THE IMPACT OF CONSTITUENCY APPROPRIATE BUILDING TECHNOLOGY CENTRES ON ACCESS TO HOUSING IN KENYA: A CASE STUDY OF KAKAMEGA COUNTY.

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DECLARATION

This Research Project is my original work and has not been presented for an award of a degree in any other University.

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DEDICATION

This work is dedicated to the entire family of Mzee Albert Sikuku Wanyama for their prayers, understanding and constant encouragement throughout the study period.

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ACRONYNMS

ABT	Appropriate Building Technology
ABTCs	Appropriate Building Technology Centres
MLHUD	Ministry of Land, Housing and Urban Development
HABRI	Housing and Building Research Institute
NHC	National Housing Corporation
EPS	Expanded Polystyrene Panels
SSBs	Stabilized Soil Blocks
ISSBs	Interlocking Stabilized Soil Blocks
CIDP	County Integrated Development Plan
GoK	Government of Kenya
UN	United Nations

ABSTRACT

This study sought to assess the impact of the Constituency ABTCs on access to housing in Kakamega County. It specifically sought to: - establish the relationship between Appropriate Building Technology (ABT) physical facilities and access to housing; determine the relationship between ABT equipment and access to housing and; examine the relationship between skilled labourers in the use of ABTs and access to housing. The study also sought to validate the hypotheses that availability of physical facilities, equipment and skilled labourers being the three parameters of ABTCs were all significant in promoting access to housing. The study adopted purposive and simple random sampling techniques in determining the sample elements from the sample frame obtained from Kakamega County Director of Housing. Questionnaires and interviews were used to collect data. Data analysis and presentation was done using SPSS and Excel Programs. The main study finding was that the impact of constituency ABTCs on access to housing in Kakamega County was 8.8 % according to the regression model results. This therefore implied that 91.2 % of variations in access to housing were explained by factors beyond the scope of this study. Specific findings on one hand were that availability of ABT equipment and skilled labourers had significant impact on access to housing in Kakamega County. On the other hand, availability of physical facilities had no significant impact on access to housing. The conclusion for this study was that Constituency ABTCs were relevant and could even play a more significant role in facilitating access to housing in Kakamega County. The study recommended for enhanced capacity building processes such as adequate investment in equipment, training of more skilled labourers particularly the youth and women as well as increased visibility of the physical facilities. It also recommended a policy shift from constituency ABTCs towards establishment of ABTCs at larger devolution units and in this case, the counties.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

In most developing countries, access to decent and affordable housing remains a challenge for the majority of the population. This is despite the fact that housing as an economic and social good is critical for sustainable development. It is therefore imperative to have in place comprehensively structured policy, programmatic and legislative interventions to realize this basic human right.

The 21st Century has witnessed rapid transformation of the world's population into urban dwellers. It is now estimated that half of the world's seven billion people live in urban areas. The remaining half residing in rural areas is largely dependent on cities and towns for their economic survival and livelihood. In Kenya, over 40% of her population lives in urban areas and the proportion is expected to rise to 50% by 2030. Inadequate housing, high incidences of poverty and high unemployment rates are among the major challenges arising from this high rate of urbanization.

At the global level, there have been concerted efforts to address access to housing and other urbanization challenges facing humanity. The Universal Declaration of Human Rights (1948) declared housing a basic human right. Article 25(1) of the declaration stipulates that everyone has the right to a standard of living adequate for their health and well-being and this includes food, clothing, housing, medical care and the necessary social amenities. The International Year of Shelter for the Homeless (1987) called for providing every household with decent shelter by the year 2000. During the Earth Summit (1992), Local Authorities and Communities were called upon to actively contribute to the implementation of Agenda 21.

Habitat Agenda (1996) in its resolutions specified that Adequate Shelter and Sustainable Human Settlements Development require the active engagement of civil society as well as the broad based participation of all people. In the year 2000, world leaders agreed to pursue Millennium Development Goals (MDGs) in addressing challenges facing humanity. Of much relevance to housing is MDG 7 target eleven "which aims to significantly improve the lives of at least 100 million slum dwellers by the year 2020" (UN-HABITAT, 2003).

Kenya has had a long history in attempts to provide decent and affordable housing to the population. The first comprehensive housing policy developed in 1966/67 as Sessional Paper No. 5 directed the Government to provide the maximum number of people with adequate shelter and healthy environment at the lowest possible cost. Sessional Paper No. 3 of 2004

on National Housing Policy encourages use of appropriate building materials and technologies to reduce the cost of housing. This was to be realised by intensified training in requisite skills and construction technologies through youth polytechnics, women and youth groups, community-based organizations and appropriate technology building centres. The centres envisaged here were to be established at former provincial (regional) headquarters which borrowed heavily from the Indian model of regional centres.

The first Medium Term Plan as an implementation road map of Kenya Vision 2030 identifies Establishment of appropriate building technology centres in every constituency by the year 2030 as one of the flagship projects. The Constitution now recognizes housing as an economic and social right. Article 43 (1) (b) of the Constitution stipulates that "every person has the right to accessible and adequate housing and to reasonable standards of sanitation.

Despite these efforts, an estimated urban population of over 1 billion people globally and over 5 million people nationally find themselves living in deplorable housing conditions. The situation is no better for the rural inhabitants given the linkage between rural and urban areas. This calls for interrogation of the current interventions being implemented at the national level to inform policy, programmatic and legislative measures being undertaken by authorities at various administrative levels.

1.2 Statement of the Research Problem

The existing housing policy identifies main inputs into housing delivery process as including land, building materials, and finance. It also recognizes the fact that building materials account for well over 60 per cent of total housing cost. The policy further proposes promotion of use of local and appropriate building materials and technology as a way of lowering housing cost for many to afford. In this regard, it calls for establishment of ABTCs to facilitate research and technology dissemination to the local people. The ministry in charge of housing initially planned to establish nine Provincial ABTCs in Nairobi, Mombasa, Kisumu, Kakamega, Eldoret, Nakuru, Nyeri, Embu and Garissa. The first centre was launched at Eldoret in October 2006 during the National Celebrations of World Habitat Day. Other provincial centres have since been established. The strategy later changed and the Ministry further established 71 Constituency ABTCs.

It should not be about the number of centres established or the number of people trained in the use of the building technology. It should be about the number of people who have

embraced and are utilizing the technology in improving their housing. It should be about the number of dwelling units that have been put up using the technology. It is only by funding outcomes and not inputs that the Ministry in charge of Housing will realize the overall objective of the centres. How will the Ministry eventually be seen to have funded outcomes of the 290 centres by the year 2030 unless the impact or the effectiveness of the centres so far established is assessed? This fundamental concern was addressed through research study of ABTCs in Kakamega County.

The research question addressed by this study was: - What was the impact of the Appropriate Building Technology Centres on access to housing in Kakamega County?

1.3 Objectives of the Study

The overall objective of the study was to assess the impact of Constituency Appropriate Building Technology Centres on access to housing in Kakamega County.

The specific objectives of this study were to:-

1. Establish the relationship between ABT physical facilities and access to housing in Kakamega County.
2. Determine the relationship between ABT equipment and access to housing in Kakamega County.
3. Examine the relationship between skilled labourers in the use of ABTs and access to housing in Kakamega County

1.4 Justification of the Study

Implementation of ABT Programme from inception was based on establishment of provincial (regional) ABTCs across the Country. This was seen as an effort to enhance access to housing by the majority of Kenyans in line with the Sessional Paper No.3 of 2004 on National Housing Policy. This strategy based on the Indian regional model meant development of only nine centres countrywide.

One of the Vision 2030 flagship projects is the establishment of ABTCs in every constituency by the year 2030. With this new strategy, a total of 290 centres will be established by the end of the Vision period. According to the then Ministry of Housing, investment in 290 Centres will cost approximately Kshs 3.48 billion, at an average of Kshs 12 million per Centre.

By the end of the year 2012, the then Ministry of Housing had established 80 constituency ABTCs countrywide including the nine Provincial Centres which adopted the new title. By sheer numbers of the Centres established over the last six years, the progress was commendable. However, the centres were not an end in themselves but a means to the end which was improved access to housing by Kenyans.

It was important that the assessment of the impact of constituency ABTCs on access to housing in Kenya be supported by key actors in the housing sector. This was because the study was aimed at enabling the Government to ascertain the viability of the Constituency ABTCs in view of huge investment.

The findings of this research were quite useful and would inform effective Appropriate Building Technology (ABT) policy formulation and implementation by the key stakeholders in the housing sector including academic research institutions, Kenya Vision 2030 delivery Secretariat and the Ministry in charge of housing.

1.5 Scope and Limitations of the Study

Dissemination of ABTs has been carried out in virtually all the 47 counties of the Republic of Kenya. The proposed study however, was conducted in Kakamega County just to get detailed information so as to make inferences about the counties. The study was limited to functional and sampled ABTCs established by the then Ministry of Housing over the period of 2006-2012. In the course of the study, individual as well as institutional projects were sampled in order to address the research objectives.

Due to cost factors, the study was restricted to only two constituencies and the same reflect the geographical spread of the county. The study further envisaged limiting factors that may affect the study plan and time frame such as weather (heavy rains), accessibility of sample elements (poor road network) and availability of respondents. The research assistants were advised to commence work very early in the morning to avoid extreme weather of high temperatures and heavy rains associated with afternoons. To address envisaged limitation of accessibility, the research assistants were encouraged to use boda boda[1] means of transport. Simple random sampling was employed to address the limitation of non-availability of respondents in view of the longer period (2006-2012) the study covers.

[1] Boda boda is a bicycle used to transport people in a less expensive and faster manner

1.6 Definition of Concepts

Appropriate Building Technologies (ABTs) According to Ng'ang'a (2011), ABTs are defined as building processes, materials and tools that are cost-effective, safe, innovative, green/environmentally friendly as well as acceptable to the climate, socio-economic conditions and natural resources of an area. This study adopted this definition.

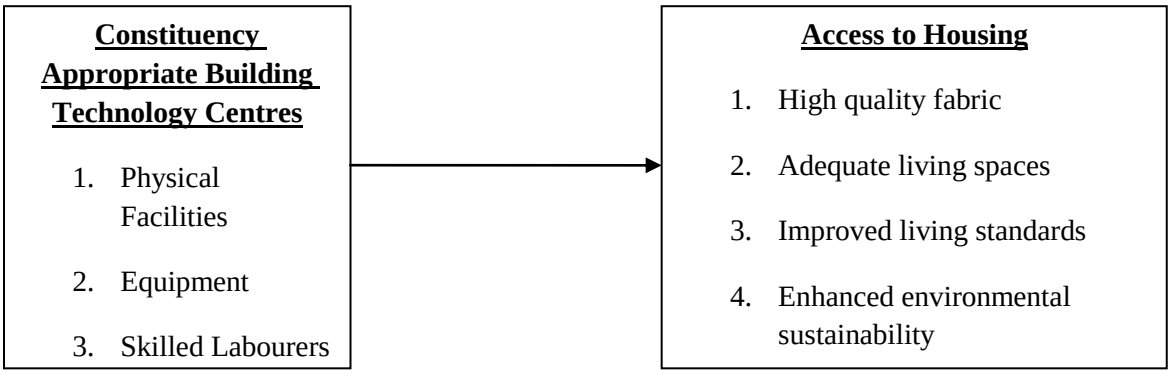
Appropriate Building Technology Centres (ABTCs) ABTCs are defined as designated facilities established by the Ministry of Land, Housing and Urban Development for purposes of research and development, training and dissemination of ABTs.

Access to Housing Access to housing is defined as the opportunity to enjoy the advantages/benefits of adequate housing including housing quality, decency, space and housing infrastructure in sustainable environment.

1.7 Conceptual Framework

The research aimed at assessing the relationship between Constituency ABTCs as inputs and access to housing as outputs in housing delivery process. This relationship is depicted in Figure 1.1.

Figure 1.1: Conceptual Model



Source: Researcher, 2014

1.7.1 Independent Variable

From the conceptual framework, the ABTCs was the independent variable and comprised mainly three parameters namely physical facilities, equipment and skilled labour. The study assessed the relationship between the ABTCs and access to housing in the study area. Physical facilities entailed classrooms, workshops, offices, production/storage shed and ablution block. In this study, classrooms, workshops and offices constituted the model building. Equipment comprised block making machines, soil testing kits, block testers, production and construction tools. Skilled labourers were people with expertise in the use ABTs acquired through practical training sessions and tested over time.

1.7.2 Dependent Variable

This study analysed access to housing as the dependent variable whose indicators were; high quality fabric, adequate living spaces, improved living standards as well as enhanced environmental sustainability. High quality fabric was measured in terms of the durability and aesthetic nature of the construction materials used while adequate living space was measured in terms of the overall size of dwelling units constructed as well as individual room sizes. Improved living standards was assessed by gauging if centres contribute to employment creation while environmental sustainability was assessed through observing how centres contribute to the conservation of environment.

1.8 Research Hypotheses

The research hypotheses broadly formulated for this study to be tested and validated by respondent data collected from the field were:-

1. H_0: Availability of physical facilities is insignificant in promoting access to housing in Kakamega County.

   H_1: Availability of physical facilities is significant in promoting access to housing in Kakamega County.

2. H_0: Availability of equipment is insignificant in promoting access to housing in Kakamega County.

   H_1: Availability of equipment is significant in promoting access to housing in Kakamega County.

3. H_0: Availability of skilled labourers is insignificant in promoting access to housing in Kakamega County.

   H_1: Availability of skilled labourers is significant in promoting access to housing in Kakamega County.

1.9 Report Outline

The study report is organized into five chapters. Chapter one discusses the background, statement of the problem, objectives, justification, scope and limitations of the study, definition of concepts, conceptual framework and research hypotheses. Chapter two focuses on the related studies regarding the use and adoption of appropriate building materials and technologies both at global, regional, national and local levels. Chapter three discusses the methodology that was used to carry out the study in order to answer the specific objectives. Chapter four discusses and presents the research findings. Chapter five provides the summary, conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter is organized into general and empirical literature. General literature focused on the use and adoption of appropriate building materials and technologies at global, regional, national and local levels. Empirical literature focused on related studies that provided insights into the topic under investigation.

