3 Conclusions	51
5.4 Way forward	51
6 Bibliography.....	53
Appendix:	57
Questionnaire	57

Figures

<i>Figure 1: The location of the City growing informal settlements</i>	10
<i>Figure 2: Water availability per person in Kenya</i>	19
<i>Figure 3: Population Density in Kibera</i>	30
<i>Figure 4: Occupation of persons above 18 years</i>	31
<i>Figure 5: Poverty levels among households in Kibera</i>	31
<i>Figure 6: Farming activities in the study area</i>	37
<i>Figure 7: Traditional Farming within the study area</i>	38
<i>Figure 8: Sack gardening within the study area</i>	39
<i>Figure 9: UA impacts on transportation and accessibility</i>	45
<i>Figure 10: Impacts of UA on water reticulation within the study area</i>	45
<i>Figure 11: indirect impacts of UA on Infrastructures</i>	47
<i>Figure 12: Reaction to UA on housing investment</i>	48



PDF Complete

Your complimentary use period has ended.
Thank you for using PDF Complete.

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

Tables

<i>Table 1: Impacts of UA on the informal settlements</i>	26
<i>Table 2: sample character</i>	36
<i>Table 4: commonest UA practices in each village within the study area</i>	38
<i>Table 6: Distribution of Infrastructures within the study area</i>	40
<i>Table 5: Infrastructures description within the study area.....</i>	41
<i>Table 8: intensity of UA impact on physical infrastructures</i>	42
<i>Table 9: the rate of Impact of UA on grouped infrastructures</i>	43

List of Abbreviations

CBD	Central Business District
FCND	Food Consumption and Nutrition Division
HIV/AIDS	Human Immunodeficiency Virus Infection / Acquired Immunodeficiency Syndrome
IMF	International Monetary Fund
IFRA	French Institute for Research in Africa
IRIN	Humanitarian News and analysis
ITDG-EA	Intermediate Technology Development Group; Eastern Africa
MPND	Ministry of Planning for National Development
NGO	Non Governmental Organization
SIDA	Swedish International Development Agency
UA	Urban Agriculture
DDT	Dichlorodiphenyl Trichloroethane
UPAL	Urban and Peri-Urban agriculture and Livestock
GIS	Geographic Information System
MDG	Millennium Development Goals
FAO	Food Agricultural Organization
ERWESC	Economic Recovery Strategy for Wealth and Employment Creation

Abstract

Urban Agriculture has been viewed as a sound coping strategy in the face of dwindling food security, economic upheavals, civil strife and unprecedented population growth within many urban centers in the world. The state of unemployment, need for recreation and desire for engaging in farming activities in itself for self esteem are some of the reasons fronted for rising in UA among the urban residents, though in different setting and by different socio-economical groups. For the poor urban residents, food security is the main driver to farming as it is taken as coping strategy not only for food security but also for economic empowerment through selling of surplus. Among the urban poor vulnerable households urban agriculture is a livelihood coping mechanism (IFRA 2011: 31).

One of the key demerits associated with urban agriculture is the huge pressure exerted on the physical infrastructural resources within the urban areas. This is despite the enormous challenges facing the Government in provision of funds for repair and maintenance of crucial infrastructural services. It is also notable that due to failure of the infrastructure, the housing environment is degraded, filth, and has effect on the level of self esteem of the tenants.

The study used stratified random sampling to collect the data. It focused on the 10 villages that make up the study area. A total of 40 respondents (Farmers) were issued with a questionnaire while 4 policy makers in the field of agriculture, provincial administration, urban planning and NGO were interviewed during data collection. The researcher also traversed the study area observing and noting the characters of the farms and their influence on the infrastructural services. Photography were taken during the data collection and were later used for analysis.

Data for this study was analyzed using the Ms excel and word. Charts, figures and tables were used for data presentation and analysis. The study has indicated that UA has 92.5% impact on the physical infrastructures in the informal settlements; however such impacts were categorized within scale of severe, moderate and negligible. The study also recommends further studies which could not be sufficiently covered by the research.

I am highly indebted to the following personalities and institutions for their contribution towards this study.

I wish to sincerely appreciate the material and moral support of the entire staff of the Department of Real Estate and Construction and especially my able supervisor; Mr. Dennis Mbugua for his constructive criticism that provided benchmark on which this study was built. I am highly indebted and humbled by his patience and reliable guidance he offered me while writing this study. I also, with equal measure, appreciate the guidance of Dr. Mary Kimani for the invaluable criticism, corrections, guidance, and improvements she made on my study to make it more scholarly.

I also sincerely thank Kibera farmers associations, through the Office of President; Kibera District officer, Chiefs and the village elders for their unwavering support during data collection; I am also grateful to the Ministry of Agriculture, the Nairobi County Council and officials of Solidarites Non-Governmental Organization for participating in the interview to establish the valuable information pertaining this study.

I thank the Ministry of Housing officials for the financial, moral and material support accorded to me during the entire school programme and while undertaking this study.

To my very able lead research assistant; Ms Sephima Kaitheri for guiding me through the research area, persuading the respondents to be reliable and honest and for your commitment to collect and submit the filled questionnaires despite your busy official schedule; thank you very much. Finally, I thank my family for their moral and spiritual support not only during the research but the entire school programme period; and for many other actors whose contributing inspired my success and whom I can't individually mention by the names, I owe you a lot. May God bless you all.



*Your complimentary
use period has ended.
Thank you for using
PDF Complete.*

[Click Here to upgrade to
Unlimited Pages and Expanded Features](#)

Dedication

To my son Ryan

And all those whose home is Kibera

Chapter One

INTRODUCTION

1.1 Introduction

According to Maxwell (1998:56) urban agriculture (UA) defined as "the practice of cultivating, processing, and distributing food in or around a village, town, or city" has as its main goal tackling urban food insecurity. Urban agriculture can also involve animal husbandry, aquaculture, agroforestry, and horticulture. Olima (2000) agrees with this when he asserts that urban agriculture is an instrument geared towards tackling household food insecurity, increasing urban employment, and encouraging productive participation in local and urban development. This study restricts urban agriculture to farming practices¹ carried out within the informal settlements for coping mechanism.

There is a general recognition of the importance of urban and peri-urban agriculture in most countries across the world. One of the main reasons, why people engage in urban and peri-urban agriculture is the inadequate, unreliable and irregular nature of food supplies in urban areas. Many low income households as well as higher income households use urban and peri-urban agriculture for the production of food for subsistence and income generation. Over the past ten (10) years, there has been rapid growth of interest in peri-urban agriculture as a food insecurity coping strategy (Mbiba, 1998, 1999; Lee-Smith, 1998). Lee-Smith, (1998) observes that by early 1998, 64 percent of urban households in Kenya practiced some form of urban agriculture as compared to 40 percent in 1980. This growth is more concentrated in the informal settlements of the urban areas.

Informal settlements are agglomerations of substandard housing made of recycled materials or inferior building materials. They do not have access to adequate infrastructural services and thus people adopt coping strategies for survival. As has been noted by analysts (such as: Mbiba, 1998), UA is mainly practiced in informal settlements, due to high poverty levels hence its

¹ Includes both agricultural and animal rearing practices

towards tackling; household food insecurity and urban productive participation in local and urban development. In practiced in an unregulated context, without taking into account; environmental issues, housing occupational and safety concerns, and physical infrastructure.

Physical infrastructure defined by (wikipedia.org) as assets and facilities are, in respect to this study, those items of capital nature through which service delivery is achieved. The UA practice in informal settlements exerts a huge toll on these physical infrastructures such as connecting paths, sewage lines, water piping, and the available recreational facilities. The extent of this interference differs from one settlement to the other. According to Lee-Smith, (1987) the poorest slums have the most intensive farming practices and hence the most degraded infrastructures. Urban Agriculture thus tends to play a direct negative role in efforts towards informal settlement infrastructure upgrading and provision of crucial public services. Another way in which urban agriculture interferes with infrastructural services is through the action of rummaging urban farm animals such as pigs which scatter waste materials that end up blocking drainage channels. Thus, there is a link between Urban Agriculture and deterioration of housing infrastructure in the informal settlements. With a growing population in the informal settlements coupled with growing food and job insecurity Urban Agriculture will continue to be a key livelihood coping strategy and this in essence will have an impact on important housing infrastructures within informal settlements. Thus there is need to clearly and comprehensively understand the impact of Urban Agriculture on informal settlements housing infrastructures.

1.2 Problem statement

Many researchers focus on the benefits of the UA as a coping strategy and do not look at its effects on the physical infrastructures, yet UA in the most informal settlements, Kibera included, share land with critical infrastructures such as piped water, transport network and electricity.

Proponents of urban agriculture are yet to comprehensively tackle the impacts of UA on the informal settlements housing infrastructure. As Urban Harvest (2010) observes, urban agriculture has potential to cause harm to the community by not only polluting the environment but by also denying majority of residents their right to adequate physical infrastructure use, this is because

Urban Agriculture (UA) is practiced along the railway lines, road reserves, schools compounds, and any free spaces that are normally putting a toll on the survival of these infrastructures. The UA practices within the informal settlements are not controlled yet such practices have an effect on the built environment within informal settlements.

As Njenga et al (2010) notes, the Government's approach to this practice has been at best condescending as shown by its ban of the practice within urban areas. The absence of state police powers reference to this practice is further manifested in lack of a National UA policy creating a loophole in the regulation of the UA practices. The lack of development control reference to UA has meant that promoters of UA do not pay much attention to the relationship between physical infrastructures and UA within the informal settlements. Urban Agriculture in informal settlements further advances physical planning chaos already in existence. The effect of the chaos is normally reflected on the quality of slum housing and the low self-esteem of those inconvenienced by splattered farming (Averbeke, 2005). Lee-smith (2008) further observes that UA strains physical amenities within the informal settlement due to limited space, high population (and other diverse human activities.), quest for high production (which cannot be sustained without use of agricultural chemicals which include the banned pesticides containing DDT) and limited resources such as water and land. The competition between the farmers occasionally result into over utilization of these infrastructures, infrastructural sabotage, or/ and vandalism of infrastructure components for scrap materials or mere mischief between farmers.

Urban Agriculture is seldom understood and analyzed in the context of national development; therefore, it is rarely reflected in national and rural development policy strategies. It is the lack of clear strategies to deal and promote sound UA in the informal settlements that result into compromising of the physical environment in pursuit of food security and income.

Studies on negative impacts of UA on physical infrastructure within informal settlements are few. This implies a knowledge gap which this study intends to fill through an analysis of the contribution of UA to physical infrastructure deterioration within Kibera informal settlement.

To investigate the impacts of urban agriculture on physical infrastructure within informal settlements

1.3.2 Specific objectives

1. To identify the main urban agricultural practices in urban informal settlements
2. To identify the main physical housing infrastructural services found within informal settlements
3. To examine the impacts of UA on housing investments in the informal settlements
4. Make appropriate recommendations

1.4 Research questions

1. What are the main UA practices carried out in the informal settlements?
2. How do UA practices impact on the housing infrastructure in the informal settlement of Kibera?
3. What are the likely impacts to the housing investment good in the informal settlement as a result of UA practice?

1.5 Significance of the study

Urban Agriculture (UA) has had an intimate relationship with cities historically, accepting organic wastes, including treated human sewage and providing fresh food in return (Cole et al. 2010). The study of aspects of UA is therefore essential in understanding the dynamics of biodegradable waste disposal, conservation of recyclable waste disposed from the human habitation and most importantly understanding issues of urban food security and its influence in urbanization.

According to Maxwell (1994), UA forms a crucial coping mechanism for the urban poor yet its impact on the service infrastructure has not been extensively researched so as to ascertain to what extent it does influence the failure of such services. The impacts of the UA to the infrastructure are certainly long lasting. This study therefore will seek to establish how the farmers interfere with infrastructure and be can useful in informing the local authority on proper mitigations and maintenance of the infrastructures.

health practitioners since UA is a consumer of heavy farm transferred through food chain and can be toxic after used as farms can be conduit through which pathogens are transferred to human. Sewage farms also discourage habitation within the close by houses and may deter tenancy and therefore result in loses and in the long run discourages housing investment. Players in the housing sector can highly benefit from this study as it would inform them on the extent of the damage of the infrastructure partly occasioned by UA. Slum upgrading is both beneficiary of UA but may be slowed by the nature of its practice and therefore this study is critical to slum upgrading programme.

Urban agriculture is a prolific consumer of water resource, more often creating conflicts between urban consumers (Maxwell 1994) Water disconnection discourages people from living in certain neighborhoods that are known to be chronic to the vice. This unfairly denies landlords desired revenue. Without revenue, other housing related investments are impossible to undertake such as maintenance. This leads to deterioration of the housing condition in the slum within the affected areas. This study therefore will inform and guide both urban farmers and the housing authority on decision making for the good of all. The outcome of this study may lead to appreciating sound UA agriculture and need to conserve water to minimize possible conflict arising from use of natural resources.

This study will be beneficial to the following stakeholders: the Authorities, National and County Governments, in terms of policy formulation on upgrading and infrastructure provision, water and sewage company; on water conservation and usage measures as well as waste disposal; Non-Governmental Organization; on the decision making in respect to their funding of coping mechanisms and the local community; for the information on the infrastructure maintenance, the education sector; for the scholarly value of this project.

1.6 Scope of the study

Conceptual scope: This study will have urban agriculture as its key concept. It will specifically focus on the impact of urban agriculture on the physical infrastructures that are related to housing environment. The study will examine the contributions of the unregulated crop growing and animal keeping, the site of the farms and its dynamics, the input and output of these farming

physical infrastructures and delivery of services. It will
rail/road/foot-path pass-ability, water reticulation, sewage
The study therefore will be limited to only those
infrastructures that are tangible and occupy space.

