

AN EVALUATION OF PERFORMANCE OF THE APPROPRIATE
BUILDING MATERIALS AND TECHNOLOGIES PROMOTION IN
KENYA

BY

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DECLARATION

This research project is my original work and it has never been presented for award of a degree in any other University.

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DEDICATION

This work is dedicated to the entire Sangori family for the love and unwavering support and constant encouragement throughout the study period.

LIST OF ABBREVIATIONS

ABMTs	:	Appropriate Building and Material Technologies
LDCs	:	Least Developed Countries
DCs	:	Developing Countries
APHA	:	American Public Health Association
CDF	:	Constituency Development Fund
GATE	:	German Appropriate Technology Exchange
GoK	:	Government of Kenya
HABRI	:	Housing and Building Research Institute
ITDG	:	Integrated Technology Development Group
MDGs	:	Millennium Development Goals
MOH	:	Ministry of Housing
NACHU	:	National Cooperative Housing Union
NCST	:	National Council for Science and Technology
NEMA	:	National Environmental Management Authority
CDH	:	County Directorate of Housing
UNCHS	:	United Nations Centre for Human Settlement
UNEP	:	United Nations Environment Programme
UNESCO	:	United Nations Education, Science and Cultural Organization
ISSBs	:	Interlocking Stabilized Soil Blocks
SSBs	:	Stabilized Soil Blocks
FCR	:	Fibre Concrete Roofing Tiles
ABTs	:	Appropriate Building Technologies

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ABSTRACT

Research and development on Appropriate Building Materials and Technologies is not a new concept in the Kenya's Built Environment and the Housing Sector at large. This is prompted by the fact that large segments of the population are characterized by low purchasing power and as a result of which are living in inadequate housing conditions (GoK, 2004).

In the early 1980s and mid-1990s, various institutions drawn from both the public and private sector engaged in research on local construction materials that mainly related to the walling and roofing aspects in building construction. The lead architect of the research component at the time was the University of Nairobi through its research institute, The Housing and Building Research Institute in collaboration with a host of other institutions. The initiative involved undertaking research on various aspects of low cost housing and community participation in both rural and urban areas with the involvement of the Public Universities, NGOs, International Agencies and other institutions, both public and private.

At the time of the research development in the country, the Government did not take a lead role and was only leveraging little funds as research token especially to HABRI to supplement their work. These past initiatives involving research on the ABTs failed to materialise to the next stage of their development at a national scale. At present, the government through the Ministry of Lands, Housing and Urban Development is involved in promoting the adoption and use of Interlocking Stabilized Soil Blocks (ISSBs) developed by Hydraform Ltd from South Africa.

This study looked into the development and progress made in the promotion and use of ABMTs in Kenya. The information provided by the ABMT programme trainee beneficiaries and key informants revealed the need for close linkages between the sector players involving the government, research institutions and the private sector to realize full potential of affordable housing development in the country.

CHAPTER ONE

INTRODUCTION

1.1 Background

The World growing population poses major challenges to the efforts being championed by various Governments in facilitating access to affordable and adequate housing for their citizens. The 20th Century has seen an evolution from a World barely urbanized at 13% at the cradle of the 20th Century (UN-HABITAT, 2004) to one that is fast cruising past 48% at present. Towns and cities have grown at a rapid urban growth and the dramatic problems linked to it include; huge shelter needs, emergence of squatter settlements and slums, and deficient infrastructure in many low-income settlements. On the socio-economic and related development fronts, over-urbanization is much more pronounced thereby directly being a challenge to achievement of the Millennium Development Goals by 2015 for the Least Developed (LDCs) and the developing countries (DCs), more so, MDG 7, target 11, “which aims to significantly improve the lives of at least 100 million slum dwellers by the year 2020 (UNHSP,2003). Universal Declaration of Human Rights (UN, 1948), declared housing a basic human right, stipulating under Article 25(1) that everyone had the right to a standard of living adequate for their health and well being and this included food, clothing, housing, medical care and the necessary social amenities. The International Year of shelter (1987) called for provision to every household with decent shelter by the Year 2000. In addition, discussions in Rio de Janeiro called on Local Authorities and communities to actively contribute to the implementation of the objectives of Agenda 21. Further, Habitat Agenda (1996) specified that sustainable human settlement development requires the active engagement of civil society organizations, as well as the broad-based participation of all people.

In the Kenyan context, population increase has been tremendous over the years with the 2009 Census result reporting high numbers of (38.610097 Million) people, a situation that has created huge housing demand for the low, middle and high income groups in the society. Sessional Paper No. 3 of 2004 on National Housing Policy for Kenya indicates that annual demand for housing in urban areas is 150,000 units while 300,000 units need to be improved in the rural areas. However, paltry 30,000 units can be afforded annually to cater for the urban dwellers (GoK. Sessional Paper No.3 of 2004).

Engagement in research initiatives could provide a vital link to bridge the gap in the available housing stock and those in need of housing services. Past three decades was characterized by active research

initiatives by various actors encompassing the Government, Research Institutions, and the Private Sector. Research undertakings at the time were on alternative building materials, more so the Appropriate Building Technology. Among the technologies tested and disseminated at a significant level were Stabilized Soil Blocks (SSBs) and Fibre Concrete Roofing Tiles (FCR). The aspects tested and disseminated were applications involving stabilizers and binders in the production of SSBs and FCR tiles for use by local communities. The focal point in the promotion and dissemination of ABTs in Kenya was Housing and Building Research Institute (HABRI) which was transformed from Housing Research and Development Unit (HRDU) of the University of Nairobi. The institution closely collaborated with Government of Kenya through the Department of Housing and other development partners such as the Federal Republic of German through its cooperation agency, that is, GTZ among other stakeholders (GTZ/GATE, 1996).

1.2 Statement of the problem

Past practices geared towards cost reduction in housing delivery resulted in active promotion of research and development in the alternative/ or Appropriate Building Technologies (ABTs) which has roots way back in the 1970s. It was understood that low cost or affordable construction technologies and materials could be a panacea in meeting the ever growing demand for rapid housing delivery in developing Countries, Kenya being no exception. The ABT initiatives were championed by Housing and Building Research Institute (HABRI) in the periods ranging from mid 1970s to the mid 1990s. At inception, the ABTs programme was spearheaded by HRDU, an outfit that was later transformed to HABRI with expanded mandate in the research and development on affordable building technologies in Kenya. The Government at that time, was participating by leveraging facilitation approximately to the tune of Kshs.600,000 to HRDU for research annually. Generally, the Ministry in-charge of housing was hands-off on the project implementations compared to the current scenario where the Ministry in charge of Housing is playing a lead in the promotion and utilization of Appropriate Building Materials and Technologies in housing delivery, specifically the Interlocking Stabilized Soil Blocks (ISSBs) to various local communities across the Country (Agevi, 2013).

HABRI implemented research projects involving material production, testing and building construction between 1984 and 1994 after which, it ceased to operate. The discontinuation of activities of a research institute in the caliber of HABRI came as a cropper in the integration of research activities with the National Development. More discerning is the fact that a host of organizations which were involved in

the various projects implementation faces also became dormant thereby throwing the conceived ABT promotion into disarray. In present day Kenya, the Constitution has given an onus task to the Government in ensuring facilitation to adequate housing to all Kenyans, a task that can be supplemented by the promotion of Appropriate Building Materials and Technologies, which are a product of collaborative research championed by the academic institutions. This research was thus meant to evaluate the performance of past and current ABT projects implementation processes across the Country, by examining the role of the government, research institutions and the private sector.

The research findings if implemented to the later and spirit would help in unlocking the challenges faced in the promotion and utilization of ABTs by the government, research institutions and private sector players in their attempt to facilitate provision of adequate and cost-effective housing in Kenya.

1.3 Objectives of the Study

Appropriate Building Materials and Technologies promotion takes cognizance of a number of factors including associated cost applicable in the housing delivery. The overall objective of the study was to find out the performance of various actors involved the technology use application as well as to examine whether the need for low-cost housing initiatives has diminished in Kenya. The specific objectives of this study included the;

1. Establishment of the causes of failures of previous attempts of Appropriate Building Materials and Technologies Promotion in Kenya.
2. Establishment of the strategies/methodologies applied in propagating ABMTs utilization in Kenya.
3. Recommendations on the safeguard measures that should be put in place to make current ABTs promotional attempts successful in Kenya.

These objectives were achieved through adequate validation of the corresponding formulated hypotheses.

The research findings have been necessitated by addressing the main research question of whether the need for low-cost housing initiatives has diminished in Kenya. The specific questions that the study addressed were as provided:

1. What led to the failures of previous attempts of Appropriate Building Technologies Promotion in Kenya?
2. What strategies/methodologies have been applied in propagating ABTs utilization in Kenya?
3. What safeguards should be put in place to make current ABTs promotional attempts successful in Kenya?

1.4 Study Proposition

The research broad hypothesis formulated for this study that was tested and validated by respondent data collected from the field was;

H0: The need for low-cost housing initiatives had diminished in Kenya.

H1: The need for low-cost housing initiatives had not diminished in Kenya.

The research specific hypotheses for this study that were tested and validated by respondent data collected from the field were:

1. H0: There were adequate institutional capacity to enable dissemination of ABTs in Kenya.

H1: There were inadequate institutional capacities to enable dissemination of ABTs in Kenya.

2. H0: There were effective strategies applied in the ABTs promotion in Kenya.

H1: There were ineffective strategies applied in the ABTs promotion in Kenya.

For hypotheses testing, descriptive statistic from the respondent data analysis was used in the validation process

1.5 Justification of the Study

The continued acceleration in population growth as witnessed in Kenya in recent times calls for the Country's institutions mandated to facilitate housing provision to be more proactive to realize sustainable development as propagated in the Agenda 21. As provided in both the Constitution of Kenya 2010 and Kenya Vision 2030, attainment of adequate, affordable housing and reasonable standard of sanitation is a fundamental right to the Kenyan citizens. Over the years, attempts in meeting housing demand by citizens both in the urban and rural areas has witnessed enormous use of conventional building materials and technologies, most of which are exploited from the surrounding environment with adverse environmental impacts. The use of appropriate building materials, especially, Interlocking Stabilized Soil Blocks (ISSBs) poses minimal negative impacts to the environment/environmentally friendly (Sangori, 2012) hence can play an important role in the realization of sustainable development. The study findings are important in helping various players in the housing sector to find ways of which to promote the ABTs and to further actualize the affordable housing aspiration by a majority of the Kenyan citizens.

1.6 Scope and Limitation of the Study

This study evaluated ABMTs projects implemented individually or jointly by Academic Research Institutions, Private Sector and Government Departments. More specifically, it looked at information from two sets of groups notably; the policy makers and implementers on the one hand and the project implementation beneficiaries on the other hand. The information sought related significantly to past projects implemented in collaboration between HABRI and the Department of Housing (Government of Kenya) between the years 1984 and 1994. In addition, it involved visiting on-site training and demonstration areas as conducted by the Department of Housing within Nyamira County. Further, during the study, private manufacturing firms specializing in local manufacture of Appropriate Building Materials production equipment with bias on Stabilised Soil Blocks (SSBs) utilization were visited. The data collection process was by way of interviews involving beneficiaries (trainees) and Key Informants, photography and personal observation.

1.7 Research Methodology

This study used various data collection techniques in order to address the stated objectives and to validate the research hypothesis. Further, it aided in drawing conclusions and recommendations. In the

publication of GTZ/GATE (1996), HABRI implemented a significant number of ABT projects in collaboration with a host of institutions. Further, Sangori (2012), indicated that the promotion and adoption of appropriate building materials and technologies was actively being championed by the Government of Kenya, through the then Ministry of Housing, more so, the use of interlocking stabilized soil blocks (ISSBs). The scope of the study in Sangori (2012) however did not capture how the various actors (both past and present) involved in dissemination of ABT programmes performed in their promotional strategies. In her work (Omayi, 1993) focused on the constraints to the dissemination and utilization of Fiber Concrete Roofing Tiles in Kenya. This study mainly looked at the projects that were implemented by HABRI in partnership with a host of other organizations, especially with GTZ, USAID, local communities among others.

The primary data for this study was obtained from the field through Key Informants and Trainee Beneficiaries interviews to three categories of organizations namely; the Government, Research Institutions and private sector players. This involved data collection in Nairobi region which hosts the headquarters of the targeted organizations in the case of key informant interviews and selected field areas for beneficiaries (trainees) interviews. Apart from questionnaires, the study also employed the use of Photography and Personal Observations.

There was also search for secondary data through literature review of both published and unpublished materials including seminar papers, journals, past research projects among others.

1.8 Organization of the Study

There are about five sections to which this study has been discussed notably; chapters 1, 2, 3, 4, and 5.

Chapter one basically includes introduction to the study. It contains:- the background of the study; statement of the problem; objectives of the study with study questions, study hypotheses; justification of the study; scope and limitations of the study; research methodology; and the study outline/ or organization.

Chapter two incorporates literature review of past studies related to the proposed study. It includes highlighting key concepts of appropriate building materials and technologies promotion in Kenya as well as the conceptual framework.

Chapter three discusses the methodology of the study and it comprised an introduction, study design, description of the study area. It further incorporated the types of data, the data collection design, population size, sampling frame, sample size, data collection methods and tools, as well as ways of data analysis and presentation.

Chapter four of this study comprised of data analysis, presentation and discussion. It also had an in-depth grasp of the outcome of the study.