2.2 General Literature

2.2.1 Housing Situation

Housing is both a basic need as well as a fundamental human right as proclaimed in various International and national legal instruments. The Universal Declaration of Human Right (UN, 1948) stipulates that everyone has the right to a standard of living adequate for their health and well-being including; food, clothing, housing, medical care and necessary social amenities. In the Kenyan context, the Constitution of Kenya (2010) in Article 43 (1) (b) outlines the right of every person to accessible and adequate housing and to reasonable standards of sanitation.

The housing need is huge with high proportion of people recorded to be homeless (100 million people worldwide). In most countries of the World, the number of households grows at a much higher rate than the population and housing stock, with the result being that of the demand for housing units particularly for small apartments, having escalated more rapidly than the population growth would indicate. UN-Habitat (2009) observed that about 3 billion people lack decent housing globally with estimated 1 billion residing in developing countries of Southern Asia, Eastern Asia, and Sub-Saharan Africa. This proceeded an observation that, "homelessness represents the most obvious and severe manifestation of the un-fulfilment of the human right to adequate housing. While estimates on the of homelessness are invariably difficult to ascertain with precision, relevant United Nations documents indicate that there are about 100 million homeless persons in the world and that few, if any, countries have entirely eliminated homelessness. In many nations, this phenomenon is clearly increasing rather than declining hence action is clearly required to eradicate homelessness" (UNCHS, 1999d).

According to GoK (2004), urban annual housing demand stood at 150,000 units while about 300,000 housing units required quality improvement in the rural areas annually. Further, Kenya Vision 2030 called for delivery of annual urban housing to the tune of 200,000 units in

its first implementation road map (GoK, 2007). The huge housing deficit outlined above needs to be met for the country to meet both her national and international obligations in line with the vision of facilitating access to decent, affordable, adequate and quality housing for Kenyans. Kakamega County experiences acute housing shortage that needs redress, and as such, introduction and promotion of new / appropriate technologies is necessary.

2.2.2 Housing and Population

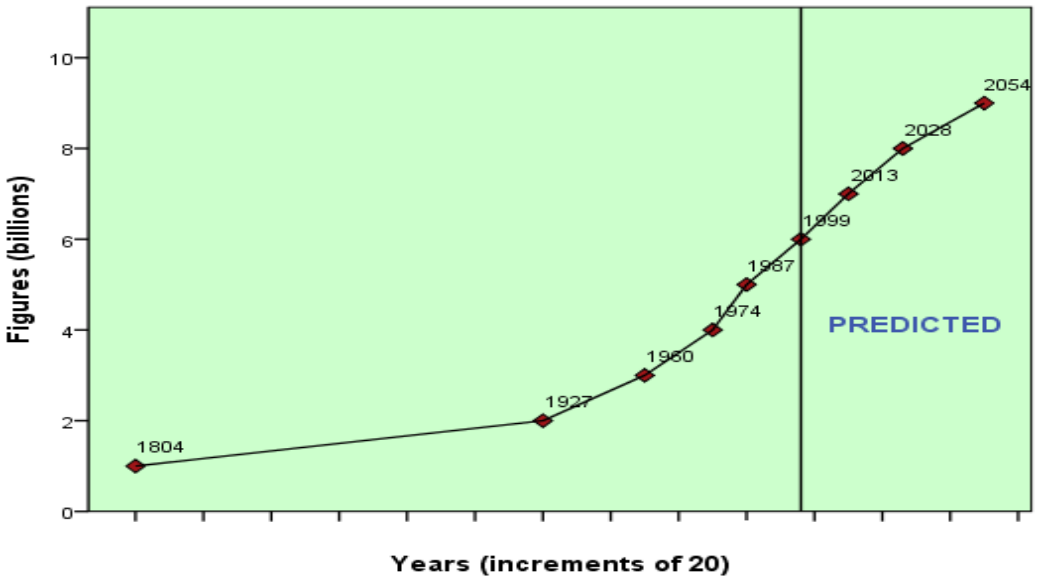
According to Moloughney (2004), housing is the central hub of everyday living and as such, a multi-dimensional concept that encompasses the characteristics of the house (physical structure and design), home (social and psychological features), and neighbourhood (physical and social characteristics, and local services). Given the a foregoing, it can be expressed that the central influence of housing on people's lives raises the possibility that housing could act as a pathway through which social and economic determinants of health influence population health. In the contemporary world, the cost of housing significantly influences to a large extent the amount the family has available to meet other expenses and also the type of community in which the family resides (Thompson, 1938). Further, it emerges that at any given level of living, housing needs vary almost directly with the size of the family and that one of the easiest ways for a very large section of the population to maintain a given standard of living is to keep the family to the size that can be provided for at the desired level.

The population debate has continued to elicit varied views and according to Malthus (1798) "the power of population is so superior to the power of the earth to produce subsistence for man that premature death must in some shape or other visit the human race. The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction, and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague advance in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear and with one mighty blow levels the population with the food of the world"?

Further, BBC news (1999) reported World UN chief welcoming the six billionth baby at a maternity hospital in Sarajevo. At the time, the UN chief warned of the challenge the world would face in coming years to; feed, clothe and house its growing population, and that the sheer scale of the population growth poses a severe task for housing suppliers. In related development, Government's concern as regards the high population growth rate was first

highlighted in the Sessional Paper No. 10 of 1965 on *African Socialism and its Application to Planning in Kenya* which prompted the Government to launch the National Family Planning Programme in 1967.

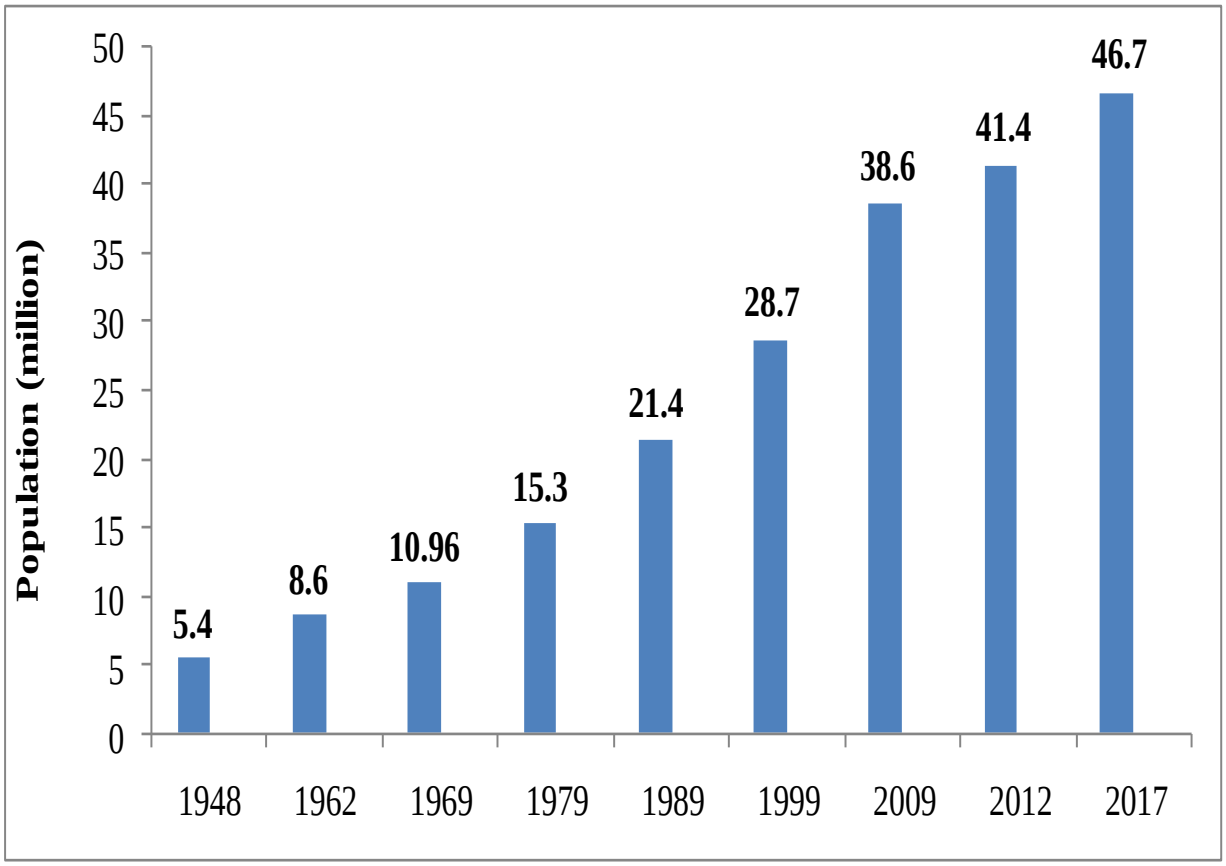
Figure 2.1: World Population



Source: Modified from BBC Online Network, 1999

Despite these programmes being in place, the rate of population growth increased to 3.8 per cent in 1979. Sessional Paper No. 4 of 1984, on *Population Policy Guidelines* was developed to mainstream population issues in national development. In further developments, Sessional *Paper No. 3 of 2012 on Population Policy for National Development* was developed to fast track attainment of high quality life of the citizens by managing population growth to a level that can be sustained with the available resources (GoK, 2013). Fig. 2.2 depicts the trend of population increase in Kenya over the last six decades as well as population projection in the foreseeable future.

Figure 2.2: Kenya population trends and projections over the period 1948-2017



Source: Kenya National Bureau of Statistics (2009)

According to the population and household census (2009), Kakamega County is one of the most densely populated counties in Kenya. The CIDP indicates the County's population was 1,660, 651 by 2009 consisting of 797,112 males and 863,539 females giving the population distribution of 48 per cent male and 52 per cent female. The projected 2012 population was 1,789,989 constituting of 859,195 males and 930,794 females as shown in Appendix A; while the county population is projected to be 1,929,401 and 2,028,324 by 2015 and 2017 respectively. Appendix A depicts the population spread in the County.

The population growth rate for the county is estimated at 2.5 per cent. This has put great pressure on socio-economic facilities; especially on health, education and land. Resources, which could have otherwise been utilized elsewhere, have been diverted to meet the health and education needs leaving very little for other investment. Given the level of population density and housing demand, the adoption of appropriate walling materials could be important in meeting housing obligation for the county residents.

2.2.3 Housing and Urbanization

One of the definitions of urbanization is the process by which large numbers of people become permanently concentrated in relatively small areas, forming cities. Rapid growth of such areas is proportionately related to the faster rate of population growth. In the last quarter of 2011, the world population reached the seventh billion mark coming 12 years after the six billion mark. It took 123 years to double from one billion to two billion but "only" 33 years to cross the three billion thresholds (UN HABITAT, 2012).

According to UN (2008), half of the world's population was expected to live in urban areas at the end of 2008. Further, it was projected that 64.1% and 85.9% of the developing and developed world respectively will be urbanized by 2050 (Urban Life, 2012). Given the rate and levels of the earth's population explosion and as developing nations begin to use their share of the world's resources, it is necessary to ascertain how the earth's precious resources are used (Froeschle, 1999). More fundamental is the fact that urbanization was largely influenced by the national policies that were characterized by high rates of urban growth (rural-urban migration), promotion of growth centres as well as the impacts of globalization. Table 2.2 depicts the urban trends in Kenya from colonial times to current period.

Table 2.2 Trends of urban growth (1948-2009)

Year	Kenya ('000s)	Urban ('000)	% urban	Urban growth rate (%)	No of urban centres	Nairobi ('000s)	Nairobi growth rate (%)	Nairobi % of total urban
1948	5,406	285	5.2	-	17	119	-	41.7
1962	8,636	671	7.8	6.3	34	227	4.6	33.8
1969	10,942	1,076	9.9	7.1	47	509	12.2	47.0
1979	15,327	2,314	15.1	7.7	91	827	4.9	35.7
1989	21,448	3,864	18.0	5.3	139	1,324	4.7	34.3
1999	28,686	5,360	18.7	3.4	179	2,143	4.8	38.9
2009	38,610	12,487	32.4	-	-	3,138	3.8	25.1

Source: Owuor, 2011

It is estimated that the global proportion of urban population rose dramatically from 13% (220 million) in 1900, to 29% (732 million) in 1950, to 49% (3.2 billion) in 2005 with further projections indicating a likely rise to 60% (4.9 billion) by 2030 (UN, 2005). With rapid

urbanization, there is need for innovative and affordable ways of meeting the housing demand. One such important building technology is the interlocking stabilized soil bock (ISSBs) which could be cost-effective, environmentally friendly and leads to faster delivery process.

2.2.4 Addressing Housing Challenges

National Housing Policy of 2004 and Draft Reviewed National Housing Policy, 2014 acknowledge the deteriorating housing conditions in the country as well as the huge shortfall of housing stock to satisfy the housing need among Kenyans. The prevailing condition is aggravated by among others: population explosion; rapid urbanization; widespread poverty; and escalating costs of providing housing. This is manifested through overcrowding, proliferation of informal settlements and emergence of slums (GoK, 2004).

The country's housing development initiatives have also been characterized by: minimal and sporadic investments in the sector, limited research on low cost building materials and construction techniques, stringent planning regulations and high infrastructural standards among others. The strategies applied in the promotion and dissemination of ABT programme at the national level can equally be applicable in Kakamega County. As such, the community projects involving schools, churches and other community social amenities development projects form part of the areas where the Appropriate Building Technologies could be applicable in the County. On the other hand, individual home builders could also find the use of ABTs desirable in accomplishing their housing needs.

2.2.5 Global Overview of Role of Emerging Building Technologies in Housing Delivery

The emerging building technologies may also be referred to as the appropriate and / or new building technologies. The greater contributions of these materials and technologies are in the growth of local building industry as well as participation of communities, which form key processes that could be stimulated by a fusion of informal vernacular, conventional and innovative technologies. Further, the initiative facilitates the construction of functionally adaptable and climatically responsive buildings which utilize local and readily available materials, suited to self-help and semi-skilled labour. One such area of focus is walling materials and technologies in which walls without mortar can be built with interlocking blocks. For instance, in Thailand, first demonstration building was built in 1984 at the Asian Institute of Technology in Bangkok (Minke, 2001).