Physical Scope: The study will be geographically confined to Kibera slum, focusing on its 10
villages namely: Kianda, Soweto west, Raila, Gatwekera, Kisumu ndogo, Kambi muru, Makina,
Mashimoni, Lindi, Laini saba , Silanga and Soweto east

1.7 Definition of key terms

Physical infrastructure: these are infrastructure in respect to housing environment that are
physical and provided for the common good of all through investment by
the National Government, County Government, Non-Governmental
Organization, the locals or Individuals. In the context of this study
physical infrastructure are; water pipes, foot paths, open fields (assumed
to be used for recreational purposes) rail leave ways, road reserves, water
channels and sewer lines. Informal settlements: reference to slum, which is
a condition of living whose standards are normally low with other
characteristics being. High population density, i.e. Kibera has 68,000
persons per square Kilometer. The physical layouts are haphazard, urban
services are minimal or non-existence, chronic poverty, and there is no
security of tenure.

Urban Agriculture: Growing of food and animal keeping in peri-urban and urban areas. In the
context of this research, urban agriculture is taken as a coping strategy
among the urban poor settling in the informal settlement of Kibera. Here
UA is focused on the core urban areas and doesn't to peri-urban UA
practice.

Coping strategies/ Mechanisms: Coping strategies/mechanisms refer to the specific efforts, both
behavioral and psychological, that people employ to master, tolerate,
reduce, or minimize stressful events. The coping strategy discussed here is
problem-solving strategies (efforts to do something active to alleviate



PDF Complete

Your complimentary use period has ended. Thank you for using PDF Complete.

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

stances) (Folkman & Lazarus, 1980) UA is a coping
insecurity in the context of this study.

Sanitation infrastructure: the physical infrastructures that will comprise; drainage system: open and closed, sewer lines, community sanctioned dumpsites

Chapter Two

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the relevant literature that has been reviewed in relation to the objectives of this study. It analyses the set up of informal settlement and the urban agriculture practiced therein as a coping mechanism. In this chapter, the practice of agriculture in urban area has been discussed in broad way, from the world scene narrowing down to the practice within the study area. This is to give appropriate insights on the varying degree of UA by different actors across the world in attempt to inform the problem and suggest useful leads that can be tapped in the methodology section.

2.2 Informal settlements

“Urban slums are settlements, neighborhoods, or city regions that cannot provide the basic living conditions necessary for its inhabitants, or slum dwellers, to live in a safe and healthy environment” (Ramadhan 2007: 121). An assertion the United Nations Human Settlements (UN-HABITAT: 2009:11- 14) agrees with by defining a slum settlement as;

“a household that cannot provide one of the following basic living characteristics:

- Durable housing of a permanent nature that protects against extreme climate conditions.
- Sufficient living space, which means not more than three people sharing the same room.
- Easy access to safe water in sufficient amounts at an affordable price.
- Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people.
- Security of tenure that prevents forced evictions.”

This study agrees with the above definitions on the informal settlements, and since it is more concerned with the infrastructures, it looks at the informal settlements as a place where the provision of the infrastructure is not at par with the needs of the growing population. Provision of infrastructural services within these areas is likely to be of poor quality, inaccessible and inadequate.

Urban informal settlements

more than 50% of the urban population (RoK, 2009).

According to Syagga (2011:105-106) despite similarity in characteristics between the informal in Kenya and in other countries, Kenyan informal settlements have the following characteristics:

1. **High population:** densities per unit area of land e.g. Kibera, the largest informal settlement in Kenya, is approximately 2.5 square kilometers with a population density of 68,000 persons. Further, UN-HABITAT (2008) asserts that depending on the city, 60-80 percent of Kenya's urban population live in slums.
2. **Minimal urban services or lack of them altogether:** In Kisumu, refuse collection efficiency is mere 20 percent and only 10 percent have sewerage connections. Over 60 percent of the slum dwellers obtain their water from unsafe sources resulting in high rates of water and sanitation related diseases and morbidity UN
3. **High levels of poverty:** majority of the residents in the slums are low-income a fact that Oxfam-GB (2009: V) concurs with this; Poverty in the city is worst amongst those with low levels of education, another cause for concern given that considerably fewer children attend the later stages of school in Nairobi than in Kenya's rural areas, and many slum areas have few or no public schools. Meanwhile gender inequalities remain severe, with female slum-dwellers being 5 times more likely to be unemployed than males
4. **Mixed tenure:** tenure in the informal settlements is mixed e.g. Squatters on private/public land, group purchases through land buying companies illegally subdivided land by original owners who subsequently sold it
5. **High morbidity and mortality rates:** these are caused by diseases stemming from environmental conditions and are significantly higher than planned areas of towns.
6. **Temporal housing structures:** houses are largely made of recycled materials of iron sheets, mud and wattle etc.

2.2.2 Nairobi Informal settlements

According to African Population and Health Research Center (2010), informal settlements in Nairobi have some of the highest population density as they occupy less than 6 percent of Nairobi's residential land yet they are home to home to 60 percent of the city's population. The large number residing in the Nairobi informal settlements do not own the land and therefore have

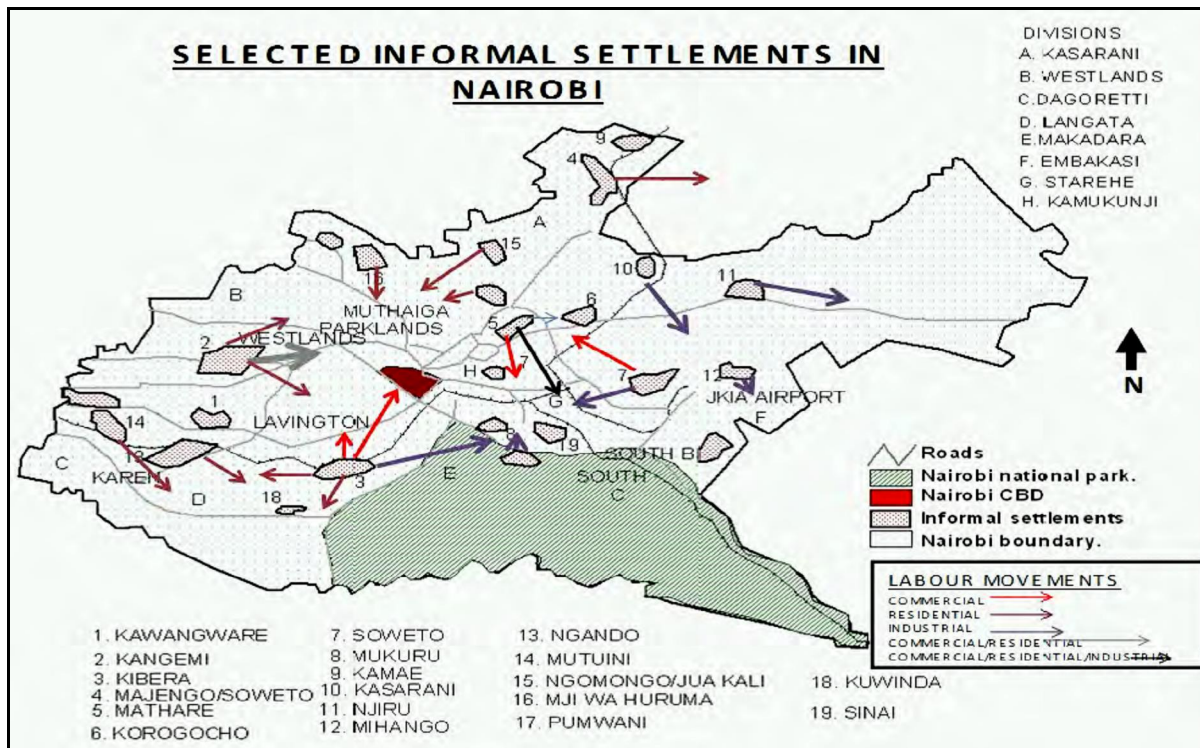
t. The provision of basic infrastructures therefore depends on the local actors such as NGOs and church organization. The process in the informal settlement is mixed e.g. squatters on public/private land, group purchases through land buying companies, illegally subdivided land by original owners who subsequently sold it.

'The total number of informal settlements keeps changing as some new settlements emerge near construction sites, factories, acquired land parcels from formerly private/agricultural land (northern periphery) or ranches (eastern zones) close to the city by LBCs and cooperatives. Rapidly urbanizing peripheries also include the western zones which were predominantly private freeholds but are now developing housing to capitalize on the city expansion. The southern city periphery is spared by the protected National Park'.

Makachia (2011: 86)

The above indicates that, the growth of the informal settlements is an on-going process and reflects the rate of urbanization. Most of the informal settlements in Nairobi are found in fragile ecosystems or steep topography where ordinary settlement would be difficult to sustain.

Figure 1: The location of the City growing informal settlements



Source: Syagga (2001)

that formally recognized by the government and thus lack education, and health services. The result is poor socio-economic conditions, high child mortality and morbidity rates. According to (pulitzercenter.org) the difficult living situation in most of the slums have led to a number of coping mechanisms and thus slums have become a site for a plethora of socio-economic initiatives by NGOs and international agencies promoting different coping strategies. Urban Agriculture is one of the strategies aimed at tackling food insecurity. Urban Agriculture in Nairobi is practiced in backyard farms, open spaces under power lines, along roadsides, railway lines and riverbanks, as well as on institutional land (Njenga et al 2010). As Lee-Smith et al. (1987) observes in mid-1980s when the population of Nairobi was around 1 million, 20 percent of the Nairobi households were growing crops and 17 percent kept livestock within the city limits. In 1990s it was estimated that 30 percent of the households were involved in urban farming² (Foeken & Mwangi, 2000).

Of noteworthy interest as it concerns the growth of urban agriculture practice in the Nairobi informal settlements is the clear contrast in the effort put in promoting this strategy and corresponding lack of UA practice standard controls, the latter is best illustrated by Mukisira, (2005) who observes that variety of pesticides, herbicides and fungicides applied by the urban farmers in Nairobi informal settlements are not safe and only raise the levels of risk to water and food consumed within the localities of its applications. This implies that, urban agriculture benefits in unregulated environment are peripheral and besides its various impacts on infrastructures it has direct negative effects on the health of the residents.

2.3 Urban Agriculture

Urban agriculture is defined as the production of crops and/or livestock within the administrative boundaries of the city (Mukisira, 2005:24) however, according to Tinker (1994:382), urban Agriculture should not be seen as merely the growing of food crops and fruits trees butí also the raising of animalsø The latter author acknowledges the difficult of defining urbanøand Peri urbanøin terms of agricultural practices since their boundaries in most cases overlap.

² In 1998, there were about 24,000 dairy cattle in Nairobi, which produced about 42 million litres of milk, while an estimated 50,000 bags of maize and 15,000 bags of beans were annually produced in Nairobi (Mukisira, 2005).

ulture should be seen as an industry located within (intra-) of a town, a city or metropolis, which grows or raises, of food and non-food products, (re-) using largely human and material resources, products and services found in and around that urban area, and in and turn supplying human and material resources, products and services largely to that urban area. This therefore implies that UA is not limited to the core of the city but does overflow to the periphery as well, yet it must stand out from the rural agricultural practices. Limpton (1977:6) observes that:

“urban agriculture is not simply rural agriculture done in cities. Different constraints and opportunities that are absent or of limited significance in rural contexts affect urban agriculture; the need to make use of micro space, poor soil, quality or lack of soil, opportunities to use vertical space; abundant availability of recyclable nutrients for soil and animals, availability of waste water; need for bio management of insects and diseases pests; need to manage high risks urban contaminants etc.”.

These opportunities and constraints give different characteristics to urban agriculture and demand that the approach be different too.

Notable factors that affect UA are the household income and the expected benefits. FAO (2007) notes that investment decision whether or not to adopt a specific coping strategy in UA is pegged on the available financial resources which also corresponds with the derived income. This is also supported by observations of Machethe (2004) that the level of farm income increases relative to total household income, suggesting that urban agriculture remains an important source of income, even though households derive a significant proportion of their income from non-farm sources. In this study's context, UA is interpreted as unregulated urban agriculture within the informal settlements. Since this study is keen on the UA effects on infrastructure, it further treats UA as all farming activities that take toll on physical infrastructure within the informal settlements.

2.4 Physical housing infrastructural services

Physical infrastructure is a broad array of systems and facilities that are used as a conduit for services (Olutah et al 2009), (wikipedia.org) further describes physical infrastructure as organizational structures needed for operation of society or enterprise or the service and facilities needed for the economy to be operational. According to (Thesaurus.org), physical infrastructure

installations needed for the function of the community or communication systems, water and power lines and public other public utilities. This study defines physical infrastructure as key facilities of capital investment installed for the provision of services. This study specifically focuses on ; water pipes, electricity cables, foot paths, rail leave ways, road reserves, open drainage channels and sewer lines

2.4.1 Situation of Physical Infrastructure in the informal settlements

Infrastructure facilities like piped water, transport network, sewage disposal systems such i.e. open drainages and sewer lines, and electricity cabling have been overstretched. This and other factors have led to high incidences of poverty, diseases, malnutrition etc hence the low living standards and quality of life in the informal settlements (Burchardt 1997).

Perhaps the most obvious element of an informal settlement is the state of housing which is structurally poor and has its environment poisoned by various activities that are undertaken within and without the dwelling space of the slum dwellers. In addition, slum settlements have a very high population density because of the proximity to economic activity centers and urban infrastructure as well as access to sources of employment (Fernandez, 2011). For this reason:

1. Plots size and open spaces are small
2. Waste production is correspondingly high and dangerously unregulated.
3. Dump bins often grow in any open space whether for a public utility of private owned.
4. Occasionally, huge dumps grow along the paths, rail lines, buffers and reserves hindering accessibility and expansion of very important services crucial for housing. Morbidity and mortality rates are high due to un-sanitized environment especially during rainy seasons

Maxwell (2004:57) notes that management of household waste can be contentious issue in the informal settlement due to the following facts:

1. Lack of municipal services to dispose off waste
2. The growth of UA that produces bio waste coupled with little or lack utilization of composite manure for the urban gardens



PDF Complete

Your complimentary use period has ended. Thank you for using PDF Complete.