Chapter five highlights conclusions as well as the study recommendations. This chapter in addition provide suggestions on areas for further research for policy makers / or implementers and the academia.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focused on related studies regarding the performance of various initiatives mounted by the Government of Kenya, Research Institutions, and the Private Sector in the promotion of Appropriate Building Materials and Technologies for use across the Country. It also drew lessons from the International best practices and offer productive critique on the adopted strategies for the betterment of ABMTs promotion and utilization in Kenya.

2.2 World Population and Housing

According to Eisner (1993) the population of the World is exploding, with the rising flood of urbanization surging outwards from the Centre and engulfing the surrounding Countryside congestion festers within and about the edges. In the year 1999, Baby Six billion was born and by 2025, the world population is expected to reach about 9billion adding pressure to the volatile housing situation. The council of Europe (2002) recognizes housing as a social right and denotes it as those provisions, expressed in legal and other forms, which are necessary for the fulfillment of people's needs and for the promotion of social cohesion and solidarity. Further, access to social rights forms a chain whereby, the declaration and framing of the right, the process through which it is to be realized, and the activities and resources necessary to realize it are all interconnected (Council of Europe, 2002).

The United Nations Committee on Economic, Social and Cultural Rights (1991) observed that the right to housing should not be interpreted in a narrow sense which equates shelter to merely housing a roof over one's head, but rather as the right to live somewhere in security, peace and dignity. According to Agenda 21, overcrowding and inadequate housing contribute to respiratory diseases, tuberculosis, meningitis and other diseases. In Kenya, population has increased from 8 million at independence to well over 38 million in 2009 (KNBS, 2009). The issue of adequate space is quite fundamental in providing adequate housing for the population in need of the housing services. Table 2.1 depict minimum room sizes permitted for separate rooms according to Housing and Urban Development of the United States (1965).

Type of living unit and type of room	Minimum Area (Sq Ft)		
	1 to 2 Family Housing	Multi-Family Housing	Low Cost Housing
Living unit with			
1 bedroom:			
Living room	160	160	140
Dining room	80	100	80
Kitchen	60	60	50
Total bedrooms	120	120	110
Living unit with			
2 bedrooms:			
Living room	160	160	140
Dining room	80	100	80
Kitchen	60	60	50
Total bedroom	200	200	180
Minimum bedroom	80	80	70
Living unit with			
3 bedrooms:			
Living room	170	170	150
Dining room	95	110	90
Kitchen	70	70	60
Total bedrooms	280	280	250
Minimum bedroom	80	80	70
Living unit with			
4 bedrooms:			
Living room	180	180	160
Dining room	110	120	100
Kitchen	80	80	70
Total bedrooms	380	380	320
Minimum bedroom	80	80	70

Table 2.1: Minimum Room Sizes permitted for families; HUD (1965)

According to Goodman (1974), the rooms for family need based on the household composition allowed for: a base of two rooms (exclusive of bathrooms) for head and wife or single head; one additional room allocated for each single person age 18 and above; one room for a married couple other than head and wife; and one room for every two children of the same sex under 18 years. The rising population therefore calls for adoption of innovative building technologies and strategies to provide for the housing needs of the masses.

2.3 Housing Provision and Sustainable Development

According to Agenda 21, International Cooperation and Partnership as well as the effective implementation of the outcome of the Second United Nations Conference on Human Settlements as deliberated in 1996 (Habitat II) should take into account the integration of adequate shelter and sustainable human settlements development with broader environmental, social and economic considerations. Building and construction industry is considered key in sustainable development, with the potential to significantly impact on society and the environment (UN-HABITAT, 2009).

The Agenda 21 (1992) propagates that states and Governments have the responsibility to: establish and strengthen the indigenous building materials industry, based, as much as possible, on inputs of locally available natural resources; formulate programmes to enhance the utilization of local materials by the construction sector by expanding technical support and incentive schemes for increasing the capabilities and economic viability of small scale and informal operatives that make use of these materials and traditional construction techniques; adopt standards and other regulatory measures which promote the increased use of energy – efficient designs and technologies and sustainable utilization of natural resources in an economically and environmentally appropriate way; promote the use of labour-intensive construction and maintenance technologies which generate employment in the construction sector for the underemployed labour force found in most large cities, while at the same time promoting the development of skills in the construction sector.

The Governments on behalf of their people are further required to: develop policies and practices to reach the informal sector and self-help housing builders by adopting measures to increase the affordability of building materials on the part of the urban and rural poor, through, inter alia , credit schemes and bulk procurement of building materials for sale to small-scale builders and communities; promote free exchange of information on the entire range of environmental and health aspects of construction, including the development and dissemination of database on the adverse environmental effects of building materials through the collaborative efforts of the private and public sectors; promote the development and dissemination of databases on the adverse environmental and health effects of building materials and introduce legislation and financial incentives to promote recycling of energy-intensive materials in the construction and conservation of waste energy in building-materials production methods; promote the use of economic instruments, such as product changes, to discourage the use of construction materials and products that create pollution during their life cycle; promote

information exchange and appropriate technology transfer among all countries, with particular attention to developing countries, for resource management in construction, particularly for non-renewable resources; and promote research in construction industries and related activities as well as to establish and strengthen institutions in the construction sector.

Promotion of sustainable construction industry activities is quite vital to the achievement of the national socio-economic development goals of providing shelter, infrastructure and employment. Such construction methods could involve the adoption of ABT products which are noted to be environmentally friendly and could therefore be significant in the realization of a healthy-environment and sustainable development.

It is however noted that these activities can at the same time be a major source of environmental damage through depletion of the natural resource base, degradation of fragile eco-zones, chemical pollution and the use of building materials harmful to human health. The objectives of promoting sustainable construction industry activities are, first, to adopt policies and technologies and to exchange information on them in order to enable the construction sector to meet human settlement development goals, and second, to enhance the employment-generation capacity of the construction sector (Agenda 21).

The principles of sustainable development are slowly being incorporated into the national development agenda, more so, within the built environment. As such, the Kenya Vision 2030 propagates for the establishment of Appropriate Building Materials and Technology (ABMTs) Centres at every constituency in Kenya.



Plate 1 & 2: Model Appropriate Building Materials and Technology Centre

2.4 Enabling Approach in Housing Delivery

United Nations Centre for Human Settlements (1991) observed that the right to adequate shelter is recognized universally and constitutes the basis for national obligations to meet shelter needs. The population estimates for Kenya provide shocking statistics bearing in mind the accompanying shelter requirement for all the segments of the population. The concept of Housing is quite dynamic and as such, it is classified both as a basic and a human right. As a basic right, housing comes third after food and clothing, and as human right, it's placed third after political and civil rights. According to the Council of Europe (2002) access to social rights forms a chain whereby, the declaration and framing of the right, the process through which it is to be realized, and the activities and resources necessary to realize it are all interconnected.

The Kenya Constitution (2010), provides for provision of adequate, affordable and reasonable standard of sanitation to her citizens. These requirements poses the biggest challenge ever to the actors in the housing sector as the government at the moment does not engage in direct production of houses but through partial engagement, provides enabling environment to public and private sector players to affordably invest in real estate and promote individual home-ownership initiatives (GoK, 2004). The enabling approaches were necessitated by the fact that the human settlements sector is a large consumer of national financial and natural resources and any increase in the production of shelter would increase pressure on visibly strained governmental resources. It asserted that the prevailing concept of planning and implementing shelter projects must give way to one of establishing sustainable shelter-delivery systems that can operate at required national scale.

The adoption of Global Strategy for Shelter formalized the shift of focus from project-by-project development to integrated efforts geared to ensuring the functioning of a responsive housing-delivery system congruent with the scale of the need. UN-HABITAT (1991) therefore provides that the Global Strategy focuses in the “enabling” approach thus facilitating and guiding the actions of all present and potential participants in the shelter-production and shelter-improvement process. This does not imply a reduction of government responsibility in the shelter sector but rather a reallocation of public activities and human, physical and financial resources.

2.5 Building Materials and Technologies as Used in Promoting National Shelter - Strategies

World over, significant number of Countries have embraced research and training for development of building materials (UNCHS, 1991). In the African Continent, Algeria has extensively undertaken surveys and assessment of raw materials and resources together with strengthening research and training activities for the development of local building materials and the construction workforce. In some parts of Asian the initiative include: setting up of the Building Materials and Technology Promotion Council by India at the national level in order to strengthen the technology transfer mechanism; strengthening the research capabilities of the Building and Housing Research Centre in Tehran for training in areas of small-scale cement production and improved lime production as well as the introduction of quality control measures in construction by the Islamic Republic of Iran.

The development of new construction techniques by the National Building Research Organization of Sri Lanka aimed at lowering construction costs by promoting greater use of previously underutilized building materials, and improvement of quality of traditional materials have been quite key in improving housing delivery processes. There are also initiatives that involve undertaking research and trial production of Natural-Fibre Concrete Roofing Sheets, using Jute Fibre, Coconut Fibre and Bagasse as an alternative to Clay-Tile production by the Viet Nam's Institute of Building Materials Research. Other initiatives include conducting survey on local materials as well as setting up the necessary building-materials laboratory facilities and provision of training to 40 engineers and technicians in quality control for wide use of local building materials in Yemen. In the Kenyan context, research on low cost building materials and construction techniques has been limited thus not providing viable guidance to the development of low cost housing in the sector (GoK, 2008).

2.6 Research and Development on Building Materials Technologies

Building materials and construction industry constitutes one of the most important sectors of any given economy. It forms the basic means for the implementation, expansion, improvement and maintenance of all civil engineering and human settlement projects (Omayi, 1993). The rapid advance of construction methods, the increasing introduction of mechanical tools and plants, and changes in the organization of the building industry may appreciably influence the choice of materials (Duggal, 1998). From ancient times, housing sector has witnessed the application of both the conventional and appropriate building materials.

The conventional building materials are those which satisfy the material specifications in the Building Code. These include: concrete (massive concrete or reinforced concrete, concrete blocks, concrete tiles for roofing and floors); stone (conventionality or appropriateness depends on mode of production, that is, if capital intensive and employs a lot of heavy machinery, it is regarded as conventional); sawn or processed timber; plastics; burnt clay bricks (classified both as appropriate or conventional depending on mode of production, that is, factory produced bricks are conventional building materials); and galvanized corrugated iron sheets – gci(Omayi, 1993). Some of these conventional building materials are as depicted in plates 3 and 4.



Plate3: Quarry Stone



Plate4: Burnt Brick

On the other hand, appropriate building materials are based on local resources and take into account the prevailing climatic, economic and socio-cultural conditions. They are climatically adaptable, socially acceptable and relatively cheaper to produce as well as contribute to the realization of affordable housing to the majority of those in need (Syagga, 1993). They include; Stabilized Soil Blocks (SSBs), Fibre Concrete Roofing Tiles (FCR), Ferrocement or Mortarmesh, Natural Stone, Grasses or leaves (Makuti), Pozzolanas, Sulphur Concrete, Sun dried or Adobe Blocks and Rammed Earth (Omayi, 1993). An example is Plates 5 & 6 depicts an example of appropriate building material that is applicable to wall masonry in Kenya.



Plate 5 & 6: Standard Hydraform Block (Sample of Interlocking Stabilised Soil Block)

2.7 Global Overview of Appropriate Building Materials and Technologies Promotion

Appropriate Building Technologies utilization within the building industry has increased in global scale, more so, in the developing countries. It is imperative to note that strengthening local small-scale industries in the building – materials sector is being actively undertaken in many countries. For instance, in the Asian Sub-Continent of India, it is being increasingly felt by governmental agencies and nongovernmental organizations (NGOs) that technological diffusion may be one of the solutions to the housing problem (<http://www.bmtpc.org>, 2013). This concept of technological diffusion seeks to reduce the cost of dwelling units to the minimum so that it matches the affordability of the people in the low-income group and is achieved by developing and disseminating more cost-effective, technological alternatives for building houses through building centres. Through partnership with Bureau of Indian Standards (BIS), BMTPC developed standards covering use of about 22 proven technologies. It is

further noted that the state agencies have confidence in the use of the cost-effective technologies and as such, the Delhi Industrial Development Corporation used the technologies in the delivery process of targeted 3160 houses for Industrial Workers at Bawana (<http://mhupa.gov.in/ministry/associates/>, 2013).

Some instances of technological diffusion include the practice in Afghanistan which undertook projects to improve the output of traditional building materials, improve affordable water proofing of traditional roofs, disseminate building techniques and prepare a number of pilot low-cost housing proposals for different locations. In the East Africa region, Tanzania has set up the Building Materials Production Supply Centre at Nkuhangu East with appropriate equipment to produce walling and roofing materials for a project involving several hundred low-cost housing units (<http://www.unhabitat.org/content.asp>, 2013).

