MODELLING THE DETERMINANTS OF HOUSING CONSTRUCTION COSTS IN TANZANIA IN DETERMINING AFFORDABILITY.

Ndosi, Esther

M.Sc (Construction Economics and Management) Dissertation

Ardhi University

November, 2018

MODELLING THE DETERMINANTS OF HOUSING CONSTRUCTION COSTS IN TANZANIA IN DETERMINING AFFORDABILITY.

By

Ndosi, Esther

A Dissertation Submitted in Partial Fulfillment of the Requirements for an award of Master of Science in Construction Economics and Management of the Ardhi University

November, 2018

CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by the Ardhi University the dissertation titled "**Modelling the Determinants of Housing Construction Costs in Tanzania in Determining Affordability**." in partial fulfillment of the requirements of an award Master of Science in Construction Economics and Management, of the Ardhi University.

………………………………………..

Dr. Makoba

DISSERTATION SUPERVISOR

Date………………………

DECLARATION

AND

COPYRIGHT

I, Esther Ndosi, declare that the contents of this report are results of my own study and findings, and, to the best of my knowledge; have not been presented elsewhere for a diploma, degree or any other award in any institution of higher learning.

Signature……………………

ACKNOWLEDGMENT

I would like to express my gratitude to all those who gave me the possibility to complete this dissertation successfully. In this regard I am deeply indebted to my supervisor; Dr. Makoba,N. D. of the Ardhi University, whose efforts, and stimulating suggestions as well as encouragements helped me to carry out my research smoothly.

Special thanks are due to the School of Construction Economics and Management of the Ardhi University for their academic and scientific support throughout my studies. Special thanks go to Dr. Mushumbusi, M. Z. whose encouragement brought success to this research. Special thanks to Dr. Ntiyakunze, S. K. Dr. Lugoe, Dr. Kikwasi, G. and Dr. Shiyo, T. who devoted their time to guide and teach me.

Special thanks are due to consultants of KJ & Associates Consultancy Ltd, Municipal of Temeke, Ilala and Kinondoni, CRDB Bank and Mwenge hardware shops for their participation in getting information and documents for research.

Special thanks to my grandparents and parents and my family for their support in love, patience and funds which helped me in completion of this dissertation successfully. To my best friends Glory Ngaiza, Haika Mtango and Mrs. Doreen Mushi for their constant support and love which encouraged me and to my friends Flaviana and Athanas, for sharing information and love towards me.

Finally, I would like to give my extraordinary thanks to my grandfather who is like a father to me Mr. Yohana Kirangani Masisi whose unconditional love and patience and understanding which helped me compete this work successfully.

DEDICATION

To my amazing and loving grandfather and grandmother Mr. and Mrs. Masisi who kept praying for my success, raise my spirit when it was down, and their unconditional love toward me; to my mother Happy Yohana and my father Douglas Ndosi for their constant dedication in praying for my success; to all School of Construction Economics and Management who were available at all times for their advice and to all of my friends who stood beside me with great commitment. I dedicate my respect to all of them.

ABSTRACT

In this study, simulation models have been used to determine how low-income households can have affordable and adequate housing by integrating housing processes and delivery methods. The purpose of this research was to look at how housing can be made affordable to low-income earners. The researcher has used simulation models in the three major components of housing, which are: access to land, infrastructure and services, building materials and affordability in terms of finance.

The main objective of the study was to advance housing provision for low-income households by determining affordability using simulation models. Specific objectives were to examine: (i) the housing production process and factors that influence affordability, (ii) to develop cost simulation model and do simulations to establish ways and means of making housing affordable to income levels and (iii) to recommend measures for enhancing affordability to low-income earners.

As this research is mostly based on simulation models, limited data is needed to enable models be developed. Major types of data source were used, namely documentary information (basic information) and interviews. A major finding from this study is that if the cost of land is high, it can be reduced to enhance affordability. In housing design, cheaper alternative materials with same satisfactory performance are available and can be used to cutdown costs. It has also been established that the configuration of a house influences its cost. Consideration should be given to increased depth of the building more than the width for an affordable house. This is in relation to the cost of infrastructure. Housing financing options available are own financing, loan (mortgage loan) and rent. It has also been confirmed that two models namely Save and Build (SB) and Save, Build and Borrow (SBB) models take long time for the house to be completed while the Save, Build, Rent and Build (SBRB) Model and Save, Borrow, Build, Rent and Build Model (SBBRB) have taken shorter periods of time.

Basing on these findings the study advances the following three recommendations. Firstly, builders are to avoid very irregular (complex) designs to save on external walls. Secondly, construction aspects with limited finance, incremental construction of room-by-room should be followed rather than full foundation and then room-by-room. Thirdly, if room-by-room construction is opted for, it is advisable to combine saving, renting and borrowing, step by step as source of finance. These recommendations will enable low-income earners to complete construction of a habitable house within a reasonable period. For further study the author recommends addressing the factors that hinder provision of low-cost housing so as to facilitate provision of low-cost housing.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATION

BRU	-	Building Research Unit
CBOs	-	Community-Based Organizations
CMSA	-	Capital Markets and Securities Authority
IDA	-	International Development Association
ILFS	-	Integrated Labour Force Survey
NBS	-	National Bureau of Statistics
NGOs	-	Non-Governmental Organizations
NHBRA	-	National Housing and Building Research Agency
NHC	-	National Housing Corporation
NSGRP	-	National Strategy for Economic Growth and Poverty Reduction Strategy
RoB	-	Registrar of Buildings
TAS	-	Tanzania Shilling
TBA	-	Tanzania Building Agency
THB	-	Tanzania Housing Bank
TMRC	-	Tanzania Mortgage Refinance Company
TP	-	Tenant Purchase
TPHFC	-	Tanganyika Permanent Housing Finance Company
RUCUs	-	Rural and Urban Construction Units
UN	-	United Nations
VMTP	-	Village Management Training Programme

CHAPTER ONE

GENERAL INTRODUCTION

1.1 Background

Housing is paramount to human existence as it ranks among the top three needs of humanity. The provision of adequate housing in any country is vital, as one of the greatest problems in the world today is that of provision of shelter (Golland, 2006). Housing continues to act as a stimulant of the national economy (Erguden, 2001). It is durable asset, which accounts for a high proportion of a country's wealth which households spend a substantial part of their income. Housing has been a concern of individuals, families, groups and government since the dawn of urban civilization. This problem has often been linked to land acquisition problems, low-income of individuals, high cost of building materials, statutory regulations, and non-use of locally available and cheap alternative building materials and provision of services and infrastructure. It is usually a situation of either the government has failed in meeting up its obligations or that the individuals, for some time, had remained incapacitated in breaking through the various bureaucracies in land acquisition procedure.

Tanzania is a growing economy, straddling the East African and Southern African economic development communities. The country is one of the fastest growing countries on the African continent, and is rich in natural resources. At least 31.6 percent of the country's 53.47 million people live in urban areas, with a population growth rate of almost three percent and urbanization rate of five and a half percent per annum (Tanzania invest, 2015). The Tanzanian economy is growing but affordability of house links a challenge, as rental housing is expanding. Rental accommodation in Tanzania has usually been associated with low-income households but it has also become the main form of housing for middle-income households. The low house markets providers have been unable to provide low and affordable housing to middle and low-income earners in Tanzania. According to the National Housing Corporation (NHC), the largest – state-owned real estate developer established to support the growth in Tanzania's property market, Tanzania's housing demand is estimated at 200,000 houses annually, which represents 7.83% of the African daily housing demand (Tanzania invest, 2015). The gap between supply and demand is more relevant to low and middle-income households who represent 48 % of the required new houses. The lack of appropriate housing has resulted in the expansion of informal settlements. Many people are forced into overcrowded establishments or are left completely homeless. Some researchers suggest that over 50% of Dar es Salaam population resides in slums (Alawi, 2015). The concept of informal settlements presents a twofold housing approach; overcrowded slums and adequately spaced good houses, of course all being constructed without following planning and building regulations. The current living of many Tanzanians has resulted in insufficient facilities, poor health standards, lack of infrastructure and environmental degradation. The economic, social and physical welfare of a household and community is strongly related to their access to decent and affordable housing.

According to Hassanali, (2009) despite some attempts at achieving decent housing for Kenya, Kenya has, on the whole, failed to address the dire housing conditions of her population, which is the same as Tanzania. There are however very few players in the low-cost housing industry and there seems to be a minimal interest of other private sector housing developers to venture in. These private sector developers are successful in the middle and high-income housing markets and this implies that they may have the capacity and skill set to supply the low-income housing required to reduce the housing shortfall in the country. They have however, shied away from the low-income market mainly because the profitability margins are lower as compared to housing developments for the other markets.

1.2 International base

All housing policy documents in the world in recent years confirm that governors and planners have to promote full housing accessibility for high risk people including the disabled and women as heads of families, which can be reflected in gender equality in policies, programs and Low-income housing projects as sustainable human settlements development (UN-Habitat, 2015). On December 1948, the general assembly of the United Nations adopted and proclaimed the Universal Declaration of Human Rights. Article number 22 mentions:

"*Everyone, as a member of society, has the right to social security and is entitled to realization, through national effort and international co-operation and in accordance with the organization and resources of each state, of the economic, social and cultural rights indispensable for his dignity and the free development of his personality*"[1]

1 UN. Human Rights. Universal declaration of human rights. New York : s.n., 1948.

“Housing rights are unmistakably part of international human rights law” (UN-Habitat, 2015). The right to adequate housing is embedded in the Universal Declaration of Human Rights (1948) and major international human rights treaties such as the International Covenant on Economic, Social and Cultural Rights. The second United Nations Conference on Human Settlements (Habitat II) (UN-Habitat, 2006), held on 3-14 June 1996 in Istanbul, Turkey, set out important changes in the approach to the development of human settlements in an urbanizing world. The Habitat Agenda, the main document adopted by the 171 UN member states in Istanbul, recognizes that adequate housing is a fundamental human right. In this conference, members reconfirmed that adequate shelter is for all and reaffirmed sustainable human settlements, enablement and participation, gender equality, financing shelter and human settlements, international cooperation for helping poor people. Five years after Habitat II, the general assembly of the United Nations held a special session to review and appraise implementation of the Habitat Agenda worldwide under the name Istanbul+5. The focused on some of the main outputs proposed by the Habitat secretariat for the Istanbul+5 exercise, namely: a declaration on the norms of good urban governance (UN-Habitat, 2001); a World Charter of Local Self- Government and; a declaration on secure tenure. UN members renewed a rights-based approach to the Habitat Agenda and stressed issues such as women and land inheritance, slum upgrading and alternatives to forced evictions. This helped define a consultative process towards the development of a normative framework for security of tenure. Members urged Habitat to utilize the preparatory process for Istanbul+5 to enhance the draft declaration on secure tenure.

1.3 Affordability to low-earners

The income of many Tanzania households is very low to afford conventional housing construction and therefore there is a need for flexibility in applying standards and need to see it as an evolving process – we can build to a certain standard today, and upgrade them in future (Mukama, 2002). In Tanzania and especially in un-planned urban areas, the incremental process of housing construction is widely used where some room by room and others element by element. This takes long but it ends up in a habitable house[2].

1.4 Statement of the problem:

The urban majority in the developing countries cannot afford decent housing due to the high cost of production of housing units and materials, accessibility to land for housing, housing finance and housing infrastructure and services which have considerable influence on housing costs. The current demand for housing in Tanzania is estimated at 200,000 houses annually, and a total housing shortage of 3 million houses (Tanzania invest, 2015). Although there has been some effort in Tanzania to provide for low-cost housing to the low-income people, the cost is still far from being affordable by the targeted lower income earners and renters.

> *"There is a myth that low-income earners can rarely build houses. This myth is not really acceptable as it comes up based on the existing requirements of building standards and regulations, which are really beyond the low-income affordability. Many low-income earners in Tanzanians have managed to have their own houses without loan assistance and therefore negating the myth above."* (Makoba, 2008: 5)

---

[2] http://eprints.covenantuniversity.edu.ng/697/3/Chapter%20TWO%20pdf.pdf

According to Seidel (1978), house prices and rentals tend to reflect the cost of producing that house in terms of life cycle costing. The author also argues that obtaining precise figures on such costs is extremely difficult. Bourne, (1981) identified cost components in the construction of single and multi-family housing to include:

a) The normal costs of production – building materials, wages, land and capital and

b) The cost of development, which includes the cost of obtaining necessary planning permits from local authorities, the cost to the authorities that provide necessary services and the costs to the developer for managing the diverse activities.

Land cost a particularly important variable depending on location. For single family units, land costs may take from 15 to 30% of total costs depending on location and whether the supply of developable land is tightly regulated or not. Since material and labour costs do not vary as much as land costs within an urban region relative increase in the latter will alter both the type and price of housing produced and the location of that production. Other factors which are considered to be a hindrance to the realization of the low-cost housing to the low-income earners in the housing sector. Hostile tax regime, rising inflation and massive investment in infrastructure (Finnigan, 2012).

It is therefore necessary to know the factors which include, land, housing infrastructure and services, material for housing, housing finance and general NHC hindrance factors - hostile tax regime, and rising inflation, that affect housing construction costs in Tanzania; in order to predict their future levels. Knowledge of these factors would help in establishing measures that could be taken to bring down the high cost of housing to developers, owners including low-income earners. Such factors can be broken down into a cost simulation model, as a decision-making tool and measure to assist on how housing can be made to heighten affordability.

1.5 Research Issue

This research looks at how low-cost housing can be made affordable, as the main issue is affordability of housing to the lower income earners, towards provision of acceptable housing for many people in developing countries who live in unsanitary conditions. The "Shelter for all by year 2000" as proclaimed by the United Nations General Assembly in 1988 was not achieved as a result of governments failing to enable its people in attaining housing. Millions of people are not adequately sheltered despite the right declared in the UN charter on Universal Human Rights (Kroes, 1987). The issue of adequacy is not to be generalized as it is a subjective issue with different countries depending on the level of development.

The major problem is how housing is approached in developing countries. It is the sector approach that makes housing results to be attained in parts. Tanzania has been approaching housing by providing land and forgetting other important issues such as infrastructure and financing. As a result, housing is still a problem. The research will consider integrated approach in housing provision, where all ingredients are considered in totality.

1.6 Objective of the study:

The main objective of the study is to advance housing provision for low-income households by determining affordability using simulation models. It aims at determining how the low-income households can have affordable and adequate housing by integrating housing process and delivery methods. This necessitates integrating the major components of housing, which are access to land, infrastructure provision, technical services, building materials and financial affordability.

1.7 Specific objectives

- ❖ To identify the housing production process and factors that influence affordability
- ❖ To develop cost simulation model to establish housing affordable in relation to income levels.
- ❖ To recommend measures for enhancing affordability to low-income earners

The main and specific objectives are connected to one another in combination of all objectives which leads into cost simulation model in simulation factors of land for housing, housing finances, building material, tax regime, housing infrastructure and inflation that can enhance affordability and suitable houses to low-income owners.

Cost simulation models show change and explain in detail how different levels of factors impact on every change of level and objectives direct the cost simulation model to manipulate factors in different classification, to lead on how to attain affordable housing for low-income earners without affecting housing typology and create a beautiful standard house.

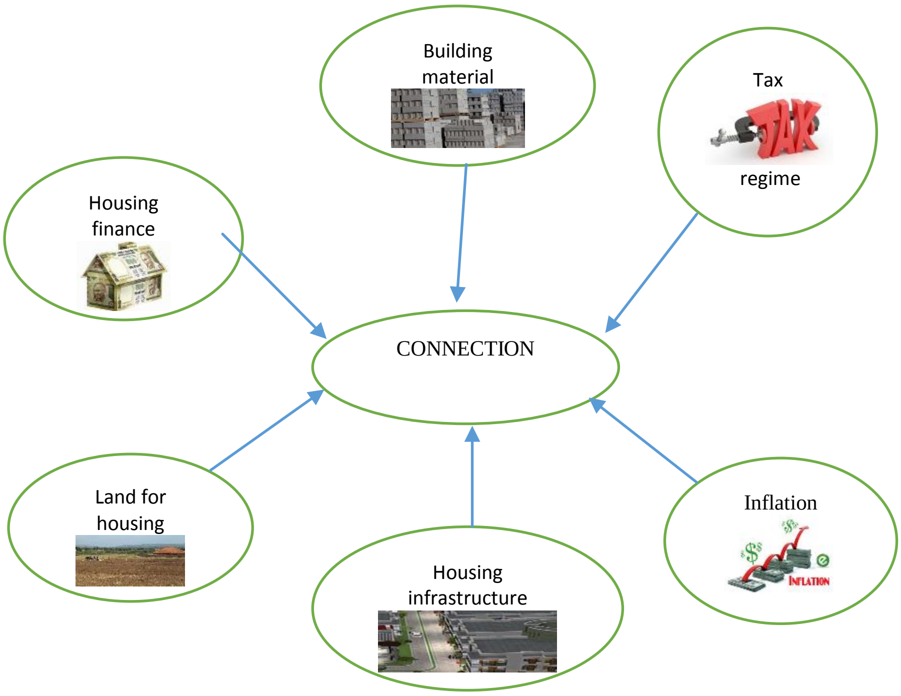


Figure 1.1 the connection concept

1.8 Research Questions

The questions to be answered in this research include;

- ❖ Processes of housing production go through and what factors influence affordability for housing?
- ❖ How could a cost simulation model be developed for establishing housing affordability in relation to income levels?
- ❖ What are the recommended measures for enhancing affordability to low-income earners?

1.9 Methodology

The researcher's search on the how to achieve affordability as the literature tells on global trend in housing provision for low-income earners and the Tanzania context enabled to understand the background of the study, and the existing models of housing provision. Simulation models were formulated as a basis for the study and these were adjusted to realistic models after getting data from the field.

Major sources of data that will be used are: documentary information (basic information); involving land, material, finances, infrastructure and services to the current situation; observations, and interview. In this research interview was conducted with low-income workers and financial institution as respondents on the matter of affordability. The data collection was limited to explain the existing situation and what in simulation models. Simulations have been done with the aim of looking at the effects on housing provision with changes of input parameters. By simulation, different scenarios were looked at so as to achieve the objective, which is affordable housing.

1.10 Significance of the study

The research is designed to provide knowledge and information to the lower income people who are seeking to build affordable houses. Knowledge gained from the research will be of great significance to Tanzania workers (private and public workers) and business people in building affordable houses in respect to land, material, finances, infrastructures and affordability.

1.11 Limitation of the study

For a manageable research that matches with existing constraints, such as time, fund and accessibility to information, data was collected in Dar es Salaam to get input data for the models. Dar es Salaam has not been taken as a case study but because it is rich in the necessary information required for the study. However, models are general, what is needed is to determine input data, which can be determined in any specific location needed for study.

1.12 Structure of dissertation

This dissertation consists of five chapters

Chapter one introduces the study by the background of the study, statement of the problem, objectives (main objective and specific objectives), research focus, methodology, significance of the study, limitation of the study and structure of the dissertation.

Chapter two covers the literature review theoretical framework of the study about affordability, affordable house demand, housing as a process, government institutions on provision of housing, problems that contribute to unaffordability in housing production and other researches concerning affordability.

Chapter three is the methodology where/how researcher can get information and data.

Chapter four discusses information and data.

Chapter five summarizes the findings, conclusion and recommendation on housing affordability based on the simulation models.

1.13 Summary

This chapter detail introduction to the study, statement of the problem, research issue, objective of the study, research questions, methodology, significance of the study, limitation of the study and structure. Next chapter provide literature review related to research topic by referring previous researches, books and journals.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review from various written documents and authors such as books, journals, internet source which relate to the theoretical framework of the study, affordability, house demand, housing as a process, government initiatives on provision of housing, problems that contribute to unaffordability in housing production and cost simulation models. The aim was to find out what has already been done, relating to the study and contrasts with what other countries faced on the similar issue of affordability.

2.2 Theoretical framework of the study

A theoretical framework is a structure of concepts which exists in the literature, or a ready-made map for the study (Smith, 2008). The literature review highlights research, current thinking, debates, issues and gaps in research. It revealed and consolidated the range of theory across several disciplines, but particularly within the broader education sphere, that needed to be considered in the development of the study and modules as well as allowed for the testing out of this theory in practice within the context of the Information Literacy Instruction module.

2.2.1 Theory of Maslow's hierarchy of needs

From the theoretical base, housing as a basic necessity is underpinned in Maslow's theory of "hierarchy of needs". Maslow's theory when implemented implies that if a decent shelter is unaffordable, then this creates a barrier to improving economic status and social well-being (Saul, 2018). Maslow refers to shelter as a house on the physiological level of need (Figure 2.1). Physiological needs are the physical requirements for human survival. According to Maslow if a basic structure or building is provided protection from the local environment, puts human physiology at risks.