In East Africa, the use of ISSBs has been gaining recognition with vast application in national projects in Kenya, Uganda and Southern Sudan among others (UN HABITAT, 2009). Plates

1 and 2 in Appendix B depict an upgraded school learning block from Mabati walling to ISSBs walling at Ndurumu Secondary School, Laikipia County.

2.2.6 Building Technologies and the Environment

Housing provision is a vital undertaking in meeting the basic human need. The use of conventional bricks has been revolutionised by the development and usage of interlocking masonry techniques. Environmental sustainability with regard to the building sector and society is a key principle of the Agenda 21 and the National Environmental Action Plan which is greatly hampered by greenhouse gas emissions into the atmosphere especially the emission of Carbon dioxide gas mainly through the anthropogenic actions. The scope of environmental issues is widening from a single issue discussion into a full integration of all aspects during the whole lifetime of a building and its components. As such, one of the main causes why the environment is threatened is the huge mass flow, more particularly that, over 50% of material resources taken from nature are building related and that over 50% national waste production comes from the building sector (Woon/Energie, 1995). Further, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) estimated that between 1970 and 2004, global greenhouse emissions due to human activities rose by 70 per cent with the building sector contributing up to 30 % of global annual greenhouse gas emissions and consumes up to 40 % of all energy (UNEP, 2009). Plates 3 and 4 depict in Appendix B some building materials within the environment.

On Carbon dioxide emission reduction, Kintingu (2009), observed that the adoption of appropriate, easy, fast and cost-effective mortar less ways in wall construction could save up to 50% in both wall construction cost and cement consumption respectively, thereby leading to 40% reduction in carbon emissions. For pro-poor friendly construction, Maasdorp & Humphreys (1975) observed that initiatives for public provision of mass low-cost housing always fell far below the actual demand. To meet the provision of affordable housing for the poor therefore, needed to be facilitated through the development of innovative strategies (Webb, 1983). In essence, typical environmental issues are raw materials, embodied energy, emissions, hindrance, waste, recycling, repair, life time and it is thus important to select the building products that have the lowest environmental impact.

2.2.7 Role of Appropriate Building Materials and Technologies in Improving Access to Housing in Kenya

Appropriate building materials and technologies are forms of emerging building and construction technologies that are considered much more advantageous in comparison to the

traditionally acclaimed conventional building materials and construction methods. Through research and development, various kinds of materials have been developed and introduced for use in the housing sector and by large in the construction industry. Two of the outstanding materials include; interlocking Stabilised Soil Blocks (ISSBs) and the Expanded Polystyrene Panels (EPS Panels).

2.2.7.1 Interlocking Stabilised Soil Blocks (ISSBs) Adoption

Interlocking Stabilised Soil Blocks (ISSBs) is one of the appropriate building materials and technologies that the Government of Kenya is currently promoting adoption and use by various stakeholders. The standard Hydraform block – a form of ISSBs technology in use has dimensions of 110mm in height, 220mm wide and length ranging between 220mm-230mm long (Hydraform manual 2005). The use of the ISSBs has been necessitated by the huge housing deficit in the country coupled with the high cost of materials and construction requirement that characterizes the use of conventional building materials and technologies. Utilization of ISSBs technology is widely accepted as Hydraform technology complies with the South African National Building Regulations, satisfying the requirements for structural performance, rainwater penetration, fire protection, thermal performance and durability, and is nationally approved for use under certificate № 96/237 (Hydraform Ltd, 2005). The various processes of ISSBs production and completed projects are depicted in plates; 5, 6,7and 8 in Appendix B.

In Kenya, ABT promotion initially adopted the regional approach model of India. The approach was however, later changed to the Constituency ABTCs strategy. Given that only 40 centres successfully serve that vast sub-continent, there is need to examine whether it is necessary to have the envisaged 290 centres as propagated by the Kenya Vision 2030.

It is further observed that ABT promotion in India, where the current concept being promoted by the Kenya Government was borrowed, adopted the regional approach strategy in order to address regional peculiarities of the vast sub-continent (www.bmtpc.org,). It is coordinated by the Building Materials and Technology Promotion Centre which is involved in the evaluation, validation, certification and standardization of innovative building materials and construction technologies through Performance Appraisal Certification Scheme.

2.2.7.2 Expanded Polystyrene (EPS) Panels

EPS panels have recently been introduced for use in the construction industry by various players. One such market player is National Housing Corporation (NHC), a parastatal within

the Ministry of Land, Housing and Urban Development. Given the rising levels of cost of construction coupled with expensive cost of finance which has made housing to be unaffordable to the majority of low and middle-income earners, NHC, through research, identified the use of the EPS panels in its bid to ensue large-scale production of houses as demanded by the market at an affordable rate (GoK, 2013). The EPS technology is tested and widely implemented in other countries including; Mexico, Britain, Qatar, Nigeria, Mozambique, USA among others.

According to NHC (2013), for realization of faster technology transfer and sustainability, establishment of local factory was found to be desirable and this was achieved in the year 2012. As such, the use of EPS panels as a substitute to traditional materials used in erecting walls, stairwells, floors and roofs is expected to reduce construction periods as well as direct and indirect costs. In their usage, the panels are assembled on-site and in-situ poured concrete (double panels, floors, stairs) and shotcreted concrete (single panel) to realize the different elements system (NHC, 2013).

2.2.8 Appropriate Building Technology Promotional Strategies

The Government of Kenya in an effort to enhance the dissemination process of appropriate building technologies for use in various locations across the country advocates for community participation in mobilization of locally available materials and labour required during the production and building demonstration processes. According to Habraken (1972), during the implementation of the housing process, there exist two domains where action need to be recognized, notably, the action of community and that of the individual occupant. He argued that when the occupant does not participate and is excluded, then the result is rigidity. On the other hand, when only the individual takes action, the result may be chaos and conflict. The results of the various ABT promotional strategies notably community/group approach and individual efforts are demonstrated in plates 9, 10, 11 and 12 in Appendix B.

The community participation approach seemed to have been the main driver behind the appropriate building technology programme in Kenya. As such, the first phase of ABTs promotion and adoption was rolled out through the regional ABTCs in which training and demonstrations were conducted to the community members and other technology beneficiaries (GoK, 2004). Later, the ABTs strategy focal points changed from the regional concept to the Constituency Centre concept mainly due to the fact that, the constituency ABTCs were noted to be much closer to the community members and this reduced the distance covered by beneficiaries to access the ABT services that were offered by the

Government (GoK, 2006). In such kind of development, participation becomes essential when defining needs, converging vested interests, getting accurate information on the ground, mobilizing resources and positioning problems accurately, all which are aimed at delivering more sustainable solutions (Practical Action, 2010).

2.2.9 Structural Performance of Interlocking Stabilized Soil Blocks (ISSBs)

Demand for houses for low to medium income population exceeds the supply level. According to Minke (2001), earth as a building material has lost its credibility mainly because of the fact that most modern houses with earth walls cannot withstand earthquakes in some earthquake prone areas. Earth is also considered as the building material for the poor. With increase of construction materials costs such as cement, steel and timber, contractors are not enthusiastic to build these houses on a tight budget and as such, alternatives through using the industrialised building systems (IBS) with faster construction and completion time has to be sought (Nasly et al, 2009).

The use of mortar-less load bearing interlocking block building system integrates the production of construction of elements with building construction at the site that results in cheaper building costs due to faster completion time, less skilled workers and less wastage as production processes are done on-site with the employment of local materials and local labour (Sangori, 2012). Further, structural stability and durability of interlocking block constructions can be far greater than that for comparable timber constructions. Gichuhi in an article of the Star of 2012 explained that soil stabilized with some cement forms a solid hard rock seconds after compression and when soil block is submerged into a bucket of water overnight together with a masonry stone, then lifted shoulder high and left to fall freely, will still not break while the masonry stone will break into two if subjected to the same fall.

2.2.10 Appropriate Building Technologies Policy and Regulatory Framework

Kenya's population has risen over time from an estimated 8.6 million people at independence to well over 38 million people in recent times as depicted in table 2.3.

Table 2.3: Population Trends in Kenya by Province (1979-2009)

Name	Capital	A (km^2)	1979	1989	1999	2009
Central	Nyeri	13,176	2,345,833	3,116,703	3,724,159	4,383,743
Coast	Mombasa	83,603	1,342,794	1,829,191	2,487,264	3,325,307
Eastern	Embu	159,891	2,719,851	3,768,677	4,631,779	5,668,123
Nairobi	Nairobi	684	827,775	1,324,570	2,143,254	3,138,369
North Eastern	Garissa	126,902	373787	371,391	962,143	2,310,757
Nyanza	Kisumu	16,162	2,643,956	3,507,162	4,392,196	5,442,711
Rift Valley	Nakuru	173,868	3,240,402	4,981,613	6,987,036	10,006,805
Western	Kakamega	8,360	1,832,663	2,544,329	3,358,776	4,334,282
Kenya	Nairobi	582,646	15,327,061	21,443,636	28,686,607	38,610,097

Source; Modified from Sang'ori, 2012, p26

The high population growth coupled with large numbers of household formations necessitates facilitation of access to adequate housing, a situation that is not effectively achieved with sole reliance on the conventional building materials and technologies. The key challenge on the use of appropriate building technologies relates to the building standards used in the country as the current building code dates back to 1967 and attempts to revise it resulted in the introduction of new building regulations in 1995 (code 95). This was to enable use of cost-effective building methods through various innovations and application of local materials. It however did not succeed as envisaged as most local authorities at the time failed to adopt the content of code 95 (Kimani and Musungu, 2010). Current policy directions are being guided by the Kenya Vision 2030 which advocates for the establishment of Constituency Appropriate Building Materials and Technology Centres as part of the vision flagship projects.

2.2.11 Project Implementation Process

According to David Osborne and Ted Gaebler (1992), the tendency to focus on process is so natural that managers faithfully measure expected volume of inputs and rarely think of the outcome (results). They rarely think of what impact the activity has on those the agency is designed to serve. Osborne and Gaebler say that a perfectly executed process is a waste of time and money if it fails to achieve the outcomes it desired. It may be very easy from the

records of the then Ministry of Housing to ascertain how much money has been spent on the functional centres. However, the impact of the existing centres can only be determined through a study. So far no study has been carried out to conclusively say that ABTCs contribute to promoting access to housing in Kenya.

2.2.12 Role of Monitoring and Evaluation in Project Cycle

In definitional terms, monitoring may refer to systematic and continuous assessment of the progress of a piece of work over time, which checks that things are "going to plan" and enables adjustments to be made in a methodical way. Further, it may imply the routine tracking of the key elements of programme/project performance, usually inputs, outputs and outcomes. These processes are as contained in table 2.4.

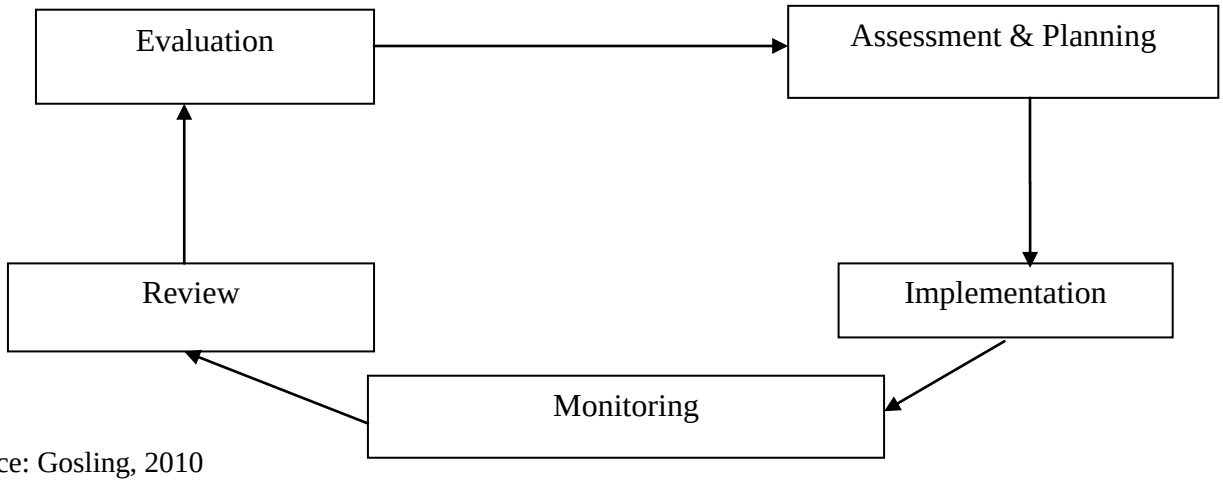
Table 2.4: Monitoring processes

Point of Measurement	What is Measured	Indicators
Outputs	Effort	Implementation of activities
Outcomes	Effectiveness	Use of outputs and sustained production of benefits
Impact	Change	Difference from the original problem situation

Source: Fowler, 1997 in Gosling 2010

On the other hand, evaluation may involve episodic assessment of the change in targeted results that can be attributed to the programme or project, and attempt to link a particular output or outcome directly to an intervention after a period of time (Gosling, 2010). Programme evaluation therefore involve a collection of methods, skills and sensitivities necessary to determine: whether human service is needed and is likely to be used; whether the service is sufficient to meet the unmet need; whether the service is offered as planned; and whether the service actually does help people in need at a reasonable cost without unacceptable side effects. In the process of ABTs programme / or projects implementation, it is key that government and all other stakeholders enhances the monitoring and evaluation efforts in order to: provide data on programme progress and effectiveness; improve programme management and decision making; provide data to plan future resource needs and; provide data useful for policy making and advocacy. Project cycle processes are depicted in figure 2.3.

Figure 2.3: Project Cycle



Source: Gosling, 2010

2.3 Empirical Literature

The Universal Declaration of Human Rights (UN, 1948) stipulates that everyone has the right to a standard of living adequate for their health and well-being including; food, clothing, housing, medical care and necessary social amenities. According to Moloughney (2004), housing is the central hub of everyday living and as such, is a multi-dimensional concept that encompasses the characteristics of the house (physical structure and design), home (social and psychological features), and neighbourhood (physical and social characteristics, and local services). In the Kenyan context, the Constitution of Kenya (2010) Article 43 (1) (b) states that every person has a right to accessible and adequate housing and to reasonable standards of sanitation.