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

in tenants and lack of awareness in waste recycling

The environment is worsened by action of the rummaging animals and other natural dispersion of waste. Poor disposal of waste is thought to be main causes of sewer blockage in the informal settlements. Where tenants in the informal settlements use borehole water for domestic purposes, poor waste disposal whether agricultural or industrial is also likely to cause water contamination (Porter et al 2013)

2.4.2 Urban Agriculture and informal settlement Housing Infrastructure

The relationship between UA and the physical infrastructures in informal settlement is an intricate one in nature and has been a field of scholarly as well as administrative conflicts. Proponents of urban agriculture assert that UA should be seen as part of the urbanization process Maxwell (1999) whilst critics of UA assert that, UA only plays psychological effects as a coping strategy but leaves irreparable damage on both the social and physical urban infrastructure (Kramer et al 2006). The effects of the UA as a coping strategy subjects residents to infections and diseases, considering the use of chemicals on farms and destruction of important infrastructures such as sanitation resulting to health hazard (Maxwell, 2008). Lee-smith (2008) further observes that UA strains physical amenities within the informal settlement due to limited space, high population and other diverse human activities, quest for high production which cannot be sustained without use of agricultural chemicals (which include the banned pesticides containing DDT) and limited resources such as water and land. The competition between the farmers occasionally result into over utilization of these infrastructures, infrastructural sabotage, or/ and vandalism of infrastructure components for scrap materials or mere mischief between farmers.

Urban Harvest (2010) argues that, in many slums, illegal connections of water and diversion are manifest of the effects of UA in the informal settlements. Since the biggest percentage of the UA in the informal settlement is meant as a coping mechanism and practiced by low income earners, the likelihood of the UA taking the form of sewer farms, a former waste bin or raw sewage being substituted with fertilizers is high. Daily Nation, 23 August, 2011 suggests that most of the vegetables grown around the city of Nairobi are fertilized with sewage. Since the raw sewage has

often leads to disintegration of the infrastructure that addition poses primary health hazards to urban tenants.

There are few studies on the effects of UA on overhead power cables, but Satcher et al (2012) suggests that farming under such conditions leads to destruction of electricity power posts through wood rot due to exposure to moisture conditions. Illegal connections of power in the informal settlements occasionally involve underground cable network which pass through farms or open field with possibility of being interrupted by gardening. It therefore remains a challenge to enjoyment of uninterrupted power supply within this area especially during the farming periods. Road and footpaths are obstructed by gardens that infringe on its reserve. The same is likely to happen along the railway line and its reserve. This will likely interfere with works related to improvement of railway transport. The above discussion shows that, UA practices are a major contributor to physical infrastructure damage in the informal settlements.

2.5 Integration of UA and human settlement experiences

2.5.1 Urban Agriculture in developed Countries

Personal gardens have always been a cultural tradition in the European culture. Most of these gardens are for vegetable and flower farming. Copenhagen, Amsterdam, and Berlin are large cities that illustrate this cultural practice. Berlin has more than 80,000 allotment gardens in public use (Beatley, 2000). One important feature in many of the new development areas planned in the cities mentioned above is the provision for community gardens, in both rural and urban sites. Many European cities, like Helsinki, provide more than just garden space, by including services like lending tools and providing information.

City farms are municipally-owned and operated farms, which are usually on the outskirts of the city, and are used for recreational, educational, and other purposes. The United Kingdom has its own network of city farms, with a National Federation of City Farms made up of sixty members (Beatley 2000:17). These farms are often in urban environments, integrated with development, and consequently get a fair number of recreational and educational users who are local residents—something that is not as feasible for a rural farm. City farms are also able to obtain direct customers for their products more readily than traditional farms. In addition to acceptance of urban gardens as a valid land use, there is also political support for urban

European Union and the United Nations. Many of these localized and integrated into national and municipal policies related to unregulated urban farming. Localisation of sustainable UA practices is recognized in Agenda 21 which states that "major adjustments are needed in agricultural, environmental and macroeconomic policy, at both national and international levels, in developed as well as developing countries, to create the conditions for sustainable agriculture and rural development," (United Nations 2010). This goal is also linked to the promotion of sustainable development, addressing the need for internal resource development, integration of environmental infrastructure, sustainable land-use planning and management, and access to land resources as an essential component of low-impact lifestyles. The eco-villages located throughout Europe demonstrate the "human settlement" concept and the adoption of these goals in a complete and holistic manner. (Beatley 2000). In meeting challenges of raising food prices, European countries Municipal Authorities were obliged to "allot small plots to workers' families for food production, (Burchardt, 1997). Most of the European cities have practiced this allotment since with the practice spreading to Asia and Latin America, especially Brazil and Mexico which are known for Vertical farming in its cities.

2.5.2 Urban Agriculture in developing countries

In Mexico³, *Rooftop Rain Gutter Garden* in Guadalajara is one of the many examples of low cost urban agriculture designed to respond to coping strategies of the local urban population in attempt to contribute towards food security (Averbeke, 2005). This approach enables UA to be carried out as a food insecurity coping strategy while ensuring that the character and aesthetic value of the building and the environment is observed.

In Uganda, a lot of socio-political problems including the Idi Amin's rule of '70s, and civil wars of 1980s contributed immensely to ad-hoc urban agriculture (Lee-Smith 2008). Though the UA in Kampala is visible across the city, it is quite notorious in the slums of Banda, peri-urban transition area of Buziga and city peripheral areas of Komamboga where basic infrastructure lay in dysfunctional state. In all these areas, farming has rendered delivery of services difficult

³ Mexico is used here due to its broad class of socio-economic deprived persons depending on the UA coping mechanisms

community itself in return. In Nigeria, especially in cities of
used as a strategy for poverty reduction (Egbuna, 2010).
agree that UA can be used as poverty reduction tool since it
tends to present immediate satisfaction while jeopardizing on aspects such as health (as
occasioned by farm chemical use, unvaccinated farm animals among others).

The post-apartheid South African government provided some incentives to rural urban migrants
to curb the rising food insecurity within the urban centres of Mpumalanga, Limpopo, Kwa Zulu-
Natal, and Gauteng among others. Studies carried out in the informal settlements of Jeffsville-
Op-Die-Berg, Phomolong, Concern, Vergenoeg and Brazzaville of the Gauteng Province show
that accessibility of water, fertilizers and land is the main challenge of UA in the informal
settlements (wrc.org).

2.5.3 Differences between UA in developed and developing countries

Political support: UA in developed countries enjoys political support since; according to
Beartley (2007) European urban farms are municipally owned. On the other hand, developing
countries discourage urban agriculture by banning all agricultural practices within its urban
centers. Further, the municipalities of the developing countries do not have farms nor do they
have legal framework in support of the same.

UA as a coping and recreation mechanism: developing countries see UA merely as a coping
mechanism since it is practiced by the urban poor; this is contrasted by view of UA within the
developed countries Maxwell (2004) implies that, most UA practices in the developed countries
practiced by individuals are for recreational purposes as opposed to UA in the developing
countries where it is practiced as a coping mechanism. Foeken (2005:139) notes that such coping
mechanisms are unlikely and in fact do compromise the living conditions of the
tenants including destruction of infrastructures during various farming processes

Planning of UA: developed countries show great deal of planning such that urban agriculture in
their cities do not infringe on the infrastructural services unlike developing countries. The latter
has the UA imposed on the already unplanned infrastructures leading to further deterioration.
Burchardt (1997:66) explain that "Growth of UA can be empirically traced to growth of
informal and unplanned settlements more than planned and orderly urban settlements. The



PDF Complete
Your complimentary use period has ended.
Thank you for using PDF Complete.
[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

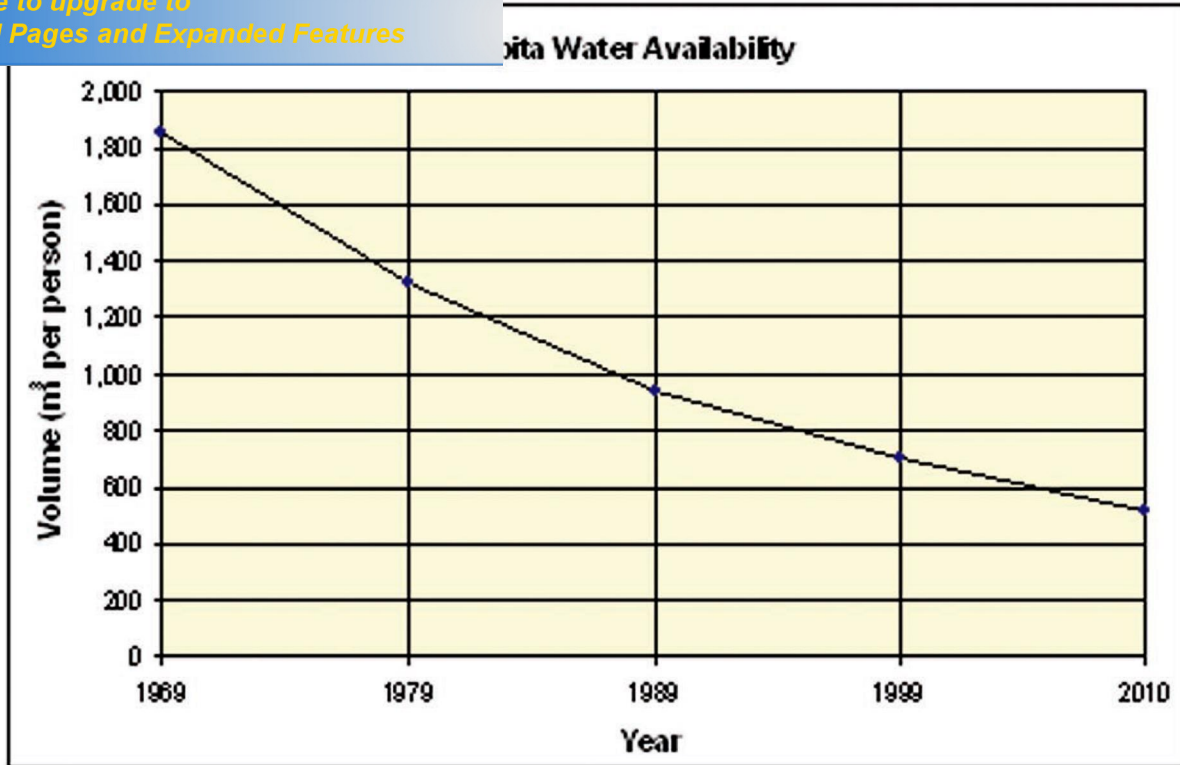
form the base of the informal settlers resorted to urban farming, to escape from vagaries of urban economies. While this was not the case in the developed countries since urban planning considered UA as integral part of the urban ecosystem.

Provision of agricultural inputs: accessibility of the farm inputs such as land and extension services are not provided by developing countries and therefore results to unregulated farming characterized by competition among the farmers. This is in contrast to services provided by the developed countries to its farmers. By providing these services the developed countries avoided consequences that come with unregulated farming.

Tibaijuka (2004), observes that European economies exported the divide between rural and urban to the colonies with efforts made to keep local rural producing populations out of urban areas, while at the same time developed countries unified urban and rural agriculture in their own cities by putting in place proper strategies.

Contrary to these assertions African cities failed to factor urban farming as a key driver to sustainable urbanization as evidenced by their failure to plan and implement elaborate and all inclusive urban development policies this may be because UA in many African cities are an afterthought occasioned by socio-economic factors and thus has a direct consequence on the already planned infrastructure (Tibaijuka, 2004).

Services planning and delivery: Due to inclusive planning of UA within the urban centres, the developed countries are able to stem the problems associated with unregulated agriculture such as shortage of water. This is very important especially at the background of global warming. Most of the developing countries are already reeling from water shortage and contamination. For instance Kenya's water supply per person has been dwindling over time as shown in figure 2 thus the need to regulate use within the urban centers.



Source: (RoK, , 2002)

Water resource management in developing countries is wanting. Water recycling is not usually undertaken in a largescale manner its conservation is also not seriously observed as it is in developed countries. UA plays a big role in over-utilization of water coupled with deforestation and destruction of wetland to pave way for urbanization and farming activities. Whilst this is attributed to poverty, RoK (2006) notes that ERSWEC does not recognize the management of Kenya's water resources as an integral part of poverty alleviation strategy.

In the informal settlement, the question of water utilization is key. This is amplified by the fact UA is a consumer of water resource against a background of severe scarcity. The resulting scenario is competition for the available water causing destruction of the infrastructure, conflicts among the residents and possible conflict among the resource users.

2.6 UA and the Urban environment health

Farmers in Kampala and Nairobi, depend heavily on municipal dumps, sewage systems, animal droppings and peelings which are used as manure for farming (Maxwell, 1994). While animal

to chemical fertilizers, municipal dumps, and sewage treatment that may contaminate food stuff in the high level as a result. Numerous studies dealing with microbiological water and crop contamination on urban vegetable farms in Ghana recorded high fecal coli form and parasite egg levels that exceeded guidelines for food quality (Urban Harvest, 2011). This further support the emerging school of thought that, the long term effects of UA may be quite detrimental to human health. It can be argued that, the high costs that result from the unregulated UA in the informal settlements are transferred to the same residents in the area i.e. the coping strategies that are put into play have dire consequence and end up negatively influencing the general living conditions of the slum dwellers. Increased spending from the poor on health put severe competition and restricts investment on proper safer housing among the slum dwellers (wrc.org).

Maxwell (1994) asserts that in Yaoundé, Cameroon, urban agriculture sometimes acts as sinks for urban waste used as nutrients and are closely linked to markets. Dependence on the sewage is high in slum because it is cheap and effective on the farms despite its health implications. In Uganda, Lee-smith (2008:91) observes that, yams planted near the sewage lines developed bad taste as opposed to the planted in a well drained black clay soil or in sack gardens. He also asserted that, though the poor may be aware of health risks from UA they are unable to avoid them because their life depends on getting food and water for themselves and their families.