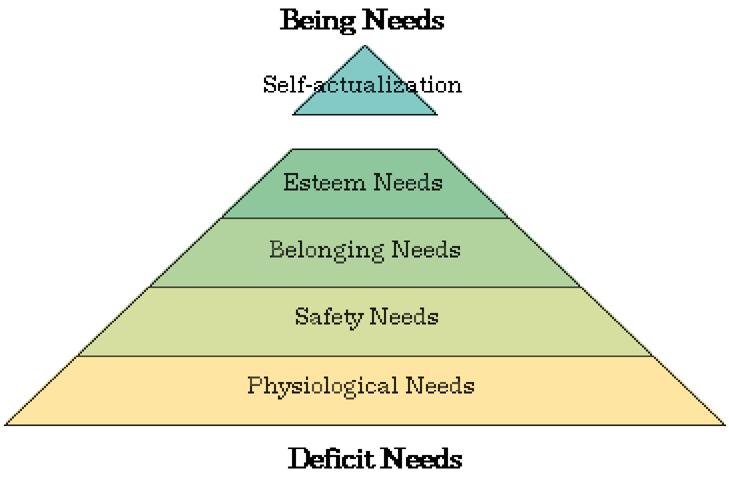


Figure 2.1: Maslow's famous hierarchy of needs pyramid (Saul, 2018)

The definition of shelter to mean a house/ building is restrictive because shelter (or housing) considered in the field of human settlements is more than four corners and a roof. Housing should consider supporting services that go with it including facilities of the dwelling's immediate environment (Linn, 1983)

2.2.2 Systems Theory

A "system" is defined as "an organized unitary whole composed of two or more interdependent parts (sub-systems), where the whole contains identifiable boundaries from its environment (supra system)" (Lallan, 2011:138). Housing process can generally be considered as a system due to its integration of a number of disciplines. General system theory was developed in response to provision of a unifying analytical and explanatory framework throughout the hierarchy of nature. It provides a tool for integrating the contributions of different disciplines. A system approach, in essence, entails considering the various agents interacting in the world as a system (Makoba, 2008).

All living systems are open systems, therefore housing, in which living systems live are never completely stable, so living systems must try to obtain reasonably stable flows from sources that can be changing over time. Systems are delineated to define inputs and outputs to the system.

Housing as a system has a number of sub-systems that influence it. Decisions made in policies regarding industrialization, planning, international trade and so on, will affect housing. An integrated approach in dealing with housing is actually an implementation of the systems theory.

2.3 Demand for housing

It has been clear for some time that housing supply is not keeping up with demand. Reasons for rising demand include improved life expectancy rates and a growing number of one-person households (Wilson, 2010). Natural population growth, rapid urbanization, low-income and demographic structure are also contributing factors to housing shortages (Kombo, 2015). Studies conducted by the Housing Department Division of the then Ministry of Lands, Housing and Urban Development in 2000 showed that the total demand for dwelling units in urban areas, was then estimated to be more than 2,200,000 units (Luvuba, 2016). On the other hand, the National Bureau of Statistics survey of 2011/12 revealed that housing demand stood at 3,000,000 units. The shortage had been growing from 21,000 houses in 1969 and

300,000 houses in 1982. The growing housing shortage can be confirmed by overcrowding levels that are found in urban areas. Affordability in this context according to (Steven, 2004) means different things to different people, and the affordable housing needs of some vary from the needs of others. Collins Dictionary as cited by (Ademiluyi, 2008) defines 'afford' as being able to pay without incurring financial difficulties. But (Robinson, 2006) were of the opinion that it is very difficult to decide exactly when one does have financial difficulty and often, things are considered unaffordable even when some income is clearly greater than the cost of an item. An often-quoted rule of thumb is that households should spend no more than 30 percent of their income on housing, unless they choose to do so (Nelson, 2002). However, (Stone, 1993) criticizes this affordability defining criteria by saying that, once a household has paid housing costs which is typically regarded as a preeminent item in the household budget, it is "shelter poor" if the remaining income is not enough to cover for the basic, non-housing necessities.

2.4 Housing as a process

Housing production involves a number of dependent constituent elements. Any inefficiency in one element will render the whole process ineffective and therefore failing to deliver the required objectives (Curristine, 2007). The elements required in the housing process are access to land and the entire infrastructure including services related to it, appropriate building materials and technology applied to suitable building typology and the availability of housing finance. The process is supposed to take place within appropriate institutional arrangements and legislative framework. The existing situation with regard to the housing elements in Tanzania is not fully supportive of the affordable housing to the low-income earners (Nnkya, 2014). A brief look into the constituents of housing in Tanzania will give some light on the housing problem.

2.4.1 Land for housing

As demand continues to exceed housing availability for affordable housing, government interest in using public land for affordable housing offers one such opportunity. The use of public land for affordable housing can provide low- and middle-income families access to decent, safe, and affordable homes (Gopalan, 2015).

Land is one of the basic resources for any society or individual development. It provides physical space and constitutes resource for various economic undertaking including housing projects. Accessibility to land for housing refers to and includes the mechanisms, processes and procedures facilitating and regulating residential land delivery. Accessibility to residential land is increasingly becoming a big problem faced by developers including public and private institutions and individuals. In both big cities and medium sized urban centers in Tanzania, the inadequacy and at times, lack of buildable housing land is a major concern (Makoba, 2008).

2.4.2 Materials for housing

Low-cost housing projects are characterized by an increasing demand mainly due to development and increase of population. The selection of building materials should meet the needs of local conditions to improve quality of life for the most needed ones by building new structures or by improving existing structures.

Tanzania has some of the fastest growing cities in sub-Saharan Africa. As in other sub-Saharan cities, government housing programmes have reached only a tiny percentage of urban residents. The majority of Tanzanians will either build without input from professionals or live as tenants in houses provided by others. House owners still struggle to build modern houses in concrete blocks, which offer higher standards of comfort and security as well as bringing in higher income from rent. Those who cannot afford to do so, are obliged either to rent one or more rooms in a house constructed by others or to build a modest house using traditional materials (Well, 1999).

2.4.3 Housing finance

The primary objective of a mortgage finance system, also known as the housing finance industry in Tanzania, is to channel funds from savers or borrowers, so that real estate can have the capital to build and owners have the credit to buy suitable housing.

During the last 54 years, Tanzania has undergone rapid population growth and urbanization, resulting in cities, towns and municipalities with high levels of income inequality and inadequate housing (Kibuuka, 2016).

As the country's urban population continues to increase, the World Bank Country Director for Tanzania, Philippe Dongier, in February 2015, underscored the urgent need to improve access to finance for affordable and adequate housing supply. Dongier was speaking on the backdrop of the new US$60m financing provided to

Tanzania by the World Bank Group's International Development Association (IDA) for funding construction of affordable housing.

One of the key ways of raising housing finance is the use of a mortgage. According to the Banking and Financial Institutions (Mortgage Finance) Regulations 2011, a mortgage is a loan granted to a borrower for the purpose of acquiring, improving or constructing a residential house. A mortgage instrument also serves as an alternative source of investment for Tanzania's pension funds, whose liabilities are considered long-term (Kibuuka, 2015).

Normally, mortgage loans are set to amortize over a set period of time, ranging from 20 to 30 years; but in Tanzania, mortgage regulations impose a maximum term of 20 years. The Bank of Tanzania's Mortgage Market Update released on 31 December 2013 shows interest rates are in the 18 to 21 percent range. With such high interest rates, coupled with a depreciating Tanzanian shilling, demand for mortgage loans may dampen and a long shadow may be cast over the growth prospects of the market.

Nevertheless, the development of a stable and effective mortgage finance market cannot only significantly lead to financial deepening, but also make ownership of suitable housing more affordable through longer amortization periods and help real estate developers liquidate their unsold housing stock. It is crucial to note that the anticipated acceleration of Tanzania's mortgage finance market is, for the most part, dependent on the strength of the overall economy; the efficacy of the legal system to support registration of properties and enforcement of rights; and the willingness and capacity of mortgage lenders to accept risks and offer mortgage loans (Kibuuka, 2016).

Other initiatives by the government have included the passing of the Unit Titles Act 2008 that introduced the condominium law governing sectional properties; the establishment of the Tanzania Mortgage Refinance Company (TMRC) in 2010 to provide medium to long-term liquidity for its shareholder-banks to extend amortizing mortgage loans to individuals promulgation of the Banking and Financial Institutions (Mortgage Finance) Regulations, 2011. The government has also made concerted efforts to streamline property registration processes, strengthen the capacity of the judiciary to resolve disputes, and encourage land development by improving titling. As a matter of fact, proper titling encourages investments in the housing sector.

However, there is still a need for new initiatives and solutions to address, among other things, the hovering interest rates and the rapid depreciation of the shilling that could lead to low demand for mortgage loans, despite the government taking steps towards promoting housing affordability and the increase in the number of banks providing mortgage financing. A favourable interest rate regime and a stable currency will increase uptake of mortgage loans; and therefore, spur housing market growth, encourage savings and increase the overall demand for houses. But even so, the cost of housing is comparatively higher than income levels. That's why the government supported the creation of, the TMRC to enable participating banks to offer amortizing mortgage loans to individuals and, the Housing Microfinance Fund aimed at assisting lower-income individuals to access conventional, quality housing (Kibuuka, 2015).

Perhaps as a means to achieve this goal, some government housing subsidies, such as, where applicable, investor guarantees, tax deductions and price controls, could be considered. Be that as it may, some studies have found that housing subsidies introduce distortions in mortgage finance markets. Instead, the government should facilitate the role of the private sector and real estate developers in increasing the supply of houses by further improving land, finance and infrastructure systems (Marja, 2008).

All of the above aim at channeling funds from savers to borrowers and require the right legal and regulatory framework to support the registration, enforcement and final pledging and sale of mortgage loans. In reality, an efficient, comprehensive and definite real estate registry system is a critical requirement for the development of a sound primary mortgage market in Tanzania. A key law for regulating the activities of real estate and mortgage brokers and safeguarding the rights of mortgagors from any unpleasant market practices is long overdue.

2.4.4 Affordability

According to the Integrated Labour Force Survey (ILFS) of 2014 as carried out by the National Bureau of Statistics (NBS), the working age population in Tanzania, in 2014 comprised of 25.8 million persons of whom 86.7 percent were economically active, mostly in rural areas. The survey also revealed that two-thirds (67.8 percent) of paid employees earn less than TZS 300 000 (US$135.30) mean monthly income, with less than five percent of paid employees earning a mean monthly income above TZS 900 000 (US$406.32) and (12.9%) of employees earn between TZS 300000-900000 (US$ 135.30-406.32). According to a World Bank report of 2015 Tanzania's work force is expected to grow to 40 million workers who will need productive jobs by 2030. The share of the population employed in emerging sectors is expected to increase to 22 percent whereas the average income per worker is expected to only increase to US$1 900 by 2030 (exchange rate according to Bank of Tanzania July 2017). Table 2.1 shows Tanzania workers' wage in detail monthly according to (Trading Economics, 2016).

Table 2.1: Shows monthly wages of Tanzania workers (Trading Economics, 2016)

Tanzania Labour	Last	Previous	Highest	Lowest	Unit
Unemployment Rate	10.30	10.70	12.90	10.30	Percent
Labor Force Participation Rate	86.70	89.60	89.60	86.70	Percent
Population	48.80	47.42	48.80	10.07	Million
Living Wage Family	633700.00	633700.00	633700.00	633700.00	TZS/Month
Living Wage Individual	253600.00	253600.00	253600.00	253600.00	TZS/Month
Wages	334017.00	322527.00	334017.00	242857.00	TZS/Month
Wages High Skilled	1014900.00	750000.00	1014900.00	704000.00	TZS/Month
Wages Low Skilled	386500.00	185000.00	386500.00	170000.00	TZS/Month
Youth Unemployment Rate	13.70	14.90	14.90	13.70	Percent
Employed Persons	2141351.00	1858969.0	2141351.00	933358.00	

With almost 70 percent of paid employees earning a mean monthly income of less than TZS 300 000 (US$135.30), the average mortgage size of TZS 133 million (US$60045.14) is on the high side, indicating that most clients with above TAS 1,000,000 are high income earners, with majority of the households financing their housing through cash sourced from household savings, micro credit loans and personal loans. A number of NGOs cater for the lower income market segments, but their reach is insufficient to meet the scale of demand (Centre for Affordable Housing Finance in Africa, 2017).

The UN poverty line is less than TZS 2215 (US$ 1.00) per day, which is equivalent to is TZS 66,450 (US 30.00) monthly and which cannot even maintain their own basic need. A Dar es Salaam resident pays the largest chunk of his/her earnings on house rents than on any other basic commodity that a human being must get to survive. The study from world bank report also states that at least 34.1 percent of earnings are spent on rent – leaving the remaining 65.9 percent to cater for other basic needs, in which two-thirds (67.8 percent) of paid employees earn less than TZS 300 000 (US$135.30) mean monthly income fall in this part of spending 34.1% on rent according to a World Bank report 2015.

2.4.4.1 Affordability for housing

Housing is a priority in every household around the world. Consumers, especially low-income groups, find it harder to access appropriate and adequate housing at an affordable cost. As a part of Asian countries, Indonesia’s government regulated a decent and affordable housing as one of priorities highlighted in the implementation of housing and settlements (Indrianingrum, 2017). This is to ensure that low-income society have the same access to the ownership of housing as much as the high-income groups generally do. Low-income society is comprised of people who have a limited purchasing affordability, and thus needs government’s supports. It is therefore important to look at affordability not only on income, but also on the housing prices.

There is an argument that:

> *"There is no such thing as "affordable housing." Housing, in and of itself, is neither affordable nor unaffordable. Affordability is not an inherent characteristic of housing, but a relationship among housing cost, household income, and a standard of affordability. The term "affordable housing" is at best meaningless and at worst misleading, for it ignores or obscures the central question of who can and cannot afford housing*" (DTZ Research, 2004:19).

The above argument supports the approach of this study, whereby income groups are related to specific housing costs and standards to test their affordability. In that case housing affordability can be defined as the ability of households to pay for the cost of housing by buying the house or constructing the house without imposing too much constraints on the living costs of the consumer. Affordability has three key dimensions (DTZ Research, 2004:8):

a) Affordability to would be home owners
b) Affordability to renters
c) Affordability to existing homeowners

A number of Tanzanians would require owning a house; this is due to the value they attach to a house especially in the case of uncertainties of income. In the 2012 Population and Housing Census, Dar es Salaam was found to have a population of 4.36 million accounting for 10 percent of the total Tanzania Mainland population.

Some other urban centres have continued to grow into municipalities and cities. These are Mwanza, Mbeya Bukoba, Tabora, Morogoro, Kigoma, Dodoma and Tanga. In these towns and cities, and today in some of the villages, about 50% of people own a house without considering the quality of the house (Kwanama, 2015). The Human Settlement policy of 2000 also encourages people to be home-owners as individual house builders are contributing more than 80% of the low-income housing stock. However, if owning will be affordable, this will increase housing stock and therefore rentals will go down and be affordable to many renters.

a) Ability to pay

With regard to housing loans, the ability to pay is looked at before loans are issued. Ability to pay is generally measured using a maximum loan payment-to-income ratio based on household earnings. Ability to pay itself does not guarantee cost recovery; it should go with willingness to pay. Willingness to pay is as integral part of affordability as is the ability to pay. In Tanzania for mortgage loan purposes lenders will look at either private or public institution. The government automatically will act as the guarantee for public institutions while in private institution the lender will look at the company stability as security to pay. For business people these give houses or land certificate as security/collateral. Loan provided depends on once income and amortization period with interest. Ability to pay can sometime be hard for household with income below TAS 500,000.

b) Saving ratios for housing

It is usually being assumed that 20 to 30 percent of income can be assumed for housing (SMETS, 1999:), but these figures may not be realistic across. These ratios are increasingly being criticized, because of the inaccuracy in defining the actual income of a household and predicting the willingness of the beneficiaries to allocate a specific part of the budget for housing. The standard 25 or 30 percent are very high burden for a large group of low-income households, because it leaves them very little for other necessities.

2.4.5 Housing infrastructure and services

Infrastructure plays a big role in helping create the communities we want to see. One of the key goals is to increase densification as a way to make better use of the existing infrastructure - water pipes, sewage, transit systems, fire and police services, and garbage collection. Infrastructure is central to improving the value and reach of those assets, but it is also key to enhancing the resilience of a community and housing development, both from a social and a physical perspective. Investing in affordable housing on transit is important and just as important is planning for living wage jobs on transit lines too (Kathleen, 2017).

Another deterrent to housing production by both the private and public sectors is the high investment cost of land infrastructure particularly where the development is distant from existing infrastructure. The developer fully bears the high investment cost of provision of water and road infrastructure to a new site, without future benefits for connections made off these infrastructures to other sites by other individuals or developers (Olusola, 2012). This high cost of infrastructure significantly influences the final price of the serviced land and ultimately, the cost of housing to the consumer. Therefore, there is a need to firstly, re-examine the high initial cost of land infrastructure cost and secondly, to develop a common approach for the provision of utilities to housing developments. The cost of infrastructure accounts for about 25–30% of housing expenditures. It is a main factor in the delivery of inexpensive housing. Authority in Tanzania has ignored this area and developers now deliver same, thus increasing the cost of houses. This is obvious in many gated residential communities across the populace, where the contractor provides autonomous electrical energy, water treatment plant, sewage plants, and access roads to the estate (Olusola, 2012).

In urban Tanzania, only 25.6% of the urban population have water piped to their home, while a further 23.7% depend on water piped to their neighbour. When asked about the two-week period before the Demographic and Health Survey was completed in 2015–2016, 62.2% of urban Tanzanians said that they had experienced at least one day without access to water. Similarly, only 9.1% of urban Tanzanians had sanitation facilities linked to a sewer or septic tank (including those who shared among several households) (Worrall, 2017). In other words, millions of urban Tanzanians lack access to reliable and safe services. This burden is borne unequally. In peri-urban and smaller urban areas, cultural norms mean that the burden of collecting water continues to fall on women and girls. Urban sprawl can make this task much more time-consuming and physically arduous.

This reflects the informal nature of urban development taking place across the country. Almost two thirds of Tanzania's urban areas are informal and an estimated 80% of its urban residents live in informal areas. Informal urban development can create patterns of sprawl, and it is difficult and expensive to extend infrastructure and services to reach these areas because these areas have been settled outside legal or formal systems, governments may also lack the incentives to provide essential services and infrastructure.

Infrastructure has a considerable influence in housing costs; it is imperative that when talking of housing provision, infrastructure costs should not be disregarded. User participation is seen to have intrinsic values to the participants, leads to sense of responsibility and a catalyst for further development efforts (Kyessi, 2002).

An option of incremental provision of infrastructure whereby for example basic infrastructure is provided, and others provided incrementally while improving it through user participation is seen as a way to bring down the initial costs and therefore help the low-income household afford infrastructure. It should be borne in mind, here, that theories of local government, social participation, organised community development and self-help, as well as self-sustained development, appropriate technology, incremental growth etc., all seek to make the development model appropriate to local realities and resources by refining work and design procedures, as well as products (Makoba, 2008).

2.5 Government initiatives on provision of housing.

Article 24 of the National Constitution of 1977 recognizes the right of every citizen to own property including housing. As a consequence, the government declared housing as one of the basic necessities alongside food and clothing. As a result, various public housing institutions were established; and housing programme, projects, schemes and policies were initiated to address the housing problems that faced residents in both urban and rural areas. Some of these initiatives are outlined below:

2.5.1 Housing Provision Initiatives

The demand for housing in Tanzania is certainly evident and needs to be addressed. It is from this premise that the housing backlog has increased demand and scope of private housing development especially in Dar es Salaam. Tanzania invest, (2015) Demographic projection shows that it would be necessary to develop 200,000 dwelling units in the next ten years in order to meet present and expected needs. To meet the needs of the ever-increasing housing demand, public and private property developers have come forward with initiatives in housing provision.

a) **Government Housing and Tanzania Building Agency (TBA):**

Public houses owned by the Central Government were managed by the Ministry of Works until 1997 when they were transferred to Tanzania Building Agency (TBA) which was established by the Executive Agencies Act No. 30 of 1997 pursuant to the Public Sector Reform Programme I (PSRPI). The Agency has the responsibility of managing and constructing houses for the civil servants. Up to 2017 TBA are responsible for managing and constructing houses for civil servants.

b) National Housing Corporation (NHC)

The National Housing Corporation (NHC) was established by Act of Parliament No. 45 of 1962. Its establishment was a government response to mitigate the housing problem that faced the majority of African urban dwellers. Between 1962 and 1974, the Corporation constructed housing units in different urban areas under slum clearance and rental and tenant purchase (TP) schemes. The NHC was reconstituted through the Act of Parliament No. 2 of 1990 which dissolved the Registrar of Buildings (RoB) and entrusted its responsibilities to the NHC.

c) Registrar of Buildings (RoB):

The RoB was established by Act of Parliament No.13 of 1971 and was charged with the responsibility of managing buildings that were acquired under that Act. In 1990, the government dissolved this Corporation and entrusted its responsibilities to the present NHC.

d) Better Rural Housing Campaign:

This campaign was introduced in 1974 with an objective of encouraging the rural people to build better houses for themselves in the context of durability of dwellings, improved standards of hygiene, and better building skills. The Village Management Training Programme (VMTP) and Rural and Urban Construction Units (RUCUs) were started under the Prime Minister's Office. However, by 1980s, these units collapsed due to lack of equipment and proper management.

e) Housing Cooperatives

Since 1962, the government had encouraged people to form cooperatives in order to provide better housing for themselves. Examples are Mwenge Housing Cooperative Society and Sigara Housing Cooperative Society. The housing cooperative drive lost steam since the 1980s mainly due to mismanagement and administrative weaknesses.

f) Employer-based Housing

Due to housing shortage that faced the majority of employees, the government had encouraged public institutions and especially parastatal organizations to construct houses for their workers. A substantial number of houses were constructed by these parastatals. However, by the 1980s the capacity of these parastatals to construct more houses had waned mainly due to the financial constraints that were caused by the economic difficulties.

g) Non-Governmental Organizations (NGOs) and Community-Based Organizations (CBOs)

The NGOs and CBOs play a major role in tackling the housing problem of the poor. These organizations seek to increase the capacity of local communities to improve the quality of their houses. Their activities include among others, micro-enterprise finance, secure land tenure, fund mobilization, provision of low-cost infrastructure and sanitation and provision of housing loans. The government has created conducive environment for NGOs and CBOs to work with communities for their socio-economic development. Some of these are the ecumenical Habitat for Humanity, HST - Human Settlements Trust and the Centre for Community Initiatives

(CCI) which focus on assisting the disadvantaged groups to access housing and participate fully and effectively in all aspects of human settlements development [3].