One of the strategies employed by the Kenya Government in an effort to realize access to housing is the promotion of ABTs as propagated for in the National Housing Policy (2004) and the Kenya Vision 2030. The Vision 2030 blue print specifically calls for the establishment of ABT Centres in every constituency across the country by the year 2030. Hydraform Ltd (2005) asserts that utilization of ISSBs technology complies with the South African National Building Regulations, satisfying the requirements for structural performance, rainwater penetration, fire protection, thermal performance and durability, and is nationally approved for use under certificate No 96/237. Other machines that were earlier used in the production of stabilized soil blocks included CINVA RAM machines which were capable of exerting pressure of up to $10KgN/M^2$ (Kintingu, 2009). Hydraform Ltd and Kintingu do not in any way bring out the role of ABTCs in promoting access to housing.

According to Sangori (2012), Interlocking Stabilised Soil Blocks by Hydraform have numerous advantages as they are easily portable through towing on the road, compaction levels are achievable to some degree of precision, as well as high production output of blocks per day. For instance, the single chamber Hydraform machine has a production capacity of about 1500 blocks while a double chamber Hydraform ISSB machine has a production capacity of about 3000 blocks (Hydraform manual, 2009). In related research, Sangori (2013) in his study "An Evaluation of performance of the Appropriate Building Materials and Technologies in Kenya" looked into the development and progress made in the promotion and use of ABMTs in Kenya with key focus on various institutions involved in the past three decades. This study however did not critically look at the contribution of ABTCs in housing delivery process.

Ng'ang'a (2011) while investigating on the factors influencing effective implementation of appropriate building technologies and materials demonstrated that ISSBs programs are effective at improving the housing situation and much more in reducing poverty. Both Sangori and Ng'ang'a therefore did not analyze the role played by the ABTCs with regard to access to housing. Further Ng'ang'a (2013) examined the factors affecting effective use of ISSBs for reduced cost of shelter improvement and provided information that comparatively related to capacity building (trainings on technology use) and dissemination.

2.3.1 Critical Analysis of Empirical Literature

From the empirical literature reviewed, most studies on ABTs have tended to concentrate on the structural performance of the SSBs, effective implementation of ABTs, effective use of ISSBs as well as the environmental impacts of some of the ABTs like Interlocking Stabilized Soil Blocks (ISSBs). From the above analysis, it is evident that no research has been done in Kenya on the impact of Constituency ABTCs on access to housing. This study was therefore set to fill the gap that currently exists in this area.

CHAPTER THREE: METHODOLOGY

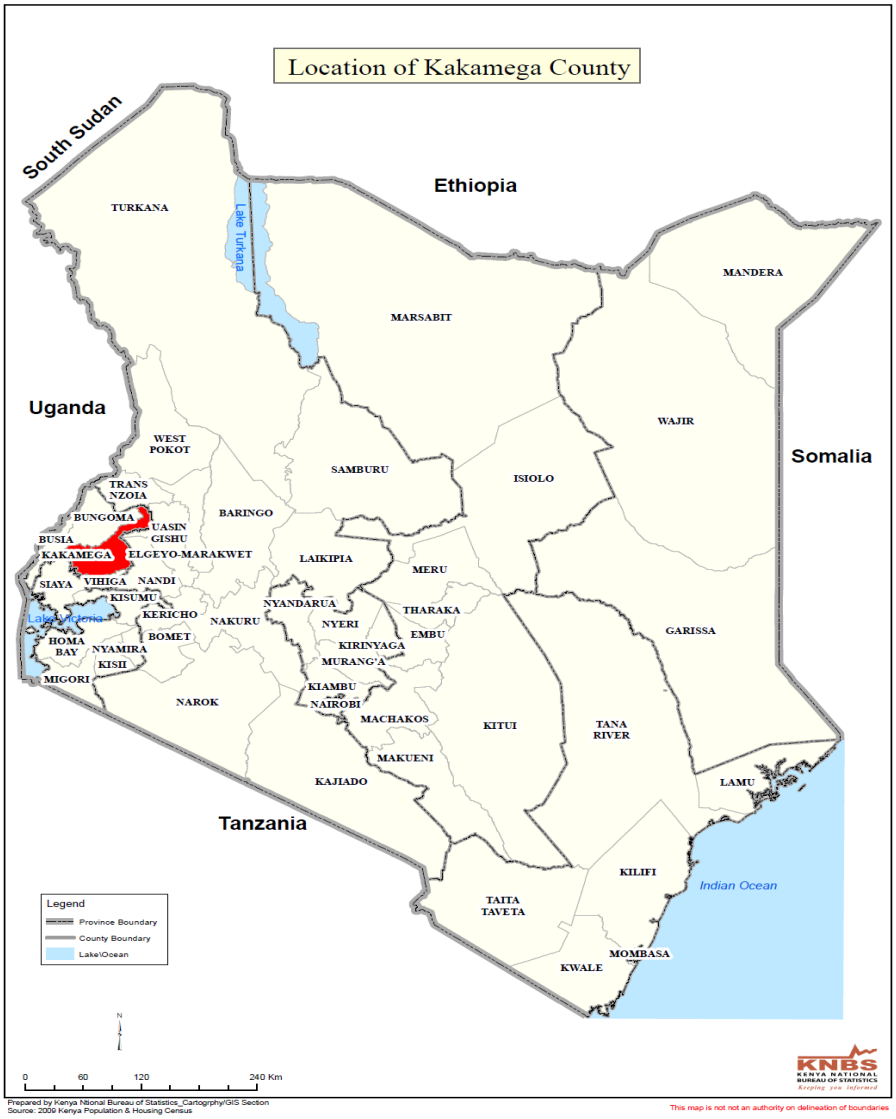
3.1 Introduction

This chapter discussed the methodology that was used to carry out the study. It explained the study area and population, sampling techniques, data collection techniques and data analysis techniques.

3.2 Study Area and Population

This research was conducted in Kakamega County which is located on the western part of Kenya as shown in Figure 3.1.

Figure 3.1: Location of Kakamega County in Kenya

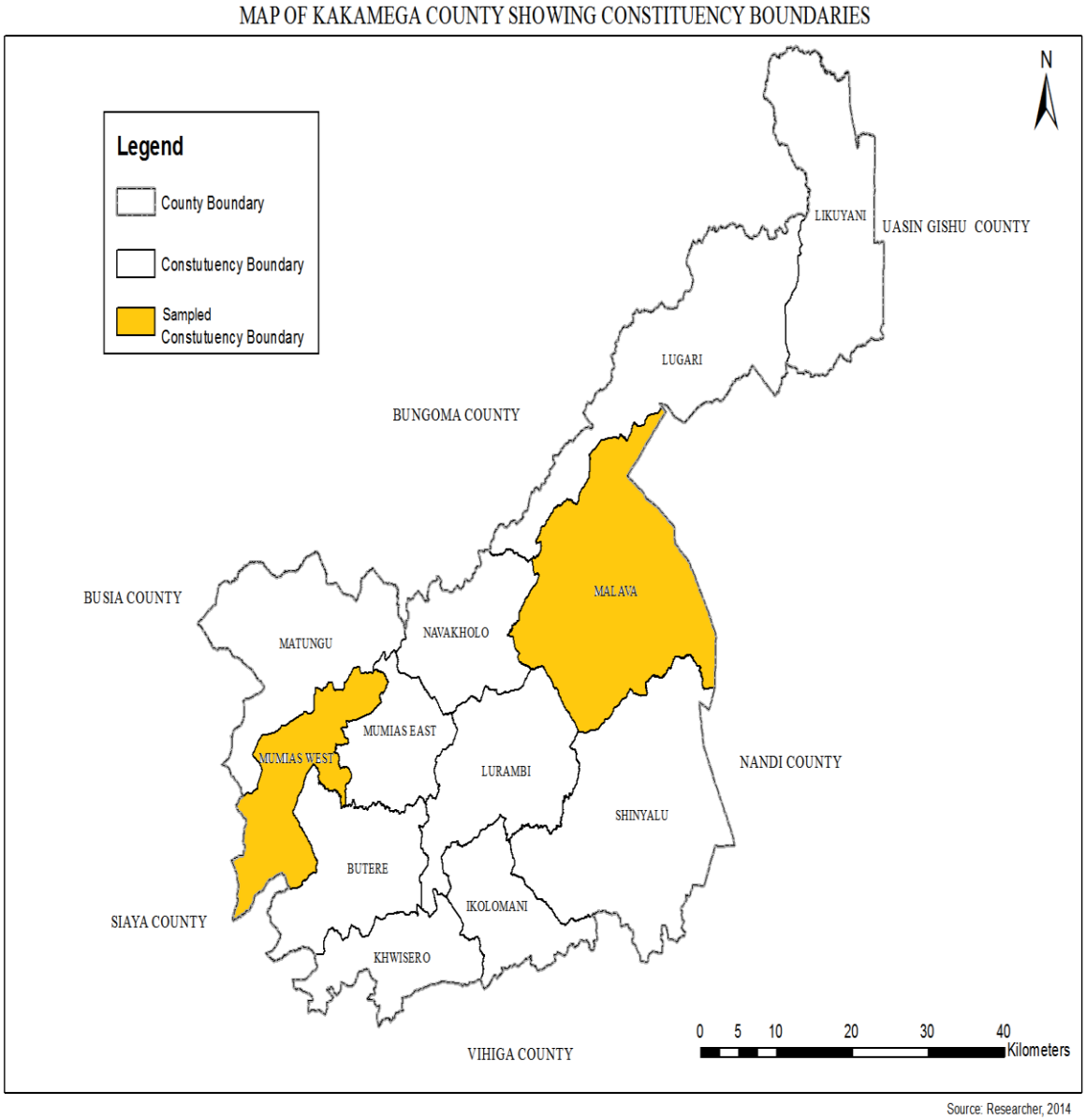


Source: Kenya National Bureau of Statistics, 2013

Kakamega County is bordered by Bungoma County to the North West, Vihiga County to the South, Siaya County to the South West and Busia County to the West as shown in Figure 4.2.

The County is comprised of twelve (12) constituencies namely; Lurambi, Navakholo, Malava, Lugari, Likuyani, Mumias East, Mumias West, Matungu, Butere, Khwisero, Ikolomani, and Shinyalu. Four ABTCs had been established in the area during the study period at Lugari, Butere, Mumias West and Malava Constituencies. Mumias West and Malava as shaded in figure 3.2 were the sampled constituencies for this study.

Figure 3.2: Map of Kakamega County showing constituency boundaries



Source: Researcher, 2014

The soils are generally good as most locations within the County exhibit mostly red volcanic soil that is favourable for soil stabilization and able to produce quality blocks with good structural performance within the built environment. Further, the area receives annual amount of rainfall which is adequate for ABT application and block production requirements. The

population of the area was estimated to be 1.7million and was seen as a source of cheap labour in the promotion and use of Appropriate Building Technologies within the County.

The choice of the proposed study area was necessitated by need for access to information. Kakamega County implemented quite a significant number of ABT projects as it previously served as the headquarters of Western Province in the old administrative boundaries. Most of the technical staff with knowledge of ABTs who were previously in Western Province were redeployed at Kakamega County and were instrumental in the success of the study. In addition, the concept of ABT was new in the County and no research on access to housing had been conducted.

3.3 Sampling Technique

This study focused on the trainee beneficiaries of ABT programme who were the individuals and organizations that have applied the technology for their use as well as those who attended the official training sessions directly organized by the Kakamega County Housing Office. The three categories of beneficiaries within Kakamega County formed the population of the study. The organizations/institutions and individual beneficiaries were sampled across the county at two levels with a bias towards the constituencies where ABTCs had been established. The research employed multi-stage sampling techniques in which the sub-groups in the population were identified and their proportions in each sub-group proportionately selected. The first sampling unit was the constituency and the second sampling unit was the training centres.

The list for the sample frame in this study was obtained from the Kakamega County Director of Housing implementing the project during a reconnaissance study. This involved first obtaining information on the constituencies in which the ABTCs had been established and sessions of trainings held. From the existing constituency centres, through multi-stage sampling, two (2) strata were obtained comprising of two constituencies namely: - Mumias West and Malava as shown in Figure 3.2.

An exhaustive list of trainee beneficiaries, individuals and institutions that had implemented the project was then obtained/ developed for sampling purposes. In summary, the sample frame in this particular study comprised:-

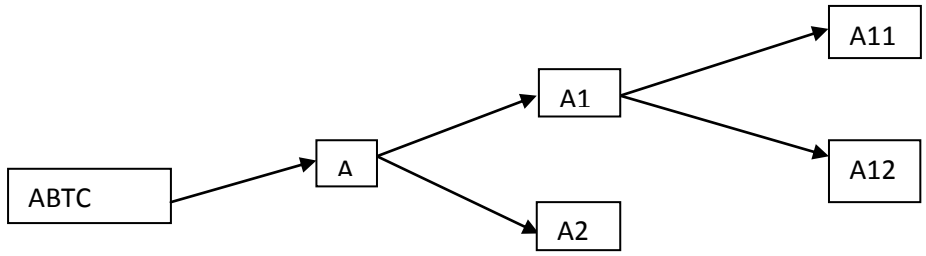
1. List of those who benefitted from ABT training and staff involved in the dissemination process. The beneficiaries were either skilled labourers (trainees) or project owners (individuals or institutions).

2. Details of the physical facilities
3. Details of equipment

The procedure depicted in figure 3.3 used in the generation of sample frame was:-

1. Defined ABTC1 namely Malava as MV and ABTC2 namely Mumias as MS.
2. Generated a list of all documented beneficiaries in each sampled centre and designated it as list A.
3. Segregated list A into project owners (list A1) and skilled labourers or trainees (list A2) by sampled centres.
4. Segregated list A1 into list A11 for institutions and List A12 for individuals
5. Generated list B for project facilitators (key informants).