2.8 Building Standards and Regulations

The biggest challenge facing the wide spread use of low-cost construction technologies in a modern economy today is primarily not sustainability but compliance with current norms in building standards and their ability to provide what we have come to currently socially characterize as reasonable shelter and comfort (Kuchena and Ushiri, 2009). In the European Zone, Eurocodes establish standards for the design of structures across the European Union. So far, by 1997, Eurocodes 1 to 5, 7 and 8 including concrete, steel, composite and timber had been published, while the others were in preparation (Lyons, 1997). To date, the European Standards have been incorporated alongside the former British Standards and comparisons are made to update readers familiar with the earlier data and terminology such as ‘stress grading’ for timber become ‘strength grading’; ‘sulphate-resisting’ becomes ‘sulphate-resisting for cement; and grade 43A steel is now designated as S 275 (Lyons, 1997). In Kenya, the building and construction sector faces the problem of outdated legal and regulatory framework, unco-ordinated policy implementation, low private sector participation, insufficient capacity, poor governance, and inadequate financing to buyers and developers (GoK, 2008). More fundamentally, the Government of Kenya has moved in to arrest the situation by establishing National Construction Authority to regulate the construction sector activities (GoK, 2012). Further, sanity is expected to prevail within the built environment when a number of proposed legislations and regulatory measures are enacted and compliance by the same realized. These include; Draft Built Environment Bill 2011, Draft Housing Bill 2012, Draft National Building Maintenance Policy, revised National Housing Policy among other measures.

2.9 Emergence of BRICS Economic Block and Role in Appropriate Building Technology Development

The acronym BRICS refers to the concept of a rising new block on the planet encompassing countries from across continents (Brazil, Russia, India, China and South Africa). The first BRIC Summit was held in the year 2009 and South Africa joined the grouping in the year 2010 (Wikipedia, 2013). The main focus for the BRICS formation was on means of improving the global economic situation and reforming financial institutions. Further, it aims at finding ways that the countries could better cooperate in the future as well as ways to become more involved in global affairs. According to Escobar (2012), the BRICS countries are expected to account for almost 40 per cent of global gross domestic product (GDP) by 2050. Haub (2012), considers BRICs (Brazil, Russia, India and China) as countries at the same stage of economic development, but not yet at the point where they would be considered more developed countries.

In the year 2010, combined Gross National Income (GNI) of the BRICs was USD 10.5 billion comprising about 25 per cent of GNI of high-income countries and in the 2009, it comprised about 15 per cent of the World total. Some selected indicators for Brazil, Russia, India and China are as provided in the table2.1.

Indicator	Brazil	Russia	India	China
Population Mid-2011 (Millions)	197	143	1,241	1,346
Population 2050 (Millions)	223	126	1,692	1,313
Per cent of Population < age 15	25	15	33	17
Total fertility rate	1.9	1.6	2.6	1.5
Per cent of Population living < USD 2 / day	10	1	76	36
2010 GNI (billions)	\$1,830	\$1,4040	\$1,554	\$5,721
2010 World rank for GNI	8	12	11	3
2010 GNI per Capita	\$9,390	\$9,910	\$1,340	\$4,260
GNI growth rate (%), 2009-2010	15.8	6.3	10.1	17.1

Table 2.1: Selected indicators for BRIC Countries; Haub, 2012

Most of the countries in the BRICS formation have been actively involved in the Promotion of Appropriate Building Materials and Technologies in their strategies for affordable housing delivery to the majority poor segments of their population, more particularly, Brazil, India and South Africa. With the envisaged economy power propelled by the close ties forged in the BRICS formation of the

economic block, the desired level of resources are expected to be available for the promotion of ABTs and sustainable building development. The success of such initiatives could provide good insights for replication in the East Africa Community setting.

As such, by setting up the regional Appropriate Building Material and Technology Centre, Kenya could be in a better position to take lead in the field of technology promotion that would further accelerate the rapid growth in the construction industry as witnessed in recent times, more so, within the real estate sector.

2.10 Approaches in Dissemination of Appropriate Building Technologies in Kenya

Institutions have carried out research into the production of alternative materials and through pilot projects have been trying to disseminate appropriate building technology throughout the country. The demonstration projects aim at introducing appropriate materials into the community which is then expected to replicate the projects by continuing to produce these appropriate materials for use in similar projects or for sale to other people wishing to use these materials (Omayi, 1993).

The players in the ABMTs promotion in Kenya have mainly been in three categories namely; Government, Research Institutions and the Private Sector. The roles played by each of these three categories of technology promoters are reviewed below:

2.11 Performance of Government of Kenya's Institutions in ABMTs Promotion

According to Sangori (2012), Government of Kenya through the 1984/88 National Development Plan, formulated several housing policies and objectives which included; formulation and adopting of realistic and performance oriented building standards, especially in the area of low-cost housing; promote self-help in housing construction both in urban and rural areas so as to increase housing stock at a reduced construction technologies. In the 1980s, there existed a technical co-operation for research and development project implementation between the Government of the Federal Republic of Germany and the Government of the Republic of Kenya.

The ABMT projects were implemented by the Housing and Building Research Institute (HABRI), University of Nairobi (previously called Housing Research Development Unit, HRDU) with support from the Division of Environmental and Resource Protection and Dissemination of Appropriate Technology (GATE) of GTZ between (1984 – 1994) together with short-term expertise assistance from

the Institute for Tropical Building (IFT), Germany (GTZ/GATE, 1996). During project implementation, various phases emerged notably; the academic research, collaborations (HABRI and COTU), as well as the technical aspects and social aspects of housing. The place and future of Appropriate Building Technologies sounded bright and was projected to provide a sigh of relieve in light of the numerous challenges that faced the housing sector and construction industry in general.

The Government Institutions that are key in the ABMTs development and promotion in Kenya include; the then Ministries of Housing; Local Government and Local Authorities; Public Works; National Housing Corporation; Planning, National Development and Vision 2030; and Kenya Bureau of Standards (Kebs). At the onset of technology promotion, the Department of Housing supported ABMTs initiatives in Kenya by leveraging some facilitation token to HRDU for research endeavours. In addition the participation of public works department in conjunction with Kebs resulted in the approval of standards for Stabilized Soil Blocks (SSBs) and Fibre Concrete Roofing (FCR) Tiles in the year 1993, more particularly KS1027 on soil stabilization.

According to Vision 2030, first medium term plan (MTP) propagates the establishment of Appropriate Building Materials and Technology (ABMTs) Centres at the Constituency level across the country in a progressive manner by the year 2030 for purposes of accelerating research and development on appropriate materials and technologies for use by local communities. Plates 7, 8, 9, 10, 11, and 12 depicts buildings constructed with Interlocking Stabilized Soil Blocks in Kenya.



Plate7: Material Preparation for ISSBs production

The action depicted in plate 7 demonstrates the Hydraform Block production process. It involves material mixing- a process that is preceded by taking suitable ratios of both raw materials (soil and sand) as well as stabilizers (cement). There are two types of mixes namely; dry mix and wet mix. In dry mixing, material ratios are first mixed 2 to 3 times to achieve a uniform mix. This is then followed by wet mixing whereby water is added to give the moisture content required for cement and any other stabilizer used to gain the desired strength (Hydraform Manual, 2009).



Plate8: ISSBs production in progress

The action depicted in plate 8 above demonstrates Hydraform machine operation and block handling processes. Once the material mix is ready, a 10 litre bucket is used to load the ready mix into the block production chamber through the soil hopper. After loading the mixture, the operator by operating the gear levers lowers the top Ram followed by lifting of the bottom Ram in order to compact the loaded material mix. The compaction strength is achieved through the preset standard pressure. Once the compaction is completed, the block is taken out of the machine for stacking at the block yard in readiness for curing.



Plate9: ISSBs laying yard

Block curing is a very important component in achieving desired quality blocks. Plate 9 depicts the block yard where block laying is done once production is completed. It is worth noting that to maintain good quality blocks upon production process, the block laying ground must be well leveled to avoid blocks falling off and breaking while still wet. The other important aspect of curing involves covering the blocks with black polythene paper to avoid rapid moisture loss. This is done for about 14 days, a period within which the blocks are also watered to allow cement gain the required strength as well as to make the blocks to be strong and of good quality.



Plate10: Curing of ISSBs at the yard

During block production, water ingredient is very useful in attaining high quality blocks. As such, plate 10 depicts the curing process by watering the blocks. It is recommended that watering be done twice daily (early in the morning and late in the evening) when temperatures are cool. Proper watering supervision should be carried out to ensure that watering is well distributed across and along the block layers. This should also be to ensure that both the top and bottom stacked blocks receives adequate water for proper curing.



Plate11: ISSBs constructed police post

The photo presented in plate 11 above demonstrated the flexibility in the use of Interlocking Stabilized Soil Blocks. The structure presented above is a police post with the section of strong room and criminal cell constructed in quarry stone while other rooms / and or offices are built with Interlocking Blocks.



Plate12: ISSBs low cost housing development in progress

The development presented in plate 12 shows low cost housing units comprising single self-contained rooms with walls constructed in Interlocking blocks. It should be noted that the technology processes need to be well managed in order to realize the saving on building cost which may be upto 50 % (Hydraform Ltd, 2009).

2.12 Performance of Research Institutions in ABMTs Promotion in Kenya

Research and Development undertakings play a key role in ABMTs promotion and adoption in any given environment. In Kenya, research initiatives were championed by Housing and Building Research Institute (HABRI), formerly HRDU, established in the year 1966/67 in the Department of Architecture-Faculty of Architecture, Design and Development (ADD), University of Nairobi, with the aim to

undertake research on various aspects of low cost housing and community planning in both rural and urban areas (GTZ/GATE, 1996).

According to GTZ/GATE (1996) report, the objectives of HABRI was to: explore social, technical and economic problems of housing and community planning and help establish appropriate policy guidelines; build a body of knowledge, in preparation for advanced research and training in the fields of urban management and building science; produce prototype designs, test building systems and assist in the construction of experimental housing projects, including community facilities, in co-operation with public or semi-public bodies; participate in the teaching of subjects concerned with housing, building science, planning and urban management, at the University; and disseminate information to the public and researches on various aspects in which the Institute has the competence.

It is imperative also to explore the role that other institutions and agencies play in research and development activities as well as promotion of Appropriate Materials utilization mainly; Kenyatta University (Appropriate Technology Centre), Egerton University (Home Economics Department), National Council of Science and Technology (NCST), UN-HABITAT, and GTZ/GATE among others.

2.13 Private Sector and Non-Governmental Organizations

The promotion of ABMTs in Kenya over the years, have been supported by both private sector and NGOs at various levels. The key Non-Governmental Organizations that were associated with HABRI project phase's implementation included; Intermediate Technology Development Group (ITDG-Kenya), Action Aid/Kenya, Undugu Society, Mazingira Institute, National Christian Council of Kenya (NCCCK), Appropriate Technologies for Enterprise Creation (ApproTEC), Makiga Engineering Ltd, Shelter Forum, and National Co-operative Housing Union (NACHU) among others (GTZ/GATE, 1996). On the International front, collaborators included; African Housing Fund (AHF), Building Advisory Service and Information Network (BASIN), Building Research Establishment (BRE) UK, Shelter Afrique, United Nations Centre for Human Settlements (UNCHS), United States Agency for International Development (USAID).

The Ministry in charge of housing was hands-off during the HABRI projects implementation making the research institutions and the private sector players to be in the lead at that point in time. The paradox however, is that, the technology promotion became dormant after the lapse of the HABRI project funding phase by GTZ in 1994. This dormancy existed till the period the Ministry of Housing took

charge and upon the introduction of Hydraform-Interlocking Stabilized Soil Blocks (ISSBs) for adoption in Kenya under the Appropriate Building Technologies Programme in the year 2006 as informed by the provision of Sessional Paper No. 3 of 2004 on National Housing Policy providing for research and development on affordable and appropriate building technologies which are environmentally friendly.

2.14 Conceptual Model

The concept of ABMTs development and promotion has existed for over four decades with the success depended on the strategies adapted in the development and dissemination processes. It is observed that effective implementation of ABMTs programme calls for close collaboration among main actors, more so, the government, research institutions and the private sector players. The collaboration could be enhanced as manifested in the relationship in diagram 2.1, eventually resulting in the development and dissemination of ABMTs, thereby leading to increased technology adoption and shelter provision.