This suggests that, unregulated UA has can be detrimental to human health, may affects investment geared towards infrastructure and general welfare of the people in the informal settlement.

2.7 Institutional framework

2.7.1 What have been the urban policy responses to urban agriculture in Kenya

Currently there are few but inadequate urban planning policies that specifically address the issue of urban agriculture (futurepolicy.org). Previous planning approaches have led to dense residential areas with little space left over for urban agriculture practices. The regulations regarding crop cultivation, however, are still forbidding save for agricultural land that came to be located within the recently urban boundaries after their expansions. Urban planners in Kenya

interest in urban agriculture as a legitimate urban land use

- i. Food systems such as urban agriculture are indirectly linked to built environment
 - ii. Urban agriculture and food security issues affect planning only as land use, zoning and location decisions
 - iii. Provision of spatial framework to harmonize the environmental and Socio-economic development activities.
 - iv. Production and distribution of accurate geographical data transformation of land tenure system through ascertainment of rights and interests.
 - v. Maintenance of land records for safe custody of land resource.
2. Agriculture is a rural issue
- i. Food farming issues should be handled by rural development policies
 - ii. Agriculture in urban areas interferes with more productive use or rent of land by other economic activities
3. Public health concerns ó urban agriculture may lead to contamination risks of producers, handlers and consumers.
4. Environmental issues ó Visual untidiness, soil erosion, destruction of vegetation, pollution of resources, and depletion of water bodies.

2.8 Policy, Legal and Regulatory Framework

Some of the available Acts of parliament that support or hinder urban and peri-urban agriculture are as follows:

1. The Draft National Urban and Peri-Urban Agriculture and Livestock Policy, 2010 acknowledge the growth of Urban and Peri Urban activities and many challenges that they face among them support services. If adopted and implemented the Draft National Urban and Peri-Urban Agriculture and livestock policy will lead to improvement in UA's perception and practices in the country. It seeks to support UPAL activities in realization of sustainable urban centers since the draft policy seek to bring together different actor in the UPAL sectors, it will likely result to improvement in the way urban agriculture is carried within the informal settlements.

0, under the Chapter 4, section 42 (1b-d) Bill of Rights the right to accessible and adequate housing, and to ion; be free from hunger, and to have adequate food of acceptable quality and also to clean and safe water in adequate quantities. The constitution therefore gives right to UA for the urban residents in order to secure themselves hunger , but subject to ensuring they also do not interfere with other people enjoyment of their rights i.e. right to property. The practice of UA to avert hunger would also be subject to maintenance of a clean and healthy environment, this is however not the case within the informal settlement since standards and controls are lacking to promote food security and at the same time sanitation condition within the informal settlements inadequate.

3. The Public Health Act (Cap 242) in section 157 (1) empowers the Minister for Health to prohibit cultivation or irrigation within and around townships.
4. The Land Act (2012) realizes "settlement" as a form acquisition; it does not do so in respect to urban settlements where UA is concentrated. In fact, it categorizes urban settlements as land under squatter occupation. The Land Act however provides for controlling transaction of agricultural land. However, the minimum agricultural land that can be transacted is about 1 acre. This is unsupportive of UPAL since smaller land parcels than these exist where intensive UPAL activities are practiced. In addition, the Act directs that any agricultural land in municipalities or townships must be so declared by the Minister in charge of Lands in the Kenya Gazette. This act is not in tandem with the reality of UPAL in the urban centers; the minimum agricultural land is smaller than the prescribed 1 acre and therefore deemed illegal. Furthermore, for this plot to be declared agricultural, the bureaucracy the act suggests is discouraging.
5. Agricultural Act (Cap 318): This law provides for conservation, management and development of natural resources for agricultural growth and development. However, this is particular for rural and not urban agriculture. Currently, agro processing and value addition activities are not provided for. The current challenge to UPAL is that of striking a balance between production and postproduction and marketing activities. Efforts to link production, agro- processing and value addition awareness and skills are largely lacking and there is need for institutionalization of these, as well as rural-urban linkages.

... prohibits use or dispose into the environment a pesticide
... of the provisions of the Act. UA in the informal
... out observation of this act and therefore endangering the
lives of the people downstream

The current laws, which include the Land Act (No. 6) the Physical Planning Act (Cap 286) and the Public Health Act (Cap 242), and National land policy, Sessional Paper No. 3, (2009) are not supportive of UA activities. The laws that implicitly support UA such as the Constitution of Kenya (2010), Draft National Urban and Peri-Urban Agriculture and Livestock policy (2010) depend on the full implementation of other acts that have not been formulated. Housing Policy, Sessional Paper No 4 (2004) while acknowledging the situation of urban housing and related infrastructural services fails factor housing improvement in the informal settlements.

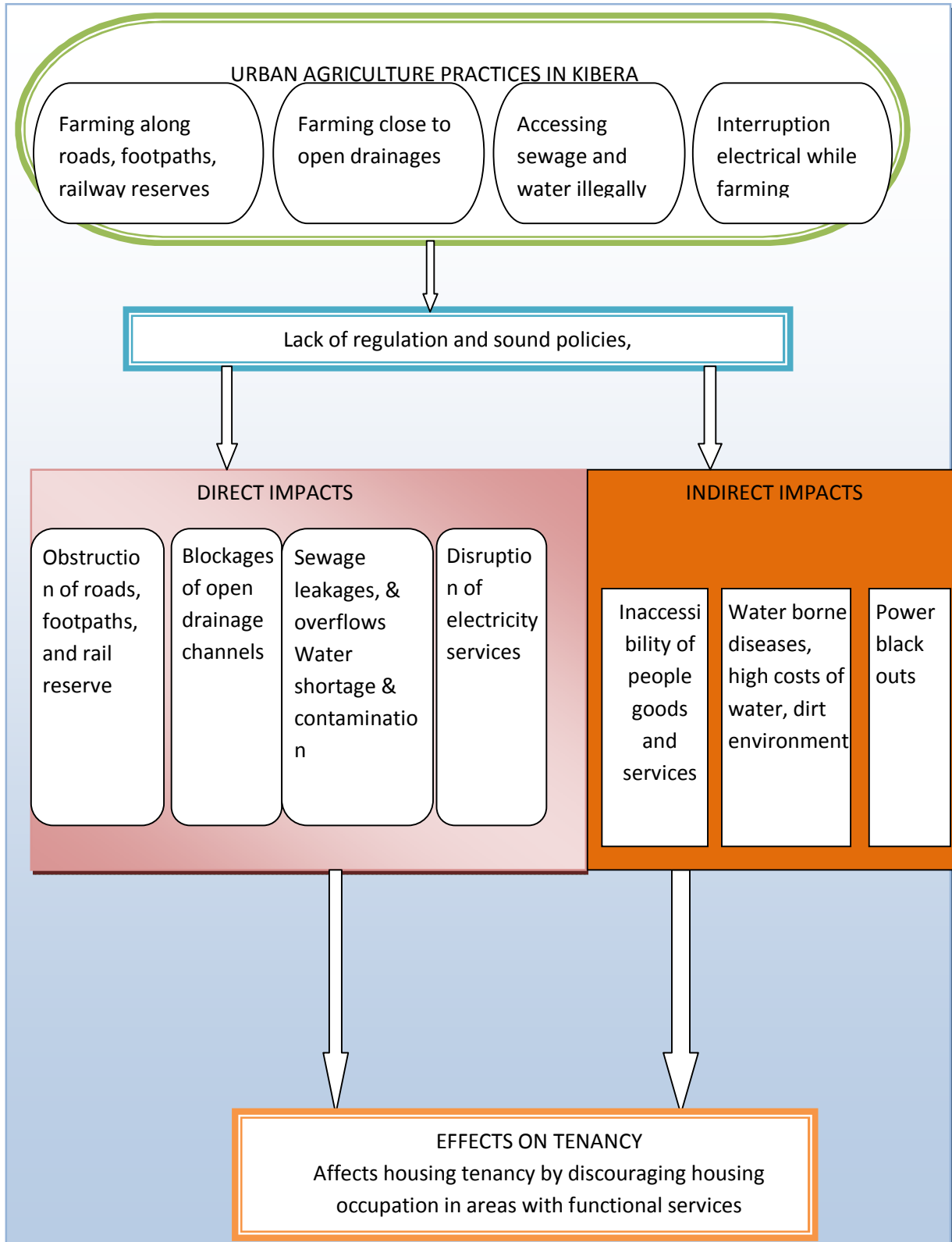
Water Act (2002) regulates water and sewerage services with intentions of taking care of all users however this has not been practical within the informal settlements. Whereas it should regulate the materials used for water connections, it has not been the case in the informal settlement; this often results to poor materials and procedures being used for water reticulation making it vulnerable to UA activities.

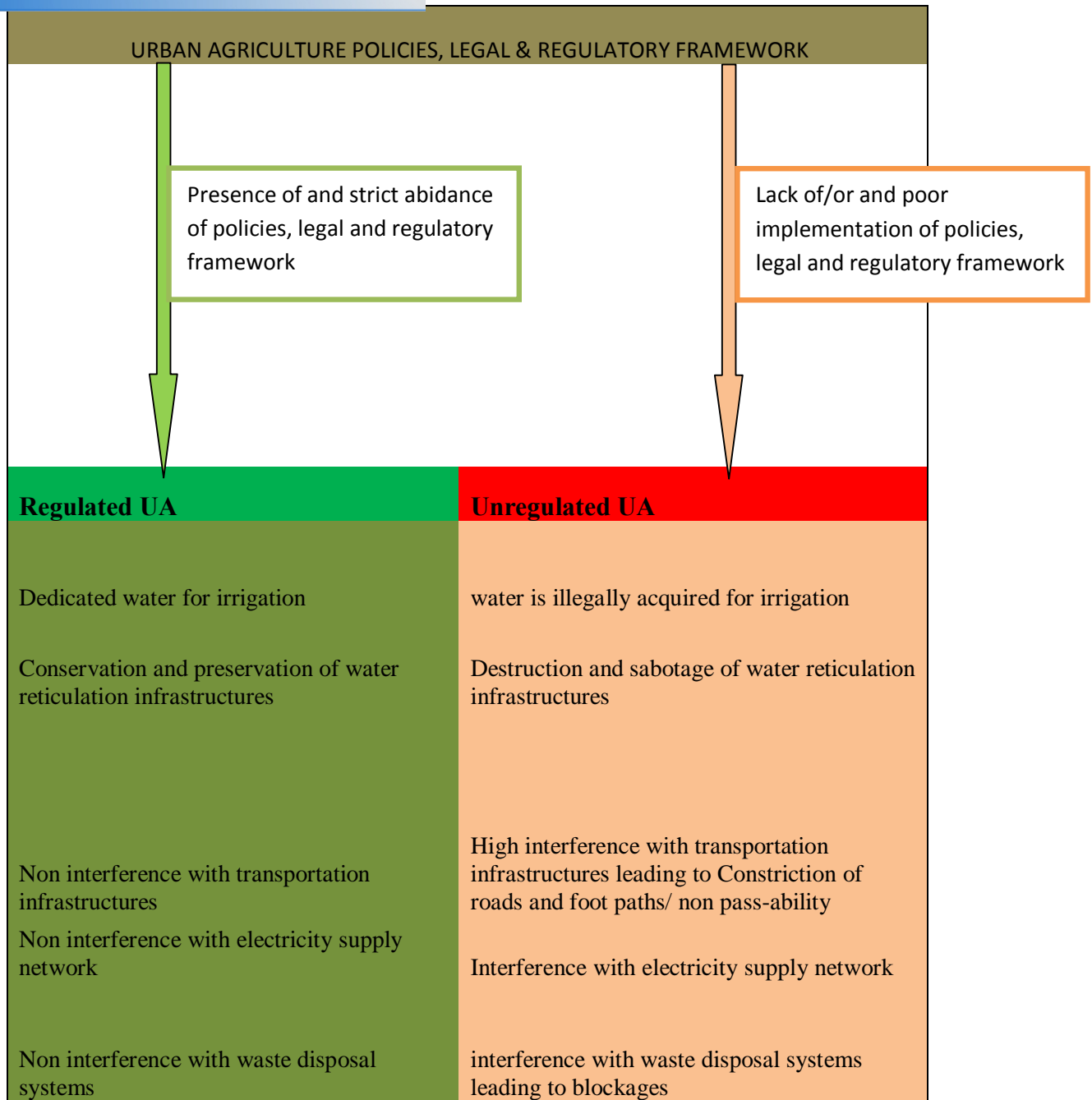
It is recommended that urban agriculture ought to be improved and integrated into formal city planning. This can be done at individual level, city level and at the level of central government with the Nairobi City Council drawing up an urban food policy for Nairobi and updating its physical development plan. There is need to amend the city council by-laws, enabling legislation as well Public Health Act (Cap 242) to facilitate and enhance urban agriculture to the benefit of the Urban-resource poverty (GoK 2010). Within the food policy framework, the issues of infrastructures would be expected to be dwelt with in ensuring sustainable urban food production while minimizing overhead operational costs as occasioned by UA in unregulated environment.