2.5.2 Capacity Building and Delivery of Technical Services

a) Building Research Unit (BRU)

The BRU was established through Cabinet Paper ECC No. 7 of 1970 and charged with the role of providing technical support to house construction by increasing the use of local and readily available building materials through research. The Unit was transformed into a National Housing and Building Research Agency (NHBRA) through Act of Parliament No. 30 of 1997. The objective of this transformation was to enhance the institution's mandate and capacity to undertake research on building materials and technology for housing development.

b) Ardhi university

Ardhi University has its humble beginning as a Survey Training School between 1956 – 1971 training Survey Technicians at Certificate Level. The Surveying Training School was renamed Ardhi Institute in 1972 and started offering 2 years Diploma Programmes in Land Surveying and Estate Management and Valuation.

In 1975, the two-year programmes were upgraded into three-year Advanced Diploma Programmes in Land Management and Valuation, Land Surveying, Town and Urban Planning, Architecture and Quantity Surveying.

[3] http://www.nhbra.go.tz/uploads/documents/sw/1471249197-x.28th CONFERENCE PROVISION OF AFFORDABLE HOUSING

In 1996, Ardhi Institute became a Constituent College of the University of Dar es Salaam in the name of University College of Lands and Architectural Studies and started offering four-year Degree Programmes. In 2007, the University College of Lands and Architectural Studies became a fully-fledged University and Ardhi University was born[4].

2.5.3 Housing Finance

a) Establishment of Housing Loan Fund

After independence the civil service expanded extensively. The Government in 1964 established a Revolving Housing Loan Fund to finance construction, renovation, or purchase of houses for its employees to cushion the impact of shortage of government housing. It was however abolished following the establishment of the THB in 1972. The Fund was reintroduced through staff Circular No. 8 of 1992 in order to fill the vacuum created by the demise of the THB. The fund was transformed into Government Employees Housing Company (Watumishi Housing Company – WHC 2013).

b) Establishment of Tanzania Housing Bank (THB)

It was established by the Act of Parliament No. 34 of 1972 following the dissolution of the Tanganyika Permanent Housing Finance Company (TPHFC) Limited which provided mortgage lending in the 1960s. The bank became insolvent and was liquidated in 1995.

[4] http://www.aru.ac.tz/index.php/geting-to-know-aru

2.5.4 Land Delivery Schemes.

a) Access to land and provision of Surveyed Plots, Sites and Services Schemes:

This programme was introduced in 1972 with an objective of providing serviced sites for housing development by individual households so as address acute shortage of housing in the urban areas.

b) Squatter Upgrading Schemes

This programme involved improvement of informal housing areas by providing social and physical infrastructures, as well as security of land tenure. This programme was also funded by the government and the World Bank.

c) Regularization of Informal Settlements:

Pursuant to the Land Act No. 4 of 1999, since 2004 the Government has been undertaking a programme of regularization of informal settlements. in Swahili 'MKURABITA' The objective of this programme is to promote secure tenure and provision of infrastructure and services in these settlements and to promote socio-economic development for the majority of the urban inhabitants in line with the National Strategy for Economic Growth and Poverty Reduction Strategy (NSGRP) in Swahili MKUKUTA. The government's target is to regularize all unplanned settlements in the country by 2020.

2.5.5 Policies and Legislations

a) National Housing Policy 1981

A National Housing Policy was formulated in 1981 with the objective of providing a framework for the housing sector development in the country. This policy was not implemented due to government budgetary constraints and a change in economic policy direction from command to market economy.

b) National Land Policy

In 1995 the government passed a Land Policy that would be commensurate with the market economy. Modalities of operationalization of the Land Policy (and Land Law) were worked out in the World Bank sponsored Land Market Reform Project of 1999. Both the land policy and land market reforms are key catalysts for an efficient housing and housing finance markets.

c) National Human Settlements Development Policy

This policy was approved in 2000 with the objective of creating an enabling environment for all to access adequate shelter, advocates for efficient land delivery system, simplified building regulations and standards, upgrading of unplanned settlements, housing finance, infrastructure and service provision, and better rural housing.

2.5.6 Other Policies

The Government has enacted other policies and laws which support efforts to enhance access to housing. Such policies are the Tanzania's Development Vision 2025, the Construction Policy, the Community Development Policy, the Science and Technology Policy, the National Strategy of Growth and reduction of Poverty

(NSGRPI&II), the mortgage finance policy and enacted a regulating legislation for unit titles - the Unit Tiles Act[5].

2.6 Problems Contributing to Unaffordability in Housing Production

There are several factors responsible for high rate of house production. These include land acquisition costs, the high cost of funding, the high cost of building materials especially cement and steel, logistical challenges and the dearth of skilled artisans. The price of land is beyond the reach of most individuals and even where government partners with developers, the land allocation costs and charges make it impossible to deliver the housing units at affordable prices for the low-income market (Oladapo, 2014).

2.6.1 Land for House Development

Land availability has always been at the bottom of the challenges for housing development. However, what is clear is that without a major restructuring of the mechanisms of land assembly, development and delivery and the strengthening of housing finance, it is unlikely that sufficient housing of adequate quality can be made available in large cities to absorb new population growth (Sivam et al 2001). While the cost of urban land for housing development in most developing countries is arguably lower compared to the developed countries, the development of housing has nevertheless lagged behind the demand for the same. As a strategy to avail housing for themselves, medium and low-income earners buy un-serviced plots of land which they gradually develop using household savings.

5 http://www.nhbra.go.tz/uploads/documents/sw/1471249197-x.28th CONFERENCE PROVISION OF AFFORDABLE HOUSING

A sustained high rate of urbanization has resulted in an ever-rising demand for affordable housing in which absence the growth of informal settlements has proliferated (Macaloo, 2015). Individual developers have constantly experienced land ownership, planning and infrastructure related problems which directly affect their ability to construct quality housing and to access financial assistance for construction of their houses. Macaloo, (2015) contends that in practice, the public sector has very little direct control over land available for development.

Land constitutes a significant proportion of the total cost of financing incremental housing construction process and access to low-cost land is very essential in making the progressive housing development process viable.

Land should be made available for residential development to all income groups. The first step to solving housing problems involves access to land by the low-income households in suitable locations. Access to land makes it possible for low-income families to construct their dwelling and access to other basic services and employment opportunities within the urban area (Cavalcante, 2016). Access to land is conditioned by land tenure, which is inextricably linked with historical, cultural, legal and economic factors that affect people perceptions and behavior. It is related to location, the nature and distribution of employment centres, transportation and other public infrastructural services (Payne, 2002)

Payne (2002) argues that for the very poor urban households, their priority is to obtain access to land where they can maximize their livelihoods opportunities and this is usually in prime locations in urban areas where there is very high competition for land and land prices are very high. Payne further posits? that, for more established low-income households, their ability to cover transport cost influences their decision to construct their dwelling at less central locations in the urban areas and the type of tenure that afford this, becomes an important element for access to services and credit.

Land regulation and property titles are at the cornerstone of housing. In Tanzania, land and property regulations have been inherited from colonial times and involve a rather complex tenure mechanism framed in many different laws. By-and-large, land tenure was administered through a system of customary laws and can vary depending on ethnic groups, predominant land use or cultural practices (World Bank, 2011).

Cost of Land and Low-Cost Housing

Land is a key factor of production. Access to land is a critical element in providing low-income housing (UN, 1984). The supply of land is very limited, coupled by the need for it as a public utility for low-cost housing, makes it very scarce. Consequently, there is a growing class of landless whose access to land and shelter is becoming more difficult every day. This is a notable fact as in the past; land for low-income housing was provided or allocated easily which in most cases is no longer the case (Makoba, 2008). Nabutola (2004) cites that land in urban areas is highly valued and is mostly in the hands of the central government and the local authorities. The only other landowners are speculators seeking to make a quick buck. This makes land inaccessible to the majority who need it most but cannot afford its premium price.

The price of land depends on many factors including location; distance from services and amenities, nearness to commercial, academic, health facilities, availability of public transport. The further land is from the city centre, the cheaper the price of land is likely to become. At the city peripherals land prices may end up being low enough to be afforded by low-income groups. Unfortunately, in such locations there will be inadequate or no facilities in terms of services and amenities.

2.6.2 Infrastructure for Housing Development

Availability of infrastructure is a basic requirement for housing development and usually influences investment in housing development. However, housing developers have tended to move beyond this constraint and usually develop their houses with minimum infrastructure or none at all. How this affects the quality of houses developed is a key consideration in the strategy to improve individually spearheaded housing development that is continuing to play a significant role in the overall provision of housing in developing countries (Ondiege, 2012).

Deterrent to housing production by both the private and public sectors is the high investment cost of land infrastructure particularly where the development is distant from existing infrastructure. The developer fully bears the high investment cost of provision of water and road infrastructure to a new site, without future benefits for connections made off these infrastructures to other sites by other individuals or developers. This high cost of infrastructure significantly influences the final price of the serviced land and ultimately, the cost of housing to the consumer (Oladapo, 2014).

Therefore, there is a need to firstly re-examine the high initial cost of land infrastructure cost and secondly to develop a common approach for the provision of utilities to housing developments. The cost of infrastructure accounts for about 25–30 % of housing expenditures. It is a main factor in the delivery of inexpensive housing. Authority has ignored this area and developers now deliver same, thus increasing the cost of houses. This is obvious in many gated residential communities across the populace, where the contractor provides autonomous electrical energy, water treatment plant, sewage plants, and access roads to the estate (Oladapo, 2014).

Oladapo (2014) proposed that since some of the housing problems are as a result of public policy, there is need for a public sector approach to check the inefficiencies in housing especially through the development of infrastructure to encourage private development of housing. However, during the past decade, the public sector has failed to live up to this obligation, thus future housing and infrastructure development solutions re mainly within the private sector domain. As a measure to ensure effective private sector involvement, he proposed the revision of past policy instruments that could be used by the public sector in housing development such as:

a) Regulations on land-use planning which include zoning, subdivisions, building bylaws, building permits and rent control,
b) Fiscal and financial policies. These include control of mortgage, property taxation, and budgeting user charges on housing and housing services.
c) Supply of housing services; these include land provision, public services (sewerage, drainage, water supply, roads and electricity), and the direct provision of shelter (Ondiege, 2012)

Management and Infrastructure

Currently, most African economies are experiencing economic stagnation and decline. The situation is causing considerable concern in government about effective local management and controls over decentralized activities. City authorities in many countries have barely managed to maintain, let alone redevelop, their deteriorating infrastructure base. In Tanzania for example, infrastructure which is supposed to be availed to all constructed houses but, just rough roads, which are not well maintained.

2.6.3 Cost of Building Materials for House Development

Volatile and rising costs of materials have contributed to the non-governmental constraints on housing development and improvement. These costs are a substantial part of the increased housing costs in the past decade. Builders are forced to pass those increases along to the home buyer or renter. In the last several years, construction costs for materials and land have significantly increased, as the demand for housing. These increased costs can no longer be passed on to the taxpayer by the local jurisdiction and must be borne by the developer, who then must pass them along by increasing the cost of housing or rents (Case, 2003). Prices of construction materials are a major impediment to the ability of a community to augment its housing stock, and influence rents and sale prices when new units are placed on the market. A major component of these costs is the price of building materials, which has seen a significant increase so far this decade, though is showing signs of leveling off. Prices of material remain at a high level, and the uncertainty of material prices is currently having a far greater impact on the final cost of housing.

According to Un-Habitat (2001) building materials often constitute the single largest input to housing construction in most developing countries. It is estimated that the cost of building materials alone can take bigger part of a standard low-income formal housing unit. A number of factors influence construction costs and the sales price. A reduction in amenities and the quality of building materials could result in lower sale prices. Another factor related to construction costs is the number of units built at one time. As the number increases, overall costs generally decrease as builders are able to take advantage of economies of scale. This type of cost reduction is of particular benefit when density bonuses are used for the provision of affordable housing. Manufactured housing may provide for lower priced housing by reducing construction and labor costs. However, due to the high cost of land in urban neighborhoods, new construction of manufactured housing cannot be assumed to meet the housing needs of lower-income households. It is difficult for builders to know how much of the actual cost of construction consists of the cost of materials or of labour, since most of the work is done by subcontractors, and the subcontractors often supply both materials and labor. A wide range of building materials is available for the construction of rural buildings and structures. The proper selection of materials to be used in a particular building or structure can influence the original cost, maintenance, ease of cleaning, durability and, of course, appearance.

The building industry has been experiencing shortage of building materials. It has been difficult for some developing countries to import raw ingredients for the manufacturing of building materials due to lack of foreign exchange. Appropriate materials produced locally have been scantly used in the construction of low-cost housing. The building industry is not adequately aware of properties, qualities and suitability of such materials in the construction of such housing. Small producers of appropriate materials e.g. stabilized soil blocks have not received good support from the government. This leaves them to depend on themselves or other agencies for advice on production, pricing and marketing which is inadequate. There is also consumer bias against the use of appropriate materials. There are other factors such as availability of labour and technology which affect the construction of affordable house. The reason for shortage of materials could be the defective supply of materials occasioned by general shortages in the industry, poor communication amidst sites and head office, poor purchasing planning and materials coordination (Gichunge, 2001).

2.6.4 Issues on Housing Finance

Construction is one of the big investments in one's lifetime for the majority of the population, but it is so capital intensive that not many individuals can afford to acquire through their normal savings. Housing finance as a mechanism provides borrowing opportunities for the less capable house builders, through housing loan and mortgage facilities.

Tanzania's mortgage finance market needs to be improved by ensuring that (a) long-term loans from a number of competing banks are available, as long as conditions are met (b) interest rates are charged at market price (c) valuation of land and properties is ethically done (d) mortgage lenders operate on a market basis, albeit with limited interference from the Bank of Tanzania, which should; at this nascent stage of the market, give more attention to developing the market rather than regulating it (Kibuuka, 2016).

Presently, commercial banks account for the majority of the mortgage lending business in Tanzania. However, it is challenging for banks, whose major source of mortgage loans is short-term deposits, to operate in an unstable economic environment. This is why some industry experts argue that since Tanzania's mortgage finance market is still young, specialized companies would be better placed to do mortgage lending as they are more determined and committed to tackling the obstacles that hamper the growth of the market and to influencing government policy.

In any case, a stable economic environment, accompanied by a low and steady rate of inflation, can help develop the mortgage finance market in Tanzania. Confidence in the market will encourage individuals to enter into long-term mortgage commitments (Kibuuka, 2015).

2.6.5 Participation of Actors on Housing Development

In many countries the actor plays an important role in housing development. It constructs housing either for sale or rent for different income groups, enabling the production of housing by creating/designing policies and legislation which support housing development and considerable responsibilities to manage and guide human settlements. It also engages in the production of building materials and the provision of infrastructure. Actors includes:

a) Central Government

Central governments are supposed to act as facilitators or enablers in the production of housing by putting in place relevant policies and legislations. They should also create institutional framework, which will facilitate such a process and allocate enough resources for the sector in the national budget (Blasi, 2001).

Since Tanzania got its independence in 1961 it has formulated and implemented a number of policies, which have a bearing on housing development. Such policies on Urban Housing Problems in Tanzania, among others, covered urban settlements and shelter development; land, environmental management, decentralization and city management (Governance).

However, the institutional framework within which housing development policies are implemented is not very clear. There is complex system of institutions i.e., ministries, departments, local authorities and parastatals to guide, support and control the development of human settlements. These institutions have not been effective in ensuring that, for example, land is made available, planning mechanisms guide and control developments in accordance with agreed plans, and that finance is available for infrastructure and for individuals wishing to build. There has also been a serious lack of co-ordination between the various institutions. One unfortunate set back is also that, government's allocation of the national budget to housing has been generally low and is declining (Blasi, 2001).

b) Local Governments

Local authorities have considerable responsibilities to manage and guide human settlements by way of investment or regulation. They are at the local level where main activities take place. In Tanzania urban authorities (i.e. town, municipality) were reinstated under the 1982 Local Government (Urban Authorities) Act. No. 8, while District Authorities or Councils were reinstated under the Local Government

(District Authorities) Act No.7.Those acts gave local authorities planning powers over settlements within their areas of jurisdiction. However, it is important to note that Local Authorities had been abolished in the country since 1972. Therefore from 1972 to 1982 most development programmes were centralized being administered by the central government through the region's headquarters. The approach of project implementation was at most times a "top down" approach. This, to a large extent, affected the success of development projects putting into consideration also that it has been taking time for Local authorities to take fully their role in the development of the country.

c) Individual Developers

It is principally now agreed that every person should endeavor to have a shelter which is a basic necessity of life. The government will play a facilitating role to enable him achieve this noble objective. In most countries individual housing contributes a big portion of the available housing stock. In Tanzania nearly, all housing in the rural areas and at least 90% in urban areas is constructed with little or no intervention from the public sector.

While individuals are being keen in having shelter, they have faced a number of bottlenecks, which need to be addressed namely:

a) Building land is available but cost of land is high for lower-earner

b) Lack of affordable building materials, infrastructure services, housing credit facilities, enough local authority support and housing development technical assistance (Blasi, 2001).

2.6.6 Tax regime in Housing Development

The levy problem on housing provision and development in Tanzania is huge. Value added tax (VAT), which is deducted at numerous stages of the building approval, adds as much as 18 % to the total cost of a house. This is exclusive of titling fees and stamp duties. This eventually places the sales price of the item beyond the reach of low-income recipients (Tanzania invest, 2015).

Tax incentives designed to encourage personal superannuation benefit high-income and high-wealth households and run the risk of creating an economy in which income and wealth are even more unevenly distributed than at present. Such inequalities may impose greater pressures on the housing market than have been felt in the past. In creating additional affordability problems for those whose incomes and wealth have not kept pace with the national average as national average salary per mouthy is TZS 300,000 after deduction of tax the salary average keep decreasing which is not suitable for wide range of lower earners.

2.7 Simulation Model

The simulation model was used to control the availability of certain features: instruction and data profiling, memory timing, and the micro-architectural interface. To allow for maximum performance when these features are used, they are compiled as separate processor implementations.

2.7.1 What is modeling?

Modeling is the process of producing a model; a model is a representation of the construction and working of some system of interest. A model is similar to but simpler than the system it represents (Anu, 1997). One purpose of model is to enable the analyst to predict the effect of changes to the system. On the one hand, a model should be a close approximation to the real system and incorporate most of its salient features. On the other hand, it should not be so complex that it is impossible to understand and experiment with it. A good model is judicious tradeoff between realism and simplicity.

Simulation practitioners recommend increasing the complexity of a model iteratively. An important issue in modeling is model validity. Model validation techniques include simulating the model under known input conditions and comparing model output with system output (Maria, 1997).

Generally, a model intended for a simulation study is a mathematical model developed with the help of simulation software. Mathematical model classifications include deterministic (input and output variables are fixed values) or stochastic (at least one of the input or output variables is probabilistic); static (time is not considered) or dynamic (time-varying interactions among variables are considered). Typically, simulation models are stochastic and dynamic (Maria, 1997).

2.7.2 What is Simulation?

A simulation of a system is the operation of a model of the system. The model can be reconfigured and experimented with; usually, this is impossible, too expensive or impractical to do in the system it represents. The operation of the model can be studied, and hence, properties concerning the behavior of the actual system or its subsystem can be inferred. In its broadest sense, simulation is a tool to evaluate the performance of a system, existing or proposed, under different configurations of interest and over long periods of real time (Anu, 1997).

Simulation is used before an existing system is altered or a new system built, to reduce the chances of failure to meet specifications, to eliminate unforeseen bottlenecks, to prevent under or over-utilization of resources, and to optimize system performance.