Figure 3.3 Tree Diagram of Sample Section



Source: Researcher, 2014

Table 3.1 Summary of Beneficiary Lists (A)

Sampled ABTCs for the study			
Malava (MV) - ABTC 1	**No. of Beneficiaries**	**Mumias West (MS) - ABTC 2**	**No. of Beneficiaries**
MV A1	20	MS A1	25
MV A11	11	MS A11	14
MV A12	9	MS A12	11
MV A2	88	MS A2	120

Source: Researcher, 2014

Both purposive and probability sampling techniques were applied in the sampling process as appropriate on the basis of the sampling frame. A proportionate sample size was adopted in this study in a much more representative way as required in social sciences researches. The sample size was determined by adopting the recommendations of Nkapa (1997) which provided that, for a population which runs into thousands, the sample size should be in the range of 5% to 20%, but for a population that runs in hundreds the sample size should be 50%. The sample size of 160 respondents was derived from the summation of the total institution owners, total individual owners and total skilled labourers (trainees) from the two ABTCs as well as the key informants as shown in table 3.2.

Table 3.2 Composition of the Sample Size

Category A	**Malava (MV)**	**No. of Beneficiaries to be interviewed**	**Mumias West (MS)**	**No. of Beneficiaries**	**Total Sample Size**
	MV A11	11	MS A11	14	25
	MV A12	9	MS A12	11	20
	MV A2	44	MS A2	60	104
Category B	Key Informants				11
Overall sample size					160

Source: Researcher, 2014

The study employed simple random sampling with replacement technique in sampling those to be interviewed. All the technical staff at the Kakamega County Housing Office and project owners at the two constituencies were included in the interview purposively given that their numbers were less than 30. Selection of skilled labourers (trainees) was identified through the procedure outlined below:-

1. At least 50% of the target population
2. Simple random sampling with replacement
3. Direct contact aided by their mobile phone numbers

3.4 Data Collection Techniques

Both qualitative and quantitative research strategies were used to collect data. The researcher used the survey design for this study. The survey design provided quantitative and numeric descriptions of some part of population. Since the population of the study was massive, survey design was more suitable given that only a part of the population was sampled to represent Kakamega County. This made the survey to be more economical in terms of time, cost and quality of research.

This study used both primary and secondary data. The primary data was provided directly by the respondents during field data collection especially on usefulness, appreciation of significance and challenges of the initiated projects. This was achieved through the application of various techniques such as interviews, photography and direct observations. The tools used included questionnaires, cameras and field note books. Secondary data on the other hand helped in establishing the output as well as the extent of technology use within the research area. It involved document review from the project implementation offices within Kakamega County. Other relevant information was sourced from various research institutions, respective government departments and libraries.

A structured and self-administered questionnaire was used to collect data from respondents as recommended for a large survey. The questionnaire was pre-tested before main data collection and adjusted accordingly. Data collection was conducted by two research assistants. They administered well-structured questionnaires to skilled labourers (trainees) and project owners as well as conducted interviews with key informants. Projects' photographs were taken by the field team for analysis and interpretation. The research assistants were trained by the researcher on data collection and administration skills and were issued with an introduction letter approved by the University. The purpose of the survey was explained and depending with the respondents' knowledge of the ABT and literacy level, they were allowed to fill the questionnaire either themselves or with the aid of the research assistants. This was only allowed in exceptional cases, otherwise, the research assistants strictly administered the questionnaire and also recorded the verbal comments that were made by the respondents that relates to the study. In other instances, the research team made direct observations on the state and conditions of various projects within the study area.

3.4.1 Data Collection Equipment

The equipment for data collection and analysis that was utilized in conducting this research included: Digital Cameras for photography work, Structured Questionnaires and Personal computer for field questionnaire preparation and report production. The use of these field data instruments are as described below:

3.4.1.1 Camera

Camera (Digital) was used to take still photos especially of various training and completed ABT projects, as well as evidence of field data collection (interviews) for use during project report writing where applicable.

3.4.1.2 Questionnaires

The study adopted the use of both closed and open-ended questionnaires to capture the required information from the field. The questionnaires were administered between 1st and 12th September 2014 to the various categories of respondents notably: project owners, trainees and sampled key informants.

3.5 Data Analysis Techniques

Data analysis was done using SPSS version 20 and Excel. A codebook was created in SPSS platform to facilitate data entry and cleaning procedures. The analysis of the study was done in two steps, preliminary analysis and the main analysis.

The preliminary analysis involved mainly descriptive statistics to summarize data especially the demographic characteristics of the respondents in order to simplify the understanding of the sample data. Descriptive analysis was done using measures of central tendencies such as means and measures of dispersion such as standard deviation, skewness and kurtosis to describe a group of subjects as well as to summarize the sample data collected.

The main analysis involved the use of inferential statistics notably regression analysis. Inferential analysis was used to draw conclusions concerning the relationships and differences found in research results. A researcher uses the sample statistics to draw conclusions about the population from which the sample is drawn. In this study, inferential analysis was best suited to draw conclusions and to answer the hypotheses for this study.

CHAPTER THREE:RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter set out to present data and to discuss the findings of the study on the basis of the responses made within the study area. It discussed the demographic profile, reliability of the study instruments, descriptive statistics of ABTCs components, impact of ABTCs on access to housing and significance of the ABTCs on access to housing. It also provided summary of the regression model, adoption challenges of ABTs and suggestions on upscaling technology adoption in Kakamega County.

4.2 Demographic Profile

4.2.1 Response Rate

From Table 4.1, the study recorded a fairly high response rate (above 70%) which was adequate and sufficient to draw conclusions for the study. Out of 160 respondents sampled in the study, 132 responded giving a high response rate of 82.5%.This was supported by Mugenda (2003), whose argument was "a response rate of 50% is quite adequate for analysis, 60 % response is good and 70 % and above responses are very good.

Table 4.1: Response Rate by Constituency and Respondent Category

Respondent Category	**Malava**	**Mumias West**	**Target Sample Size**	**Actual Respondent**	**Response Rate (%)**
Institution Owners	8	10	25	18	72.0
Individual Owners	7	8	20	15	75.0
Skilled Labourers (Trainees)	30	58	104	88	84.6
Key Informants			11	11	100.0
Overall sample size			**160**	**132**	**82.5**

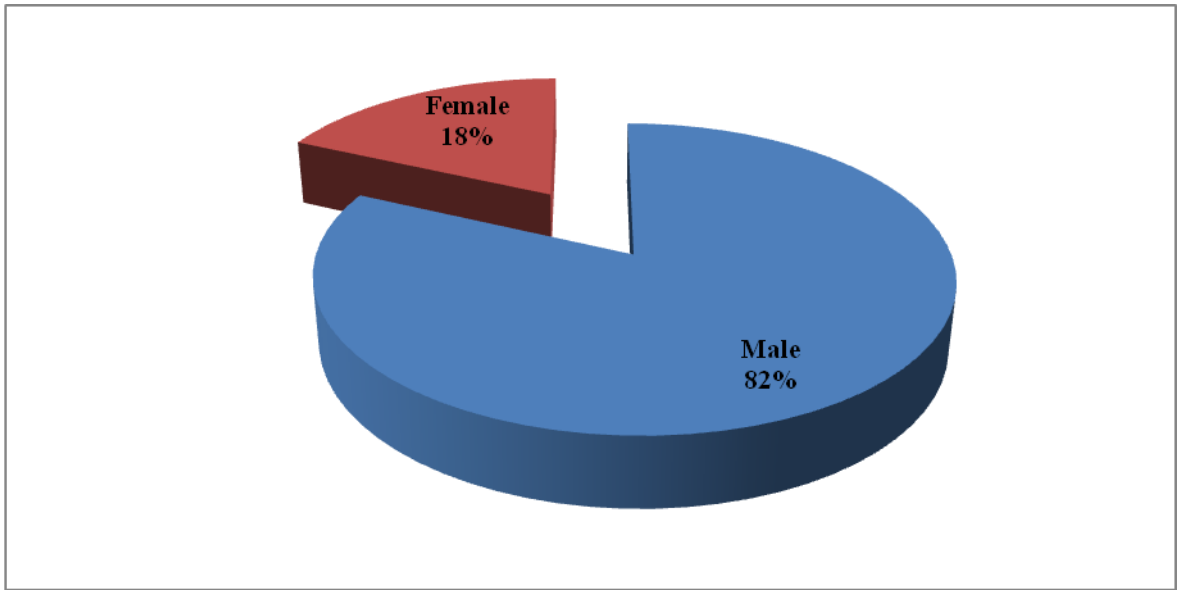
4.2.2 Actual Response Rate

The highest number of actual respondents came from the category of skilled labourers (trainees) which was 88 in total, an equivalent of 67 % as shown in table 3.1. This was a category that project owners engage during construction of houses while utilizing ABTs. However it would have been good if the highest actual respondents came from the category of project owners. This would have meant that ABTs were being adopted by many locals in the county.

4.2.3 Gender of Respondents

The distribution of respondents by gender is provided in Figure 4.2.

Figure 4.2: Respondents' Distribution by Gender



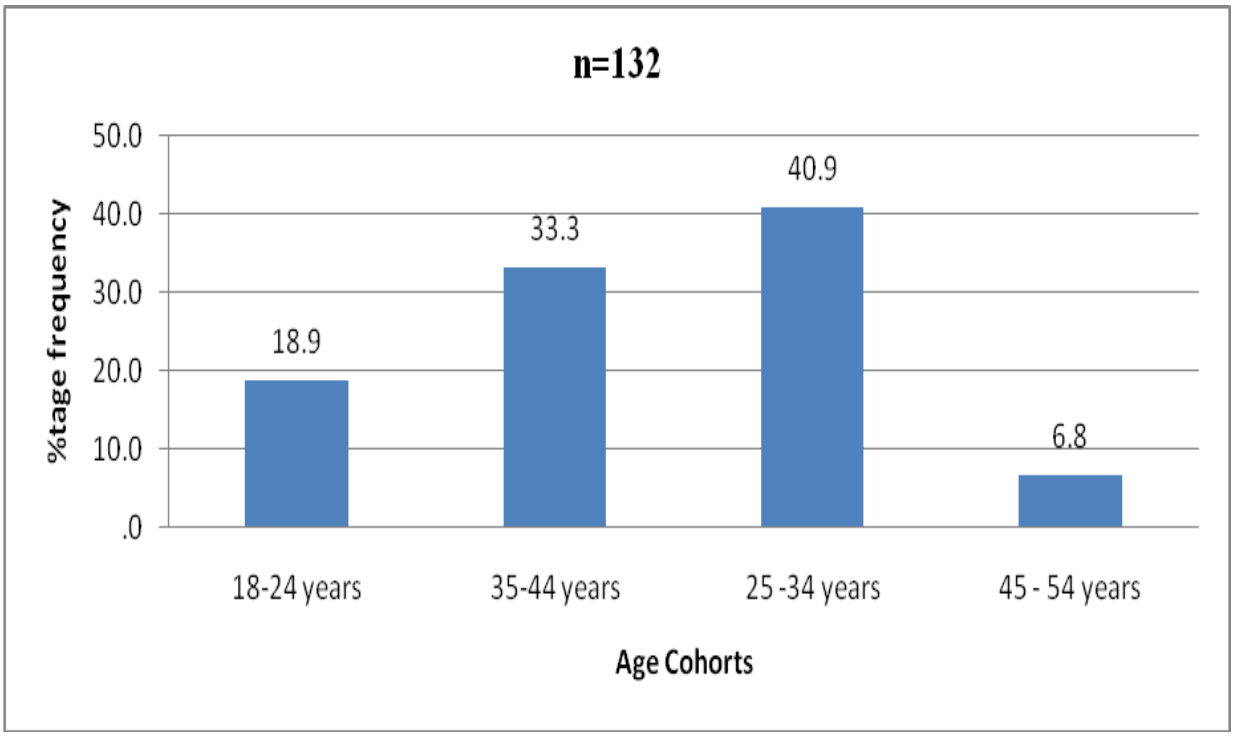
Source: Researcher, 2014

The resulting respondent rate by gender as depicted in Figure 4.2 showed a higher percentage of males involved in the ABTs related engagements at 82 per cent with only 18 per cent of females involved. However, for ownership and realization of faster promotion of the ABTs in the housing delivery process, both genders should be equally engaged.

4.2.4 Age Cohorts

The distribution of the respondents by age is depicted in Figure 4.3.

Figure 4.3: Age Distribution



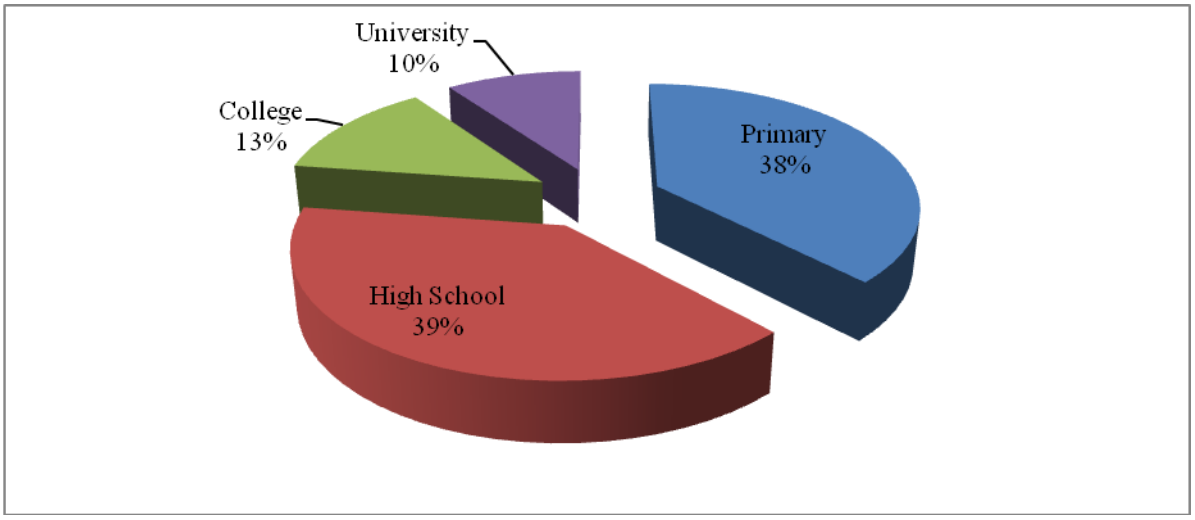
Source: Researcher, 2014

Most of the ABT applications are labour intensive. For instance, the production of interlocking stabilized soil blocks involves among others; materials selection and assembling (soil excavation), preparation (sieving and mixing), machine operation and block production, block laying and curing. All the outlined activities, therefore, require the services of active individuals for maximum daily production to be realized. This is depicted in fig 4.3, where 93.1 per cent of respondents were between the ages of 18-44 years.