Methodological framework

Methodology of how the study will be undertaken and its

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)





Source: author 2013

Click Here to upgrade to Unlimited Pages and Expanded Features

Impacts on the informal settlement infrastructure

Farming Practices	Infrastructure Cluster affected	Components	Direct impacts of UA activities	Indirect Impacts of UA	Measure/Indicators of impacts
1. Vegetable growing: sack gardening and traditional farming 2. Animal rearing: piggery, fowls, goats and sheep	water supply Infrastructure	water pipes	1. Illegal water connections for irrigation 2. Total diversion of water for irrigation purpose in some pipelines 3. destruction of ground pipes during farming	1. Water supply disruption causing periodic or total lack of water in some neighborhoods 2. High water costs to households 3. Likelihood of waterborne diseases	No. farms depending on piped water in the study area No of households buying water from water vendors due to water diversion or disconnection owing to UA No of cases associated with vendors water
	sanitation infrastructure	sewer lines waste dumps open drainages	1. Diversion of sewage for farm fertility 2. Destruction of ground sewer lines through farming 3. Dispersion of solid waste by animals such as pigs, fowls, goats and sheep 4. Blockage of open drainages	increased likelihood of water pollution likelihood of infections caused by dirt environment food contamination by lead found in raw sewage	No. of observed farms using raw sewage for fertilization No of total cases of sewer lines destruction observed and reported No cases of infections associated with improper waste disposal Distance (in Meters) of waste dispersed by

Impacts on the informal settlement infrastructure

	affected		Direct impacts of UA activities	Indirect Impacts of UA	Measure/Indicators of impacts
					actors in UA measured from center point individual dump mould
	Electricity Infrastructure	Ground cables timber Electricity posts	Dislocation of underground cables	Possible electrocution and loss of life Possible black outs and power outages	1. No electricity posts affected by UA 2. No of cases of electricity interruption reported by HHs due to interference with underground electricity cables
	Transportation and accessibility systems	Road networks(Foot paths, roads and Railway leave way)	Obstruction of paths by gardens	Hindering free movements of people, good and services	1. No. of obstructions observed along the paths and roads 2. No of farm along the railway line

Source: Author 2013

Chapter Three

RESEARCH METHODOLOGY

3.1 Study Area Background

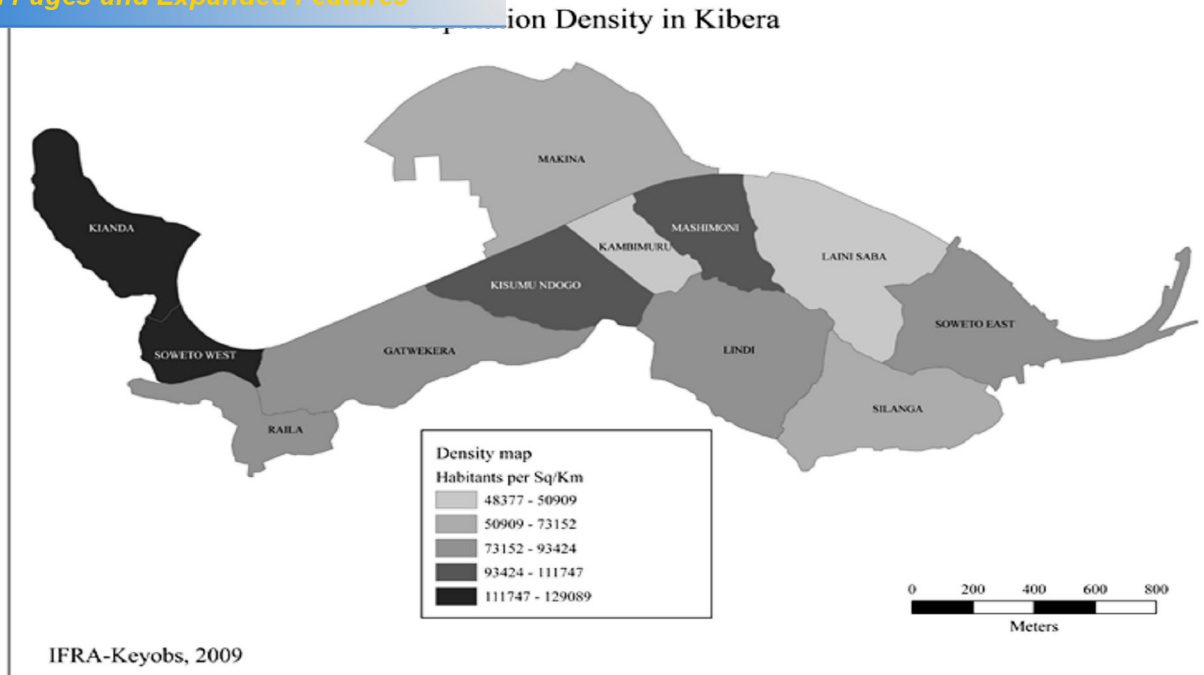
UA remains one of the most convenient coping mechanisms for the urban poor. The growing of food such as vegetables and rearing of farm animals such as pigs is a common practice in Kibera. Although the vegetables are mostly grown for consumption and animals are kept for market, in the hope that sufficient income may be derived from them. UA in Kibera has been mainly adopted as part of an economic livelihood strategy; it is likely that where there is open space, a form of farm: a sack garden, traditional garden, a pig sty, a cow shed, or a poultry house will develop. The main concern about this development is the effect of the UA on the physical infrastructure in Kibera. The pertinent question arising from the development of UA is whether or not the merits of UA supersede its demerits, especially against the background of slum upgrading attempts where infrastructure provision is seen as an important element in tackling poor service delivery. Kibera suffers from unregulated UA that has interfered with these critical infrastructures thereby frustrating much needed infrastructural upgrading. The existing infrastructures in Kibera are not sufficient enough to serve the entire population. Some of the villages such as Lindi, Silanga and Soweto east do not have most of the basic facilities, yet a casual field reconnaissance paint a picture of deterioration of some of the infrastructure provided through national slum upgrading endeavour especially in Soweto East. During the reconnaissance, water pipes were seen vandalized consistent with farming activities, those farms overstretch to roads and footpaths. This study is therefore necessary to investigate the impacts of UA on infrastructure within Kibera.

Kibera is located south west of Nairobi CBD, and approximately 4.5 Kilometers from city centre. It is served by a tarmac road and a railway line from the CBD. Kibera has 10 villages namely Kianda, Soweto west, Raila, Gatwekera, Kisumu Ndogo, Kambi Muru, Makina, Mashimoni, Lindi, Laini saba, Silanga, Soweto west. Kibera stretches across from Ngumo estate to east road to Jamhuri Park. To the south it borders Nairobi National Game Park and to its North is Woodley estate.

3.2.2 Population

Population wise Kibera is the biggest slum in Kenya.. It is located to the south-west of the CBD. According to IFRA (2011), Kibera has a population of ⁴204,000 people, while RoK (2009 enumerated 170,000 people contrary to the belief of many that Kibera exceeds a million people. The inhabitation is skewed across the 10 villages with Kianda and Soweto west being denser than other villages (IFRA 2011, RoK 2009).

⁴ IFRA and Keyobs, a Belgian Company used Geographic information Systems (GIS) methodology and ground survey to reach at this conclusion (IFRA 2011)



Source: IFRA-Keyobs (2009)

3.2.3 Climate

The mean annual temperature is 17°C, with mean a mean daily maximum of 23°C and minimum of 12°C (Situma, 1992). The area receives an average of 900 mm of rainfall which comes in two distinct seasons from mid-March to the end of May (long rains) and from Mid-October to Mid-December (Short rains) (Kenya Meteorological Department, 2009).

3.2.4 Socio-economic

Around 91% of the men above 18 years old in Kibera are employed in the informal sector. This includes, those in self employment, formally employed, or working as casuals. According to IFRA (2011), unemployment and underemployment is a challenge; 45% of the people are self employed or engaged in day-day work contracts; 24% of the women are self employed, while the average income of women is 42% lower than that of men (IFRA, 2011).

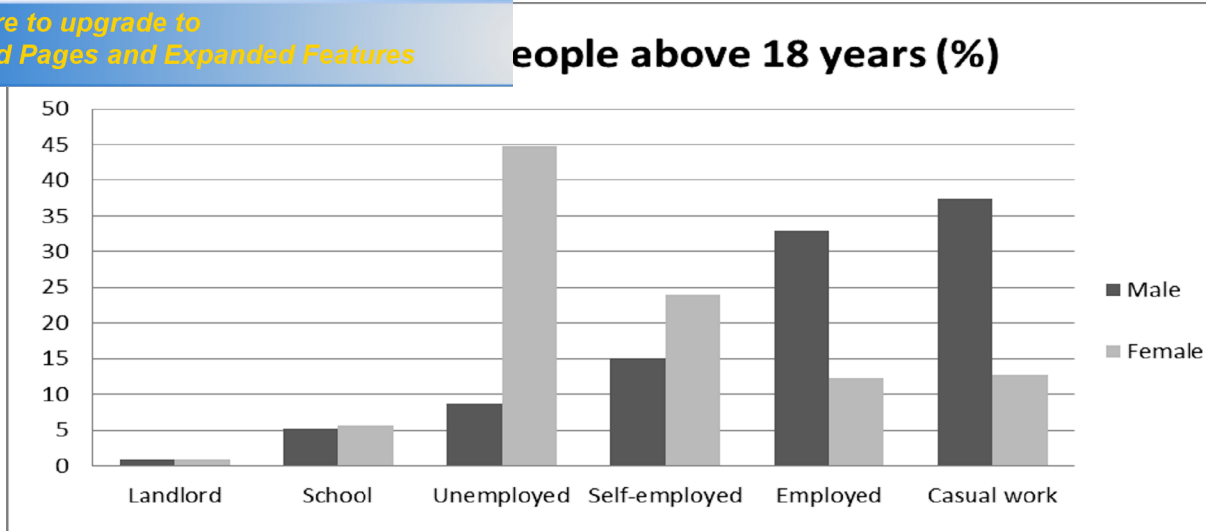
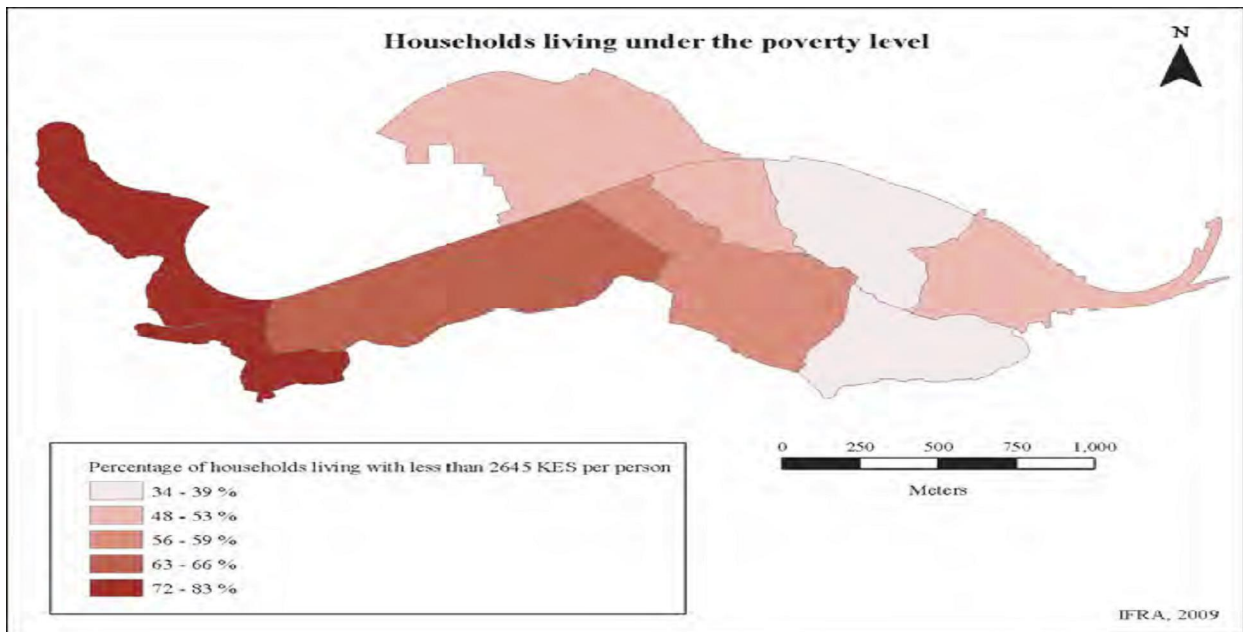


Fig. 1

Source: IFRA-Keyobs Field Survey 2009

From the above, the number of women between aged 26-50 years is more than that of men in the same age bracket. This suggests that, male migration for work is more common. It can therefore be concluded that women and children are left more vulnerable and exposed to food insecurity among other risks.

Figure 5: Poverty levels among households in Kibera



Source: IFRA-Keyobs (2009)

that areas that have high population density also have
at these areas that will form the core of this study's study
ing mechanisms include the following, vegetable growing

inform of sack gardening, and traditional gardening, animal rearing especially piggery, chicken rearing, cows and goats.

3.3 Research Design

3.3.1 Research Design

The study was primarily qualitative making use of descriptive statistics where necessary. The study employed the case study research design. A case study is considered an in depth study of a particular situation rather than a sweeping statistical survey (Mugenda & Mugenda, 2003). It is a method used to narrow down a very broad field of research into one easily researchable topic. While it does not answer a question completely, it gives indications and allows further elaboration and hypothesis creation on a subject (Hannsen et al., 1973). The case study research design is also useful for testing whether scientific theories and models actually work in the real world (Miller & Krumbein, 1954). It is argued that a case study provides more realistic responses than a purely statistical survey (Ibid). The advantage of the case study research design is that you can focus on specific and interesting cases. This may be an attempt to test a theory with a typical case or it can be a specific topic that is of interest.

As noted by Hannsen et al. (1973), case studies are also flexible and may lead to the introduction of new ideas. While a pure scientist is trying to prove or disprove a hypothesis, a case study might introduce new and unexpected results during its course, and lead to research taking new directions which could be more meaningful in the research area (Ibid). However, Mugenda and Mugenda (2003) argue that a case study is such a narrow field that its results cannot be extrapolated to fit an entire question and that they show only one narrow example. The duos add that case studies are also limited to the extent to which one can generalize them to fit an entire population or ecosystem.