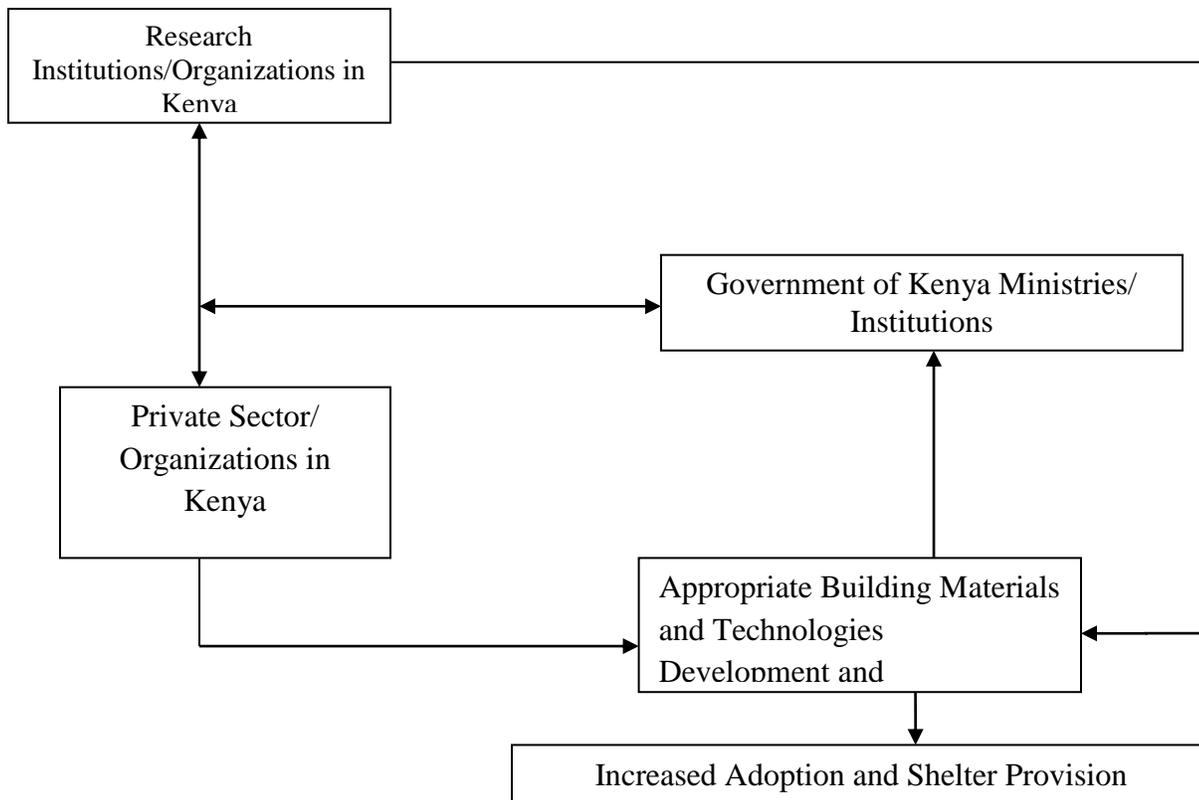


Diagram 2.1: Conceptual Model; Researcher, 2013

In the model outlined in diagram 2.1, the independent actors include the Government, Private Sector and the Research institutions. The dependent variable in the model above is represented by the research, development and dissemination centers from where information is provided to the technology beneficiaries as final users.

The actors in the Appropriate Building Materials and Technology involved in conceiving the research component comprises the independent variable group. To unlock the existing bottlenecks that hinder realization of affordable housing by majority of Kenyans, they closely collaborate and form partnership for the success of the technology promotion and adoption.

The model further present a clear picture that demonstrates the interrelationships necessary towards achieving increased ABMT adoption and resultant shelter provision as expected outcome. In this instance, research institutions or organizations play a key role in the building materials needs assessment and appropriate technology development. Subsequently, the Government and its Agencies as well as the private sector can then play an important role by taking up the recommended technology development processes through various resources mobilization including; funding, capacity building and dissemination.

At the institutional level, each actor (research institutions, government organizations or private sector) can solely contribute to the development and promotion of Appropriate Building Materials and Technologies. This however, significantly depends on the prevailing institutional capacities and whether the strategies adopted in the technologies development and promotion are effective.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The methodology employed in this study commenced with outlining the problem of the research, description of the study process including the hypotheses of the study. It also involved adequate literature review to identify the existing gap that justified the study.

The study focused on the ABMTs promotional activities undertaken by the Government, Research Institutions and Private Sector Players.

3.2 Study Area

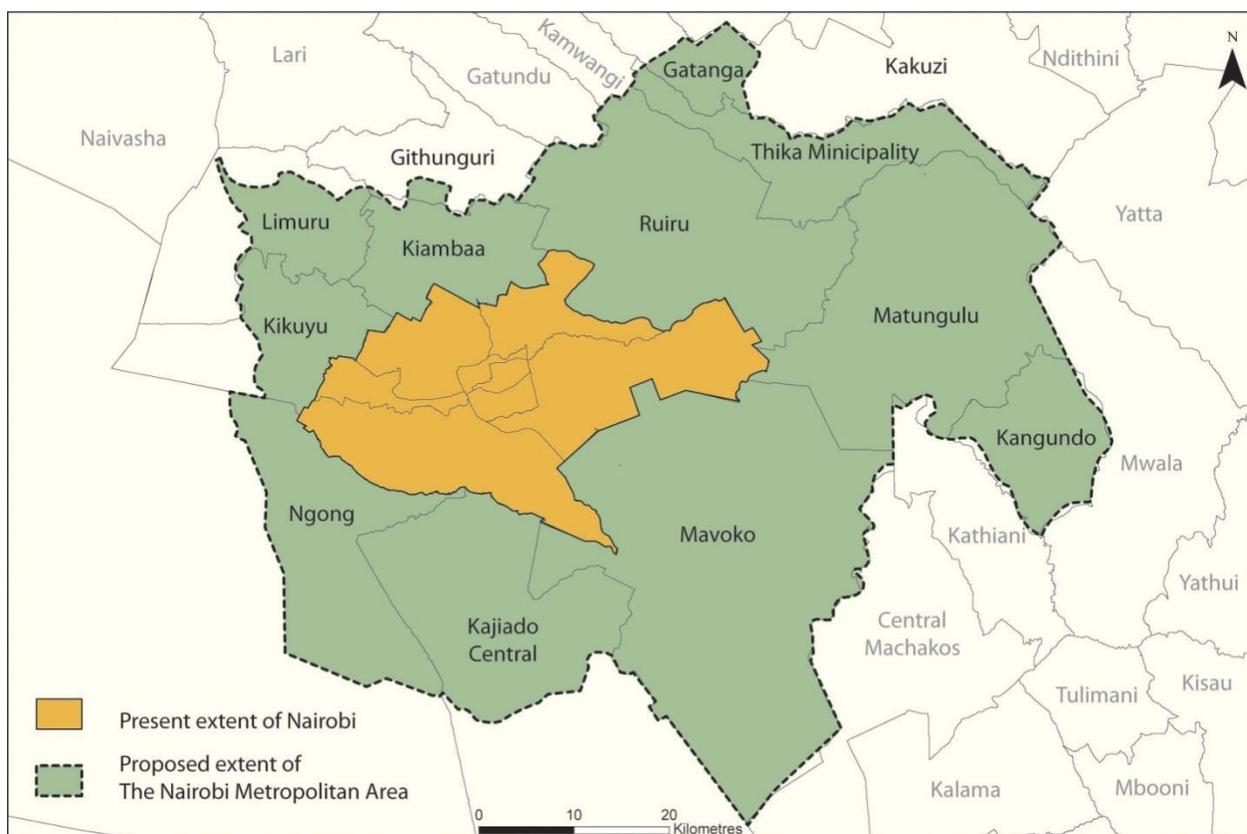
The study was done within Nairobi Metropolitan area and Nyamira County having been identified through purposive sampling. The Metropolitan area (Nairobi) was ideal for the study as it host headquarters of institutions that have been involved in ABMTs development and promotion hence presented perfect chance to interview the Key Informants. On the other hand, Nyamira County was selected for the study for purposes of convenience in interviewing Trainee Beneficiaries at the On-Site training locations where community trainings had been conducted by the Ministry of Lands, Housing and Urban Development under the Appropriate Building Materials and Technology Programme. The sites in were ideal for the study Nyamira because the researcher was at the time of the project research working within Nyamira County and this made the research to be completed as scheduled given the savings on both time and available meager resources. The sampled institutions that have been involved in ABMTs promotion and dissemination within Nairobi Metropolitan were visited in their physical presence areas to capture key informant data. In addition, the data collection within Nyamira County involved interviews with Trainee beneficiaries at the on-site training areas that have been conducted by the Department of Housing in the recent past, more so, with regard to Interlocking Stabilized Soil Blocks (ISSBs) promotional activities. The choice of the two locations made interaction and data collection process much more feasible, easier and effective.

3.2.1 Description of the Study Area

The two areas that were earmarked for this study are as described below.

3.2.1.1 Description of Nairobi Metropolitan Area

Nairobi possesses a rich history in terms of its growth both in population and accompanying socio-economic development in which housing has been a major factor. Founded in 1899 as a railway depot on the railway line linking Mombasa to Uganda, it had a rapid growth to become the Capital of Imperial British East Africa in 1907 and later became the Capital City of the newly independent Republic of Kenya in 1963 (Kilonzo, 2012). The Nairobi Metropolitan region is divided into four sub regions and the city of Nairobi forms the core centre to this region in terms of, provision of goods and services, employment opportunities and a market of the goods from the rest of the region. On the other hand, the surrounding areas serve largely as dormitory corridors for the population working in the Nairobi City.



Map 3.1: Nairobi Metropolitan; Google (Accessed on 23/05/2013)

3.2.1.2 Population and Coverage of the Study Area

Currently, Nairobi is the 13th largest City in Africa in terms of population. This growth is remarkable given that there were only 8,000 people living in the year 1901 and as at 1948, the population increased

to 118,000. Further to this, the population increased to 343,500 in 1962, and by 2009, the population overwhelmingly shot to about 3.1 million people (Kilili, 2012).

The Nairobi Metropolitan comprises of four regions which cover approximately 32000 square kilometres as indicated in table 2.

S/NO	REGION	AREA COVERAGE
1.	Core Metro	City of Nairobi (684 square kilometres)
2.	Northern Metro	Municipal councils of Kiambu, Limuru, Ruiru, Thika, and Karuri, the Town councils of Kikuyu and the County Council of Kiambu;
3.	Southern Metro	Town Council of Kajiado and the County Council of Olkejuado;
4.	Eastern Metro	Town Council of Kangundo/ Tala, the Municipal Councils of Machakos and Mavoko and the County of Masaku

Table 3.1: Nairobi Metropolitan Regions; modified from Kilili (2012)

While states are defined by geographic and political boundaries, Metro areas are shaped by economic activity, sometimes across states and national borders. As such, Nairobi is characterized by a single major employment centre composed of the central commercial area (CBD) and adjacent industrial area which together hold a majority of the city employees. Beyond the CBD, several distinct residential areas are located; to the North and west are predominantly low density and high income areas; to the south and east they comprise areas of high density accommodating middle and low income households ranging from the relatively prosperous Nairobi South area to the more modest Neighbourhoods of Eastlands and Umoja. Further to this, a substantial part of the population reside in high density clusters of low income housing in Dagoretti, Riruta and adjoining low income neighbourhoods.

3.2.1.3 Population and Housing within the Study Area

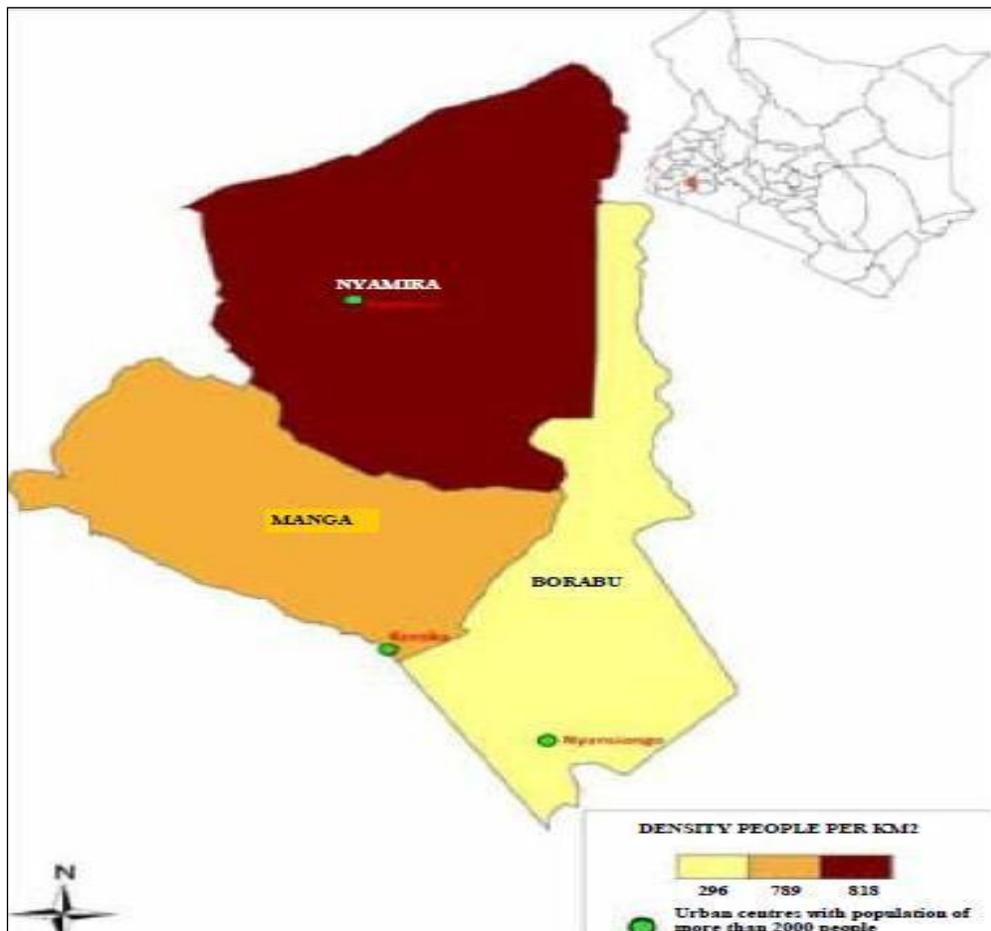
The high population growth coupled with increased coverage of the Metro areas is bound to increase the demand for housing services with large areas witnessing competition between investment in housing provision and other sectors of the economy. This fact has been witnessed before especially in areas such as Kiambu County which was predominantly an agricultural area but at present experiencing influx of both posh homes as well as gated residential areas that threatens the survival of the Coffee and tea production in such areas. In addition to this, the areas around Kitengela and Ngong regions has also witnessed high concentration of people which at times settles around the migratory corridors of wild Fauna thus aggravating the wildlife-human conflict especially, while extracting forest products to facilitate provision of homes. Further, most of the population within the Metropolitan area comprises of

poor households who mostly occupies precarious areas and utilizes temporary materials which are susceptible to fire and flooding in such areas thereby increasing their vulnerability to hazardous effects.