4.2.5 Education background

In terms of education background, all respondents were literate. While 39 per cent had a high school education, 38% had primary education, 13% had college education and10 % had university education. Most of the laborers had either primary or high school education while the project owners and facilitators had either college or university education. This is shown in Figure 4.4.

Figure 4.4: Education Background



Source: Researcher, 2014

3.3 Reliability of Survey Instrument

The suitability of the data collection instrument was tested by the use of Cronbach's Alpha. The purpose was to eliminate variables that were consistent and therefore not appropriate for testing the hypotheses of the study. Reliability is defined as the proportion of the variability in the responses to the survey as a result of differences in the respondents. In other words, answers to a reliable survey will not simply differ because respondents have different opinions, not because the survey is confusing nor has multiple interpretations.

The total reliability scale was 0.861 indicating that the instrument was reliable for the 16 items included in the independent and dependent factors. The reliability value for the study was substantial considering the fact that the highest reliability to be obtained is 1 and this was an indication that the three independent and dependent variables are acceptable for analysis. A Cronbach value of 0.7 or greater was considered reliable (Straub et al, 2004). However, four items did not meet the reliability test when the test was segmented and ran for each and every factor.

Table 4.2 shows the reliability scale of each factor calculated when each item is deleted from the factor in order to see if the deleted item is genuine or not. In case Cronbach's Alpha for a dimension decreases when an item is deleted, the item is considered genuine in that factor. From the table, it was realized that all the items showed a lower value of reliability when deleted except for the four items. These were; adequacy of sanitary facilities, availability of

well-trained fitters and roofing experts, use of centres to disseminate technologies for environmental sustainability and the increase of the number of housing units as a result of the technology. They had higher values showing they were not true measures under these factors. These items were therefore eliminated for inferential analysis since they did not meet the reliability test.

Table 4.2: Cronbach's Alpha if Item Deleted

Factors	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha for Factors
Physical Facilities	The Model Building is well constructed and adequately furnished	0.703	0.317	0.639
	The Centre has adequate sanitary facilities	0.111	0.761	
	The Centre is well fenced and secured	0.524	0.497	
	The centre has adequate shed block for production and storage	0.412	0.576	
Equipment	The centre has effective soil testing equipment	0.823	0.928	0.937
	The centre has enough functional block making machines	0.876	0.911	
	There are adequate functional block testing equipment	0.864	0.915	
	The centre has enough construction tools and equipment	0.854	0.918	
Skilled Laborers'	There are enough technical officers who advises clients at the centre	0.714	0.688	0.796
	Masons are available at the centre to undertake construction for local technology users	0.786	0.646	
	Trainees are available at the centre to undertake block production	0.770	0.662	
	There are well trained roofing and fitting experts at the centre	0.215	0.901	
Access to Housing (Impact)	The centres have been used to disseminate technologies which conserve water, energy and lead to low carbon emission.	0.365	0.782	0.744
	The number of housing units have increased as a result of the ABT Centre in the area	0.551	0.678	
	The centres are used to promote technologies that create employment to the community and improve their health.	0.754	0.556	
	The houses built using the technology as a result of the centre are of high quality (made durable and decent materials)	0.514	0.699	

Source: Researcher, 2014

After elimination of these items, the new reliability values were recalculated with an overall reliability scale for the 12 items being 0.857. The equipment reliability scales remained at 0.937 since no item was deleted under these factors. The physical facilities, skilled laborers

and impact of ABTCs reliability scale changed to 0.748, 0.901 and 0.790 respectively as shown in table 4.3. The reliability scales of all the factors are 0.7 and above and these are considered good for analysis. The 12 items were therefore used for regression analysis in order to determine the relationship between the ABTCs and access to housing.

Table 4.3: Reliability Statistics (Cronbach's Alpha) after Elimination

SN	Factor	Cronbach's Alpha
1	Physical Facilities	0.748
2	Equipment	0.937
3	Skilled Labourers	0.901
4	Impact of ABTC on Assess to Housing	0.790

Source: Researcher, 2014

4.4 Descriptive Statistics of ABTC Components

The main components of ABTCs were the availability of physical facilities, equipment and skilled labourers while access to housing was measured in terms of quality of fabrics, living space, living standards as well as environmental sustainability. The purpose was to determine if there is any relationship between the ABTCs (availability of physical facilities, equipment and skilled labourers) and access to housing (adequate living space, high quality, living standard and environmental sustainability).

4.4.1 Physical Facilities

ABTCs were established with standard physical facilities which entail classrooms, workshops, offices, production/storage shed and ablution block). In this study, classrooms, workshops and offices constituted the model building. The aim was to determine the relationship between physical facilities and access to housing in Kakamega County. Table 4.4 summarizes the descriptive statistics of the four parameters investigated under physical facilities.

Table 4.4: Descriptive Statistics of Physical Facilities

SN	Parameters on physical facilities	N	Mean		Std. Deviation	Skewness	Kurtosis
		Statistic	Statistic	Std. Error			
1	The Model Building is well constructed and adequately furnished	127	3.06	0.106	1.191	-.079	-1.286
2	The Centre has adequate sanitary facilities	126	2.79	0.093	1.046	.595	-.826
3	The Centre is well fenced and secured	124	3.79	0.093	1.038	-1.562	2.111
4	The centre has adequate shed block for production and storage	128	3.76	0.085	0.962	-1.598	2.435
	Average	**126**	**3.36**	**0.065**	**0.734**	**-.002**	**-.030**

Source: Researcher, 2014

More than half of the respondents agreed that the physical facilities were adequate. This was supported by the fact that the mean response to the four parameters of physical facilities used in this study was 3.36 with a standard deviation of 0.734 and an average skewness of -0.02 and a kurtosis of- 0.30. Therefore the data distribution was positively skewed towards strongly agree on a five point Likert scale and the responses were homogeneous with less variances around the mean. The Cronbach's Alpha was used to test internal consistency ("reliability") of the multiple Likert questions in the survey questions relating to physical facilities and the scale was determined to be reliable at 0.639 Cronbach's Alpha.

Most of the respondents also strongly agreed that the centre was well fenced and secured, the model building was well constructed and adequately furnished and that the centre had adequate block shed for production and storage. However most of the respondents did not agree that the centres had adequate sanitary facilities since it was positively skewed towards strongly disagree (Skewness = 0.595). Some of the physical facilities available in the ABTCs are demonstrated in Plates 13, 14, 15, 16, 17 and 18 in Appendix B.

4.4.2 Equipment

Equipment comprised of block making machines, soil testing kits, block testers, production and construction tools. The responses to the four aspects that related to availability of equipment at the ABTCs were analyzed and presented in Table 4.5.

Table 4.5: Descriptive Statistics of Equipment

SN	Parameters on equipment	N	Mean		Std. Deviation	Skewness	Kurtosis
		Statistic	Statistic	Std. Error			
1	The centre has effective soil testing equipment	128	2.66	0.083	0.941	1.124	0.236
2	The centre has enough functional block making machines	128	2.69	0.093	1.056	0.820	-0.488
3	There are adequate functional block testing equipment	128	2.73	0.081	0.920	0.758	-0.941
4	The centre has enough construction tools and equipment	127	2.73	0.092	1.035	0.603	-0.851
	Average	**128**	**2.70**	**0.080**	**0.903**	**0.679**	**-0.892**

Source: Researcher, 2014

The overall results indicated an average mean of 2.70, standard deviation of 0.903 with a Skewness of 0.679 and kurtosis of -0.892. The data distribution was slightly skewed to the right and was reliable at 0.937 Cronbach's Alpha. This signified the fact that most of the respondents felt that there was adequate equipment to meet their needs. However, there was still a gap in the availability of soil testing equipment which scored the lowest with a mean of 2.66 followed by functional block making machines with a mean of 2.69. The respondents were relatively happy with the adequacy of functional block testing equipment and availability of tools and equipment with a mean of 2.73 each.

4.4.3 Skilled Labourers

Skilled labourers were people with expertise on the use of ABTs acquired through practical training sessions and tested over time. The availability of skilled labourers and trainees was tested using 4 questions and responses analysed in Table 4.6.

Table 4.6: Descriptive Statistics of Skilled Labourers at ABTCs

SN	Parameters on Skilled Laborers	N	Mean		Std. Deviation	Skewness	Kurtosis
		Statistic	Statistic	Std. Error			
1	There are enough technical officers who advises clients at the centre	127	2.61	0.087	0.984	.588	-.692
2	Masons are available at the centre to undertake construction for local technology users	128	2.75	0.087	0.988	.473	-.907
3	Trainees are available at the centre to undertake block production	128	2.72	0.081	0.913	.780	-.597
4	There are well trained roofing and fitting experts at the centre	128	3.51	0.074	0.842	-.950	-.126
	Average	**128**	**2.90**	**0.064**	**0.728**	**.611**	**-.547**

Source: Researcher, 2014

On aggregate, responses were skewed towards strongly disagreeing with the four statements posed to the respondents to measure the availability of skilled labourers. The mean of the distribution stood at 2.90 with a standard deviation of 0.728, Skewness of 0.611 and kurtosis of -0.547. The data was also tested for reliability using the Cronbach's Alpha and was found to be very reliable at 0.744 and hence further analysis using inferential statistics was possible. Of the four items, the respondents indicated that they were mostly happy with the availability of well-trained roofing and fitting experts with a mean of 3.51 skewed towards strongly agree (Skewness of -0.950). All the other items scored a mean of less than 3.00 and were skewed towards strongly disagree indicating that these skills were not readily available. Plate 19 in Appendix B depicts some of the facilitators of the ABT while plate 20 in Appendix B shows the trainees involved in the production of blocks.

4.5 Impact of ABTCs on Access to Housing

The impact of ABTCs on access to housing was assessed at four levels. The levels were high quality fabric, adequate living spaces, improved living standards and enhanced environmental sustainability.

Table 4.7: Descriptive Statistics of Indicators of Access to Housing

SN	Parameters on Impact of ABTCs	N	Mean		Std. Deviation	Skewness	Kurtosis
		Statistic	Statistic	Std. Error			
1	Quality Fabrics: The centres have been used to disseminate technologies which conserve water, energy and lead to low carbon emission	127	3.96	0.048	0.540	-2.791	14.884
2	Living Space: The number of housing units have increased as a result of the ABT Centre in the area	128	3.88	0.045	0.512	-1.261	3.957
3	Living Standards: The centres are used to promote technologies that create employment to the community and improve their health.	127	3.96	0.042	0.478	-2.331	14.091
4	Environmental Sustainability: The houses built using the technology as a result of the centre are of high quality (made durable and decent materials)	123	3.98	0.042	0.470	-2.975	18.009
	Average	**126**	**3.94**	**0.032**	**0.366**	**-2.604**	**17.158**

Source: Researcher, 2014

High quality fabric was measured in terms of the durability and aesthetic nature of the construction materials used while adequate living space was measured in terms of the overall size of dwelling units constructed as well as individual room sizes. Improved living standards were assessed by gauging the contribution of centres to employment creation while environmental sustainability was assessed through observing how centres contribute to the conservation of environment. These results are presented in Table 4.7.

On aggregate, the responses were skewed towards strongly agreeing with the four statements posed to the respondents to measure impact of ABTCs. The mean of the distribution stood at 3.94 with a standard deviation of 0.032, Skewness of -2.604 and kurtosis of 17.158. The data was also tested for reliability using the Cronbach's Alpha and was found to be very reliable at 0.744 and hence further analysis using inferential statistics possible. The mean distributions

of all the four items were above 3.8 and were all skewed towards strongly agree. One could therefore conclude that the centres contributed towards: improved quality fabric, adequate living spaces, improved standards of living and enhanced environmental sustainability.

4.6 Significance of ABTCs on Access to Housing

The study sought to determine the impact of constituency ABTCs on access to housing in Kakamega County. This was done by the use of linear regression analysis of ABTCs as independent variable and access to housing as the dependent variable. The outputs of analysis are presented in tables 4.8, 4.9 and 4.10. They were aimed at testing the hypotheses of the study related to availability of physical facilities, equipment and skilled laborers. The significance of these factors towards access to housing in Kakamega was determined through this analysis.

Table 4.8 Regression Model

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.296[a]	.088	.065	.28706	.088	3.916	3	122	.010

a. Predictors: (Constant), Skilled Labourers, Physical Facilities and Equipment

Source: Researcher, 2014

Regression analysis revealed a positive relationship ($R^2 = 0.088$). R^2 of 0.88 means that 8.8% of variations in access to housing are explained jointly by physical facilities, equipment and skilled labourers. Since R^2 tends to exaggerate the scenario as it increases with the number of independent variables whether important or not, adjusted R^2 is therefore computed. From the data provided, adjusted R^2 of 0.065 means that 6.5% of variations in access to housing are explained jointly by physical facilities, equipment and skilled labourers.

The F value (3.916) changes were significant which implied that the model was fit or robust at 95% level of confidence since the P-value was less than 0.05 (p-value= 0.010).

Table 4.9: ANOVA Results

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.968	3	.323	3.916	.010[b]
	Residual	10.053	122	.082		
	Total	11.022	125			

a. Dependent Variable: Impact of ABTCs

b. Predictors: (Constant), Skilled Labourers, Physical Facilities and Equipment

Source: Researcher, 2014

Table 3.9 shows ANOVA table reports a significant *F* statistic, indicating that using the model is better than guessing the impact. It shows that variations in the performance of ABTCs on access to housing can be explained by the model to the extent of 0.968 out of 11.022 or 8.8% while other variables not captured by this model could be explained by the 91.2% (10.053 out of 11.022) of the variations in access to housing.