2.7.3 Theory of how to Develop a Simulation Model

Simulation models consist of the following components: system entities, input variables, performance measures, and functional relationships. Almost all simulation software packages seek to model each of the above components. Modeling is arguably the most important part of a simulation study. Indeed, a simulation study is as good as the simulation model. Simulation modeling comprises the following steps:

Step 1. Identify the problem.

Enumerate problems with an existing system. Produce requirements for a proposed system.

Step 2. Formulate the problem.

Select the bounds of the system, the problem or a part thereof, to be studied. Define the overall objective of the study and a few specific issues to be addressed. Define performance measures - quantitative criteria on the basis of which different system configurations will be compared and ranked. Identify, briefly at this stage, the configurations of interest and formulate hypotheses about system performance. Decide the time frame of the study i.e., will the model be used for a one-time decision or over a period of time on a regular basis. Identify the end user of the simulation model. Problems must be formulated as precisely as possible.

Step 3. Collect and process real system data.

Collect data on system specifications, input variables, as well as performance of the existing system. Identify sources of randomness in the system, i.e., the stochastic input variables. Select an appropriate input probability distribution for each stochastic input variable and estimate corresponding parameter(s).

Software packages for distribution fitting and selection include Expert Fit, Best Fit, and add-ons in some standard statistical packages. These aids combine goodness-of-fit tests, e.g., $\chi 2$ test, Kolmogorov-Smirnov test, and Anderson-Darling test, and parameter estimation in a user-friendly format. Standard distributions, e.g., exponential, Poisson, normal, hyper-exponential, etc., are easy to model and simulate. Although most simulation software packages include many distributions as a standard feature, issues relating to random number generators and generating random variants from various distributions are pertinent and should be looked into. Empirical distributions are used when standard distributions are not appropriate or do not fit the available system data. Triangular, uniform or normal distribution is used as a first guess when no data are available (Maria, 1997)

Step 4. Formulate and develop a model**.**

Develop schematics and network diagrams of the system (How do entities flow through the system?). Translate these conceptual models to simulation software acceptable form. Verify that the simulation model executes as intended. Verification techniques include traces, varying input parameters over their acceptable range and checking the output, substituting constants for random variables and manually checking results, and animation.

Step 5. Validate the model.

Compare the model's performance under known conditions with the performance of the real system. Perform statistical inference tests and get the model examined by system experts. Assess the confidence that the end user places on the model and address problems if any. For major simulation studies, experienced consultants advocate a structured presentation of the model by the simulation analyst(s) before an audience of management and system experts. This not only ensures that the model assumptions are correct, complete and consistent, but also enhances confidence in the model (Maria, 1997).

Step 6. Document model for future use.

Document objectives, assumptions and input variables in detail.

2.7.8 Theory of how to Design a Simulation Experiment

A simulation experiment is a test or a series of tests in which meaningful changes are made to the input variables of a simulation model so that we may observe and identify the reasons for changes in the performance measures. The number of experiments in a simulation study is greater than or equal to the number of questions being asked about the model. Design of a simulation experiment involves answering the question: what data need to be obtained, in what form, and how much? The following steps illustrate the process of designing a simulation experiment (Anu, 1997).

Step 7. Select appropriate experimental design.

Select a performance measure, a few input variables that are likely to influence it, and the levels of each input variable. When the number of possible configurations (product of the number of input variables and the levels of each input variable) is large and the simulation model is complex, common second-order design classes including central composite, Box Behnken, and full- factorial should be considered. Document the experimental design (Maria, 1997).

Step 8. Establish experimental conditions for runs

Address the question of obtaining accurate information from each run. Determine if the system is stationary (performance measure does not change over time) or non-stationary (performance measure changes over time). Generally, in stationary systems, steady-state behavior of the response variable is of interest. Ascertain whether a terminating or a non-terminating simulation run is appropriate. Select the run length. Select appropriate starting conditions. Select the length of the warm-up period, if required. Decide the number of independent runs - each run uses a different random number stream and the same starting conditions - by considering output data sample size. Sample size must be large enough (at least 3-5 runs for each configuration) to provide the required confidence in the performance measure estimates. Alternately, use common random numbers to compare alternative configurations by using a separate random number stream for each sampling process in a configuration. Identify output data most likely to be correlated (Maria, 1997).

Step 9. Perform simulation runs

Perform runs according to steps 7-8 above.5

2.7.9 Theory of how to Perform Simulation Analysis

Most simulation packages provide run statistics (mean, standard deviation, minimum value, maximum value) on the performance measures, e.g., wait time (non-time persistent statistic), inventory on hand (time persistent statistic). Let the mean wait time in an M/M/1 queue observed from n runs be W_1W_2…… $W_{n.}$ It is important to understand that the mean wait time W is a random variable and the objective of output analysis is to estimate the true mean of W and to quantify its variability. Notwithstanding the facts that there are no data collection errors in simulation, the underlying model is fully known, and replications and configurations are user controlled, simulation results are difficult to interpret. An observation may be due to system characteristics or just a random occurrence. Normally, statistical inference can assess the significance of an observed phenomenon, but most statistical inference techniques assume independent, identically distributed data. Most types of simulation data are auto correlated, and hence, do not satisfy this assumption. Analysis of simulation output data consists of the following steps (Anu, 1997).

Step 10. Interpret and present results.

Compute numerical estimates (e.g., mean, confidence intervals) of the desired performance measure for each configuration of interest. To obtain confidence intervals for the mean of auto correlated data, the technique of batch means can be used. In batch means, original contiguous data set from a run is replaced with a smaller data set containing the means of contiguous batches of original observations.

The assumption that batch means are independent may not always be true; increasing total sample size and increasing the batch length may help.

Test hypotheses about system performance. Construct graphical displays (e.g., pie charts, histograms) of the output data. Document results and conclusions.

Step 11. Recommend further course of action.

This may include further experiments to increase the precision and reduce the bias of estimators, to perform sensitivity analyses (Anu, 1997).

2.8 Recommendation from other researchers on affordability

2.8.1 Government

Government should first provide assistance to local authorities to housing department for housing activities, second suitable housing delivery system by creating policy, laws, program and rules for building regulation for the support lastly, government should create good cooperation with development partners and actors within and outside the country should encourage participation, collaboration and invest on the housing development by increasing knowledge, finances, supply, and research (Kwanama, 2015)

2.8.2 Land

Land and housing markets should have protective but also flexible regulation and easy adaptation to the local urban development in which the price should be regulated and unregulated land should be proper regulated to make easy affordability to the lower earner (Rewel, 2014) and also the access to land procedure need to be checked well and remove bureaucracy which hinders the easy access to land and also land title (Makoba, 2008).

2.8.3 Building material

Alternative building material and technology in which the construction consultant should implement new technology that will develop achievement of substantial saving in cost and also to conduct and motivate the developer (Rewel, 2014). Also, government can provide help by reducing or eliminate the value by consider tax costs on the building material and importation cost of the material in the country (Kombo, 2015).

2.8.4 Infrastructures

Local and national government should facilitate the construction of infrastructures and local servicing and also should motivate private developers and also actors on construction of the infrastructures and local servicing (Rewel, 2014).

2.9 Summary

This chapter has been dealing with theoretical framework of the study in structure theory and system theory, affordable house demand, housing as a process in terms of land for housing, material, infrastructures and services, house financing and affordability, government institutions in housing provision initiatives, capacity building and delivery of technical services, land delivery schemes, policies and legislations, problems that contributes to unaffordability in housing production in relation to land, material, infrastructure and finances and other researcher concern affordability.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Methodology

The general theme of this research is to develop cost simulation model to improve housing provision for low-income households. Affordability has been seen to be a problem in housing and therefore a need to look at it in depth. There are many areas that have been seen to be the cause of the high costs and this has influenced the methodology to be used for the research.

The research methodology presents the basis through which the study was conceived and has been executed. According to (Nachmias, 1996) research design is a program that guides the investigator as she/he collects data, analyses and interprets observations. The selection of research strategy is very important for it may affect the validity and reliability of data. Lerise, (1996) points out that; “a properly selected research strategy has real life practical value”. The approach has been selected based on the nature of the study, the objectives and the research questions.

3.2 Research approach

There are several approaches for doing research and these approaches suit different researches. Kumar(2005) identified three key approaches to research application, objectives, inquiry mode. Researcher will base on inquiry mode, which consists of a quantitative, a qualitative and a mixed method approach. Quantitative research also known as structured approach is about asking people for their opinions in a structured way so that you can produce hard facts and statistics to guide one. To get reliable statistical results, it's important to survey people in fairly large numbers and to make sure they are a representative sample of your target market. A qualitative research also known as unstructured approach is concerned with subjective assessment of attitudes, opinions and behavior (Kothari, 2014) and mixed method approach is the use of the both approaches quantitative and qualitative.

In this study, the inquiry approach was used for exploration, confirmation and quantification that guided the study.

3.3 Research strategy

The most common strategies used in social science research are surveys, experiments, histories and case studies. All of them can be used to explore, describe and explain a phenomenon. Each approach has its own logic of collecting and analysing empirical evidence. Moreover, each strategy has its own advantages and disadvantages. The selection of a particular strategy is guided by three conditions:

a) The type of research questions
b) The control an investigator has over actual behavioral event, and
c) The focus on contemporary as opposed to historical phenomena (Makoba, 2008).

Despite of their different logical assumptions, it is possible to use more than one strategy in the same study. As argued by Yin (1994), the strategies are not mutually exclusive. Researcher used experimental strategy, where simulation is used, to get the output from the various input variable in achieving affordability.

3.4 Unit of Analysis

The main objective of the study is to determine how the low-income households can have affordable and adequate housing by use of cost simulation tools in integrating housing process. It aims at looking into ways that low-income households can have affordable and adequate housing by integrating housing process. Considering the main objective and the research questions for this study, the unit of analysis is owner households of low-income houses. Affordability is a factor of owner households, the process of acquiring housing need to be made to help households' own housing. It is the potential owner-households who make the decision to own a house.

3.5 Cost modeling and simulation

This study is looking at how to make housing affordable and therefore requires looking at different alternatives in housing provision and their cost implications. The cost analysis and comparison of different alternatives can properly be done by cost modelling. Cost modelling is applied by pricing different alternatives and getting a comparable outcome. The cost comparisons in this study are based on abstract spatial requirements and therefore use cost models that can estimate cost in abstract values. Modelling used in this study is based on what is termed as traditional estimating methods. As successful estimating requires a huge amount of data that manual methods will find too cumbersome to handle, "excel programme" has been used as the modelling tool. The design optimization models, assisted with life-cycle costing models are used in this study.

3.6 Reliability in cost modeling

Cost modeling has undergone different changes, all with the aim of increasing accuracy to the output parameters. The trend has swung between a heavy reliance on the importance of experience and judgment to a rationale that construction costs can all be analyzed in simple or complex formulae (Ashworth, 1999). The result is models based on empirical methods, regression analysis and simulation. Also, there are models relying on heuristics, expert system and value-for-money considerations. Since the study is involved with simulation models, a detailed explanation of them is important.

While empirical type is based on observation, experience and intuition, and regression analysis models based on finding a formula or a mathematical model which best describes data collected, a simulation model seeks to duplicate the behaviour of a system under investigation by studying the interactions among its components (Ashworth, 1999).

There are some reasons why simulations need to be done. One of it is that, there has always been a desire to avoid direct experimentation where it is possible, it may be costly in the beginning but to be done when parameters have been well known. A simulation experiment differs from a regular laboratory experiment in that it can be conducted almost totally on a computer. The relationship in the data can be gathered in very much the same way as if real system were being observed. Simulation models attempt to imitate reality in a number of times under varying conditions and let the consequences studied. Simulation is very quick and effectively addresses “what if” type of questions (Curwin, 1996:423-424). The nature of simulation allows much greater flexibility in representing complex systems that are normally difficult to analyse by standard mathematical models. Models are unlikely to give perfect answers; they allow the user to work through various situations about the problem by changing one or more parameters and observing the impact on output (Makoba, 2008).

3.7 Why Dar es Salaam

Any research should have a limited area to work on; otherwise the study may not end. Dar es Salaam has been selected as a study area to data collection due to the following reasons:

- Dar es Salaam is the largest urban agglomeration in Tanzania and is one of the rapidly urbanising cities in the country[6] and has a bigger population compared to other urban centers. Dar es Salaam has a population of 4,364,541 according to the national census, 2012.
- Dar es Salaam is faced with a shortage of housing both for low and middle-income earners and therefore is a good representation of other urban centers

3.8 Data sources and collection method

As this research is mostly based on simulation models, limited data is needed to enable models be developed in housing provision. Data collection was done in two stages and mostly different types of sources of data. Major types of data source were used, namely documentary information (basic information) and interview.

[6] Dar es Salaam is the tenth fastest growing city in the World.

3.8.1 Documentary information

Documentary information used was from Dar es Salaam City Council, and its three municipalities. The Ministry of Lands, Housing and Human Settlements Development was a good source for information regarding access to land. CRDB bank provided document about finance knowledge. Consultants provided prices of material for the model.

3.8.2 Interviews

Interviews were important in searching for housing process, affordability, materials and household information. The interviewees were bankers, Quantity surveyor, local shops for material and householders.

3.9 Limitation of the study

The study looks into affordability of households in home ownership using simulation models and therefore things which will not be related to affordability of households as individuals and modelling will not be included in the study.

CHAPTER FOUR

RESEARCH FINDINGS

4.1 Introduction

This chapter presents the analysis of data obtained through documentation and interview and analysed by the simulation models. As initially presented in chapter two, the framework of the study is about affordability, affordable house demand, housing as a process, government institutions on provision of housing, problems that contributes to unaffordability in housing production. Thus, a detailed study was carried out to investigate how housing affordability to the lower income household can be achieved through simulation models. The chapter attempts to analyse the model output and provide findings from the analysis in response to affordability.

4.2 Land for housing

Before anyone thinks of building a house, land should be available. The land cost has been stated to be high and therefore necessitating a detailed study. A simulation model with all possible land access costs has been developed and simulation done to determine how savings cost can be achieved in land. The aim of the simulation model is to highlight the effect of the land access costs and determine the extent of savings that can be achieved. This is obtained by changing the input parameters of the model.

The model has taken the following into consideration:

a) Land has a price and this price has been derived per square metre. The price of land is a function of so many factors, value inclusive. The model has considered this variability of land price by having the price as an input parameter. The price of a plot will therefore be Price = (Lp*w*d*(1-Ss)

b) Formally land should be planned and surveyed before being offered to people. This involves costs which are planning costs and surveying costs. The model has considered surveying costs in two categories, fixed and variable costs. The planning and surveying costs are thus represented as: Planning and Surveying Costs = (P_c +S_f +S_v*w*d)

c) A good plot needs to have been provided with services. It has to have good roads, surface water drainage, water supply and electrical power supply: Services = (E_c+W_c+R_c)

d) Fees for plot title has to be paid: Title = T_f

e) Land rent is to be paid annually. The present value of all the yearly fees is Value = $\sum_0^t PV[Lr(1+g)^t]$

f) The sum of all these costs is the land costs and is represented by the following function. Sum=

$$[\ (Lp*w*d*(1-Ss))+(Pc+Sf+Sv*w*d)+(Ec+Wc+Rc)+Tf+\sum_0^t PV[\ Lr(1+g)^t\ ]\ ]$$

L_p	=	Land price per m^2	*w*	=	Width of plot
d	=	Depth of plot	*Ss*	=	Subsidy (as percentage)
Tf	=	Title fees	*Lr*	=	Land rent
PV	=	Present Value	*Ec*	=	Electrical cost
Wc	=	Water cost	*Rc*	=	Roads cost
t	=	Lease period	*g*	=	Growth rate
Sf	=	Fixed survey cost	*Sv*	=	Variable survey cost
Pc	=	Planning cost			

4.2.1 Model inputs

Figure 4.1 shows the model input parameters. The input parameters are shown in grey shading and include width and depth of plot, number of plots in a block, family per plot, width of main and service roads. The input parameters will result into intermediate output such as area of plot, area of block/plots only, area of block/roads only, width of block and depth of block. Land cost, infrastructure costs, surveying costs and other fees are input parameters in the model.

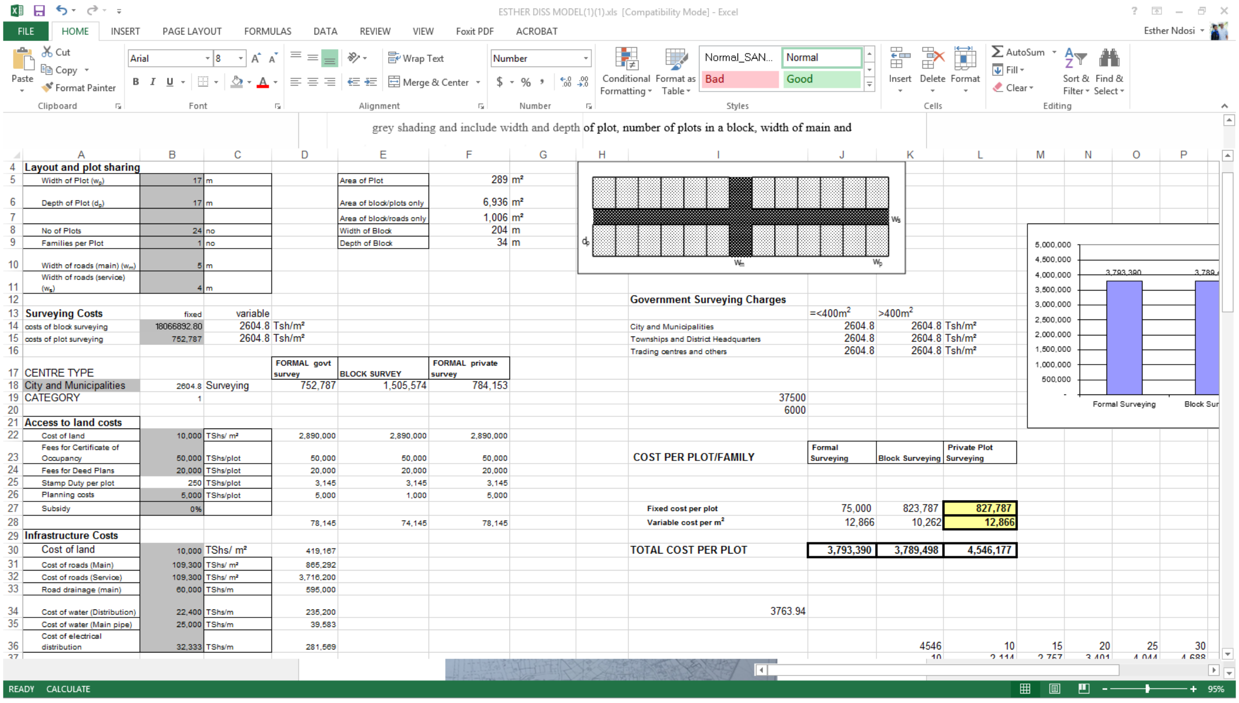


Figure 4.1: Model Input parameters for land cost

Source: Simulation models

4.2.3 Abstraction of plans

In actual street planning, it is common to have meandering streets depending on the topography of the region. A typical street layout is shown in Figure 4.2. It's not easy to characterize the twisting streets and round corners of the plots in mathematical relationship. To make it easy, the actual plans are abstracted to rectangular/square plots which typically represent the actual layout on ground.

Figure 4.2: Typical Street layout

Abstract street layout Figure 4.3 represents part of Figure 4.2 as used in the models. This idea makes it easy to assign mathematical relationship of the plots as to compare them. Figure 4.3 shows arrangement of the main roads and service roads.

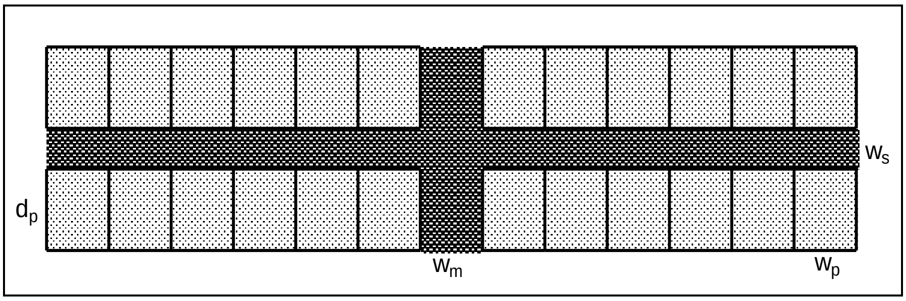


Figure 4.3: Abstraction of real plans

These factors are programmed in a simulation tool to allow for simulation.

4.2.4 Model output

The preliminary task of the model was to define areas with significant cost implication worth further detailed analysis. Other particular areas may be having very little change on cost implication to warrant further analysis. To make the elimination open, surveying costs have been divided into two categories, which are government surveying costs and private surveying costs.

A land buyer should have land with assured tenancy, and access to all public and private privileges attached to the area of the property and available when required at an affordable price. Access to land costs for a plot measuring high densities of 400m^2 in Tanzania with regard to input parameters in the model display in figure 4.4.