3.2.2 Description of Nyamira County

3.2.2.1 Population and Coverage of Nyamira County

The County has a population of approximately 598,252 persons which is composed of about 48% males and 52% female. The area population density is estimated at 665 persons per Km². The County Covers an area of about 899.3Km² and comprises of four political units namely; Kitutu Masaba, West Mugirango, North Mugirango and Borabu Constituencies. In addition, it borders a number of other Counties notably; Bomet to the East, Narok to the South, Kiii to the West, Homa Bay to the North, and Kericho to the North East. Map 2 shows the outlay of Nyamira County.



Map 3.2: Nyamira County; Google (Accessed 03/06/2013)

3.2.2.2 Housing and Building Materials within Nyamira County

The high population that characterizes the study area requires fairly high number of decent housing. At present, the numbers of households are noted to stand at approximately 131,039 households. The predominant walling material exhibited in the area is that of burnt bricks which in turn could pose dangers to environmental sustainability given the processes involved in their manufacture, as large amount of wood fuel is consumed by the firing kilns. Plate 13&14 depicts burnt bricks ready for dispatch.



Plate 13 & 14: Burnt Bricks ready for distribution at Sironga Area along Kisii-Nyamira Road

3.3 Study Design

The study used both qualitative and quantitative techniques. The primary and secondary data were collected with coverage of government, research institutions and private sector past and present initiatives. The three areas of focus formed clusters for which the study was based. The study attempted to evaluate the performance of the various institutions involved in the promotion of appropriate building technologies in Kenya.

3.4 Sampling Design

3.4.1 Target Population

The target population for the study involved past / or present initiatives that the institutions selected for the study have undertaken. During the study, each of the three designated study clusters were further represented by one institution selected by way of purposive sampling technique and data collected on

the same. In this case, government was represented by Ministry of Housing, whereas, research institutions represented by University of Nairobi (HABRI) with the private sector being represented by Makiga engineering ltd. The on-site trainings conducted by the Department of Housing within Nyamira County were visited and the trainees involved formed the target population for ABMTs programme beneficiaries interviews.

3.4.2 Types of Data

This study used both Primary and Secondary data. The primary data involved data collection from policy makers, researchers, project implementers, trainers, trainees and beneficiaries.

The Secondary data necessary for this project was acquired from organizations documentation centres, institutional publications, Government Sources, UN-HABITAT, Research Institutions, research papers and various internet locations.

3.5 Data collection Design

3.5.1 Sampling Frame

The sample frame for this study was made by the three clusters involving the Government, Research Institutions and the Private Sector. Out of the three clusters, one institution was selected from each to attain unbiased representation for the key informant interviews. On the other hand, all trainees list from four on-site training areas were included in the frame for the training beneficiaries interviews from where the representative sample were drawn.

3.5.2 Sample Procedure

The procedure used in this study involved visiting the selected institutions/organizations in Nairobi that had been involved in ABMT programmes as well as visiting on-site training sites for the Appropriate Building Materials and Technologies in Nyamira County.

3.5.2.1 Sample size for Key Informant Interviews

For key informant interviews, 3 institutions were selected purposively for this research.

Cluster	Institution	Sample size	Actual Sample Size	Response (%)
Government	Ministry of Housing	20	22	100
Research Institutions	University of Nairobi	10	6	60
Private Sector	Makiga Engineering Ltd	5	2	40
		35	30	85.7

Table 3.2: Institutional Sample Size Representation, Researcher 2013

In total thirty five key informants were incorporated in the study for ease of convenience and reliability. However, during the data collection, the actual respondents were 30 in number. The participants representing these institutions/organizations were procedurally selected by way of:-

- a) Visiting the sampled institutions
- b) Through referencing, seek contacts of institution/organization members with knowledge of ABMTs as apportioned in table 3 above with a view to administering questionnaires/conducting interviews.

3.5.2.2 Sample Size for Trainee Beneficiaries Respondents

A reconnaissance visit was conducted to the ABT on-site training sites within Nyamira County to establish the number of trainees with a view to coming up with a proportionate sample size for the respondents to be incorporated in this study. In total, four on-site training locations were visited. The procedure involved included:-

- a) Visiting ABT documentation centre at the County
- b) Seeking information on all the training/demonstration sites
- c) Extracting a list of all trainees
- d) Calculating sample size for trainee beneficiaries within the County
- e) Random selection of sample size elements was used.
- f) Interviews were conducted for the sampled trainee beneficiaries

3.5.2.3 Sample Size Calculation for Trainee Beneficiaries Interview

A population of 80 trainees was used to get the sample size for trainee beneficiaries who were later involved in the interview process. The sampling procedure assumed a 95% confidence level and the corresponding response were within $\pm 5\%$. In the works of Chava et. al.(1996), the sample size formula is given as:-

$$n = \frac{Z^2 P. q. N}{e^2(N - 1) + Z^2 P. q}$$

Where;

N = Population Size

n = Sample Size

P = Sample Proportion

q = 1-P

e = Acceptable error level at 0.05

Z = Standard variate value = 1.96

$$n = \frac{1.96^2 \cdot 0.95(1-0.95) \cdot 80}{0.05^2(80-1) + 1.96^2 \cdot 0.95 \cdot (1-0.95)}$$

n = 66

In this study, out of the 66 respondents targeted, the actual responses received were from 57 respondents. This resulted to a response rate of 86.36 % of the sample respondents.

3.5.2.4 Sample Size Elements Selection Procedure

To draw the sample elements to be administered to the questionnaire in this study, the following procedure was adopted.

- a) Gathering of all trainees at a central place within each of the training sites

- b) By way of numbering
- c) Subjecting the trainees to random picking of the numbers
- d) Trainees with the first seventeen numbers (1-17) formed part of the sample elements

3.5.3 Data Collection

Data collection was conducted by the researcher with the assistance of two Research Assistants through interviews, photography, and personal observations. The data collection process incorporated the facets of the outlined procedures above.

3.5.4 Data collection Equipment

The equipment for data collection and analysis that will be adopted in the course of conducting this research will include:

Field Note Books

The use of field note books was very instrumental as the respondents' relayed vital information during the oral interviews. These were effectively captured by noting the necessary comments which could not be placed within the questionnaire.

Digital Cameras for Photography Work

The research exercise was aided by the application of photography to capture the Appropriate Building Technology Trainings and demonstration. The pictorial images of various building materials were also taken during the field research for purposes of use in this research.

Questionnaires

The study adopted the use of both closed and open-ended questionnaire. These were formulated in a simple manner for ease of analysis with a focus to addressing the stated hypotheses. In total, two sets of questionnaires were used in the study which involved the ABMTs trainee beneficiaries and Key Informants.

3.6 Data Presentation and Analysis

Data analysis was carried out using statistical tools and/or techniques. The general statements relied on descriptive statistics as informed by the collected data. The analysis and presentation process was aided by statistical tools including; SPSS, Excel platform, and windows word program.

Data presentation has further been done by application of graphical presentations (pie charts and bar graphs), photograph images as well as tabular representations.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSIONS

4.1 Introduction

This chapter sets out to present data and discusses the findings of the study as revealed by the content of the respondents' data. As highlighted in earlier chapters, the study was based on the evaluation of performance of Appropriate Building Materials and Technology Promotion in Kenya. In an attempt to address the research theme, two sets of interviewees were involved namely; the key informant and trainee beneficiaries of the ABMTs programme within the study areas of Nairobi Metropolitan and Nyamira County respectively. This was done mainly through personal interviews, photography and observations of ABMTs processes and products.

The respondents' data and findings formed the basis of the presentation and discussions offered in this chapter.

4.2 Causes of Failures of Previous Attempts of Appropriate Building Technologies Promotion in Kenya

4.2.1 Response Rate

Respondents	Sample size	Response	Percentage Response (%)
Key Informant	35	30	85.72
Trainee Beneficiaries	66	57	86.36

Table 4.1: Response rate from administered questionnaires; Researcher, 2013

From the response rate above, the study recorded a fairly high response rate and this was adequate for the study. This stand is supported by Mugenda (2003), whose argument was that a response rate of 50% is quite adequate for instituting the analysis as well as reporting process. In addition, the 60 % response is a good response and the responses that stand at 70 % and above are very good. In this study, the categories of responses are all found to be at over 80 %, hence is quite appropriate for this study and in drawing the conclusions with desired level of confidence. The respondents' questionnaire distribution for the key informant were as provided in table 4.2

SN	Name of Institutions	Frequency	Percent
1	Makiga Engineering Services	2	6.7
3	Ministry of Housing	21	70.0
4	University of Nairobi	7	23.3
	Total	30	100.0

Table 4.2: Key Informant Questionnaire distribution per Institution

The key informant questionnaires were administered in three institutions namely: Department of Housing in the Ministry of Lands, Housing and Urban Development; School of Built Environment of the University of Nairobi; and Makiga Engineering Ltd. The percentage distribution of the responses by each institution were as provided in table 4.2

4.2.2 Gender

The distribution of respondents by gender is provided in chart 4.1

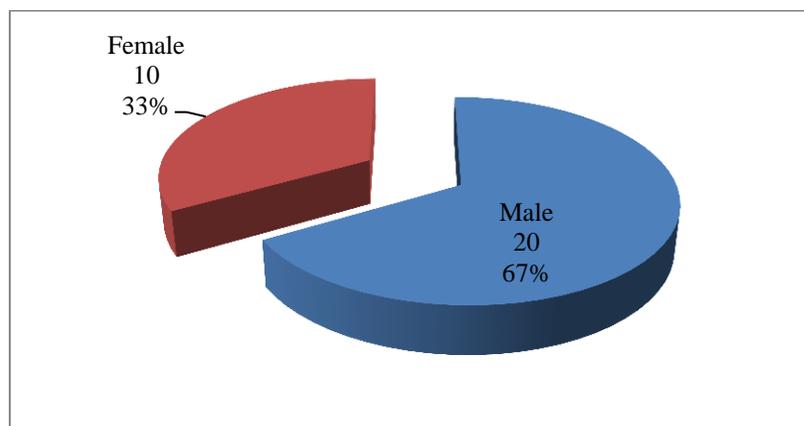


Chart 4.1: Pie Chart depicting Respondents' distribution by Gender

The resulting respondent rate by gender as depicted in chart 4.1 shows higher percentage of Masculinity involvement in the ABMTs related engagements at 67 per cent with about 33 per cent of Femininity involvement. It should be noted that for ownership and realization of faster promotion of the ABMTs in the housing delivery process in Kenya and at the global level, both genders should be equitably engaged at all technology development and promotion stages.

4.2.3 Age Cohorts

The distribution of the key informant respondents by age was as depicted in Chart 4.2

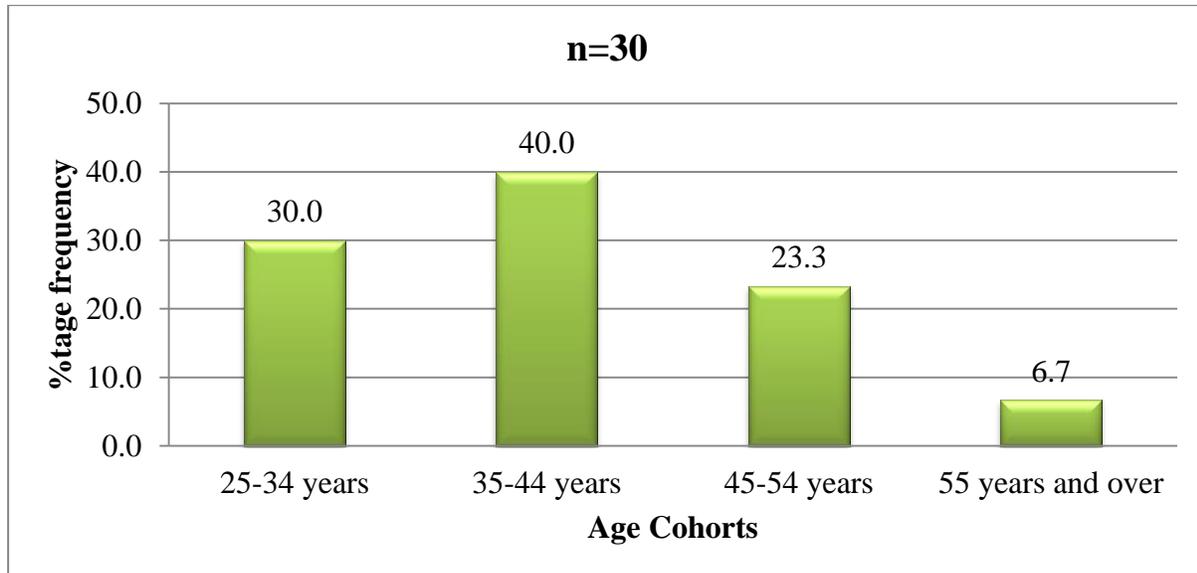


Chart 4.2: Graphical representation of respondents’ age distribution

Most of the Appropriate Building Materials and Technology application are labour intensive. For instance, the Interlocking Stabilized Soil Blocks manufacture 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 require the services of energetic individuals for maximum daily production to be realized. As depicted in Chart 4.2, the labourers below the age of 45 years who forms about 70 per cent are better placed to participate in the labour intensive block production

4.2.4: Material and Technologies in Use

The study revealed the existence of a number Appropriate Building Materials and technologies that have been used over times. Some of these materials are provided in table 4.3 and include; Interlocking Stabilized Soil Blocks, Stabilized Soil Blocks, Fibre Concrete Roofing Tiles, Micro-Concrete Roofing Tiles, Prefabricated Panels, Tevi Tiles among others.