In view of the above, case study design, was considered the most appropriate for this study for various reasons. One is because the field of study, which is urban agriculture and informal settlements, is too broad and dynamic and therefore the need to narrow down the research

to an attempt to establish whether urban agriculture in the with intentions of the UA proponents. The research was recommendations for the improvement of UA practices in relation to physical infrastructures in the informal settlements. Such issues can only be appropriately derived from a case study and not from a statistical survey.

3.4 Sampling Design

3.4.1 Stratified random sampling

Stratified random sampling is a technique which attempts to restrict the possible samples to those which are "less extreme" by ensuring that all parts of the population are represented in the sample in order to increase the efficiency (that is to decrease the error in the estimation).The study used this method owing to the unique characteristic of the population under the study. It treated each of the 10 villages in Kibera as strata since each individual village had its unique characteristics which are of interest to the study. For instance, presence of UA is more prevalent on some villages as opposed to others, while physical infrastructures are not homogeneous among all the villages. By use of stratified random sampling, it was easy to compare the results from each stratum and make informed conclusions and recommendations without bias which could otherwise have arisen when using other sampling methods.

Since the study was interested with the effects of the UA on the infrastructures, the sampling methods was used to pick the strata that have predominant UA and have significant physical infrastructures. Final Samples were derived by picking respondents at random from the stratum.

3.4.2 Purposive sampling

Purposive sampling was used to sample the policy makers within the field of study. It was chosen as the most appropriate method of isolating opinion makers since they are biased placed within the UA sector. Through purposive sampling was used in identification of Urban Planning Officer, Agricultural Extension Officer, County Inspectorate Officer, and Non Governmental Organization Worker. All these officers had knowledge about the Kibera and its Farming activities.

% of the total population in Kibera is engaged in one form of UA however the farming takes form of group and that there are about 400 active farming groups within Kibera at any time. Each of these groups has at least a farm⁵ which form the basis of this study's unit of analysis. Arleck and Settle (1995), observes that, it is seldom necessary to sample more than 10% of the population provided that the resulting sample is not less than 30 and not more than 1000 units. This study will thus deal with 10%. Of the farming population plus 4 samples identified through purposive sampling to represent the policy makers.

Therefore, 10% (of 400 farms) were sampled under the study. Hence **40 No.** was arrived at as the **desirable sample size of farmers.** Since the study was focused strata (10 villages), each village had 4 respondents⁶ representing a farm under the study was randomly chosen, in addition **4 No policy makers**⁷ were consulted on the policy making pertaining UA. This project hence deals with **44 No. samples.**

3.5.1 Data collection method

Appropriate tools were considered to adequately collect viable primary and secondary data. While secondary data was collected through relevant literature review, primary data was collected by use of questionnaires, field observation, and photography. The questionnaire was closed and structured for the ease of data analysis in the interest of the study objectives.

The questionnaire was developed and pre-tested in the research areas. Efforts were made to contract a competent and efficiency research assistant who understood the area well, was fluent in local dialect and understood morals and culture of the people so as to generate valid and feasible data.

⁵ Farm in this context are a conglomeration of either sacks with plants, traditional gardens confined within a specific region or containers with plants arranged along the roads, streams, drainages etc

⁶ The respondents may not necessarily be farmers; the research may choose any resident within the locality of the farm.

⁷ The Urban Agriculture policy makers consulted included; Agricultural Extension officer, Physical Planning Officer, Local NGO personnel in Kibera and City Inspectorate officer all within the Nairobi County



Your complimentary use period has ended.
Thank you for using PDF Complete.

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

er information pertaining the policy situation of the UA in the

3.6 Data analysis and Data presentation

Data analysis was carried out using appropriate statistical tools and/or techniques. Ms Excel and Ms Word were sufficiently used in the analysis and presentation of Data. Appropriate photograph analysis programs were used to analyze various photo acquired during the field excursion. Data presentation was done by use of charts, figures and tables for ease of understanding.

4.1 Introduction

This chapter presents the findings of the study and attempts to answer the research questions posed by the study at the outset.

4.2 Results finding

General information on respondents

The study, sampled 40 respondents all of whom responded: 36 were tenants while 4 were landlords. 29 of the respondents were female, while 11 were male. 16 respondents were of the age bracket 15-30; 14 respondents were age bracket 31-45years; while 10 said were more than 45 years. 15 respondents indicated that, they have stayed within the study area for less than 5 years; 13 said they resided in the area for more than 6 years but less than 10 years, while 12 respondents have lived in the study area for more than 10 years.

Interpretation and analysis

This field survey noted that, the ages between 15-30 comprised 40% of the farmers in the study area. This confirms with assertion of IFRA (2010), UA in the informal settlement is the preserve of the youth and women. Most of the youths are likely to be in involved in farming in the informal settlements..

Table 3: sample character

Cluster	Details	Frequency	%
Nature of Tenancy	Tenants	36	90%
	Landlord	4	10%
Gender	Male	18	45%
	Female	22	55%
Age Bracket	15-30	16	40%
	31-45	1	35%
	>45	10	25%
Period of residence	<5 years	15	38%
	6-10 years	13	32%
	>10 years	12	30%

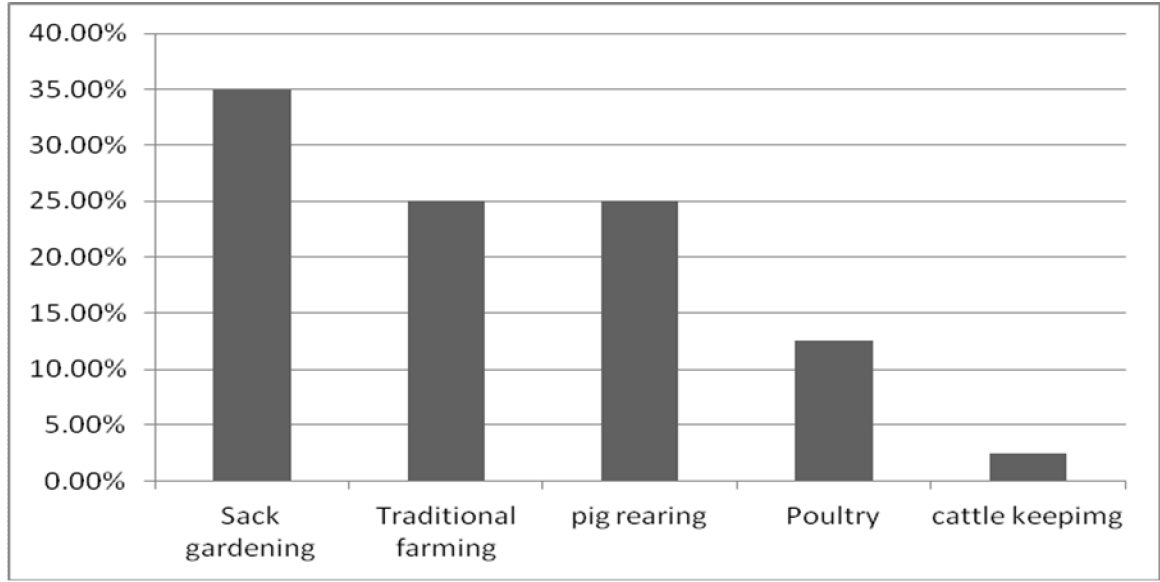
Source: Field survey 2013

55% though they were generally older than the male; this
 t women and youth are likely to be involved in UA as a
 The small percentage of the landlord, who practiced
 farming, did so for recreational purposes. Though majority of the respondents have stayed in the
 area for more than five years, those who had resided in the areas for less than 5 years had limited
 knowledge in the interaction between UA and physical infrastructural services.

Common UA Practice in Kibera

The following UA practices were indentified: sack gardening, traditional farming, pig rearing, poultry and cattle keeping.

Figure 6: Farming activities in the study area



Source: Field survey 2013

Data interpretation and analysis

As noted above the main practices within the literature review, various UA activities were expected to be unraveled in the study area. These included, sack gardening, traditional gardening, piggery, fowl farming and cattle farming. It was established that: Sack gardening, traditional gardening, and pig rearing occupied 85% of all UA activities within the study area. Other UA practices such as cattle farming and poultry took the remaining 15%.
 When disaggregated into different areas UA practices was found out to be practiced as shown below



Source: Field survey 2013

Table 4: commonest UA practices in each village within the study area

S/No	Vilage	sack gardening	Traditional farming	Pig rearing	Poultry	Cattle keeping
1	Gatwekera					
2	Kambimuru					
3	Kianda/ soweto west					
4	Kisumu Ndogo					
5	Lainisaba					
6	Lindi/silanga					
7	Makina					
8	Mashimoni					
9	Raila					
10	Soweto east					

Source: Field survey 2013

Sack gardening is the most preferred UA activity as can be seen above. Within the study area while Cattle keeping is the least desired. This choice of UA activities seemingly is dictated by

is densely populated)⁸. The sack farms are compatible and the traditional gardens. Its production⁹ was also found to farming. However, a large number of the sack gardens were abandoned as compared to tradition farming. This could likely be attributed to requirements such as labour, and water (Traditional gardening depends on rain fed water, sewage and runoff while sack farms requires constant irrigation) Traditional farming in contrast did not have a lot of requirements, depended on the rain fed water and sewage for fertility.

Figure 8: Sack gardening within the study area



Source: Field survey 2013

Cattle keeping, which involved keeping of cows, goats and sheep was found to be minimal in practice. This is also thought to be response to lack of space. However, areas that were found to have cattle, recorded minimal traditional gardening practices, were relatively sparsely populated as compared to areas where sack and traditional gardening were prominent. This included areas

⁸ National Census survey (2009) and IRIN (2010) estimates 2000 Person per square kilometer.

⁹ A single sack farm in Makina for instance, was found to have 42 kales. These could consume huge space in traditional farms

a village. This study however could not establish the within each village

Main physical infrastructural service in the study area

The research sought to know the main physical infrastructural services in the study area, through observation and the questionnaire the following was found out

The distribution of the Infrastructures within the study area is discordant with some areas having better infrastructures than others. The character of the infrastructures across the study area different in terms of use and abuse with places showing better usages while other blatant abuse:

Table 5: Distribution of Infrastructures within the study area

S/No	Vilage	Piped water	Roads	Foot paths	sewer lines	open drainages	underground electricity cables
1	Gatwekera	☺	☺	☺	☺	☺	☺
2	Kambimuru	☺	☺	☺		☺	
3	Kianda/ soweto west	☺	☺	☺		☺	
4	Kisumu Ndogo	☺	☺	☺		☺	
5	Lainisaba	☺	☺	☺	☺	☺	☺
6	Lindi/silanga	☺	☺	☺	☺	☺	
7	Makina	☺	☺	☺	☺	☺	☺
8	Mashimoni	☺	☺	☺		☺	
9	Raila	☺	☺	☺		☺	☺
10	Soweto west	☺	☺	☺	☺	☺	☺

Source: Field survey 2013

Click Here to upgrade to Unlimited Pages and Expanded Features

	infrastructural service		Situation
1	Water pipes	Plastic conduits	exposed and broken,
2	Electrical cables	Not protected by conduits	-Underground cable exposed and un-insulated
3	Open drainages	Dug out channels without concrete slabs	-some diverted to vegetable gardens -damming due to obstruction by farms -Likely to percolate due to lack of concrete flooring
4	Sewer line	Closed concrete conduits passing through the study area from other surrounding estates	-structure intact at some place -Diversion to farms through drilling at the wall of the service line at places -Missing manhole covers in the entire line.
5	Foot paths	Narrow, connecting residential plots to others and main roads	-Obstructed by farms, and housing structures - -provide space for illegal water and electricity connections
6	Roads	Most of them feeder roads, few of them accessible by a truck	main roads spot waste dumps, most of them plastics and agricultural waste -also offer space for illegal connection of water and electricity
7	Railway line	-	-turned market ground by hawkers - some form UA along the rails lines -provide ground for fecal deposit by residents without latrines.

Source: Field Survey 2013

s mainly as a result of UA in the study areas. The field areas were in existence in the study area albeit in varying

The impact of the UA on the physical infrastructural services

In attempt to identify the relationship between the UA and infrastructural services this study found out. 92.5% of the respondents agreed that UA has had effect on the physical infrastructural services while 7.5% respondents disagreed with this.

The survey restricted the respondents on the infrastructures that were defined as Physical infrastructural services in the methodology section and the conceptual framework. The study established that there was correlation between those who felt that UA had no effects on physical and the levels of physical infrastructural services within their areas since the residents who asserted UA had no impacts on physical infrastructural mainly came from the areas that were underserved. .

The intensity of UA Impact on infrastructures: The extent of the impact was investigated by asking the respondents (those who agreed above) to rate whether it was severe, moderate or negligible. The survey got the following response:

Table 7: intensity of UA impact on physical infrastructures

S/No	Measure	Frequency	Percentage
1	Severe	20	54.10%
2	Moderate	10	27%
3	Neglible	7	18.90%
	Total	37	100.00%

Source: Field survey 2013

On further interrogation of the rate of UA on the physical infrastructures it was found out that 54.1% of respondents indicated that the intensity were severe while 27% while 18.9% indicated that it was negligible. The responded stated out that they rated the impacts on a scale of severe,

hat half of them noting that the UA impacts were severe was negligible.

The above reasons can be attributed to urban farming practices population density and lack of urban agriculture regulation. In those areas where the impacts were deemed to be severe the high population density and intensive UA practices. Those areas that had negligible were poorly serviced and low population. This ranking could be attributed to specific residence and the farms of the respondents. Those who said that UA impacts was negligible were residents of low densely villages such as Laini saba, Silanga and Kambimuru. Mashimoni, Makina, Kisumu ndogo, and Kianda/Soweto west noted that the impacts were as a mixture of severe and moderate. These villages have high population and have nearly all the infrastructures present.