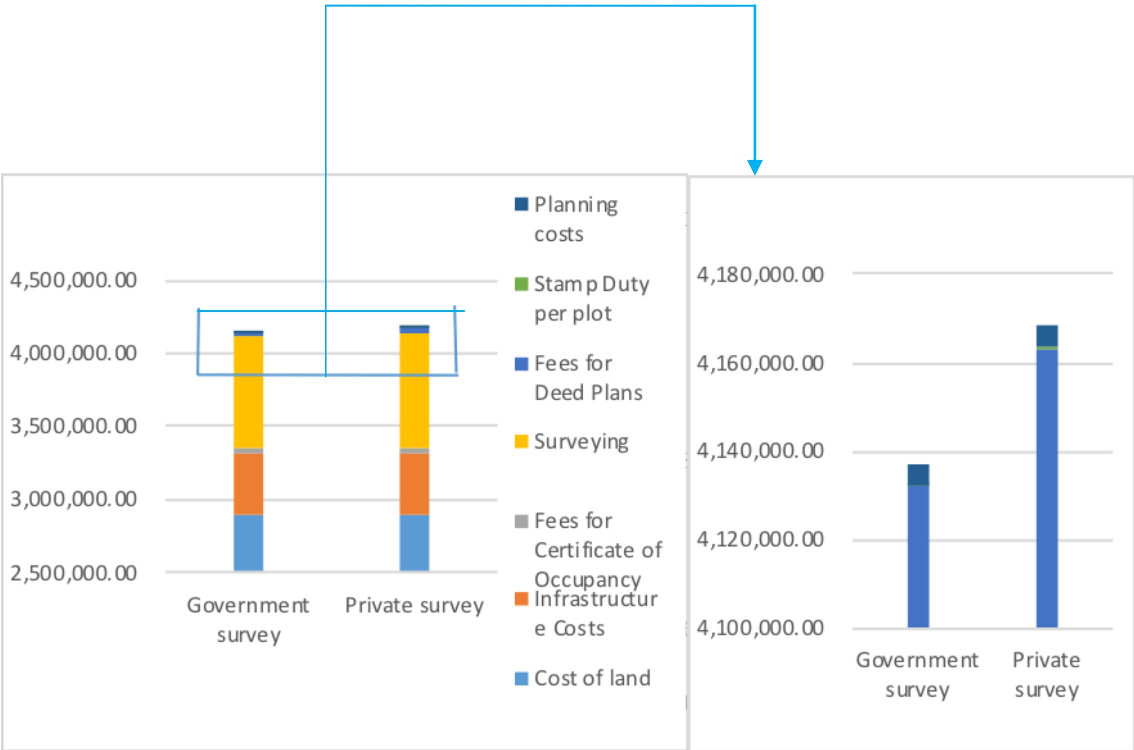


Figure 4.4: Access to land costs government versus private surveying

Source: Simulation models

Figure 4.4 shows that infrastructure, surveying and land costs take the biggest share of the access to land cost compared to planning, stamp duty, certificate and deed plans combined together (for a serviced plot).

Reducing land cost, infrastructure costs and surveying costs will lower costs of access to land, as they are the major contributors in access to land costs. How can they be lowered and what are the implications?

a) Sharing costs

The Land Act No. 4 of 1999 Orders incidents of co-occupancy and partition "In this Act, co-occupancy means the occupation of land held for a right of occupancy or a lease by two or more people". This implies a piece of land can be shared but each one having some rights on the land. Sharing cost can decrease or increase the cost according to the size of land one wants to acquire.

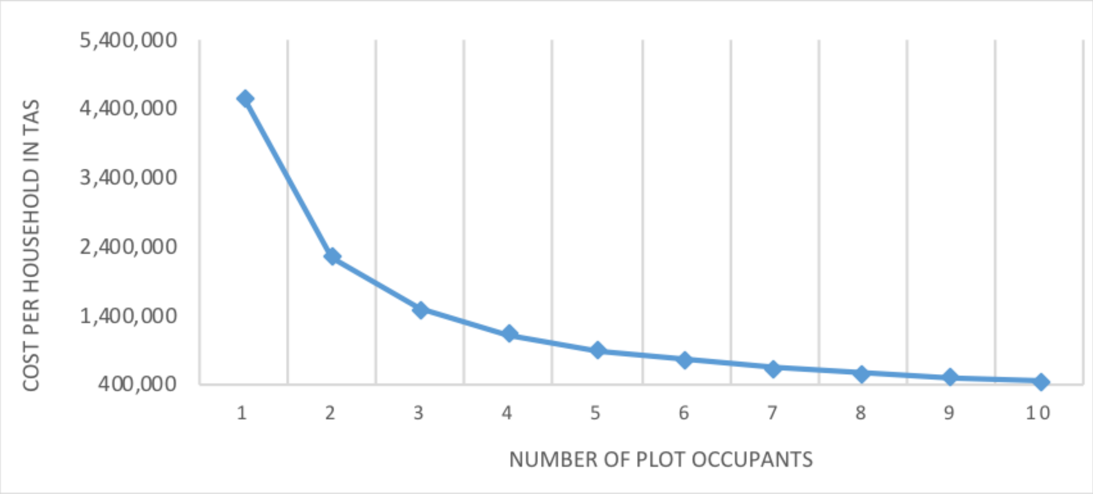


Figure 4.5: Change of present value of cost per person with increase of number of occupants on a 20x20m Plot (In TAS)

Source: Simulation models

Plots can be shared by vertical or horizontal extension. Figure 4.5 shows the effect of plot sharing with plot co-occupancy, the cost decreases significantly when two and three occupants share land and decreases marginally thereafter. There is a decrease by 50% of the cost of land access from one occupant to two and it decreases by almost 67% to the three occupants. This means when two occupants shared a plot, each occupant will pay half of the land cost and one third of land cost for each if three occupants shared plot.

All land access cost can be shared except for the individual land titles (the certificate of ownership)

b) Economical plot sizes

Increase depth and width while maintaining the same number of plots in a block will result into increased width and depth of the block and decreasing density of development.

"One of the ways that housing affordability can be encouraged within a growth management framework is by increasing the density of development, thereby reducing the land costs component of housing prices. Higher-density development can reduce sprawl, reduce cost of infrastructure and services for new development, and reduce lengths and traffic congestion" (Anthony, 2003)

Ideally, a plot should have width and depth in the ratios between 1:2 and 1:4 to reduce the run of infrastructure (Mumtaz, 1996). Davidson and Payne (Tipple, 2000) argue that 6m frontages provide economical but tight layouts, 7.5m widths are economical and reasonable, 9m gives flexibility and 12m could be regarded as very flexible. Small widths ensure that small amount is charged for cost recovery of services making it affordable.

Figure 4.6 shows that the rate of increase of access to land costs with increasing width is higher than with depth. The rate of change on width is higher because many services along the width are shared by two plots only while the whole neighborhood shares main road services. It is therefore important to carefully look at the width and depths of plots when planning a neighborhood so as to reduce the cost of plots. The graph also shows that the bigger the plot, the higher the cost.

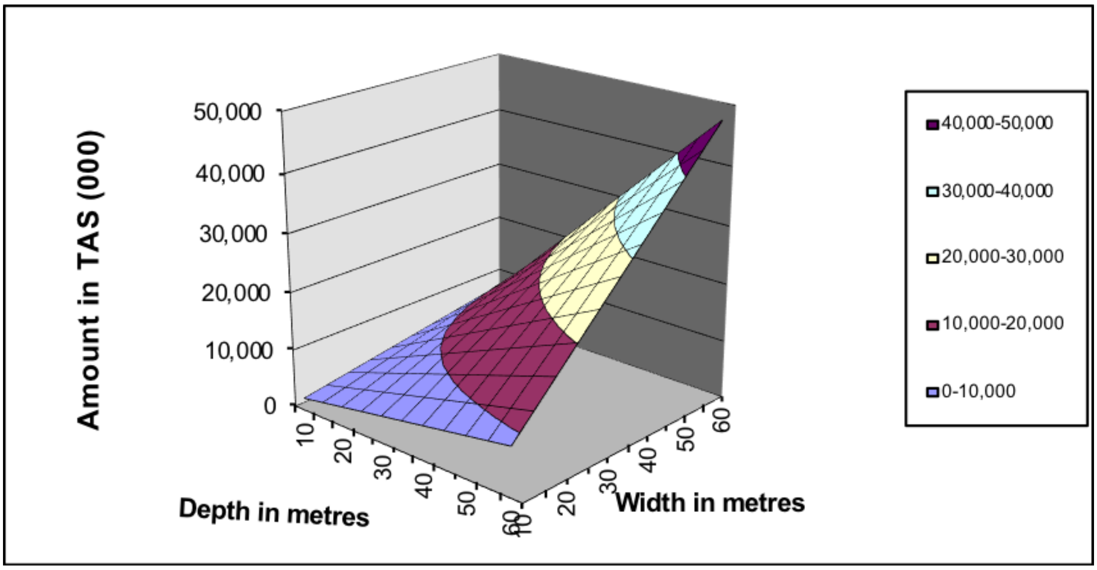


Figure 4.6: The change of access to land cost (with services) with change of width and depth of plot

Source: Simulation models

Other factors not from the model which can lower costs to land access.

a) Reduction of land access costs

The establishment of a revolving infrastructure fund can reduce the initial cost of land to the home owner. The cost of infrastructure will initially be paid by the fund (premium). In effect reducing the initial land cost to the home owner, who shall repay the fund through the rates and other user charges over a period of years as agreed.

Deferring this upfront cost will have the added benefit of spreading the cost of infrastructure to a subsequent owner and will not be such a hefty cost burden to the initial purchaser.

b) Reducing surveying costs

The cost of a land survey can vary greatly based on the size of the plot you want surveyed, how much research the surveyor has to complete, and how long the survey takes when they arrive at your property. While land surveys are an important investment if you are considering building or have a boundary dispute with one of your neighbors, you may be wondering how to reduce the cost of your survey and make it more affordable. Below are potentially way to reduce the cost of land survey.

i. Cooperating the participation of owners of neighboring land plots

If your neighbors see a strange person on or near their property, they may want to understand what they are doing there. If your surveyor has to stop to answer questions or appease an angry neighbor, this could extend the amount of time needed to complete the survey. To prevent this, talk with all of your neighbors and let them know when you plan to have the survey completed (weber-knecht, 2016).

ii. Find Your Own Deed

Before your land surveyor begins, they will need a copy of your deed and the most recent plot available for your property. This is how they will know which markers to look for and what the general survey of your land will include. Providing a copy of your deed should be easy, because you should own a copy. However, to look for a plot you may have to go to your local courthouse and request a copy of any plots for your property. Not all properties have been plotted, and it is possible that there are multiple plots for your property. If your property has multiple plots, you should request a copy of the most recent plot. Before seeking a surveyor's, input consult a planner first so that a TP drawing or an extract thereof is available to guide the surveyors, otherwise the surveyor will turn the work down (weber-knecht, 2016).

iii. Marking the land boundaries

Many survey markers are buried or difficult to find. If you feel confident with your compass skills, you can complete your own amateur survey and potentially reveal some hidden markers ahead of time, making your professional surveyor's job easier. Keep in mind that only a professional surveyor can move boundary markers. When you uncover makers, it is important that you leave them where they are, even if you think that they are not in the right place.

iv. Removing obstacles along the land boundaries write

If you have items near the property line that the surveyor has to go around or move to complete their survey, this could slow their progress. You may want to trim shrubs and cut any excessively high grass before your surveyor arrives. Additionally, tidy your plot and put away any items that are not permanently placed to make for the easiest, fastest survey possible (weber-knecht, 2016).

4.3 Design variables

The basic house was priced to identify costly elements that should be given more attention and especially when there were alternatives that may be cheaper than materials used, to cut down costs to achieve affordable house. Elements are identified as foundations, walls, floor, window, doors, electrical, sanitary and roof on the building without considering land and infrastructure.

Figure 4.7 shows elemental cost of the base building, materials are changed in different elements to see the cost effect of the complete house. The base house is assumed to be constructed by mass concrete foundations with 230mm thick foundation walls. The floor is made of 100mm thick mass concrete on 150mm thick hardcore bed with cement screed floor finish. External and internal walls are of 230mm and 150mm thick solid concrete blocks respectively including ring beam with plaster and painting internally and Tyrolean render externally. The roof is of 28 gauge galvanised iron sheets on treated timber trusses.

Windows for the base house are hardwood framed with burglar bars, expanded wire and mosquito gauze. The windows are typically the ones used for low-cost housing in Dar es Salaam. Doors are of hardwood with standard ironmongery.

The aim of the model is to determine the extent of changes in the house cost by substituting building elements with different building materials. This will enable a comparison to be made for different materials in a building to see which ones will reduce costs to make housing affordable.

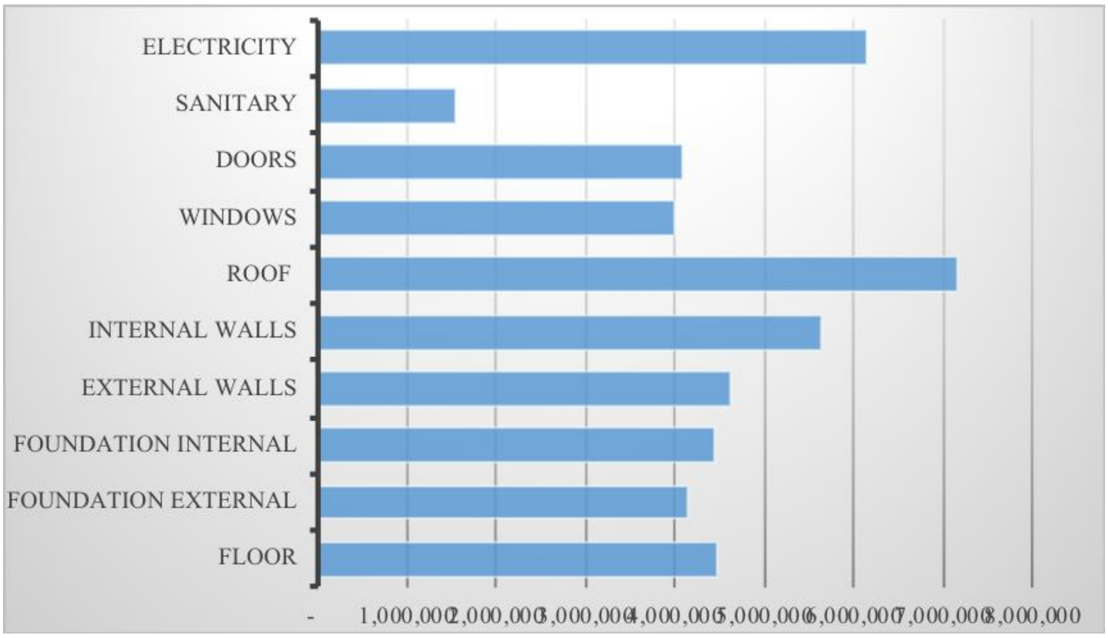


Figure 4.7 Elemental cost of the base house

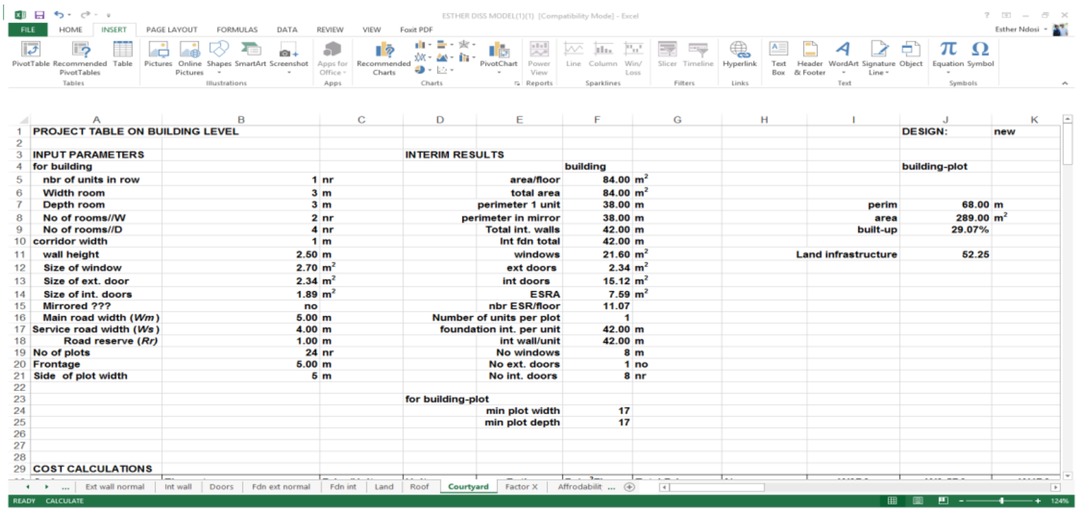
Source: Simulation models

4.3.1 The analysis model

The aim of the analysis model is to explore design of Swahili typology in cost implications. The model is based on the fact that a building cost is a total of elements and housing cost is the building cost including land costs and infrastructure cost. A data base of costs of a number of items in a building has been established and elemental cost (cost/m^2 of element) of different elements deduced (See Appendix 1).

4.3.2 Model inputs

Figure 4.8 shows the input paramers of the model analysis. Screen shows input parameters for building which includes size of room in width and depth, number of rooms in width and depth, wall height, size of window and door, main road width, Service road width, number of plot and size of the plot. Also figure 4.8 shows interm result of the builing includes total area, perimeter, total walls, total foundation, number of windows and doors and number of unit per plot.



	A	B	C	D	E	F	G	H	I	J	K
1	PROJECT TABLE ON BUILDING LEVEL									DESIGN:	new
2											
3	INPUT PARAMETERS			INTERIM RESULTS							
4	for building					building				building-plot	
5	nbr of units in row	1	nr		area/floor	84.00	m^2				
6	Width room	3	m		total area	84.00	m^2				
7	Depth room	3	m		perimeter 1 unit	38.00	m		perim	68.00	m
8	No of rooms//W	2	nr		perimeter in mirror	38.00	m		area	289.00	m^2
9	No of rooms//D	4	nr		Total int. walls	42.00	m		built-up	29.07%	
10	corridor width	1	m		Int fdn total	42.00	m				
11	wall height	2.50	m		windows	21.60	m^2		Land infrastructure	52.25	
12	Size of window	2.70	m^2		ext doors	2.34	m^2				
13	Size of ext. door	2.34	m^2		int doors	15.12	m^2				
14	Size of int. doors	1.89	m^2		ESRA	7.59	m^2				
15	Mirrored ???	no			nbr ESR/floor	11.07					
16	Main road width (*Wm*)	5.00	m		Number of units per plot	1					
17	Service road width (*Ws*)	4.00	m		foundation int. per unit	42.00	m				
18	Road reserve (*Rr*)	1.00	m		int wall/unit	42.00	m				
19	No of plots	24	nr		No windows	8	m				
20	Frontage	5.00	m		No ext. doors	1	no				
21	Side of plot width	5	m		No int. doors	8	nr				
22											
23				for building-plot							
24					min plot width	17					
25					min plot depth	17					
26											
27											
28											
29	COST CALCULATIONS										

Figure 4.8: Project table input parameters

Source: Simulation models

4.3.3 Model ouputs

Figure 4.9 has been selected for simulation on the effect of cost by changing layouts The model considers a fully constructed house as a base. Changing some cost effective aspects for this type is done and effect of changes to cost is observed and compared to the base house. The design is in abstract form and the lines around the abstract designs do not suggest plot boundary.