It is noted that Stabilized soil blocks have been used mostly with response given at 73.3 %. This was followed by Interlocking Stabilized Soil Blocks at 40 %.

SN	Material/Technology	Frequency	Percent	Percent of cases
1	ISSBs	12	24.0	40.0
2	SSBs	22	44.0	73.3
3	FCRs	8	16.0	26.7
4	Micro-concrete roofing tiles	1	2.0	3.3
5	Prefabricated panels	3	6.0	10.0
6	Tevi tiles	4	8.0	13.3
	Total	50	100.0	166.7

Table 4.3: Appropriate Building Materials and Technologies (ABMTs); Researcher, 2013

On the other hand, the Trainee Beneficiary respondents provided identity of all the types of building materials that are in use within Nyamira County as indicated in table 4.4.

SN	Commonly used materials	Responses		Percent of Cases
		N	Percent	
1	Hydraform-ISSBs	11	6.9%	19.3%
2	Quarry Stone	37	23.1%	64.9%
3	Bricks	53	33.1%	93.0%
4	Concrete Blocks	20	12.5%	35.1%
5	Timber	20	12.5%	35.1%
6	Mud	18	11.3%	31.6%
7	Iron-Sheets/ Tins	1	.6%	1.8%
	Total	160	100.0%	280.7%

Table 4.4: Building Materials used in Nyamira County; Researcher, 2013

The response rate in table 4.4 shows that the use of Quarry Stones and Fired/Burnt Bricks are common in housing delivery in Nyamira County and this stood at 56.2 per cent. The acquisition of the two materials poses some harmful effects to the environment, more so, the burnt bricks, and ways should be devised to manufacture bricks in a sustainable way within the area. There should also be concerted efforts to sensitize the residents on the adoption of alternative building materials including the ISSBs and other forms of SSBs.

4.2.5: Sources of Equipment/Machines used in

The Majority of respondents interviewed had no knowledge of the sources of equipment used in the production of Appropriate building Materials and this stood at 63.3 per cent. On the other hand, about 26.7 per cent of the respondents indicated local design and assembly with another category at about 10 per cent indicating that they are being imported. This is depicted in table 4.5

SN	Source of Equipment	Frequency	Percent
1	Local design and assembly	8	26.7
2	Imported	3	10.0
3	Don't Know	19	63.3
	Total	30	100.0

Table 4.5: Sources of equipment used in ABMTs programme; Researcher, 2013

These responses reveal that Kenya as a Country has not taking the development and promotion of Appropriate Building Technologies with the seriousness it deserve. As such, the players in the ABMT development and promotion do not work in a coordinated manner, hence the need to have a structured way through which all the actors can operate for the benefits accruing from the ABMTs use to be realized by the deserving Kenyans. In addition, the Government should meaningfully support ABMT development initiatives and take lead role in the purchase of the equipments/machines from local industries/private sector for ease of access by the citizens at the Constituency ABMT Centres Countrywide.

4.2.6: Comparison of local use versus export of locally designed and assembled equipment

Majority of the respondents do not have knowledge of the market of the locally manufactured equipment. This was demonstrated by about 73 % of the respondents. Only 4 % indicated high level of local use while 23 % indicated low use locally as demonstrated in chart 4.3

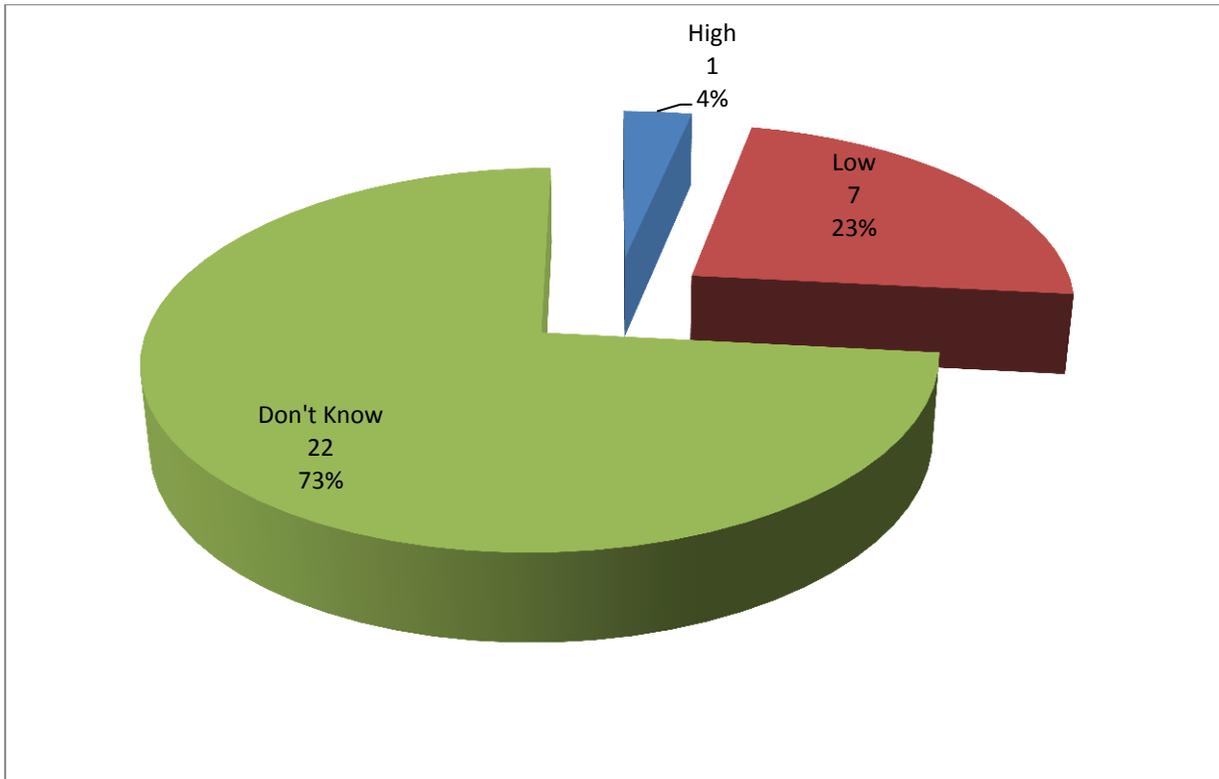


Chart 4.3: Use of Locally designed and assembled equipment

4.2.7: Reasons for low usage of locally assembled equipment

The respondents gave varied reasons for low level use or applications of locally designed and assembled equipment/machines for the construction industry. These reasons included:- labour intensive nature in the equipment use, low purchasing power by local residents, high costs involved making it expensive to hire or purchase the equipment as well as poor perception of soil products by locals

Other factors advanced for low embracing of local materials are: inadequate funds available for technology use, availability of superior machines (hydraulic machines) leading low preference for the locally manufactured manual / hand pressed machines, low public awareness on the availability of the equipment, and low level knowledge on legislation on use of ABMTs.



Plate 15: Manual Press; Malewa Trust, 2012

4.2.7: Export Destinations for Locally Manufactured Equipment

Some of the countries in the Africa Continent that imports ABT equipment produced in Kenya include; South Sudan, Rwanda, Zanzibar, Uganda, Zambia, Congo, and Tanzania among others. The local manufacturers of soil stabilization machines are notably, the Makiga Engineering Ltd based in Nairobi. The trend depicted in the sale of the technology promotion products from Kenya is worrisome and need redress with expected outcome leading to appreciation and ownership of such initiative by the Government and the players in the housing sector in Kenya.

4.2.8: Appropriate Building Materials and Technologies Trainings and demonstrations Across the Country

The responses from the field interview revealed a number of projects that the respondents have engaged in as they participate in the ABT trainings and demonstrations. Some of the projects that have been implemented and where respondents have interacted with the ABMTs dissemination and use across the Country include: ABT trainings in Eldoret, Nakuru, Starehe in Nairobi, Malava, Webuye, Mukuru in Nairobi, Siaya, Mbita, Kangemi, Komarock, Maseno, Garissa, Embu, Mombasa, Kisumu, Nyamira, Muranga, Maua, ; Establishment of constituency level appropriate materials and technology centres; Housing Expo and ASK Shows exhibition;

Others projects included; erecting Perimeter wall along the Nairobi show ground; Production of manual press machines; providing ABT projects in Nakuru and Laikia (schools, police posts, polytechnic etc); School construction in various counties; Training of various communities, individuals and groups on use of technology; and Turkana IDP resettlement project among others



Plate 16: Community Training on ISSBs production

4.2.9: Strategies/Methods Used in the Promotion and Dissemination of ABMTs in Kenya

The study revealed some of the strategies adopted in the promotion and dissemination stages of the ABTs. According to the responses and subsequent analysis, these strategies included among others:- advertisements; ASK shows exhibition; education and awareness creation; community and leaders Barazas; collaboration and partnership; community groups (CBOs, FBOs, self -help groups); community mobilization, demonstration and trainings; construction of ABMT training centers in each constituency; construction of demonstration units; display of institutional service charter; distribution of brochures; exhibitions and home expos; fliers and brochures; individual applications; and institutional linkage.

The technology promotion also adopted: application of research papers; involvement of youth polytechnics; issuance of machines at a free cost to serve as an incentive for increased use of the technology; office based information dissemination; production and distribution of Pamphletes on ABTs; Hydraform machines sourcing and distribution to local sites by the Government of Kenya; and website based information.



Plate 17: Established ABMT training Centre in Nakuru

4.2.10: Active Use of Stated Materials / Technologies

The study demonstrated that some of the stated materials are quite actively in use as was confirmed by about 63 per cent of the responses. This is further depicted in Chart 4.4

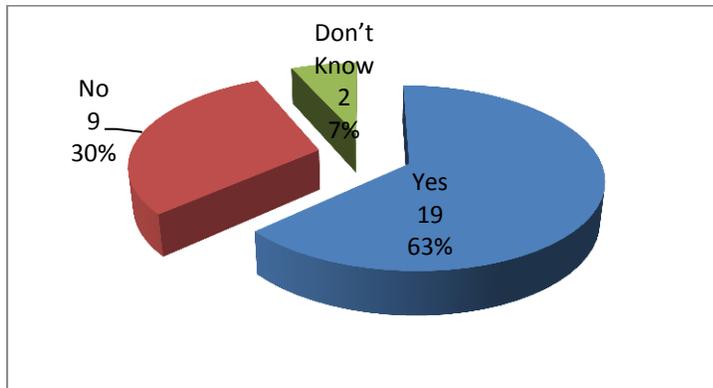


Chart 4.4: State of the ABMTs Use in Kenya

4.2.11: Reasons for Failures of Previous ABMTs Promotional Activities

The failures of previous attempts in the ABMTs promotion in Kenya by various institutions and other players within the Built Environment were varied. A summary of the same are summarized in table 4. 6

S N	Reasons	Frequency	Percent	Percent of cases
1	Inadequate funding	1	5.6	12.5
2	Inadequate personnel	3	16.7	37.5
3	Negative cultural perception	7	38.9	87.5
4	Inappropriate dissemination	1	5.6	12.5
5	Ineffective legislations on use of appropriate technologies	1	5.6	12.5
6	Lack of technology development	1	5.6	12.5
7	lack of enough government support	1	5.6	12.5
8	Lack of interest	1	5.6	12.5
9	Lack of interest by policy makers and implementers	1	5.6	12.5
10	Low pick up of technology use phases	1	5.6	12.5
	Total	18	100.0	225

Table 4.6: Reasons for Past ABMTs promotion failures

The result provided in table 4.6 demonstrates that an overwhelming majority of the respondents concurred that the efforts of ABMT use are being slowed down due to negative cultural perception, a situation that was supported by 87.5 per cent. This was followed by issues of inadequate personnel at 37.5 per cent. With no or few number of trained personnel, the new building technology dissemination and adoption cannot be propelled forward at the desirable rate thereby affecting the service delivery to the deserving Kenyans.

The other factors recorded as per the percentage given in the table above included; inadequate funding, inappropriate dissemination methods, ineffective legislations on use of appropriate technologies, lack of technology development, inadequate Government support, lack of interest by intended users, lack of interest by policy makers and implementers, as well as low pick up of technology use phases.