Areas that impacts of UA on Physical infrastructural services were rated as severe and moderate were also the areas that had prominent sack gardening, traditional farming and pig rearing except Makina village. Of the interest is that, Makina village had 2 of the 4 landlord (both aged over 45 years old and having stayed in the area for more than 10 years). It can therefore be concluded that, their age, nature of tenancy and the period of residence as the reason for them giving this information since, itø believed they interpolated general knowledge of the UA in the study and its impact.

UA impact on each infrastructure: the table below shows the rate of impact of individual infrastructures. These physical infrastructures were grouped depending with their functions for ease of data collection and analysis. Accordingly, the following frequency was noted.

Table 8: the rate of Impact of UA on grouped infrastructures

Physical Infrastructure	< 25%	26%- 50%	51%- 75%	76%- 100%
Water supply infrastructures: water pipes	1	6	19	14
Transport network: roads, foot paths and railway	5	6	10	19
Electricity supply infrastructures: underground cables	30	5	4	1
Sanitation system: sewer lines, open drainages	4	10	11	16

Source: Field study 2013

impacted different by the UA. This may be dependent on infrastructures, material composition etc. the following figure according to the respondents given in table 9 above. These results generally indicate the trend of trend of rating on figure 9.

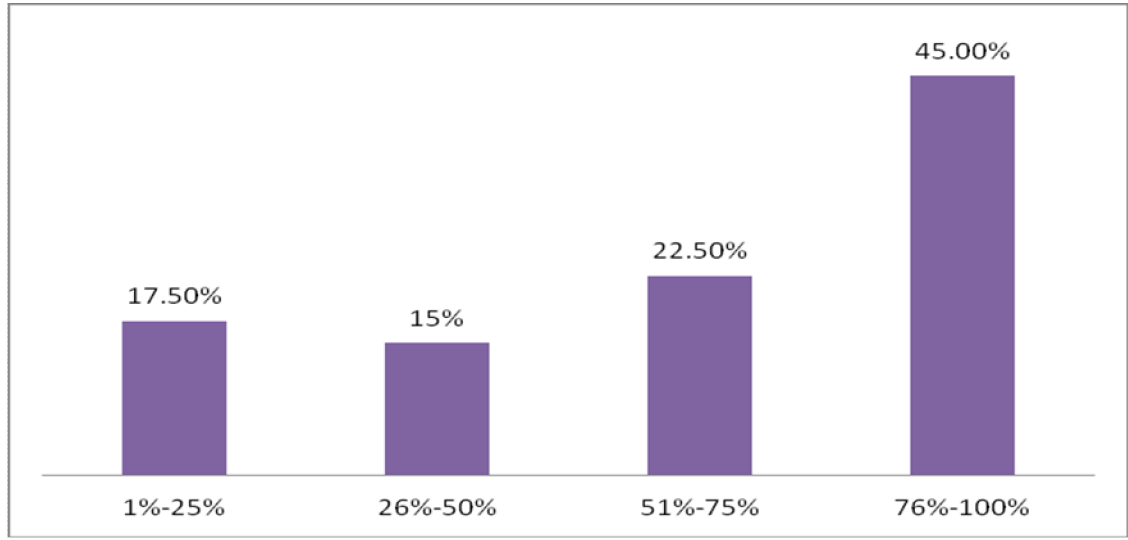
Water supply infrastructures: there is general agreement that UA affects water supply infrastructures among the respondents with 82.5% of them agreeing that 51%-100% of all water infrastructure problems are associated with UA. Only 2.5% (Respondent) thought that UA does not impact on water supply infrastructure. This is a result of UA practices during farm preparation, tilling and cultivation that cause breakages of the plastic water pipes supplying water to the neighborhoods. Transport network infrastructures: UA impacts on Transport network infrastructures were recorded highest in the cluster 76%-100% impact. This means that 47.5% of the population sample associated 76%-100% inaccessibility to UA practices. It was particularly found out that, urban gardening precede land grabbing that paves way for the construction of shacks i.e. .some NGO were found to be owning large farms that were gradually replaced by shack houses.

Electricity supply infrastructure: significantly, 30 respondents (representing 75% of the population sample) rated UA practices as having minimal impacts on electricity supply infrastructures i.e. less than 25%. This may be attributed to the fact that underground cabling though not protected by conduits, is ignored by the farmers due to dangers that electricity is associated with. Where UA practices were deemed to have significant impacts on electricity infrastructures, pig rearing and cattle rearing were common. e.g. Makina village Sanitation infrastructures: 65% of the respondents believed that 51%-100% of sanitation infrastructures problems were a result of UA. These included blockage creating sewage damming, overflows etc. 35% of respondents thought that t UA had minimal impacts i.e. less than 50%. Interestingly respondents of this view came from areas with low density and low infrastructures services in

The study also gauged the indirect Impacts of UA on infrastructure was also gauged on 0-100% rating which was divided into five sections: 0%, 1-25%, 26-45%, 46%-75%, 76%-100%. Respondents were to rate how they thought UA impacted transportation and accessibility and on the others side at what level it impacted on water reticulation.

...d out as follows. 45% of the respondents think that 76%-100% of transportation and accessibility problems arise from UA. This is almost consistent with the result on general impacts of UA. There was an increase in the number of those who felt that UA, although it has an effect on transport infrastructure, does not necessarily affect accessibility and transportation. The percentage of respondents who felt that UA has had an effect on transportation and accessibility increased from 12.5% to 17.5 percent. Possibly this is due to the fact that no boundaries are erected around the farms and that people can pass through. Another explanation probably is that most traditional farms are seasonal and they may not hinder accessibility.

Figure 9: UA impacts on transportation and accessibility



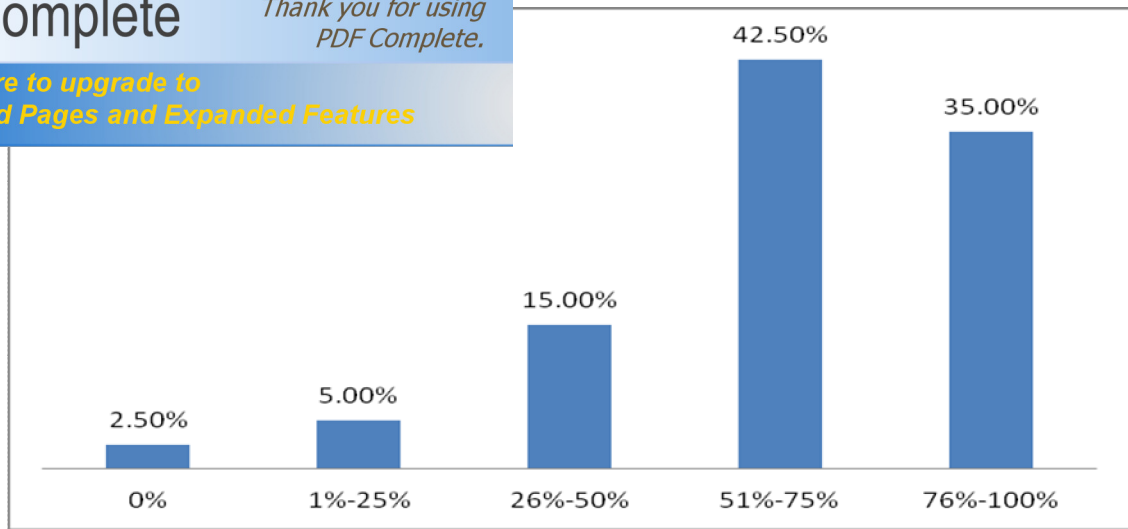
Source: Field survey 2013

45% of the respondents believe that 76%-100% transportation and accessibility problems arise from UA. Only 32.5% believes that below UA is responsible for below 50% transportation and accessibility problems. Kianda/ Soweto west and Mashimoni are some of the areas where UA has had 76%-100% impact on transportation. These areas are also densely populated and have prominence of both sack gardens and traditional farms.

Using the above rating, the impact of UA on reticulation of water was found as follows:

An AU specific impact on water reticulation was measured using the cluster above. This is what the survey found out:

Figure 10: Impacts of UA on water reticulation within the study area



Source: Field Survey 2013

Approximately 76% of respondents blamed 51%-100% of water supply interruption on UA. It was noted that those who indicated that UA is responsible for 76%-100% of water supply interruption lived in area with presence of high levels of traditional gardening, with illegal water connections. Such areas included Kisumu ndogo, Mashomoni, and parts of Gatwekera.

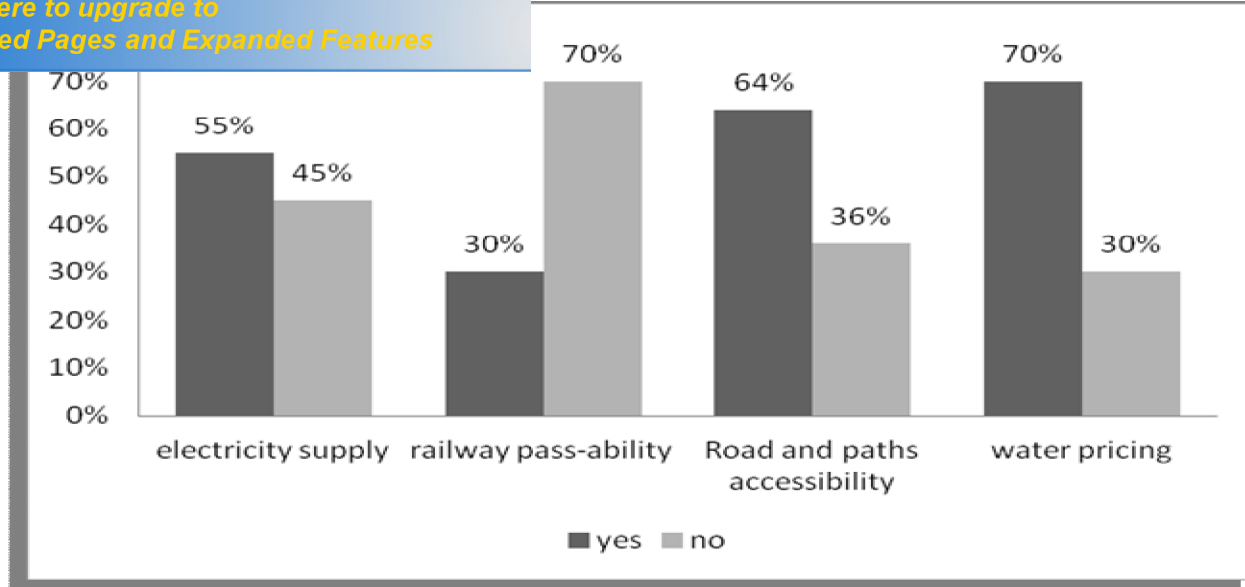
Those who felt that UA did not nor had minimum contribution to water supply interruption blamed factors such as water vendors, and the water supply company for rationing water. These included approximately 23% of the total respondents.

Other indirect impacts of UA on the physical infrastructural services:

The figure below shows how the response pertaining the indirect impacts of UA on some infrastructures:

Infrastructures

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)



Electricity effect was found to be high on the areas with a lot of traditional farming and pig rearing. However, most farmers would avoid disruption of electricity cables due to its danger. Railway pass ability is not significantly affected by UA. This response may have been affected by the fact that railway line is not found in all areas and it's a linear infrastructure by design. Road and paths accessibility are affected by UA as shown above. However the paths tend to follow boundaries of the farms and therefore do not cause permanent obstructions. Due to shortage of water created by the breakages of the water pipes, water pricing goes up in most neighborhoods. High water costs owing to disconnection of water for irrigation purposes and water prices set by the vendors are exorbitant for most informal settlers.

The study also found out that UA results into dirty environment due to sewage leaking caused by farmers, fertilizing their farms or accidental damages to sewerlines. Likelihood of waterborne diseases and other diseases associated with animals such as pig and poultry becomes a reality in face of unregulated UA.

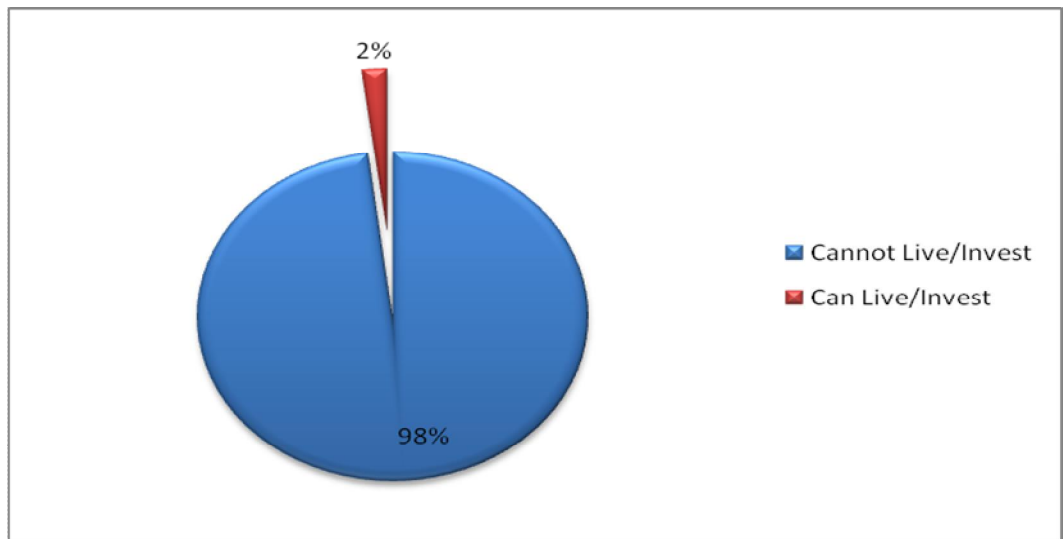
Conflicts between residents due to competition for resources such as water both for domestic and irrigation. Most of the respondents indicated that they were aware of conflicts within their neighbourhoods pertaining resources as a result of UA.

farming activities which takes large swathes of road/ costs of transportation of goods and services. Emergency agency rescue services are frustrated by invasion of UA on roads and foot paths.