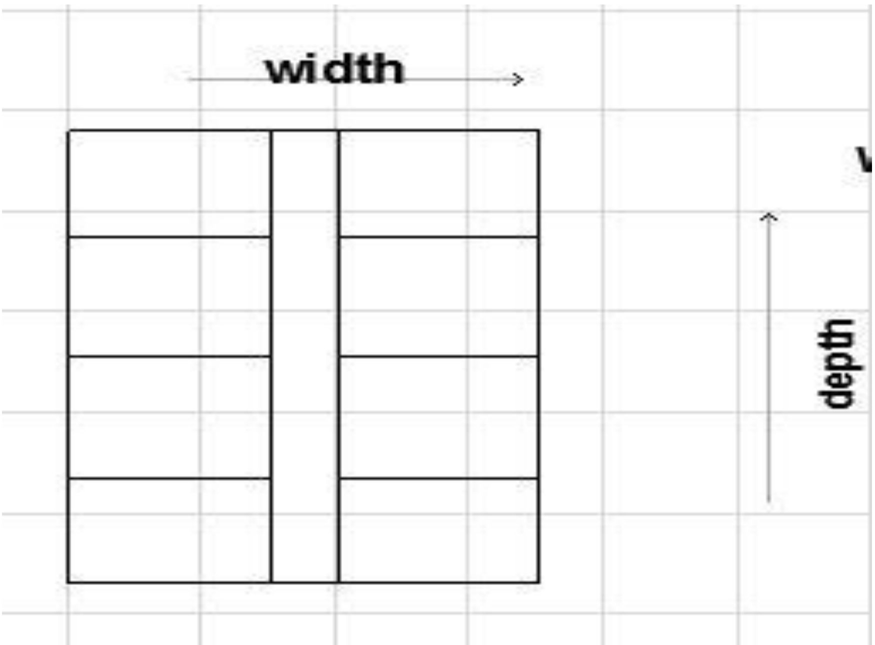
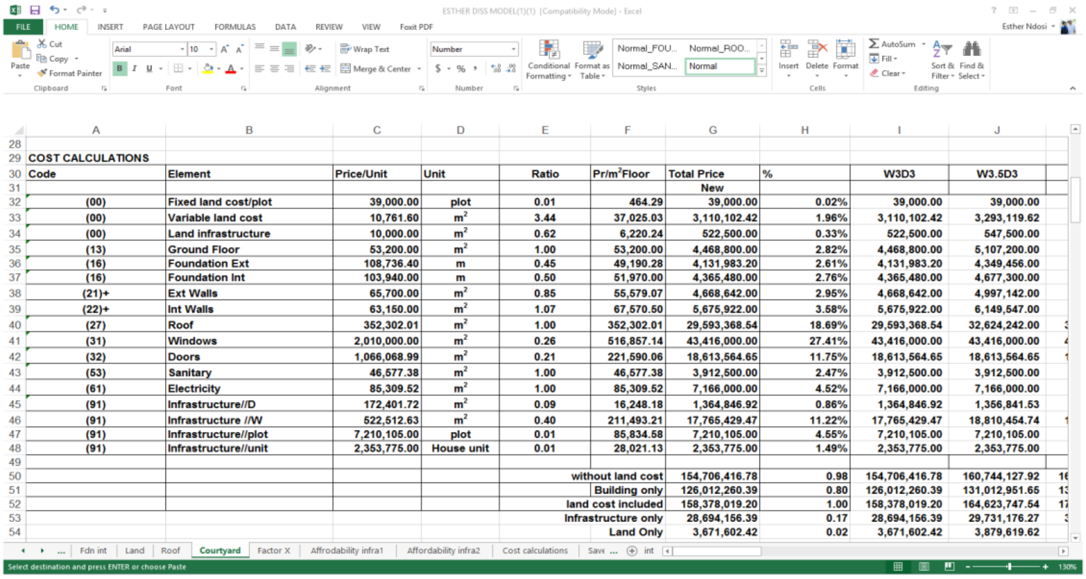


Figure 4.9: A Swahili typology for simulation

Source: Own construct

Based on year 2017 costs for Dar es Salaam, an elemental cost for a house is determined (See Appendix 2). The model can determine the elemental cost for any typology by changing the input parameters as shown in Figure 4.8. Interim results are determined and carried to a project table as shown in Figure 4.10. This compares the cost effects of changes made in the typology for analysis to determine economical options.



Code	Element	Price/Unit	Unit	Ratio	Pr/m²Floor	Total Price New	%	W3D3	W3.5D3
COST CALCULATIONS									
(00)	Fixed land cost/plot	39,000.00	plot	0.01	464.29	39,000.00	0.02%	39,000.00	39,000.00
(00)	Variable land cost	10,761.60	m²	3.44	37,025.03	3,110,102.42	1.96%	3,110,102.42	3,293,119.62
(00)	Land infrastructure	10,000.00	m²	0.62	6,220.24	522,500.00	0.33%	522,500.00	547,500.00
(13)	Ground Floor	53,200.00	m²	1.00	53,200.00	4,468,800.00	2.82%	4,468,800.00	5,107,200.00
(16)	Foundation Ext	108,736.40	m	0.45	49,190.28	4,131,983.20	2.61%	4,131,983.20	4,349,456.00
(16)	Foundation Int	103,940.00	m	0.50	51,970.00	4,365,480.00	2.76%	4,365,480.00	4,677,300.00
(21)+	Ext Walls	65,700.00	m²	0.85	55,579.07	4,668,642.00	2.95%	4,668,642.00	4,997,142.00
(22)+	Int Walls	63,150.00	m²	1.07	67,570.50	5,675,922.00	3.58%	5,675,922.00	6,149,547.00
(27)	Roof	352,302.01	m²	1.00	352,302.01	29,593,368.54	18.69%	29,593,368.54	32,624,242.00
(31)	Windows	2,010,000.00	m²	0.26	516,857.14	43,416,000.00	27.41%	43,416,000.00	43,416,000.00
(32)	Doors	1,066,068.99	m²	0.21	221,590.06	18,613,564.65	11.75%	18,613,564.65	18,613,564.65
(53)	Sanitary	46,577.38	m²	1.00	46,577.38	3,912,500.00	2.47%	3,912,500.00	3,912,500.00
(61)	Electricity	85,309.52	m²	1.00	85,309.52	7,166,000.00	4.52%	7,166,000.00	7,166,000.00
(91)	Infrastructure//D	172,401.72	m²	0.09	16,248.18	1,364,846.92	0.86%	1,364,846.92	1,356,841.53
(91)	Infrastructure //W	522,512.63	m²	0.40	211,493.21	17,765,429.47	11.22%	17,765,429.47	18,810,454.74
(91)	Infrastructure//plot	7,210,105.00	plot	0.01	85,834.58	7,210,105.00	4.55%	7,210,105.00	7,210,105.00
(91)	Infrastructure//unit	2,353,775.00	House unit	0.01	28,021.13	2,353,775.00	1.49%	2,353,775.00	2,353,775.00
					without land cost	154,706,416.78	0.98	154,706,416.78	160,744,127.92
					Building only	126,012,260.39	0.80	126,012,260.39	131,012,951.65
					land cost included	158,378,019.20	1.00	158,378,019.20	164,623,747.54
					Infrastructure only	28,694,156.39	0.17	28,694,156.39	29,731,176.27
					Land Only	3,671,602.42	0.02	3,671,602.42	3,879,619.62

Figure 4.10: Project table, simulation

Source: Simulation models

4.3.3.1 Height of the building.

Simulation model shows that total cost of a building increases as the height of a building increase. Thus for a householder to achieve affordable house, he must focus on room height of the building.

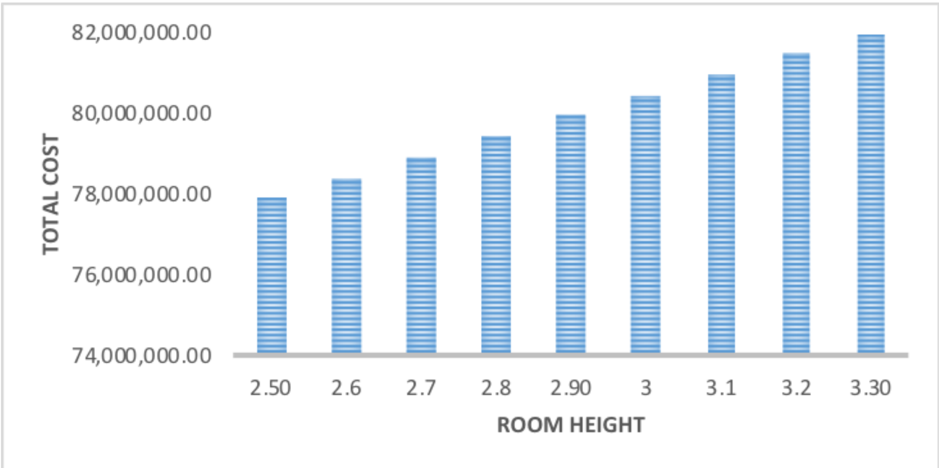


Figure 4.11: Effect of change of room height to total cost.

Source: Simulation models

Changing the quantity of walls is by reducing or increasing the wall height of the building. Wall heights in some instances may go down to 2.5 metres; depending on the weather conditions and equipment in the building.

For simulation purposes, the height of a building has been changed from 3.3 to 2.5 metres as it is shown from Figure 4.11. It is clear that the decrease of room height decreases the total cost of a building. An increase of the height, from 2.5 metres to 3.3 metres changed the value of the design in the simulation house by TAS 4,083,040.00, an increase of 0.05%.

4.3.3.2 Size of the building

An increase in the size of a building usually produces decrease in unit cost such as the square meter rate. The prime reason for this is that on costs rise proportionally with increases in the plan size of a building. Expressed in another way we can say that the Preliminary and General items expressed as a percentage of total cost tends to increase with an increase in size and cost.

The size considered room size of the building

Changing room sizes of the building

With the Swahili typology used in simulation model, if size of the rooms' width is increased, it results in a wider building and if size of the rooms' depth is increased, it results into deeper building. Similarly, if the number of rooms along depth and width are increased it will result into deeper and wider building respectively

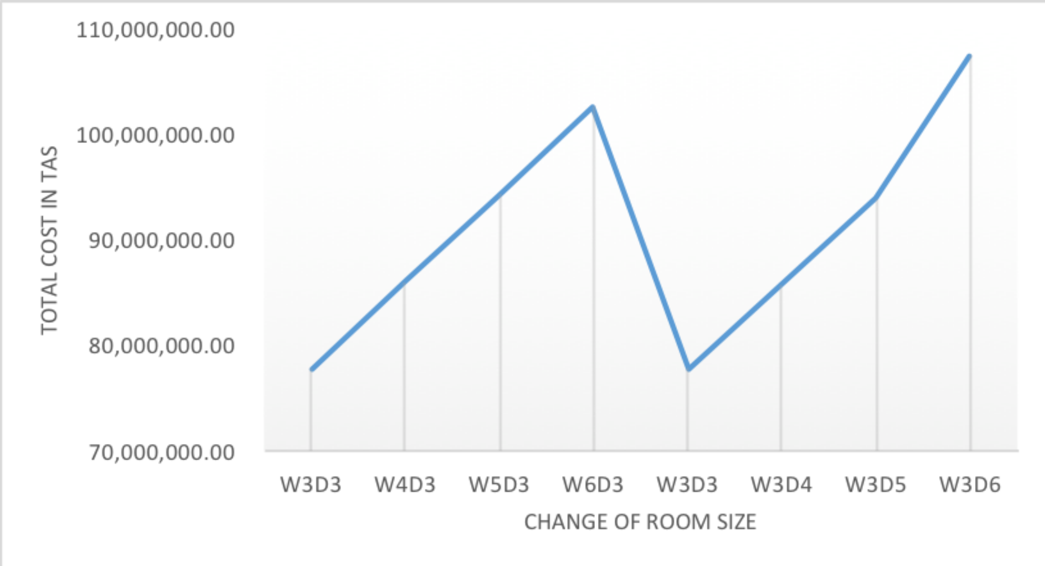


Figure 4.12: Effect of changing room size of the building to total cost

Source: Simulation models

Simulation model shows that the general total cost of a building increases as size of the building increases. Figure 4.12 shows by having a wider building with the same area as a deeper building figure 4.9, a wider building is expensive by TAS 399,875.83 equal to 0.001% than a deeper building due to the increased costs of infrastructures. To achieve affordable house must reflect much on the room size of the building.

4.3.3.3 Specification of Elements

Design is a complex and sophisticated task in order to create a successful building. One major element of a successful building is to reduce the cost of construction while satisfying the specifications. Specifications are the requirements towards the design responses to satisfy the user requirements. This is done by constraining the design responses.

a) Wall Specifications

The specification of walls for the base house is solid concrete blocks, 230mm external and 150mm internal. The change of size (thickness) of walls itself has a cost effect, without affecting the strength of the walls. It is common for external and internal walls for single storey residential house in Dar es Salaam to be 150mm.

There are various options for walls materials, which are cement and sand blocks, burnt clay bricks and un-burnt clay bricks. Quality-wise, cement and sand blocks and burnt bricks are superior, but un-burnt blocks provide the functional requirements of the walls although they wear off easily if not concealed with good plaster. Another change is made on walls by changing the specifications. Un-burnt clay bricks are used, 230mm externally and 150mm internally.

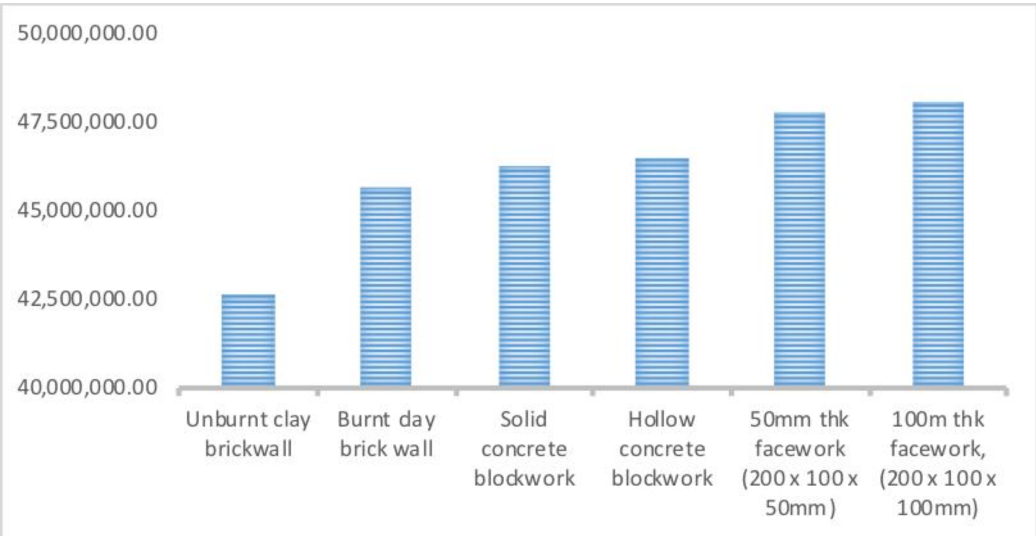


Figure 4.13: Effect of wall to total cost of the building

Source: Simulation models

On the extent of saving with regard to wall specification, Figure 4.13 shows that, when considering clay brick wall the extent of decrease of costs was 0.08% of total cost of the building in relation to the base house. It was seen that, with a minor change of specifications, there is a big change of the cost by TAS 3,612,162.00 equal to 0.06%.

b) Door specification

The door used for base house was battened door; 700 x 2100mm. Alternative of timber battened doors for base house with equal function is solid panelled doors. Hardwood panelled doors could be the best choice of door selection considering the strength and beauty but hardwood panel door is expensive in affordable house.

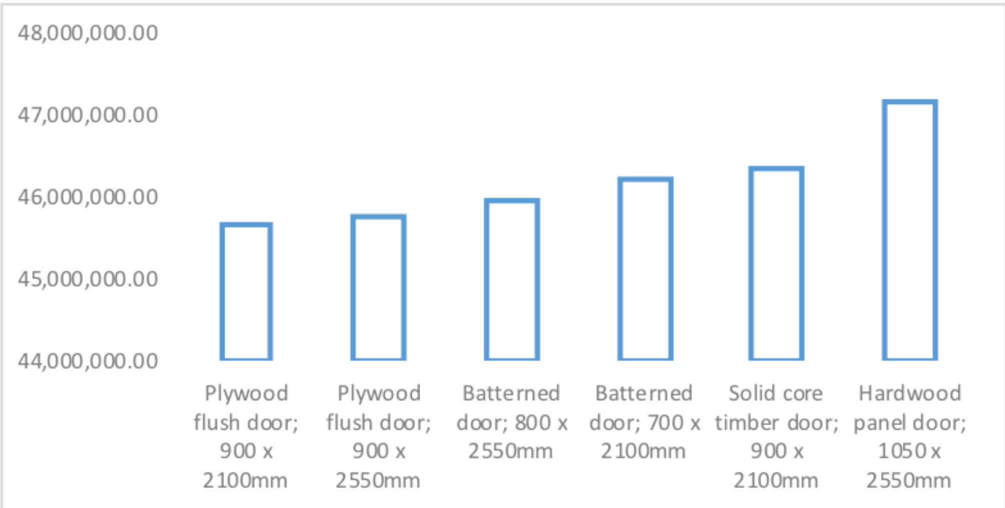


Figure 4.14: Effect of change of door type to total cost of the building

Source: Simulation models

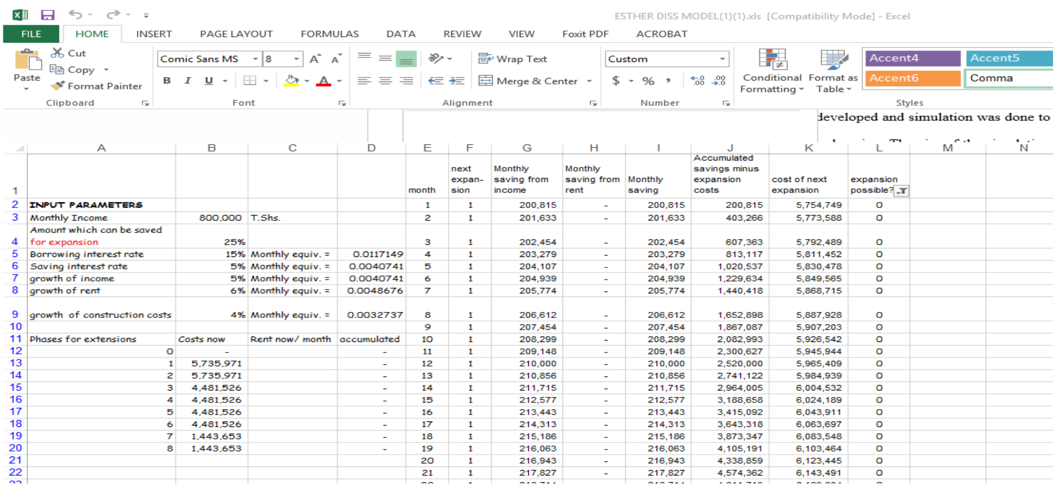
On the extent of saving door cost, Figure 4.14 shows that, when one considers using plywood flush door over battened door of base house one can save up to 1% of the total cost of the building. In relation to security purposes, plywood flush door has poor security but save up to 1% and should be stressed in consideration.

4.4 Housing financing

Housing finance is what allows the production and construction of housing. It refers to the money used to build and maintain the construction in achieved value for money. A simulation model with all possible housing finance option has been developed and simulation was done to determine which finance options were suitable in achieving housing. The aim of the simulation model was to check all financial option and determine the option that can.

4.4.1 Model inputs

Figure 4.15 shows the model input parameters. The inputs parameters are shown in left side and include monthly income, amount which can be saved for expansion, borrowing interest rate, saving interest rate, growth of income, growth of rent, growth of construction costs and also monthly equivalent.



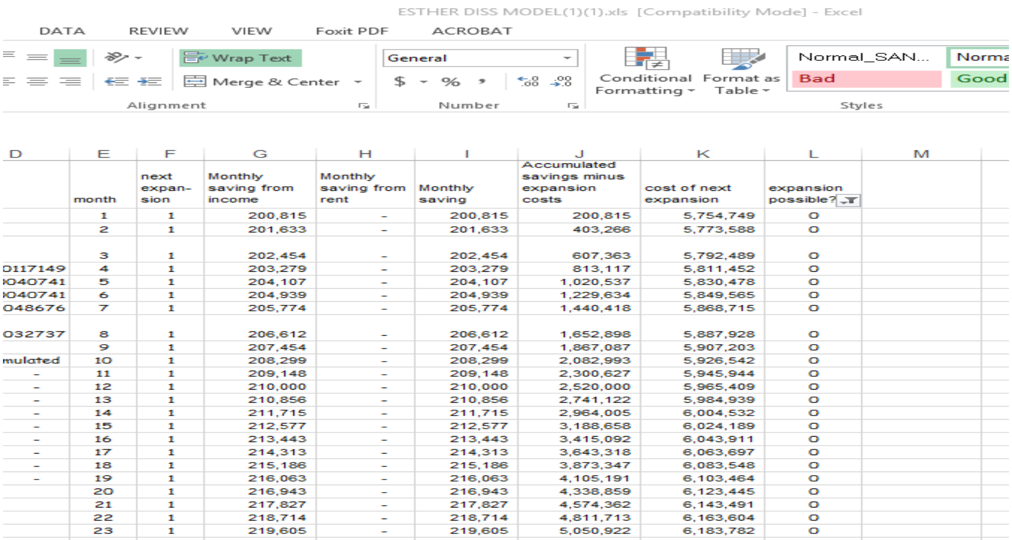
	A	B	C	D	E	F	G	H	I	J	K	L
1					month	next expan-sion	Monthly saving from income	Monthly saving from rent	Monthly saving	Accumulated savings minus expansion costs	cost of next expansion	expansion possible?
2	INPUT PARAMETERS				1	1	200,815	-	200,815	200,815	5,754,749	0
3	Monthly Income	800,000	T.Shs.		2	1	201,633	-	201,633	403,266	5,773,588	0
4	Amount which can be saved for expansion	25%			3	1	202,454	-	202,454	607,363	5,792,489	0
5	Borrowing interest rate	15%	Monthly equiv. =	0.0117149	4	1	203,279	-	203,279	813,117	5,811,452	0
6	Saving interest rate	5%	Monthly equiv. =	0.0040741	5	1	204,107	-	204,107	1,020,537	5,830,478	0
7	growth of income	5%	Monthly equiv. =	0.0040741	6	1	204,939	-	204,939	1,229,634	5,849,565	0
8	growth of rent	6%	Monthly equiv. =	0.0048676	7	1	205,774	-	205,774	1,440,418	5,868,715	0
9	growth of construction costs	4%	Monthly equiv. =	0.0032737	8	1	206,612	-	206,612	1,652,898	5,887,928	0
10					9	1	207,454	-	207,454	1,867,087	5,907,203	0
11	Phases for extensions	Costs now	Rent now/ month	accumulated	10	1	208,299	-	208,299	2,082,993	5,926,542	0
12	0	-		-	11	1	209,148	-	209,148	2,300,627	5,945,944	0
13	1	5,735,971		-	12	1	210,000	-	210,000	2,520,000	5,965,409	0
14	2	5,735,971		-	13	1	210,856	-	210,856	2,741,122	5,984,939	0
15	3	4,481,526		-	14	1	211,715	-	211,715	2,964,005	6,004,532	0
16	4	4,481,526		-	15	1	212,577	-	212,577	3,188,658	6,024,189	0
17	5	4,481,526		-	16	1	213,443	-	213,443	3,415,092	6,043,911	0
18	6	4,481,526		-	17	1	214,313	-	214,313	3,643,318	6,063,697	0
19	7	1,443,653		-	18	1	215,186	-	215,186	3,873,347	6,083,548	0
20	8	1,443,653		-	19	1	216,063	-	216,063	4,105,191	6,103,464	0
21					20	1	216,943	-	216,943	4,338,859	6,123,445	0
22					21	1	217,827	-	217,827	4,574,362	6,143,491	0

Figure 4.15: Model Input parameters for house finance

Source: Simulation models

4.4.2 Model output

Figure 4.16 shows model output which includes month, next expansion, monthly saving from income, monthly saving from rent, monthly saving, accumulated savings minus expansion costs and cost of next expansion, expansion possible. Model breakdown into three finance option which includes own financing, loan financing and rent as additional finance. Model shows how each financial option depends on household income in term of loan and period of construction.