4.2.12: Adequacy of Institutional Capacities

The respondent data analysis revealed that about 57 per cent of the respondents concurred that there exist inadequate institutional capacity in Kenya to effectively propel the ABMTs initiatives forward. This is depicted in chart 4.5

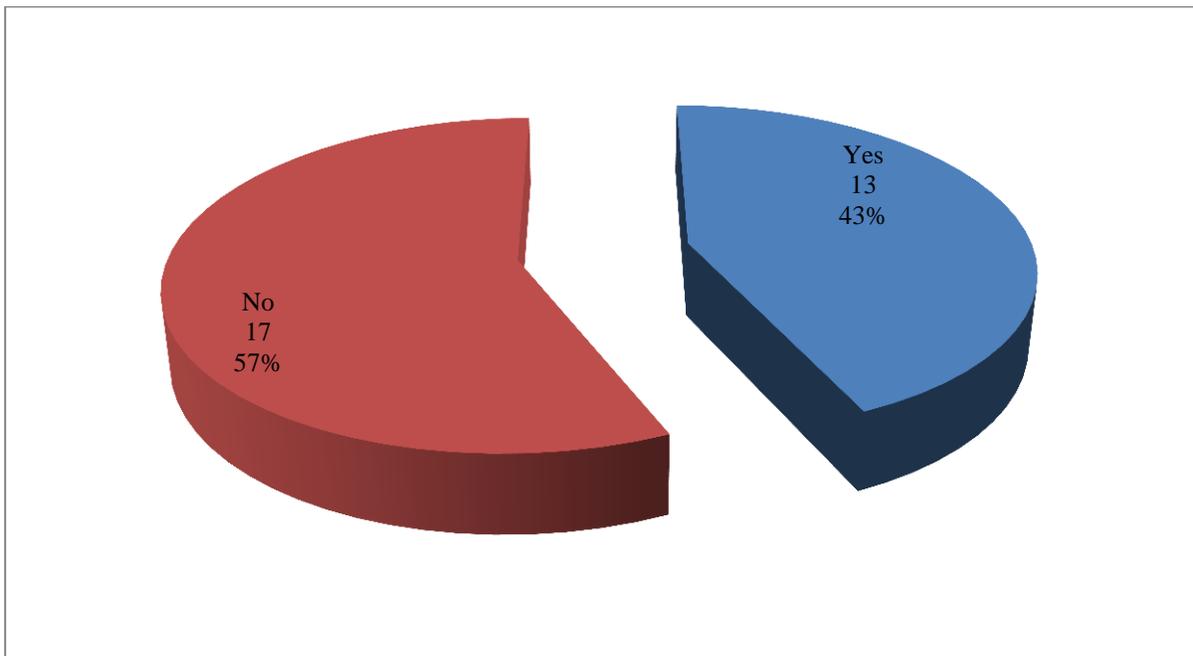


Chart 4.5: Response on existence of Adequate Capacity in ABMTs promotion in Kenya

4.2.13: Effectiveness of Strategies Used in ABMTs Promotion in Kenya

Concerning whether the strategies being used in the promotion of ABMTs in Kenya are effective or not, 53 per cent of the respondents indicated that the strategies are ineffective with 47 per cent concurring. This is well elaborated in chart 4.6

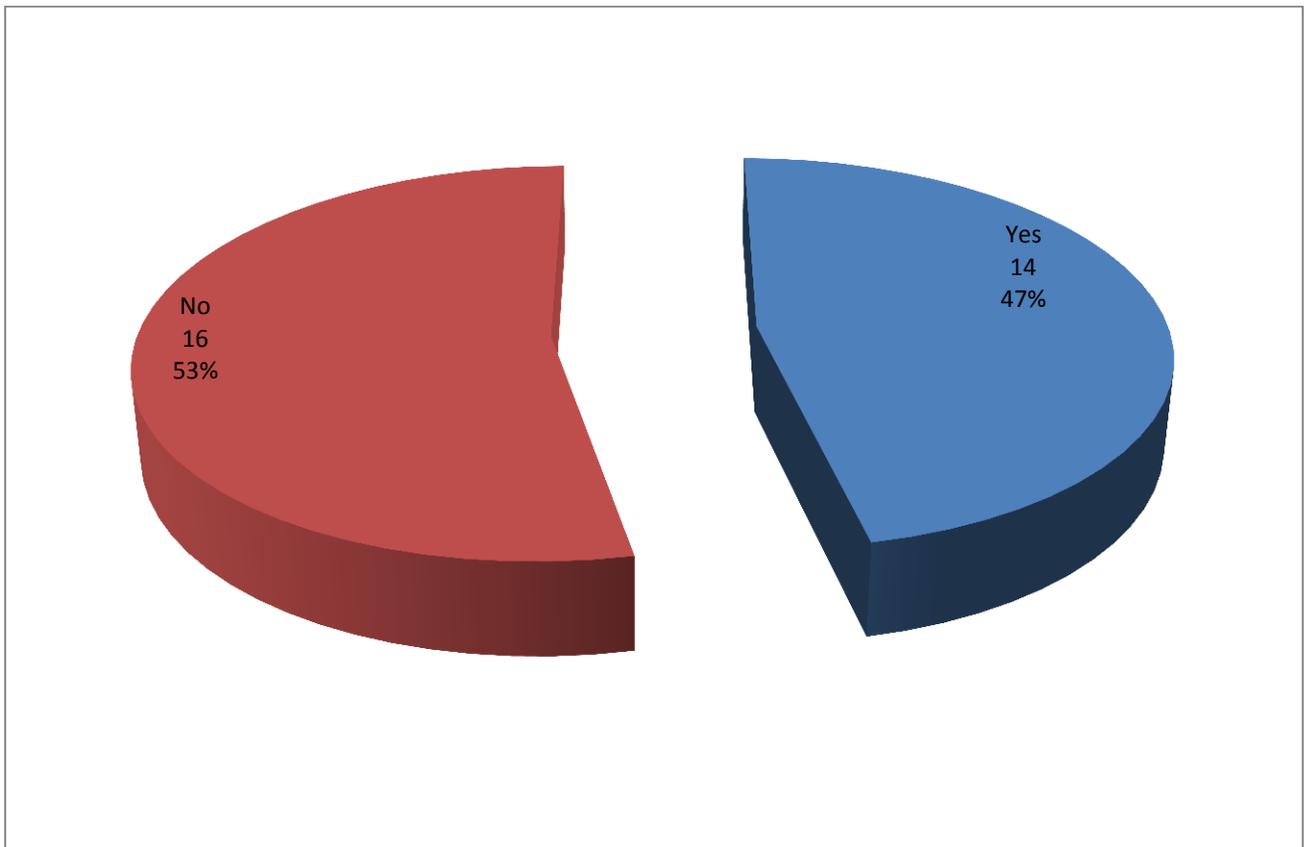


Chart 4.6: Effectiveness of ABMTs promotional strategies in Kenya

4.2.14: Measures to be put in place to make current promotional attempts successful

To make the current ABMTs promotional attempts succeed in Kenya, both Key Informants and Trainee Beneficiaries respondents offered a number of suggestions. Some of the suggestions as captured from the field data analysis included: conducting adequate research to determine the technologies that are working; provision of adequate facilities to sustain ABMTs development and promotion; proper development of local production/manufacturing sites with necessary equipment; economic empowerment of local trainees and technology beneficiaries; enhanced awareness creation and capacity

building; elevating ABMT programme as an independent unit by the Government; development of infrastructure to major ABMTs training and demonstration sites.

Further, to above mention measures, there is need for: introduction of a funds kitty to enable communities borrow money to improve their houses and to support private entrepreneurs engaged in ABMTs development and promotion; involvement of community groups and tertiary centers in various localities; National Council for Science and Technology (NCST) to fund market oriented research for the ABMT development and Promotion in Kenya; improvement of institutional capacities and enhanced coordination; adequate engagement of trainees in the technology use in a sustainable manner; ABMT to reflect cultural diversity as different cultures consider different materials; emphasis on poverty alleviation; promotion of use of locally developed ABMTs equipment in local projects; government to involve graduate students in researching on area specific ABMTs for use in Kenya; harmonization of legislation on technology use; increased funding for ABMTs use and adoption; introduce a course on ABTs in technical institutions.

In addition, there is need to: enhance research and development on ABMT development; adequately remunerate personnel involved in the training and dissemination processes; ensure that Government is proactive on the use and dissemination of ATBs and demonstrating use of the same on government funded projects; harmonize policies and regulations on use of ABMTs in the country; offer incentives towards research and development of local appropriate building materials; purchase local equipment for the ABMTs Centres by the government; strengthening the collaboration and partnership among stakeholders; and introduce peer vetted research papers as a strategy for adoption by Universities for promotion of lecturers and academic staff.

4.2.15: Low-cost housing need in Kenya

The question on whether the need for low cost housing in Kenya had diminished or not was responded to with a resounding no which stood at 87 per cent. This is depicted in chart 4.7

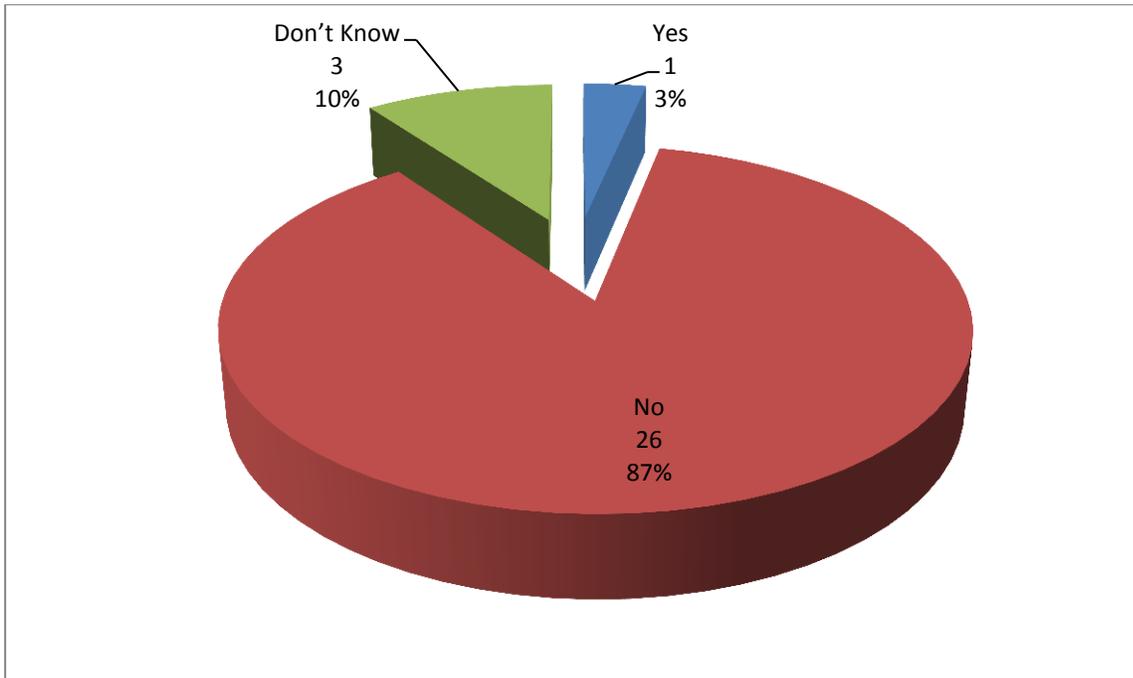


Chart 4.7: Low cost housing status in Kenya

The level of response above provides an impetus in the Appropriate Building Materials and Technology development and promotion in the Country. As provided in Vision 2030, the need to provide citizens with required level of decent and affordable housing calls for efforts towards introduction of innovative and cost-effective housing delivery processes to be up-scaled.

4.2.16: Emergence of East Africa Community and the prospects of ABMTs Programme in Kenya

Respondents concurred that in the event the EAC forms an economic block, then Kenya stands out to gain. This is more so due to the fact that the Government is at the moment developing a regional ABMTs Centre based at Mavoko within the Nairobi Metro Area. If fully operationalized, the Regional Centre may transcend the national sphere and eventually serve as a regional technology hub serving over 5 countries. The response was demonstrated in Chart 4.8

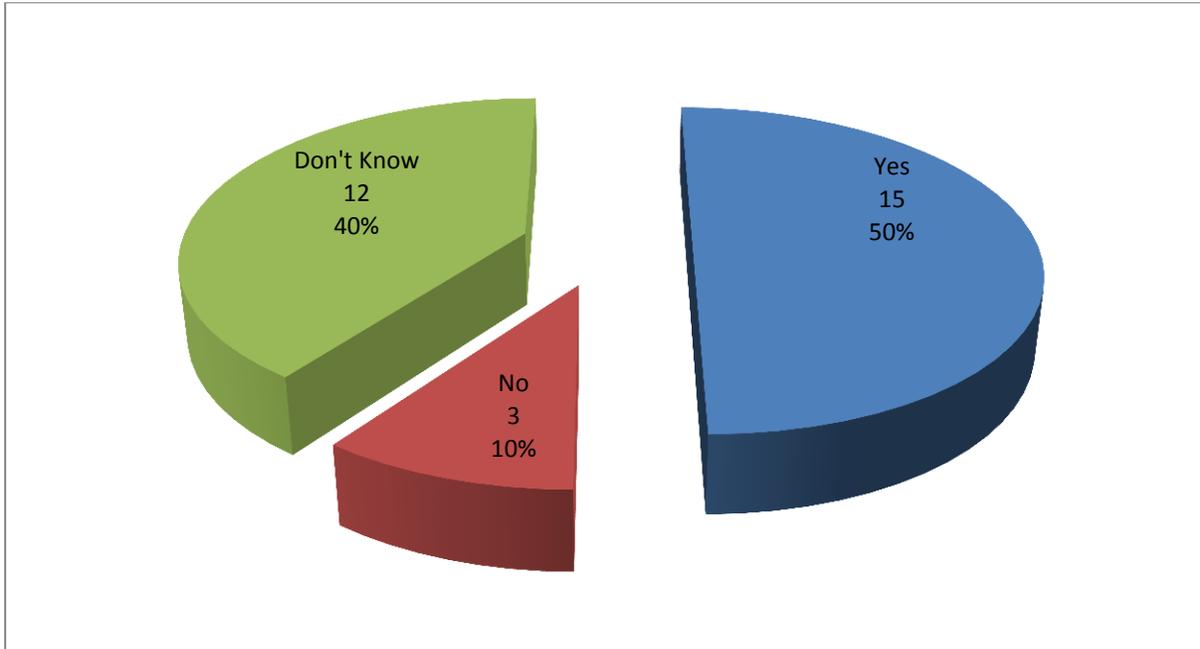


Chart 4.8: Gain by Kenya’s ABMTs Programme within the EAC economic block

The respondents gave varied opinion on the issues as already explained above. However, more efforts should be put in place to ensure that people understand the intentions of the Government. This is necessary since a significant proportion of the respondents at about 40 per cent played ignorant on the existence of the regional ABMT Centre that has been established at Mavoko. Further, these category of respondents have no idea on the benefits the Country stands to gain in the event the East Africa Community economic integration become a reality in the near future.