F value of the model produces a p-value of 0.010 which is not significantly different from zero. A p-value of 0.010 is less than the set level of significance of 0.05 (0.010<0.05) for a normally distributed data. This means that the model is statistically significant in explaining impact of ABTCs on access to housing in Kakamega County. From the Tables, it can be concluded that the ABTCs in Kakamega County had significant effect on access to housing (p-values <0.05).

Table 4.10: Regression Coefficients on Impact of ABTCs on Access to Housing

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**Correlations**		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	3.864	0.134		28.818	0.000			
	Physical Facilities	-0.038	0.040	-0.093	-0.948	0.345	-0.039	-0.086	-0.082
	Equipment	0.142	0.050	0.4320	2.855	0.005	0.047	0.250	0.247
	Skilled laborers	0.211	0.062	0.520	3.376	0.001	0.123	0.292	0.292

a. Dependent Variable: Impact of ABTCs

Source: Researcher, 2014

The regression output is presented in Table 4.10. Standardized coefficients (Beta) were used to determine the relative importance of the significant predictors of the impact of ABTCs on access to housing in Kakamega County. The larger the absolute standardized coefficient, the larger the contribution of that predictor to access to housing as indicated by the T-statistics. The skilled laborers had a larger contribution (Beta =0.520) to the access to housing, followed by equipment (Beta =.432) while the least contributor to access to housing was physical facilities with Beta value of -0.093.

The results indicated that a unit standard deviation change in the physical facilities caused a 0.093 standard deviation decline in the access to housing in Kakamega County. This implied that physical facilities were not an important factor in determining access to housing. A unit standard deviation change in equipment led to a 0.432 standard deviation increase in access to housing in Kakamega County. This implied that equipment was an important factor in determining access to housing in Kakamega. A unit standard deviation change in skilled laborers led to a 0.520 standard deviation increase in access to housing in Kakamega County. This implied that skilled labourers was an important factor in determining access to housing in Kakamega County.

A t-statistic was used to generate a p-value or coefficient of significance. A smaller p-value indicates higher significant influence of the predictor to the level of access to housing. A scan of the p-values of the two predictors shows p-values of less than 0.05 while one has a p-value greater than 0.05. This means that Equipment (p-value of 0.005<0.05) and Skilled laborers (p-value of 0.001<0.05) were important in explaining access to housing in Kakamega County while physical facilities (p value of 0.345>0.05) were not important in explaining access to housing in Kakamega County.

4.7 Summary of Model

Based on regression analysis a derived model was obtained to represent the relationship between the existence of ABTCs and access to housing. The analysis adopted a multivariate ordinary least squares model derived from regression analysis as shown in Equation 1.

Equation 1: Multivariate Ordinary Least Squares Model

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$

Where: Y - Dependent variable (Access to housing)

α - The y intercept (constant)

X_1 - Physical Facilities

X_2 - Equipment

X_3 - Skilled Laborers

β_1 - Parameters for the X_1

β_2 - Parameters for X_2

β_3 - Parameters for the X_3

ε - Error term

Substituting the parameters of the significant factors based on the values obtained from the regression analysis, the new model was therefore represented in table 4.11.

Table 3.11: Derived Parameters for factors Affecting Financial Inclusion

	A	β_1	β_2	β_3
Parameter values	3.864	-0.093	0.432	0.520
Level of significance	0.000	0.345	0.005	0.001

Source: Researcher, 2014

From the model, physical facilities had a p value of 0.345 which is more than 0.05. The null hypothesis was therefore not rejected at 5% level of significance. This means that physical facilities did not have an impact on access to housing. Equipment had a P value of 0.005, which is less than 0.05. The null hypothesis was therefore rejected at 5% level of significance meaning that equipment had an impact on access to housing. Skilled labourers had a P value of 0.001, which is less than 0.05. The null hypothesis was therefore rejected at 5% level of significance meaning that skilled labourers had an impact on access to housing.

The following statements were therefore confirmed:

1. $H_{0:}$ Availability of physical facilities is insignificant in promoting access to housing in Kakamega County.

2. H_1: Availability of equipment is significant in promoting access to housing in Kakamega County.
3. H_1: Availability of skilled labourers is significant in promoting access to housing in Kakamega County.

4.8 Challenges on Adoption of ABTs in Kakamega County

The adoption of ABT by general public in housing provision faced many challenges which reduced their level of impact on access to housing. The respondents were requested to identify some of the challenges and the results thereof were presented in Table 4.12. About 59% of the respondents identified machines/equipment as the main challenge. This was followed by the inadequacy of experts especially the qualified masons. Other main challenges identified included: lack of sufficient funds, weather conditions especially rainy weather in Kakamega County, low awareness creation and the perceived high cost of production.

Table 4.12 Challenges of ABTs Adoption by General Public in Housing Provision

SN	**Challenges of ABTs adoption**	Frequency	Percent
1	Few machines/ equipment	79	59.8%
2	Few experts especially qualified masons	56	42.4%
3	Lack of sufficient funds	27	20.5%
4	Weather condition especially rainy weather	23	17.4%
5	Awareness creation is low	23	17.4%
6	High production cost	18	13.6%
7	No staff at the Centre is bit adequate	17	12.9%
8	Poorly maintained machines	16	12.1%
9	Poverty and Illiteracy	15	11.4%
10	Insufficient trainings due to less staff/facilitators	13	9.8%
11	None qualified Masons trying to catch up with technology	12	9.1%
12	Difficult and doubtful clients	12	9.1%
13	Ferrying machine to the site	12	9.1%
14	Poorly maintained machines	12	9.1%
15	ABTCs are hidden and some abandoned	11	8.3%
16	Accessibility to the technicians	11	8.3%
17	Creation of awareness/ lack of knowledge about the ABTCs	11	8.3%
18	Creation of depression in large scale	11	8.3%
19	Lack permanent and casual employees	11	8.3%
20	Lots of damages	11	8.3%
21	Low access to technology by locals	11	8.3%
	Total	412	312%

Source: Field Research, 2014

4.9 Suggestions on the Adoption of ABTs in Kakamega County

Based on the challenges identified, the respondents were requested to suggest ways of up scaling the adoption of ABTs in order to improve access to housing. The findings were presented in Table 4.13. 56.1% of the respondents suggested that more machines should be added to each of the ABTCs. In addition they suggested that more experts and technicians should be trained and more ABTCs established. In order for technology to be appreciated, more youth needed to be employed at the centre on both permanent and temporary basis.

Table 4.13 Suggestions on Ways of Upscaling the Adoption of ABTs

SN	Suggestions	Frequency	Percent
1	More machines to each centre	74	56.1%
2	Train more experts and technicians	37	28.0%
3	More ABTCs be established	26	19.7%
4	Train more from community	25	18.9%
5	Train more youths on the technology	23	17.4%
6	Create awareness through advertisement	22	16.7%
7	Increase the funding to the technology	16	12.1%
8	Employ permanent and casual staffs	16	12.1%
9	Employ project coordinators	13	9.8%
10	More exhibition and Seminars	12	9.1%
11	Ministry to train youths at the centres	11	8.3%
12	Seminars for clients	11	8.3%
13	Display the list of experts on notice board	10	7.6%
	Total	**296**	**224%**

Source: Researcher, 2014

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter highlighted the summary, conclusion and recommendations made while taking cognizance of the study findings.

5.2 Summary

The findings of the study revealed that constituency ABTCs had significant impact on access to housing in Kakamega County. The indicators of access to housing were; improved quality fabric, adequate living spaces, improved standards of living and enhanced environmental sustainability. The study also revealed that whereas availability of equipment and skilled labourers had significant impact on access to housing within the study area, availability of physical facilities did not have any significant impact on access to housing.

The main challenges identified included; insufficient ABT equipment, inadequacy of experts, insufficient funds to effectively run the centres, unfavourable weather conditions in the technology use and low levels of awareness among others. In order to make the centres more effective, the respondents suggested the following: - increase in number of ABT equipment, training of more youth, women and experts, increasing the budgetary allocation towards running the centres and upscaling ABT awareness creation among others.

5.3 Conclusion

The conclusion drawn related to the overall objective of the study which was to assess the impact of the Constituency ABTCs on access to housing in Kakamega County. It also related to the specific study objectives which were to: establish the relationship between ABT physical facilities and access to housing in Kakamega County; determine the relationship between ABT equipment and access to housing in Kakamega County; and examine the relationship between skilled labourers in the use of ABTs and access to housing in Kakamega County.

The impact of constituency ABTCs on access to housing in Kakamega County was 8.8 % as per the regression model at 95% confidence level. ABTCs in isolation therefore could not effectively address access to housing in Kakamega County. Other factors in the housing delivery process which accounted for 91.2% must be addressed and if possible in a holistic manner.

The findings relating to hypotheses test showed that availability of physical facilities was not significant in promoting access to housing while both equipment and skilled labourers had significant impact on access to housing. The availability of skilled laborers had the greatest impact on access to housing followed by the availability of equipment. Availability of physical facilities had the least impact on access to housing in Kakamega County.

It was established that it was possible for the Ministry in charge of Housing to have achieved the maximum impact of ABTCs on access to housing in Kakamega County. This was to be realized through more investment in equipment, training of more skilled labourers particularly the youth and women as well as through increased visibility of the physical facilities.

It was further established that the existing physical facilities were underutilized hence the need to interrogate the policy to establish ABTCs in every constituency as advocated for by Kenya Vision 2030. We may in this case therefore, borrow a leaf from India where after establishing centres in every district, only 40 of them were successful and presently serve the vast subcontinent.

5.4 Recommendations

From the foregoing, this study recommended the following;

1. A policy decision should be made to model establishment of the Appropriate Building Technology Centres along the larger units of devolution and in this case, the counties. This would see the number of centres reduced to 47 for ease of operationalization and effective management.

2. Adequate capacity building processes should be enhanced to enable accelerated access to housing through the adoption of Appropriate Building Technologies in Kenya.

3. An enabling and supportive environment should be cultivated for collaborative research, technology incubation, development and transfer of innovative Appropriate Building Technologies in Kenya.

5.4.1 Suggestions for Further Research

Continuous research is required in both existing and new fields of development either for improvement or invention purposes. This study therefore recommends further research on the following aspects:

1. Conducting a study on other factors that contribute to access to housing in Kenya
2. Conducting a study that would evaluate the entire Appropriate Building Technologies Programme in Kenya.

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APPENDICES

APPENDIX A: KAKAMEGA COUNTY ADMINISTRATIVE UNITS AND AREAS

Region	Constituency	Constituency Population	Constituency Area(km^2)	Country Assembly Ward	County Assembly Population	County Assembly Ward Area(km^2)
Northern	Lugari	167014	367	Mautuma	25082	83.8
				Lugari	31381	81.3
				Lumakanda	29955	59.0
				Chekalini	19705	41.7
				Chevaywa	33145	57.0
				Lwandeti	27746	44.2
	Likuyani	125137	301.9	Likuyani	27243	97.2
				Sango	22853	56.4
				Kongoni	23701	43.3
				Nzoia	30321	54.9
				Sinoko	21019	50.1
TOTALS		**292,151**	**668.9**		**292,151**	**668.9**
Central	Malava	205166	423.3	West kabaras	26114	46.7
				Chemuche	29745	65.1
				East kabaras	22659	49.6
				Butali/chegulo	31876	78.2
				Manda-shivanga	32194	68.3
				Shirugu-mugai	25055	54.4
				South kabras	37523	61.0
	Lurambi	160229	161.8	Butsotso east	23227	33.1
				Butsotso south	17377	31.2
				Butsotso central	25744	48.8
				Sheywe	48304	17.9
				Mahiakalo	12067	13.4
				Shirere	33510	17.4
	Navakholo	137165	257.9	Ingotse-matiha	22091	34.4
				Shinoyi-shikomari-esumeiya	25352	48.4
				Bunyala west	38407	73.3
				Bunyala east	22122	45.0
				Bunyala central	29193	56.8
	Shinyalu	159475	445.4	Isukha north	23496	42.2
				Murhanda	28285	36.0
				Isukha central	34545	42.7
				Isukha south	35807	38.3
				Isukha east	17939	262.6
				Isukha west	19412	23.6
	Ikolomani	104,669	143.6	Idakho south	20917	24.0
				Idakho east	26757	39.4
				Idakho north	25861	40.6
				Idakho central	31134	39.6
TOTALS		**766,704**	**1432**		**766,713**	**1432**
Southern	Mumias west	111862	165.3	Mumias central	37214	33.6

Region	Constituency	Constituency Population	Constituency Area(km^2)	Country Assembly Ward	County Assembly Population	County Assembly Ward Area(km^2)
				Mumias north	15765	35.7
				Etenje	28162	50.6
				Musanda	30721	45.4
	Mumias east	100956	135.5	Lusheya-lubinu	37609	57.0
				Malaha-isongo-makunga	31004	43.4
				East Wanga	32343	35.1
	Matungu	146563	275.9	Koyonzo	35812	66.9
				Kholera	28821	61.9
				Khalaba	19778	39.0
				Mayoni	30584	49.8
				Namamali	31568	58.3
	Butere	139780	210.6	Marama west	31250	51.3
				Marama central	44717	61.0
				Marenyo-shianda	23065	31.9
				Marama north	20796	32.9
				Marama south	19952	33.5
	Khwisero	102635	145.6	Kisa north	19300	31.5
				Kisa east	19905	31.9
				Kisa west	21230	28.7
				Kisa central	42200	53.5
TOTALS		**601,796**	**932.9**		**601796**	**932.9**
COUNTY TOTALS		**1,660,651**	**3033.8**		**1,660,660**	**3033.8**

Source: Kakamega CIDP, 2014

APPENDIX B: PLATES DEPICTING VARIOUS PROJECTS

Plate 1: Iron Sheet Classrooms in Laikipia

Plate2: Classrooms upgraded with ISSBs

Plate 3: Site of fired bricks in Nyamira

Plate 4: Site of Interlocking Blocks in Maralal

Plate 5: ISSBs production process

Plate 6: ISSBs construction process

Plate 7: Mogotio Constituency ABTC

Plate 8: ISSBs constructed residential house

Plates: 9: School, School, ABTC and individual residential house within Kakamega County.