D	E month	F next expan-sion	G Monthly saving from income	H Monthly saving from rent	I Monthly saving	J Accumulated savings minus expansion costs	K cost of next expansion	L expansion possible?
	1	1	200,815	-	200,815	200,815	5,754,749	0
	2	1	201,633	-	201,633	403,266	5,773,588	0
	3	1	202,454	-	202,454	607,363	5,792,489	0
0117149	4	1	203,279	-	203,279	813,117	5,811,452	0
)040741	5	1	204,107	-	204,107	1,020,537	5,830,478	0
)040741	6	1	204,939	-	204,939	1,229,634	5,849,565	0
048676	7	1	205,774	-	205,774	1,440,418	5,868,715	0
032737	8	1	206,612	-	206,612	1,652,898	5,887,928	0
	9	1	207,454	-	207,454	1,867,087	5,907,203	0
mulated	10	1	208,299	-	208,299	2,082,993	5,926,542	0
-	11	1	209,148	-	209,148	2,300,627	5,945,944	0
-	12	1	210,000	-	210,000	2,520,000	5,965,409	0
-	13	1	210,856	-	210,856	2,741,122	5,984,939	0
-	14	1	211,715	-	211,715	2,964,005	6,004,532	0
-	15	1	212,577	-	212,577	3,188,658	6,024,189	0
-	16	1	213,443	-	213,443	3,415,092	6,043,911	0
-	17	1	214,313	-	214,313	3,643,318	6,063,697	0
-	18	1	215,186	-	215,186	3,873,347	6,083,548	0
-	19	1	216,063	-	216,063	4,105,191	6,103,464	0
	20	1	216,943	-	216,943	4,338,859	6,123,445	0
	21	1	217,827	-	217,827	4,574,362	6,143,491	0
	22	1	218,714	-	218,714	4,811,713	6,163,604	0
	23	1	219,605	-	219,605	5,050,922	6,183,782	0

Figure 4.16: Financial Output

Source: Simulation models

4.4.3 Own financing

Most of Tanzanians build their houses with their own financing. Own financing since there is no external support is provided during construction process except their own saving (Makoba, 2008). This is why most of the houses take too long to get finished due to slow pace of fund accumulation. A simple Tanzanian house of two bedroom can on average cost around TAS 46,000,000. Such a level of expenditure cannot be met by a low-income earner within a short period. There are very high-class housing in Tanzania, costing more than TAS 600,000,000, but being built through "own financing".

Table 4.1 shows the period taken to save a total of TAS 46,000,000 for a simple house for households with different income groups at an interest rate of 5 percent, a saving amount of 25 percent of the income and income growth of 5 percentage.

Table 4.1: Years for saving a total of TAS 46,000,000 for different incomes

Income '000	100	200	300	400	500	600	700	800	900	1000	1100	1200
Years to save	58	56	37	32	26	22	20	17	16	14	13	12

Source: Simulation models

The table above shows a household with an income of TAS 100,000 will take a period of 58 years to finish the house; which is too long a period to wait in house construction. High income earners can save within a short period of time for such a house. A period of 12 years for a household earning TAS 1,200,000 is bearable and the waiting is shorter than with TAS 100,000 income.

4.4.4 Loan financing

Mortgage loan is associated with a standard package of terms and conditions which specify the contribution of deposits, on some occasion the period of savings, the interest rate to be charged on the loan, the period of the loan and a loan to value ratios. Another important factor is the amount the loan institution is willing to lend in relation to borrowers' income. High interest rates considerably increase the cost of borrowing and make housing investment unaffordable for many families. Mortgage products are not necessarily appropriate for low-income borrowers and that government facilitation is required in the context of poverty, unemployment and lack of affordability, while securitization is only possible where a well-developed and efficient primary market exists.

Requirements for mortgage financing normally do not favor the low-income households as they do not meet the lending requirements. For a loan of TAS 46,000,000, with interest of 18 percent and a requirement to redeem the loan after 20 years (This is a common lending requirement, in addition to a mortgage), how much will be the amount to be repaid monthly? This is to check the affordability of various income groups.

The amount required to repay the loan for the conditions given above is TAS 663,073.72 per month, and with a consideration that a household can save 25 percent for housing, it implies that only households earning TAS 2,652,294.88 and above can afford the loan. With the same assumptions, how much loans can different income households afford? The amounts to be afforded as loans are shown in Table 4.2.

Table 4.2: Loans afforded by different income categories

Income ‘000	100	200	300	400	500	600	700	800	900	1000	1100	2600
Loan ‘000‘000	1.7	3.5	5.2	6.9	8.7	10.4	12.1	13.9	15.6	17.3	19.1	46.5

Source: Simulation models

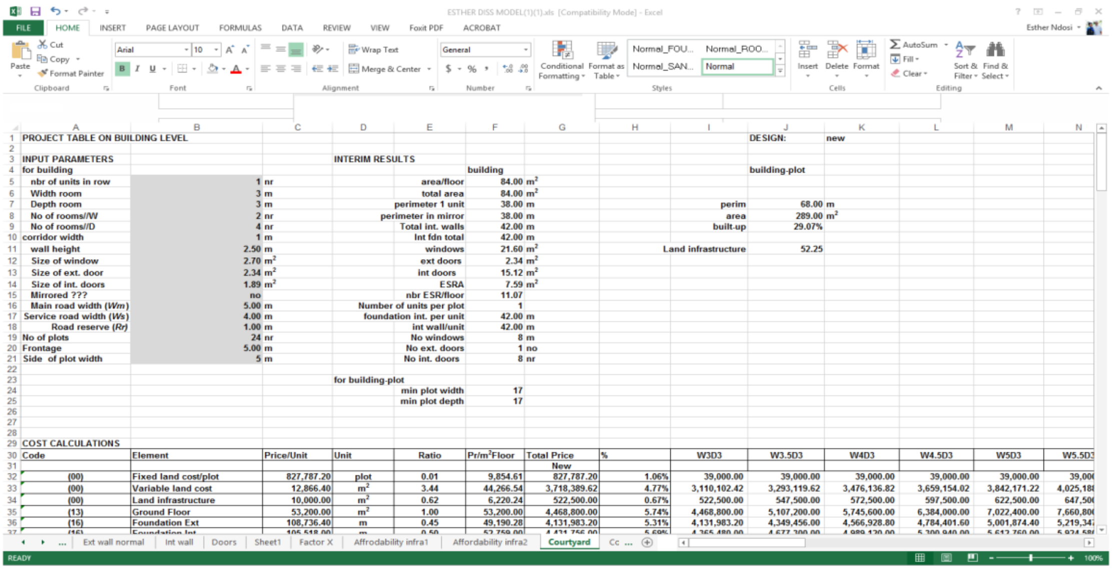
With the lowest income households in groups of 100,000 to 500,000 incomes, can they really afford a good house with the existing loan conditions they can hardly save more than 10 Million? Considering the loan for the lowest income households, can they really depend on loan alone in construction of their own house? Which alternative will be required for them to be able to build a house of TAS 46,000,000?

4.4.5 Rent

In Tanzania, big number of householders do occupy the core house first and consolidation takes several years to be constructed; with the rate of consolidation becoming faster as rental income starts coming in. In cases the tenants pay for the completion of a new room within an on-going construction for his habitation and the money used being deducted in the rents to be paid for a specific period. Renting is used as pre-paid or post-paid rent. Rent in Tanzania usually is paid in minimum of 3 months installments and this goes up to one year; this gives the house owner the means to finish up whatever is not in good order in the house.

4.5 The analysis model

The model in this analysis starts with description of costs for different elements in a building. Elemental method has been used in the analysis of costs as it directly refers to visible units of a building. The data base comprises of construction items that make up a building with their rates. The number of items making up a building is not restrictive; items can be added or removed depending on the context. The rates for the items can also be changed to suit the context to for analysis. The model allows selection of items relevant to a building for analysis and these are carried to a project table (See Figure 4.17). The shaded cells in the project table are the input parameters which include size of rooms, number of rooms in width and depth directions, doors, windows, room height, etc., the interim results are determined from input parameters and they are carried to the simulation table for simulation purpose (See cost calculations in Figure 4.17).



	A	B	C	D	E	F	G	H	I	J	K
1	PROJECT TABLE ON BUILDING LEVEL									DESIGN:	new
2											
3	INPUT PARAMETERS			INTERIM RESULTS							
4	for building					building				building-plot	
5	nbr of units in row	1	nr		area/floor	84.00	m^2				
6	Width room	3	m		total area	84.00	m^2				
7	Depth room	3	m		perimeter 1 unit	38.00	m		perim	68.00	m
8	No of rooms//W	2	nr		perimeter in mirror	38.00	m		area	289.00	m^2
9	No of rooms//D	4	nr		Total int. walls	42.00	m		built-up	29.07%	
10	corridor width	1	m		Int fdn total	42.00	m				
11	wall height	2.50	m		windows	21.60	m^2		Land infrastructure	52.25	
12	Size of window	2.70	m^2		ext doors	2.34	m^2				
13	Size of ext. door	2.34	m^2		int doors	15.12	m^2				
14	Size of int. doors	1.89	m^2		ESRA	7.59	m^2				
15	Mirrored ???	no			nbr ESR/floor	11.07					
16	Main road width (*Wm*)	5.00	m		Number of units per plot	1					
17	Service road width (*Ws*)	4.00	m		foundation int. per unit	42.00	m				
18	Road reserve (*Rr*)	1.00	m		int wall/unit	42.00	m				
19	No of plots	24	nr		No windows	8	m				
20	Frontage	5.00	m		No ext. doors	1	no				
21	Side of plot width	5	m		No int. doors	8	nr				
22											
23				for building-plot							
24					min plot width	17					
25					min plot depth	17					
26											
27											
28											
29	COST CALCULATIONS										

	Code	Element	Price/Unit	Unit	Ratio	Pr/m²Floor	Total Price	%	W3D3	W3.5D3	W4D3	W4.5D3	W5D3	W5.5D3
31							New							
32	(00)	Fixed land cost/plot	827,787.20	plot	0.01	9,854.61	827,787.20	1.06%	39,000.00	39,000.00	39,000.00	39,000.00	39,000.00	39,00[illegible]
33	(00)	Variable land cost	12,866.40	m^2	3.44	44,266.54	3,718,389.62	4.77%	3,110,102.42	3,293,119.62	3,476,136.82	3,659,154.02	3,842,171.22	4,025,18[illegible]
34	(00)	Land infrastructure	10,000.00	m^2	0.62	6,220.24	522,500.00	0.67%	522,500.00	547,500.00	572,500.00	597,500.00	622,500.00	647,50[illegible]
35	(13)	Ground Floor	53,200.00	m^2	1.00	53,200.00	4,468,800.00	5.74%	4,468,800.00	5,107,200.00	5,745,600.00	6,384,000.00	7,022,400.00	7,660,80[illegible]
36	(16)	Foundation Ext	108,736.40	m	0.45	49,190.28	4,131,983.20	5.31%	4,131,983.20	4,349,456.00	4,566,928.80	4,784,401.60	5,001,874.40	5,219,34[illegible]

Figure 4.17 Project table

Source: Simulation models

4.5.1 Simulation

Incremental construction has been used in the simulations as it is the mostly used construction process for low-income households in developing countries. The simulation Swahili typology has eight rooms. Simulation has considered constructing one room in each phase. The total cost of the simulation building at contractor's rates is TAS 46,121,931. However most of Tanzanians with lower income trend to use self-help method and hire a fundi, since hiring a professional is expensive. In this case the simulation for self-help will cost TAS 32,285,352. However, this cost applies if the building is constructed at once. With incremental construction, considering the increments of one room per phase, the costs will be distributed in phases as shown in Table 4.3:

Table 4.3: Cost of phases for the simulation Swahili typology

	SELF HELP
PHASE 1	5,735,971
PHASE 2	5,735,971
PHASE 3	4,481,526
PHASE 4	4,481,526
PHASE 5	4,481,526
PHASE 6	4,481,526
PHASE 7	1,443,653
PHASE 8	1,443,653

Source: Simulation models

The financing options for housing that has been considered in this analysis include "Save and Build", "Save, Borrow and Build", "Save, Build, Rent and Build" and "Save, Borrow, Build, Rent and Build" as will be described later. Financial input data that have been used in these simulations are as shown in Table 4.4, but these can be changed.

Table 4.4: Financial input in the model

INPUT PARAMETERS	
Monthly Income	800,000
Amount which can be saved for expansion	25%
Borrowing interest rate	18%
Saving interest rate	5%
Growth of income	5%
Growth of rent	3%
Growth of construction costs	2%

Source: Simulation models

The simulation models are discussed as under.

4.5.2.1 Save and build Model

The simplest model is save and build the finance is by saving part of one's income until amount to build next phase. The save and build mostly used by low-income household by build and buy material through the saved money.

The simulation on Save and Build option of financing for the incremental construction on the Swahili typology analysed gives results as on Figure 4.18. These results are based on a household with an income of TAS 800,000. This has been used to have a better representation of the graphs

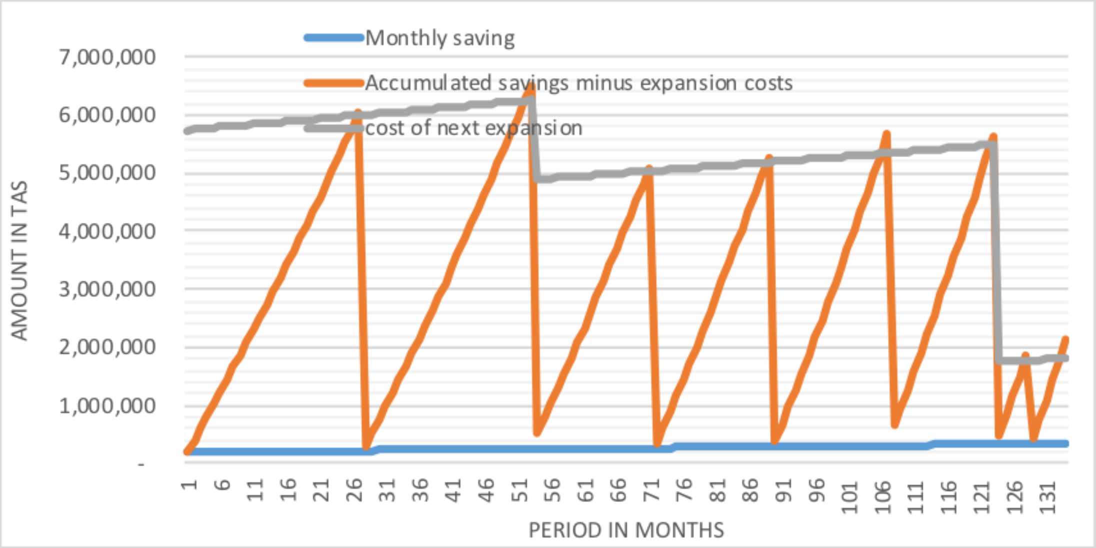


Figure 4.18 Save and Build Model

Source: Simulation models

Figure 4.18 shows saving increase monthly due to growth of income while cost of expansion for the next phase decreases. Average expansion of the phases is 17 months for eight phases with certain accumulative saving. The difference between the accumulated savings and cost of next expansion determines when the next expansion is to be effected. In this case the eight phases will be completed after 133 months which is 11.08 years.

Households with income TAS 100,000 take longer period for house completion, 554 months longer compare with income TAS 1,000,000 households shown in Table 4.5 household with income TAS 100,000 will require other subsidy to add to saving to reduce months of completion.

Table 4.5: Effect of income to monthly saving

Income '000	100	200	300	400	500	600	700	800	900	1000
Month of completion	554	372	284	231	195	169	149	133	121	111

Source: Simulation models

4.5.2.2 Save, Borrow and Build (SBB) Model

Save, borrow and build model is the same as the save and build model but with the addition of borrowing as additional fund for construction. The loan a household can borrow depend on the saving from the income Table 4.2.

The model calculates the total saving that a household can have at the end of a saving period. Building the next phase need to compare the saving accumulated and the construction cost of the building, if it is to go ahead or not. This difference is then compared to a pre-calculated maximum loan that a household at a pre-determined income can afford if he/she can save for house construction. The cost of the house less the saving at any time considered and the maximum loan that can be afforded indicates whether the household should now take a loan to supplement his saving for the house construction or not. The loan can be taken when the sum of the saving and maximum loan that can be taken exceeds the total house construction cost. The repayment period, which is an input parameter, has been fixed at 12 months in this case, but it can be changed.

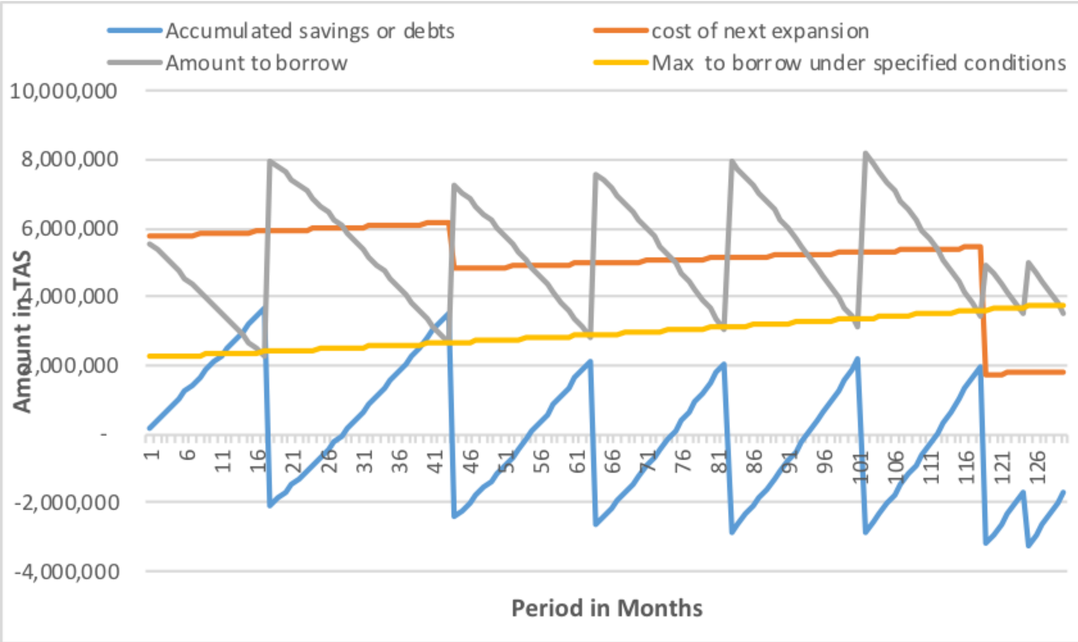


Figure 4.19 Save, Borrow and Build

Source: Simulation models

Figure 4.19 shows how household can get accumulated saving and debts from the income saving and debts. Saving made from the income monthly will be used to repay loan as the debts. Household of TAS 800,000 income loan taken is shown by the grey line indicating amount to borrow which is the maximum loan that household can borrow due to income in simulation.

Amount of borrowing increases with the increase of the cost of next expansion due to growth of income. And when the maximum amount to borrow exceeds the amount required to be borrowed to construct the next phase, the phase is constructed. With this model of financing the construction, the eighth phase will be completed after 130 months which is 10.83 years. There is a saving of 4 months from the last model of financing.

4.4.2.3 Save, Build, Rent and Build (SBRB) Model

Save, build, rent and build model is the same as Save, Borrow and Build (SBB) Model but instead of borrowing as additional income we rent. The model utilizes rental income on completed rooms as a source of income for reinvestment. The model will work if the room get the tenant as soon as it is completed or before.