Impacts on housing investments: Of all respondents, 95% (38) said that, given opportunity, they would not live or invest in residential house unit (s) within neighbourhood with prominent UA activities. Only (5%) 2 respondents said they would, this is shown as by the pie chart below.

The survey is in consistence with the findings of the literature review found out that, a large number of people would, given equal opportunities, not live or invest in the study area with prominent UA activities.

Figure 12: Reaction to UA on housing investment



All the respondents observed that, for housing investment to be sound there should be UA policy measures and standard control.

It was observed that those who interfere with the community oriented infrastructures should be made to pay for repairs and maintenance. However, this view may not be applicable in the situation since the services such as water connections, electricity supply are commonly overseen by vigilantes who discharge these services at their will. This is common in villages of Raila, Gatwekera and Lindi.

that slum upgrading program be focused on economic development. Respondents in Soweto east where slum government was only interested with development of houses and not the social-economic infrastructures that is crucial in preservation of housing character. This suggestion means that UA as a coping mechanism is likely to slow down slum upgrading in the informal settlements.

It was observed that study area suffers from impacts of UA because it is not planned and therefore development is in ad-hoc. UA provision should be included in informal settlements plan so as to minimize its impacts on the infrastructural services.

Respondents were of the opinion that regulation of chemicals used by UA was having negative impacts on the residents. The farmers result to use any chemical the encounter since they do not enjoy agricultural extension services, and many are unable to raise consultancy fee for the same. It is felt that, the Government should advice and control the farmers on the use of farm chemicals for food crop. The challenge with this opinion is that, according to the review of legal framework earlier, the government does not allow UA in the urban centers.

Policy Review suggestions

The stakeholders who were engaged in interview pertaining UA policies intervention and who included the following; Urban planner from Nairobi County Council, Agricultural Extension Officer from Ministry of Agriculture, Livestock and Fisheries; Social Worker from Solidarities (NGO), and Nairobi County Inspectorate Officer were of following opinion:

All the policy makers identified a gap in policy regulations pertaining the Urban Agriculture within the urban setup. This included old restrictive by laws, lack of urban planning proper planning, exclusive eco-social integration and improper regulations.

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of findings; draws conclusions and give recommendations on the way forward with regard the UA impacts on the physical infrastructural services.

5.2 Summary of the Findings/Results

Urban agriculture, a key economic tool for urban poor is practiced the world over. In most developing countries it is undertaken in the absence of clear urban development control and regulations. In developing countriesø urban areas (such as Nairobi, Kenya), UA is mainly found within the informal settlements. The provision of basic service infrastructures within the informal settlement is minimal and the present infrastructures serve an overwhelming number of people making the infrastructural service delivery insufficient, inadequate and ineffective resulting to total failure of provision of intended services. The eventual effect is worsening of the overall housing environment which portends a negative outcome for housing as an investment good. With an increasing urbanization rate and increasing deterioration of economic situation in the Kenyan informal settlements, UA as a coping mechanism is a common practice. The implication of this is dire in respect to physical infrastructure, which is not provided at the same rate as the urbanization growth is taking place. The need to evaluate the impact of UA on the physical infrastructure is therefore necessary to understand and appreciate contribution of UA practices on the physical infrastructural services in informal settlements.

This study found out that indeed there is correlation in deterioration of infrastructural services in the informal services and UA practices. The study identified a no. of UA practices in the informal settlements, this included: sack gardening, traditional farming, poultry, pig rearing and cattle keeping : upon disaggregating the physical infrastructure services within the study area, the study found out that urban agriculture have an impacts on physical infrastructural services such as water pipes, roads, footpaths, open drainages and sewer lines. However, it was established that

city and railway line. It was also established that UA do investments.

5.3 Conclusions

The findings of this study indicate that UA used as a coping mechanism has may be responsible on the destruction of the physical infrastructural services in the informal settlements. These impacts overreach the benefits UA intends to realize as a coping mechanism among the poor this is in line with observation of Cramer et al. (2006:64) that ðUA only plays psychological effects on the poor urban residents but leaves irreparable damaged in terms of infrastructuresö.

If un-regulated UA is left to thrive with current rate in urbanization, hosing investment will be affected adversely. It is likely that private investors who are key players in slum upgrading will be discouraged and gradually pull out. Of concern here is particularly the sustainability of the slum upgrading and conservation of humane living conditions which are influenced by physical infrastructural services.

5.4 Way forward

- 1) Sound Policies, legal and regulatory framework should be formulated and adhered to in the implementation of UA in the slum areas.
- 2) Old punitive by-laws should be repealed to pave way for formulation of friendly laws that may encourage UA without compromising the integrity of the infrastructures present
- 3) Urban planning ought to be elaborate and articulate to integrate farming within the city without the compromising other socio-economic support infrastructures
- 4) Proper organization of UA within the informal settlements to control blatant abuse of infrastructures and other socio-economic resources and also as a way of instilling discipline among wayward farmers
- 5) UA should not be seen as an important coping strategy to overlook its implication on the physical infrastructures.
- 6) Investigation should be done to un earth the relationship between UA practices and the land grabbing incidence.

- nts should be regulated and periodic monitoring and its impacts on the service infrastructures
- 8) Agricultural extension services should be availed to urban farmers to encourage sustainable agriculture
 - 9) The Ministry responsible for land should intervene to save public from being grabbed within the informal settlements in pretext of farming.
 - 10) Upgrading and fast tracking of sack gardening may alleviate many problems of UA and their impacts on Infrastructures since sacks and vertical farms may be located and moved to places without with minimal infrastructures interference.
 - 11) Further studies are recommended on the following:
 - Economic impacts of UA practices on physical infrastructure
 - Health implications caused by unregulated UA in the informal settlements
 - Influence of UA on Housing investment and slum upgrading in the informal settlement

Bibliography

African Urban Harvest 2010. Agriculture in cities of Cameroon, Uganda and Kenya, Springer.

Averbeke, W.V.2005. Urban farming in the informal settlements of Atteridgeville Pretoria, South Africa.

Buchardt, J. 1997. Rural social relations 1830-50; opposition to allotment for labourers. *Journal of Agricultural and Rural History* Vol. 45 (Part II). London.

Community Guide Water Act, 2002. 2010, Millennium community development initiatives. Kul Graphics Limited: Nairobi.

Defra.2004. Review of environmental and health effects of waste management: municipal solid waste and similar wastes. Enviro Consulting Ltd: University of Birmingham.

Foeken, D. 2005. Urban agriculture in east africa as a tool for poverty reduction: a legal and policy dilemma? ASC Working Paper 65/2005. Africa studies Centre: Leiden, Netherlands.

Girardet, H. 1992. The gaia atlas of cities. London: Gaia Books limited.

Government of Kenya, 1999. Environment management and coordination act. Government Press: Nairobi.

Government of Kenya, 1999. The environmental management and co-ordination act, 1999 no 8. Government Press: Nairobi

Government of Kenya, 2002. Water act, No 8 of 2002. Government Press: Nairobi.

Government of Kenya, 2010. Draft national urban and peri-urban agriculture and livestock policy. Ministry of Agriculture: Nairobi.

Government of Kenya, 2010. The constitution of Kenya. Government Press: Nairobi.

Government of Kenya , 2012. Land act no 6 of 2012. Government Press: Nairobi.

[http://pulitzercenter.org/reporting/kenya-thirsty-cities-nairobis-slums-food-security-malnutrition-aid-high-mortality assessed](http://pulitzercenter.org/reporting/kenya-thirsty-cities-nairobis-slums-food-security-malnutrition-aid-high-mortality-assessed) 6.4.2013).

<http://wikipedia.org>. (Assessed 10. 6.2013)



PDF Complete
 Your complimentary use period has ended.
 Thank you for using PDF Complete.

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

urban farming in Mexico (assessed 5.1.2013)

Item.php?a=1742 on Food security in slums of Nairobi

(assessed 9.1.2013)

<http://www.wrc.org.za> (assessed 17.5. 2013).

IFRA, 2010. Slum upgrading programmes in Nairobi. Challenges in Implementation. Nairobi.

IRIN (Humanitarian News and analysis), 2010. Food crisis during and post election violence in slums. Nairobi.

ITDG-EA, 2003. Nairobi solid waste management network <http://www.wastenet.or.ke> (assessed 5.1.2013)

Kenya Meteorological Department (KMD), 2009. Climatological data. (<http://www.meteo.go.ke/customer/climat/rain.html>) (Assessed 5.1.2013)

Limpton, M. 1977. Why poor people stay poor. Harvard University Press: US.

Makachia, P. 2010. The influence of the tenure system to the physical environment in Nairobi's human settlements -slum upgrading programmes in Nairobi Challenges in implementation. Ifra: Nairobi.

Maxwell, D. 1995. Labour, land, food and farming: a household analysis of urban of urban agriculture in kampala, uganda, unpublished phd dissertation. University of Wisconsin-Madison: USA.

Maxwell, D. 1999. The political economy of urban food security in sub-saharan africa. world development. International Food Policy Research Institute: Washington, DC.

Maxwell, D. 2008. The political economy of urban food security in sub saharan africa, FCND Discussion paper No. 41. International Food Policy Research Institute: Washington, DC.

Maxwell, D. 1994. The household logic of urban farming in Kampala; Cities feeding people; an examination of urban Agriculture. SIDA & ETC-RUAF, CD-ROM, RUAF: Leusden..

Government of Kenya, 2003. Economic survey. Government Press: Nairobi.

- Mwangi, A.M. & Foeken, D. 1996. Urban agriculture, food security and nutrition in low income areas of Nairobi. Leusden: Netherlands.
- Njenga M, et al. 2010. Recycling nutrients from organic wastes in Kenya's capital city. Springer: Nairobi.
- Olotuah, et al. 2009. Sustainable housing provision for the urban poor: a review of public sector intervention in Nigeria. Lagos.
- Prain, G. 2006. Participatory technology development for urban agriculture: collaboration and adaptation along the urban-rural transect; in Van Veenhuizen, R (ed) *Cities Farming For The Future –Urban Agriculture for Green and Productive Cities*, RUAF foundation., IDRC and IIRR. Leusden: Netherlands.
- Rakodi, R. 1988. Urban agriculture: research questions and zambian evidence: Journal of Modern African Studies. Earthscan: London.
- Satcher, et al .2012. Impact of the built environment on mental and sexual health: policy implications and recommendations. The Satcher Health Leadership Institute Atlanta:, USA
- Satterthwaite, & Tacolli, C. 2002. "Seeking an understanding of poverty that recognizes rural-urban differences and rural-urban linkages" In Earth Scan Earthscan Publication: London.
- Solidarities, 2011. Urban farming in kibera; End Year Report. Nairobi
- Syagga, P. 2010. Land tenure in slum upgrading projects in slum upgrading programmes "Nairobi Challenges in implementation" Ifra, Nairobi.
- Tibaijuka, 2004. Food security in Africa. Online Publication: Kenya
- Tinker, I. 1994. Urban agriculture is already feeding cities in Cities feeding people; an examination of urban agriculture in East Africa. IDRC: Ottawa.



PDF Complete
Your complimentary use period has ended.
Thank you for using PDF Complete.

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

ies of Cameroon, Kenya and Uganda. Springer: Ottawa.

igning qualitative research, Stage Publications Newbury

Park: CA.

Cramer, et al. 2004. Coping strategies for the urban poor, study of Manhattan. New York press:
New York

Mugenda, O., and Mugenda, A., (2003): Research Methods: Quantitative and Qualitative
Approaches. ACTS Press: Nairobi, Kenya.

Arleck, & Settle, 1995. Survey Research Handbook. Irwin.

Appendix:

Questionnaire

DECLARATION

I, **Gabriel M. Mbusya**, a postgraduate student at the University of Nairobi, wish to undertake a case study on the impacts of urban agriculture (UA) on housing infrastructural services in Kibera towards fulfillment of my academic requirement. The information gathered through this questionnaire will only be used for academic purposes only. I hereby therefore, request you to answer this questionnaire with impartially to enable me collect data for the finalization of this study.

1. General information for the informant

- i. Village name: í í í í í í í í í í í í í í í í .
- ii. Nature of Tenancy: Tenant Landlord
- iii. Gender: Male Female
- iv. Age: 15-30 30-45 > 45 yrs
- v. Number of years in residence 1-5 years 6-10 years more than 10

2. Direct Impacts on physical Infrastructural Services

Tick as appropriate;

- i. According to you, what is the common UA practice in Kibera?
 - Sack gardening
 - Traditional gardening
 - Pig rearing
 - Poultry
 - Cattle farming
- ii. Do these UA practices affect the physical infrastructure within the slum?
 - Agree
 - Disagree
- iii. If agreed above, how would you generally rate the effects of UA on physical infrastructures?
 - Severe
 - Moderate

on the physical infrastructure in Kibera slum. What do you think is the impact level of the following:

v.

Physical Infrastructure	< 25%	26%-50%	51%-75%	76%-100%
Water supply infrastructures				
Transport network				
Electricity supply				
Sanitation system				

Indirect Impacts

- i. UA is thought to cause inaccessibility by blocking roads and foot paths within the Kibera, to what degree do you agree with this statement?
 - 1%-25%
 - 26%-50%
 - 50%-75%
 - 76%-100%
 - 0%
- ii. UA causes water shortages through diversion water for irrigation, destruction of underground piping to pave way for farming or/ destruction by rummaging action of farm animals, to what extent do you agree with this statement?
 - 1%-25%
 - 26%-50%
 - 50%-75%
 - 76%-100%
 - 0%
- iii. Underground electrical cabling, although illegal power connection has also been affected by UA in Kibera slum causing power disruption to some residents. Do you agree with statement that UA is one of the main causes of power disruption in your neighbourhood?
 - No
 - Yes
- iv. Does urban farming in your neighbourhood affect railway transport?
 - No
 - Yes