4.2.17: Measures to be put in place by the Government of Kenya for the ABMTs Programme to Fully Gain in the EAC Economic Block

In order to derive full economic gain in the event that the EAC integrates and forms a viable economic block, the respondents in this study proposed a number of measures that the government and the Kenyan society may put in place for wider societal gain. Some of these measures include to: advocate for support and development of ABMTs in Kenya; create awareness and carry out promotional campaigns in the region; formulate and enact enabling policy legislation at the national level on ABMTs development and use; enhance collaboration and partnership among various players; government to demonstrate commitment on promotion of ABMTs by adopting use of the same in its mega projects; improve infrastructure for the regional ABT center to be easily accessed (Road and railway access);

increase funding for research and development for the ABMTs programmes and projects; increased funding towards the promotion and dissemination of information on ABMTs by public and private sector

There is also the need to: operationalize the regional ABT center in Kenya and make it the hub of building technology development and promotion; provide incentives to local manufacturers of equipment to create synergies use in the development and promotion of technology; actively participate in Regional Conventions as well as lobbying for ABMTs acceptance by member states; and offer technicians involved in the ABMTs promotion and dissemination processes adequate train.

4.3 Research Hypotheses Validation

The hypotheses in this study were validated using descriptive data as provided by the respondents for the both the broad and the specific hypothesis.

4.3.1 Broad Hypothesis of the Study

The null hypothesis stated as “The need for low-cost housing initiatives had diminished in Kenya” with the alternative hypothesis being “The need for low-cost housing initiatives had not diminished in Kenya”, was tested against the respondents’ feedback as demonstrated in the chart 4.7. From the responses, the result showed that 87 per cent acknowledged that the need for low cost housing in Kenya had not diminished. Based on this finding, through the application of descriptive statistics, the null hypothesis was rejected and the alternative hypothesis was accepted thus imploring that the need for low cost housing is still enormous in the Country.

4.3.2 Specific Hypotheses Validation

In the first specific hypothesis, 57 per cent of the respondents’ indicated that there is no adequate institutional capacity to effectively and sustainably engage in the promotion of Appropriate Building Materials and Technologies in Kenya. We thus reject the null hypothesis and accept the alternative hypothesis that “There was inadequate institutional capacity to enable dissemination of ABTs in Kenya.

As for the second hypothesis that related to whether “There were ineffective strategies applied in the ABTs promotion in Kenya” as a null hypothesis or whether “There were effective strategies applied in the ABTs promotion in Kenya” for the alternative hypothesis, the respondents data were such that 53

per cent of the respondents indicated that the strategies adopted in the ABMTs promotion were not effective while 47 per cent of the respondents concurred that the strategies adopted are effective. On the basis of the respondents' result on which the descriptive statistic is based, we reject the null hypothesis and accept the alternative hypothesis.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter highlights the conclusions and recommendations made by taking cognizance of the study findings.

5.2 Conclusions

The conclusions provided for this study relates to the objectives which were included: the establishment of the causes of failures of previous attempts of Appropriate Building Technologies Promotion in Kenya; establishment of the strategies/methodologies applied in propagating ABTs utilization in Kenya; and providing recommendations on the safeguard measures that should be put in place to make current ABTs promotional attempts successful in Kenya.

The existence of Appropriate Building Materials and Technologies in Kenya is gaining recognition and a number of strategies have been put in place in their promotion.

The failures of previous ABMTs promotional activities could be attributed to several factors notably:- Inadequate funding; inadequate personnel; negative cultural perception on soil products; inappropriate dissemination strategies; ineffective legislations on use of appropriate technologies; lack of technology development; lack of enough government support; lack of interest; lack of interest by policy makers and implementers; and low pick up of technology use phases.

The various institutions involved in the technology development right from the research to product development as well as harmonization of legislations and regulatory measures applicable to the construction industry lack adequate capacity to effectively perform the functions.

The strategies that have been employed in the promotion of the ABMTs in Kenya over the years are also inadequate and does not comprehensively aide the promotion and adoption of the ABMTs programme and projects in the country.

In order to make the current ABMTs promotional attempts successful, there is need to embrace a number of strategies including: conducting adequate research to determine the technologies that are working within specific areas; creation of adequate facilities to sustain ABMTs development and

promotion; economic empowerment of local trainees and technology beneficiaries; proper equipping of training centers to enable effective onsite training on ABMTs; enhanced awareness creation; and enhanced capacity building among others. At least from the study, it can be concluded that the country still desires the introduction and support for the development of low cost housing strategies.

In view of the emergence of the East Africa Community economic block, Kenya is viewed as a potential beneficiaries if it fully develop and support the ABMTs programme more so the regional Appropriate Building Technology Centre that is currently being developed at Mavoko. This centre also holds a huge potential of partnership and collaborative research development with the research institutions, private sector actors as well as the multinationals from other economic zones within the globe. Such global partnerships and collaborations could be tapped from both the West and the Eastern Block more so with respect to Britain and China respectively.

5.3 Recommendations

5.3.1 Policy Recommendations

To constructively benefit from the ABMTs initiatives, there is need to;

1. Adopt use of the Appropriate Building Materials and Technologies in Government projects in order to create confidence on viability of the materials and technologies
2. Development of linkages for collaboration and partnerships with technical institutions and industry entrepreneurs for training of technicians and development of adequate equipment
3. The Government should accelerate the process of operationalizing the regional ABT Centre at Mavoko to act as the advisory centre on ABMT development in the Country and the Region.

5.3.2 Further Research

This study recommends further research on the following aspects:

1. The performance of various technologies that are potentially viable for adoption in Kenya
2. The energy efficiency levels exhibited by various Appropriate Building Materials adopted in in Kenya

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APPENDICES

Appendix 1: Appropriate Building Materials and Technology Beneficiaries (Trainees) Questionnaire

An Evaluation of Performance of Appropriate Building Materials and Technology Promotion in Kenya

Hello, I am a student from the Department of Real Estate, the University of Nairobi conducting project research leading to award of Postgraduate Diploma in Housing Administration. The ABMTs beneficiaries (trainees) interview of this research is being carried out in Nyamira County for programme trainees to evaluate the performance of strategies used in the use in the ABMTs promotion by various institutions. Your choice and participation is of great significance as beneficiaries of the programme within Nyamira County. As such you are kindly requested to voluntarily participate in this important exercise by answering some few questions relating to the subject matter for strict use in this study only. The questions are a provided below:

SECTION A: GENERAL INFORMATION

1 Name of the Sub-County you come from?

- 1. Manga []
- 2. Nyamira North []
- 3. Nyamira South []
- 4. Borabu []
- 5. Masaba []
- 6. Others (Specify) []

2 Name of your Institution?: _____

3 Gender : 1. Male [] 2. Female []

4 Age cohorts:

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

5 Would you state the approximate duration you have stayed in Nyamira County?

- 1. Less than 5 years []
- 2. Between 5-10years []
- 3. between 10-15years []
- 4. Between 15-20years []
- 5. Between 20-25years []
- 6. Above 25years []

6 What materials are commonly used by residents of this county in their wall construction needs? (*Tick all that apply*)

- 1. Hydraform-ISSBs []
- 2. Quarry Stone []
- 3. Bricks []
- 4. Concrete Blocks []
- 5. Timber []
- 6. Mud []
- 7. Iron-sheets/Tins []
- 8. Polythene []
- 9. Others (Specify) []

7 Given the materials in No.6 above, which ones are locally made? State starting with the one made in larger quantities.-----

8 Would you state how old residents have been involved in local manufacture of the building materials mentioned in N0.7 above?-----

9 Which ones are the main sources of building materials in this locality?

- 1. Quarries []
- 2. Forests []
- 3. Factories []
- 4. Local Manufacturing Sites []
- 5. Others (Specify) []-----

10 Of the stated sources above, would you state whether they are still abundant or are depleted?
1. Abundant [] 2. Depleted []

11 If depleted, to what extent?
1. Extremely [] 2. Highly [] 3. Moderately [] 4. Lowly []

SECTION B: PROMOTION OF APPROPRIATE BUILDING MATERIALS AND TECHNOLOGIES WITHIN NYAMIRA COUNTY.

Appropriate Building Materials are defined as those that are known to be climatically adaptable, socially acceptable, and relatively cheaper to produce. The promotion and utilization of such technologies is one of the ways in which provision of more housing at prices that are affordable to the majority of those in need can be realized. In general, the term Appropriate Technologies (ATs) is a collective term for a broad range of technologies with proven developmental benefits. Some ATs are innovations, others rediscoveries. All address basic human needs and provide cost-effective and environmentally friendly solutions. They are viewed as affordable and simple to use and maintain. ATs are developed specifically to enable poor people to deal with their health and resource problems, and in essence constitute a basis for community empowerment leading to sustained self-sufficiency.

12. In view of the statement above, have you ever been involved in the use of any appropriate building materials and technologies or trainings?

1. Yes [] 2. No []

13. If No, would you state whether you have had of any Appropriate Building Technologies being promoted within Nyamira County (*Provide names where applicable*)-----

14. If Yes in 12 above, are the trainings sufficient for your economic empowerment?

1. Yes [] 2. No []

15. If No in 14 above, would you suggest some measures that should be put in place to sustainably engage the trainees in the ABMTs programme.-----

16. Would you state the actors involved in promoting Appropriate Building Materials and Technologies for use within Nyamira County?

- | | | | |
|--------------------------|-----|---------------------|-------|
| 1. Government | [] | 2. NGOs/CBOs | [] |
| 3. Contractors | [] | 4. Individuals | [] |
| 4. Research Institutions | [] | 5. Others (Specify) | ----- |

17. What strategies have been adopted by the various actors in the ABT promotion within the County?

18. What are the ways through which information pertaining to availability of ABTs for use by the residents of Nyamira County have been provided?

- | | | | |
|---------------------------|-----|-----------------------------|-------|
| 1. Public Barazas | [] | 2. Homes Expos/Exhibition | [] |
| 3. Print/Electronic Media | [] | 4. Office Based Information | [] |
| 5. Others (Specify) | [] | ----- | ----- |

7 If Yes in 6 above, would you state which of these materials and technologies-----

Questions 8-11 relates only to organizations involved in the local manufacture of ABMTs equipment

8 What is the source of the equipment used in the manufacture of these materials if any?
1. Local design and assembly [] 2. Imported []

9 If locally designed and assembled, how is the local uptake in comparison to export in the neighbouring Countries?
1. High [] 2. Low []

10 If low in No.9 above, would you state some of the reasons being advanced?-----

11 If involved in exportation of the equipment, would you state your major export destination?

12 In any of the stated materials/ or technologies, would you indicate the approximate time/period the institution has been/were involved in their promotion-----

--

13 Would you state some of the ABMTs projects you have participated in the past or at present-----

14 In relation to question 12, would you indicate some of the strategies/methods used in the promotion and dissemination of any stated materials/ or technologies-----

15 Are the materials/ or technologies stated in No.7 above actively in use?

- 1. Yes
- 2. No

16 If No in 15 above, would you state the reasons of failure in the promotion and use of such materials / or technologies

- 1. Inadequate funding
- 2. Inadequate personnel
- 3. Negative cultural perception
- 4. Lack of suitable materials
- 5. Unfavourable environments/poor terrain
- 6. Unfavourable climate
- 7. Others (Specify) -----

17 Are there adequate institutional capacities to enable effective dissemination of ABMTs in Kenya?

1. Yes [] 2. No []

18 Are the strategies stated in 14 above if any, effective?

1. Yes [] 2. No []

19 If No in 18 above, what safeguard measures would you recommend to be put in place to make current ABMTs promotional attempts successful in Kenya?-----

20 In the overall, would you state in your opinion if the need for low-cost housing initiatives has diminished in Kenya?

1. Yes [] 2. No []

21 The Regional Countries within East Africa are in the process of forming an economic block. Does the ABMTs programme stand to gain from this initiative?

1. Yes [] 2. No [] 3. Don't Know []

22 If Yes in No.21 above, what measures should the Government of Kenya put in place to serve as a major player in the ABMTs development and promotion within the EAC framework?

-----**END**-----

Thank you for taking your time to participate in this study and the valuable contributions.