Plate 10: BillBoard Malava ABTC

Plate 11: Malava Constituency ABTC

Plate 12: Model Building at Malava ABTC

Plate 13: Storage facility at Malava ABTC

Plate 14: Toilet facility at Malava ABTC

Plate 15: Block Shed at Mumias West ABTC

Plate 16: Facilitators at Mumias West ABTC

Plate 17: Hydraform Machine and Blocks

Source: Researcher, 2014

APPENDIX C: SAMPLE ELEMENTS

S/NO	NAME
1.	Jacob Omunono
2.	Beatrice Sikolia
3.	Christine Shitanda
4.	Jacquiline Kombo
5.	Tom Muchende
6.	Pastor Gerald Musungu
7.	Peter Soita Shitanda
8.	Wambani Simiyu
9.	Elizabeth Akinyi
10.	Oliech Mathias
11.	Otieno Joseph
12.	Owate Wambayi
13.	John Okwako
14.	Patrick Lucheveleli
15.	Benard Kwena
16.	Wambani Simiyu
17.	Chegulo Primary
18.	Mahira Primary
19.	Sawawa Primary
20.	Namanja Secondary
21.	Muchanja Primary
22.	Chemoroni Secondary
23.	Jabstar Academy
24.	Chegulo Primary
25.	St. Luke's Khabukoshe Primary
26.	Axcel Academy
27.	Elukala Primary School
28.	Eshandumba Secondary School
29.	Bulimbo Secondary
30.	Khabukoshe Secondary
31.	Julius Shiundu
32.	Wafula Isaya
33.	Barasa Sunguti
34.	Timothy Shaka
35.	Stephen Mukhwana
36.	Andrew Musungu
37.	Julius Shiundu
38.	Wycliff Lunani
39.	Nelson Luronge
40.	Walter Disii
41.	Chami Luchivya
42.	Mulupi Sayia
43.	Victor Muchende
44.	Leonard Muchende
45.	Kilu Imboko
46.	Yohana Kasaya
47.	Musa Makale
48.	Andrew Sunguti
49.	Amos Barasa
50.	David Simiyu
51.	Arcadius Katuyi
52.	Wilson Mmasi
53.	Collins Mmbazu
54.	Simon M Indimuli
55.	Julius M Samson
56.	Solomon Luchvya
57.	Richard Okello
58.	Wilson Tawai
59.	Moses Chikamai
60.	Suleiman Barasa
61.	Gibson Muhutsani
62.	Patrick Sifuna
63.	Daniel Jomo
64.	Shem Shisia
65.	Samson Iyadi
66.	Simon Barasa
67.	Muhamud Indimuli
68.	Sammy Luronga
69.	Patrick Karungani
70.	Caleb Luronga
71.	Zablon Jami
72.	Albert Mukonyi
73.	Hillary Karungani
74.	Japhred Simusa
75.	Johnstone Chisaina
76.	Coenex Sindani
77.	Patrick Lumbasi
78.	Kenneth Munyekho
79.	Isaac Lucheresi
80.	Sanford Chesoli
81.	Patrick Museve

82.	Jacob Kulecho
83.	Peter Mukonyole
84.	Chikamai Makale
85.	Murunga Shangala
86.	Yassin w. muchelule
87.	Josphat Akunda
88.	Ibrahim Washika
89.	Antony Oketch
90.	Erastus Chitech
91.	Isaaiah Kachi
92.	Swaleh Juma
93.	Bilha Nambaka
94.	Zebedayo Matabiri
95.	Zakaria W. Ongoma
96.	Livingstone Mukolwe
97.	Abdallah Chiriswa
98.	Misiko Justus
99.	Kimatia N. Kennedy
100.	Francis Kadima Manda
101.	Florence L. Okede
102.	Chrisantus O . Ndauro
103.	Shiati Clare
104.	Emmanuel Muramba
105.	Salim Osore
106.	Hesborn Mabinda
107.	Kassim Toloyi
108.	Sheban Mela Maloba
109.	Ramadhan Ismael
110.	Asman Mapesa
111.	Idris Omar
112.	Swaib Ramadhan
113.	Rashid Rajab
114.	Abdalla Shaban
115.	Ramadhan Doka
116.	Fredrick Juma
117.	Martin Shikolio
118.	Siraji Aloba
119.	Amina Abdu
120.	Doris Nelima
121.	Khadija Hamisi
122.	Shifa Nyangweso
123.	Musa Musindalo
124.	Mohammed Mahammudu
125.	Asman Nyapola
126.	Sylvester Namtandi
127.	Josephat Tisa
128.	Mathew Okwero
129.	Samson Nyongesa
130.	Richard Otieno
131.	Frank Nyangweso
132.	Rosemary Jumba
133.	Peter Ogutu
134.	Henry Mapesa
135.	Mathulmano Were
136.	Kiliopa Okhako
137.	Dickson Kangu
138.	Joel Eshitubi
139.	Kelvin Mukungu
140.	Richard Omutakha
141.	Silas Osako
142.	Francis Maero
143.	Simion Obwalaba
144.	William Osako
145.	Emmanuel Amboko
146.	Johnson Mandela
147.	Adris Afubwa
148.	Samuel Wamukoya
149.	Musa Makokha
150.	Yusuf Maende
151.	Edmond Shiundu
152.	Erick Shitana
153.	Emmanuel Wamanya
154.	Jacob Musindalo
155.	Rajab Osundwa
156.	Newton Mawate
157.	Jacob Omwyongo
158.	Collins Mmbasu
159.	Simon Indmuli
160.	Solomon Wafula

Source: Kakamega County Housing Office, 2014

APPENDIX D: PROJECT TIMELINES

The time frame for conducting the study was as outlined below:

S/No	Activity	Time Frame	Action By Who
1.	Proposal Development	1st March – 31st May, 2014	Researcher/Supervisor
2.	Submission and Comments from Supervisor	9th – 13th June, 2014	Researcher/Supervisor
3.	Proposal Finalization/ Incorporating Inputs from Supervisor and Defence	16th June – 31st July, 2014	Researcher/Supervisor
4.	Field Work Preparation and Reconnaissance	1st – 29th August, 2014	Researcher/Supervisor
5.	Field Data Collection	1st – 12 September, 2014	Researcher/Research Assistants/Supervisor
6.	Data Entry and Analysis	15th – 26th September, 2014	Researcher/Supervisor
7.	Report Writing	29th Sept – 6th October, 2014	Researcher/Supervisor
8.	Final Research Project Presentation/Defence	13th – 17th October, 2014	Researcher/Supervisor
9.	Final Project Report completion, production and Submission	20th – 31st October, 2014	Researcher/Supervisor

APPENDIX E: RESEARCH BUDGET

The budget for the study was as shown;

ITEM	**COST (KSHS.)**	**TOTAL COST (KSHS)**	**RESOURCES BY WHO**
Preliminary data sourcing on existing ISSBs housing in the study area	5,000	5,000	Self
Digital Camera Services	3,000	3,000	Self
Preparation of questionnaires & printing	8,000	8,000	Self
Two research assistants daily allowance	1000 X 2 X 15days	30, 000	Self
Travelling Cost for research assistants	500 X 2 X 20days	20,000	Self
Data entry	1000 X 2 X 5days	10,000	Self
Data Processing and Analysis	3000 X 5X2	30,000	Self
Preparation of final project document and presentation process	20,000	20,000	Self
Preparation of 6 hard bound copies of final project paper in colour	4000 X 6	24,000	Self
Miscellaneous	10,000	10,000	Self
Grand Total		**180, 000**	**Self**

APPENDIX F: LETTER TO THE RESPONDENTS

Dear Respondent,

I am carrying out a project research leading to award of a Master of Arts degree in Public Administration. This research is being carried out in Kakamega County to assess the Impact of Constituency Appropriate Building Technology Centres on Access to Housing in Kenya. You are kindly requested to voluntarily participate in this important exercise by answering some few questions relating to the subject matter. The ***information provided will be confidential and strictly used for the purpose of this research only***. Please tick and fill in appropriately where applicable.

Yours sincerely,
Charles Wafula Sikuku
Student No. C51/81152/2012
UNIVERSITY OF NAIROBI

APPENDIX G: QUESTIONNAIRE

The Impact of Constituency Appropriate Building Technology Centers on Access to Housing in Kenya: A Case Study of Kakamega County (2006-2012).

SECTION A: PERSONAL INFORMATION

1 Name of the constituency you come from?

1. Lurambi [ ]
2. Navakholo [ ]
3. Malava [ ]
4. Lugari [ ]
5. Likuyani [ ]
6. Mumias East [ ]
7. Mumias West [ ]
8. Matungu [ ]
9. Butere [ ]
10. Khwisero [ ]
11. Ikolomani [ ]
12. Shinyalu [ ]

2 Project Name?:_____

3 Gender of the respondent: 1. Male [ ] 2. Female [ ]

4 Age of the respondent's

1. 18-24 years [ ]
2. 35-44 years [ ]
3. 25-34 years [ ]
4. 45-54 years [ ]
5. 55 years and over [ ]

5 Respondent Category? 1. Individual [ ] 2. Organization [ ] 3. Trainee [ ]

6 Occupation of the respondent? _____

7 Highest level of education attained

1. Primary level [ ]

2. High School [ ]
3. College [ ]
4. University [ ]
5. Other(s) [ ]
   Specify: _____

8. In what Capacity have you interacted with the ISSBs products?

1. Unskilled labourer [ ] 2. Local fundi [ ] 3. Project Owner [ ]

9. If project owner in No.8 above, what was the project type?

1. Residential House [ ] 2. Others [ ], Specify----------

---

10. If residential in no.9 above, had you a different house before?

1. Yes [ ] 2. No. [ ]

11. If yes in No. 10 above, would you state the walling materials it was made of

1. Stone [ ] 2. Mud [ ] 3. Bricks [ ] 4. Timber [ ]

5. Others [ ], Specify----------

---

12. When was the last time you participated in the ABT use within the locality?

1. Within 1 year [ ] 2. Between 1-3 years ago [ ] 3. Over 5 years ago [ ]

13. If not 1 in No.12 above, would you give some reasons?

_____

_____

14. How did you first come to know about the technology?

1. Friend told me [ ] 2. Media advert [ ] 3. Neighbouring project [ ]

4. Public exhibition [ ] 5. Any Other [ ] Specify----------

---

15. If answer is 2 in No.8 above, do you consider the technology use as economically sustainable?

1. Yes [ ] 2. No [ ]

16. Does the Technology save on time?

1. Yes [ ] 2. No [ ]

17. How was access to housing before the centres?

1. Low [ ] 2. Moderate [ ] 3. High [ ]

4. Don't Know [ ]

18. How were people in the area accessing technologies to assist in housing delivery?

---

19. When the centres were introduced, can you gauge the difference? That is, had the centres enhanced delivery process?

1. Yes [ ] 2. No [ ]

20. If yes, what difference has the centres made?----------

Questions 21 to 27 are to be answered by the key informants (Ministry staff) only.

21. How many applications for technology use were received by your office between the years 2006-2012?

Year	**No. of Applications**	
	Individual Category	**Institutional Category**
2006		
2007		
2008		
2009		
2010		
2011		
2012		
Total		

22. How many applicants have successfully built using the ABT being promoted by your office in the period above (2006-2012).

Year	**No. of completed projects**	
	Individual Category	**Institutional Category**
2006		
2007		
2008		
2009		
2010		
2011		
2012		
Total		

23. What is the centre composed of?----------

---

24. Would you estimate the cost of establishing the centre (Model building, security/fencing, sanitary facilities, machines, others)?----------

---

---

25. Do you consider the centre to be useful?

1. Yes [ ] 2. No [ ]

26. If yes, please proceed to section B.

27. If No. would you state why?

SECTION B: INDICATORS OF ACCESS TO HOUSING

Indicate the extent to which you agree with the following statement in regards to their availability at the Constituency Appropriate Building Technology Centre within the area. Use a likert scale of 1 to 5, where 1 represents Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree and 5 = Strongly Agree.

		Strongly Disagre	Disagre	Neutral	Agree	Strongly Agree
1.0	Physical Facilities					
1.1	The Model Building is well constructed and adequately furnished	1	2	3	4	5
1.2	The Centre has adequate sanitary facilities	1	2	3	4	5
1.3	The Centre is well fenced and secured	1	2	3	4	5
1.4	The centre has adequate shed block for production and storage	1	2	3	4	5

2.0	Equipment					
2.1	The centre has effective soil testing equipment	1	2	3	4	5
2.2	The centre has enough functional block making machines	1	2	3	4	5
2.3	There are adequate functional block testing equipment	1	2	3	4	5
2.4	The centre has enough construction tools and equipment	1	2	3	4	5
3.0	Skilled Labourers					
3.1	There are enough technical officers who advises clients at the centre	1	2	3	4	5
3.2	Masons are available at the centre to undertake construction for local technology users	1	2	3	4	5
3.3	Trainees are available at the centre to undertake block production	1	2	3	4	5
3.4	There are well trained roofing and fitting experts at the centre	1	2	3	4	5

SECTION C: IMPACT OF ABT CENTRES ON ACCESS TO HOUSING

Indicate the extent to which you agree with the following statement in regards to the impact of Appropriate Building Technology adopted in the area. Use a likert scale of 1 to 5, where 1 represents Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree and 5 = Strongly Agree.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.0	Quality of Fabrics					
1.1	The houses built using the technology as a result of the centre are of high quality (made durable and decent materials)	1	2	3	4	5
2.0	Living Space					
2.1	The number of housing units have increased as a result of the ABT Centre in the area	1	2	3	4	5

3.0	Living Standard					
3.1	The centres are used to promote technologies that create employment to the community and improve their health.	1	2	3	4	5
4.0	Environmental Sustainability					
4.1	The centres have been used to disseminate technologies which conserve water, energy and lead to low carbon emission.	1	2	3	4	5

SECTION D: CHALLENGES

What are the three main challenges for failure to adopt the ABT by the general public in housing provision in this locality?

SECTION E: SUGGESTIONS

Suggest at least three ways that can be used to upscale the adoption of ABT by the general public in housing provision within the locality

---

Thank you!

FOR OFFICIAL USE ONLY

Name of Enumerator _____

Date of data collection _____

Respondent number: _____