This model has two sides of equation, savings from income and rent from completed part of a building against the cost of construction of different parts of a house. The model firstly looks at the total savings from income, when this amounts to the cost of the first phase; the model returns that the phase can be constructed. After the first phase, income will now be from saving and rental. If these amounts to the cost of the next phase, the model returns to construct the phase. This continues until the whole building is completed.

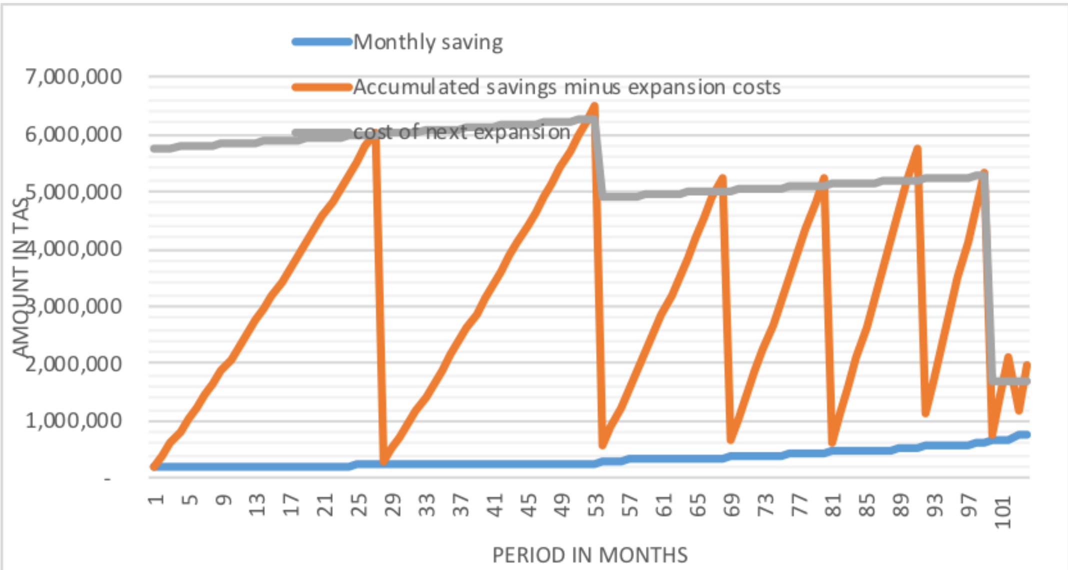


Figure 4.20 Save, Build, Rent and Build

Source: Simulation models

Figure 4.20 Show completion period for all the eight phases in this case is 104 months which is 8.67 years. Save, Build, Rent and Build (SBRB) Model is better than save and build Model and Save, Borrow and Build (SBB) Model in terms of completion. Rent as the additional income boost construction process SBRB in SB there is no rent as additional income, and SBB there is borrow as additional income but the money needs to be returned monthly from the saving.

4.5.2.4 Save, Borrow, Build, Rent and Build Model (SBBRB)

Save, Borrow, Build, Rent and Build model is the combination of the "Save Borrow and Build" and "Save, Build, Rent and Build" models. SBBRB is similar to SBRB but element of borrowing was incorporated within and form SBBRB. Model looks at when and what amount of loan can be obtained, but within the affordability of the borrower so as to build the eight phases of a house analysed. It checks when the total monthly income can service a loan equal or more than the cost of construction of the phase in question. It then calculates the loan that should be taken to add up to the construction cost of the respective phase. After the first phase is built, rent is added to the monthly saving from income and this continues for the other phases.

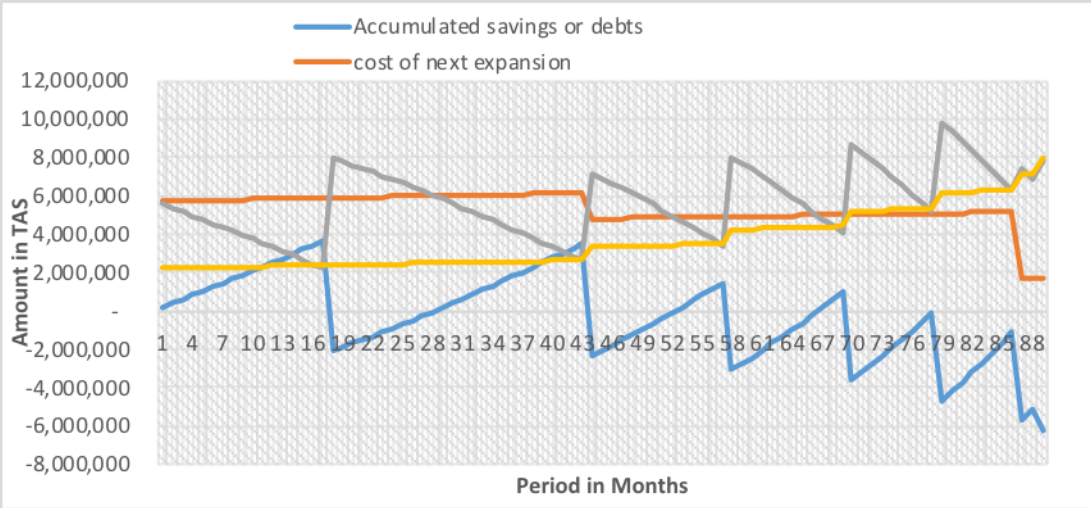


Figure 4.21 Save, Borrow, Build, Rent and Build

Source: Simulation models

Figure 4.21 shows Save, Borrow, Build, Rent and Build model has the shortest period of completion compare to other model due combined financial option. Household with TAS 800,000 income will use 89 months which is 7.42 years when use SBBRB model.

4.6 Integrating the Models

Figure 4.22 integrates results for incomes from TAS 100,000 to 400,000, which are of the lower side of the model so as to have a better comparison of the different financing models.

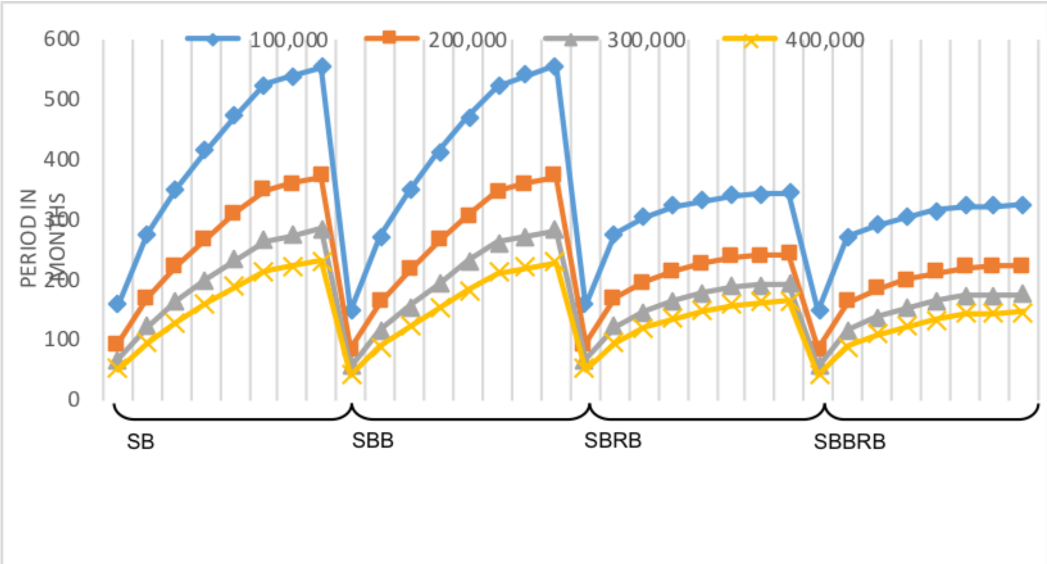


Figure 4.22 Integration of completion periods for incomes 100,000 to 400,000

Source: Simulation models

Figure 4.22 Shows that SB and SBB models take longest time to complete the house, while SBRB and SBBRB have very short periods of time, and what differentiates them is renting as source of finance. This source is big, assured and earns interest before being used in construction. Renting completed parts is a major source of fund which is used by a number of low-income house builders, and it allows them to build a number of houses through renting. The rent is in most cases reliable and often paid in advance.

Borrowing has a disadvantage that interest is paid on it, and therefore reducing the effective amount for construction. Minimum times for completion of the phases in the simulation for incomes from 100,000 to 400,000 are shown in Table 4.6.

Table 4.6 Minimum completion periods for incomes from 100,000 to 400,000

	100,000				200,000				300,000				400,000			
PHASE	SB	SBB	SBRB	SBBRB	SB	SBB	SBRB	SBBRB	SB	SBB	SBRB	SBBRB	SB	SBB	SBRB	SBBRB
1	158	149	158	149	92	83	92	83	66	56	66	56	51	41	51	41
2	275	270	275	270	168	162	168	162	122	115	122	115	96	88	96	88
3	351	348	304	292	221	215	196	185	163	156	147	137	129	122	119	108
4	416	414	31	305	267	264	214	200	199	194	165	152	160	154	135	122
5	473	472	332	315	310	307	227	211	233	230	178	163	188	183	148	134
6	524	523	341	322	348	346	237	220	265	262	188	172	214	211	158	143
7	539	540	343	323	360	359	240	221	274	272	191	174	223	220	161	144
8	554	556	345	324	372	371	242	222	284	283	193	175	231	229	163	146

Source: Simulation models

4.7 Sensitivity analysis

Sensitivity analysis done on the repayment period and interest rates (saving and borrowing). Only two financing options involve loans, the SBB and SBBRB, in which SBBRB gives shorter construction period and used to test sensitivity.

The financing model is very sensitive to income or amount that is availed for housing construction. The sensitivity is high with low-incomes but declines with higher income as seen in Figure 4.23.

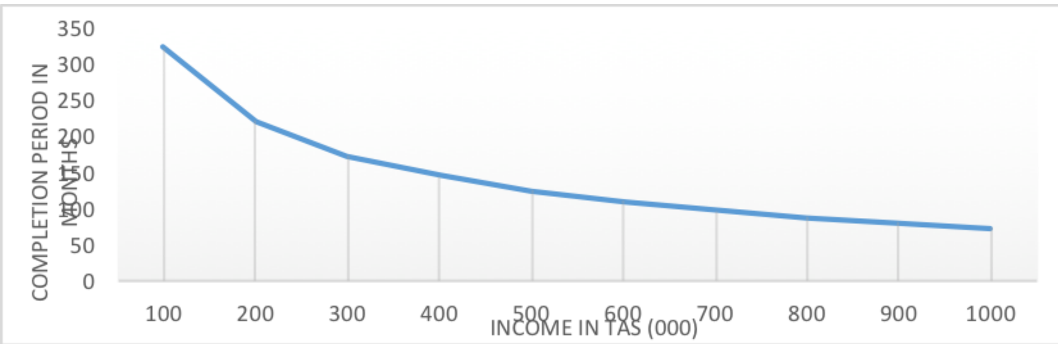


Figure 4.23: Change of income with change of completion periods

Source: Simulation models

4.8 Summary

Design variables

Low-cost house builders to consider the following in specification design variables

1. Careful selection of material specification to reduce cost of the building.
2. Identify cost of each element careful

The following have been noted

1. Increasing the size of a building will increase total cost of the building
2. Decreasing the room height decreases the cost of walls and therefore the total cost of a building
3. Cost of a building is a function of its shape.

Low-cost house builders to consider the following in shape and size design variables

1. Room heights needs to be kept to a minimum but depending on the circumstances.
2. Building expand should consider increase of the depth of the building more than the width of the building for affordable house.
3. Build simple shape buildings and avoid complex shaped buildings.

Simulation

The following have been noted from simulation

1. Most Tanzanians have low-income, making conventional housing unaffordable, especially to the low-income households.
2. Incremental construction is frequently used in Tanzania for housing construction, and it has shown to be a good way to enable low-income households own housing.

3. Renting has been shown to be a reliable source of financing housing when combined with saving and or borrowing
4. Housing is being financed through savings, informal loans and assistance from relatives and friends.
5. There is a big market for renting, especially renting rooms as compared to renting whole house.
6. Availability of mortgage loan but the interest rate is high

The following have been noted

1. Materials specification has a remarkable impact on housing cost.
2. Elements classifications of the building have incredible impact to total cost of the building.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter presents the conclusion and recommendations for the experimental study, following the model analysis which was done in chapter four. Based on information and documents hand, the model analysis all the objectives of the case study achieved.

5.2 Conclusion based on research objectives

Research questions were formulated from the research objective of the study so as to achieve the goal of the objective of the study. The findings of the study are as follows;

5.2.1 Research question one

> *"What process does housing production go through and what factors influence affordability"*

Access to housing land is not a big problem compared to the past, as planned and surveyed plots are available. Government and real estate agents announce the availability of planned and surveyed plots using media like Radios and Magazines. However, the available planned and surveyed plots which low-income earners can afford lack availability of infrastructures, good roads, sewage system, and water around the areas. Also, lower-income earners acquire informal land use rights in unplanned areas: some buy second hand unplanned land and some inherit land and incomplete/complete houses since these are less expensive compared to surveyed and planned plots and some social services are available.

Construction of houses is either incremental or build once. High income-earners and rich people always build once since they can afford. However, for low-income earners construction is incremental, which involves phases which take a very long time to complete a house.

Financing of houses is from own saving and bank loan. For high-income earners and rich people, it is easy to use both own saving and loan finance on account of their job security, ease with which they can secure bank loans, while low-income earners depend on own saving and small loans from relative and friends or "VIKOBA'. They therefore take longer time to complete a house due to shortage of finance.

Affordability: House affordability for various households is a function of varied levels of income.

"Factors that influence affordability"

A minimum requirement of land for construction of a house is 300m^2. A person earning a maximum wage of TAS 400000 per month would rather choose to purchase the cheapest planned and surveyed land sold at TAS 6000 per meter square at Vigwaza rather than an expensive planned and surveyed land sold at TAS 150000 per meter square at Oysterbay. The land at Oysterbay sold at a higher price, has good infrastructures, planned sewage systems and availability of social services nearby, compared to the land sold at a lower price in Vigwaza whereby the land itself may not be easily reached due to poor infrastructure and no available social services.

Though such land has a lot to offer, one may not afford it simply because of the income he or she earns.

Availability of finances such as mortgage, own saving or help from friend influences the affordability of house construction. However low-income earners couldn't afford house mortgages finances due to high interest rates and a requirement to secure the loan with a good fixed asset base, that one may not have.

The design of the building also influences affordability. Most complicated or unique house designs are expensively achieved and hence low-income earners do not afford the same. Therefore sometimes, a good design is not easily affordable and one may choose a normal design that can easily be afforded.

Material. The costs of materials do affect the cost of housing. For example, tiles from China are sold at a lower price compared to the same type of tile from Spain. Those from China may have a life span of 20 years while that of Spain have a lifespan of 50 years but yet someone may afford that of 20 years guarantee and still find it okay for same type of floor.

5.2.2 Research question two

> *"Cost simulation model be developed for establishing housing affordability in relation to income levels"*

Simulation models allow the user to work through various situations on a problem by changing one or more parameters and observing their impact on output. This gives a clear view of the output and a reliable solution can be determined. The models in this study are strong. They can be used in planning a housing project or analysing a project that has been designed to see its strength and weakness. By identifying the weaknesses of a project, the model can be used to determine economical alternatives to be used.

The model gave answers to the following questions

How much will be the end cost of any decision made in the housing?

As the requirement of a comfortable land for constructing a house is 300m^2 and the cost of land is TAS 10,000 per square meter, the total cost of 300m^2 land of will be TAS 5,068,676.82 which includes, fees of occupancy, fees of deeds, stamp and planning and survey costs.

The door used for base house was battened door size 700 x 2100mm and the specification of walls for the base house was solid concrete blocks size 230mm external and 150mm internal which cost of building only was TAS 46,217,527.53.

Base house design was Swahili typology, Figure 4.9 which consist of room Width of 3m, room Depth of 3m, Number of rooms in width side was 2, Number of rooms in depth side was 4, corridor width 1m and wall height of 3.3m. The total cost was TAS 77,880,360.74 which included building costs, land costs and infrastructure costs.

Finance considering own saving the period taken to save a total of TAS 46,000,000 for a simple house for households with TAS 400,000 income groups at an interest rate of 5 percent, a saving amount of 25 percent of the income and income growth of 5 percentage was 32 year.

What can be done to reduce cost within the available alternatives?

Alternative option for the lowest cost of land which is TAS 6,000 per square meter, the total cost of 300m^2 was TAS 3,703,676.82 which includes, fees of occupancy, fees of deeds, stamp and planning and survey costs. One can also reduce planning and surveying the same among neighbour.

Alternative material used in door was plywood flush door and wall specification was clay brick wall. The amount saved from the total cost of the building only was TAS 4,166,447.71 equals to 8.695%.

In design of Swahili typology, the alternative used in reducing cost was changing height of the building from 3.3 to 2.5 metres. The amount saved from the total cost was TAS 4,083,040.00 equal to 0.05% which includes building costs, land costs and infrastructure costs.

Finance the alternative used was for the purpose of adding finance to the project not to reduce cost. The finance added was loan and rent which was helpful in reducing period of completion.

Which housing process will be affordable by an income category?

Securing land for house construction is a one step. A monthly income of TAS 400,000 needs 40 months (3.33 years) to buy a 300m^2 land which costs TAS 3,703,676.82 from own saving.

In incremental building construction process a household can build one room per phase. A low-income earner cannot afford once building process, as it will be impossible to get TAS 46,217,527.53 to build once. The best option is incremental process which can also cut cost of contractor's rate since will use self-help method.

Which incremental construction process finance will suit a defined income category?

There are four incremental financing options for housing that has been considered including Save and Build "SB", Save, Borrow and Build "SBB", Save, Build, Rent and Build "SBRB" and Save, Borrow, Build, Rent and Build "SBRBB". Consider householder of monthly income TAS 400,000 SB takes 231 months; SBB takes 229 month, SBRB 163 month and SBRBB 146 month for the period of house completion. The best incremental finance option was SBRBB which give shortest construction period due to additional finance of loan and rent.

Is the investment affordable to the intended target?

Yes, the investment was affordable to the low-earner income household. The investment will take a longer period of completion but target have been achieved.

5.2.3 Research question three

> *"Recommended measures for enhancing affordability to low-income earners"*

Cost implication of housing

The percentage saving given in the chapter are indicative only as they have been attained bearing in mind assumptions and parameters used in this study. The savings may be less or more depending on the parameters used. The major areas where saving has been found in the housing process are given in Table 5.1.

Table 5.1: Areas for saving and enhance affordability

	Access to land	Building materials	Financing
1	Sharing costs and reducing surveying cost	Cheap materials to be considered with same performance e.g. flash door and battened door	Small loan with lower income but longer returns
2	Economical plot sizes	Alternative material can be used e.g. 230mm wall while 150mm wall can do	Make it available
3	Building expand should consider increase of the depth of the building more than the width of the building	Research and use of non-conventional materials need to be enhanced	Microfinance capable of saving housing for low-income households.
4	Co-occupancy	Regulations to allow use of traditional materials that are functional	

5.3 Recommendation to house builders

The implications of the results under this sub-title are those embedded in areas that are within the decision of the builder/owner. This implies that they are within the decision of the builder/owner. These are issues on design, construction and financing which can be summarised as follows:

Design aspects

a) Builders are to avoid very irregular (complex) designs to save on external walls.

b) Building should consider increase of the depth of the building more than the width of the building, as that saves infrastructure costs.

c) Minimum floor to ceiling height to be used to save on walls and their finishes.

d) Use standard door and window to save wall and their finishes.

e) Use standard roof to save roof structure material e.g. purlins, rafters.

f) Research on the material which are affordable should be done with the design process.

Construction aspects

a) With limited finance, incremental construction of room-by-room should be followed rather than full foundation and then room-by-room.

b) To completely avoid incremental construction by elements as this may lead to lack of living place while a lot of money has been used in the house.

c) On construction process household should eliminate all possible aspects which can add cost e.g. when construct ring beam after walling can cast ring beam which reduce formwork costs.

Financing aspects

a) If room-by-room construction is opted for, it is good to start building when necessary funds for the phase to be built are available.

b) Saving, borrowing and renting completed parts is the best option for construction since shorter construction period for completion.

c) Financial institution should provide support to all level of income with suitable interest depend on one’s income.

5.4 Recommendation to Government

Efforts to facilitate mobilization of finance, land delivery, research and institutional arrangement as the basis for the preparation of housing development programmes, projects and actions should be sustained. The Government, Local Authorities, NGOs, CBOs, Co-operatives, Banks, Building Societies, Regional Administration and individuals ought to set their efforts towards ensuring that the present untenable housing situation is contained.

The Government has to foster cooperation with other development partners and actors within and outside the country, and encourage them to collaborate, participate and invest in housing development using locally available resources and where necessary make use of externally sourced resources. Such actors include: housing financiers, producers, suppliers, consumers and enablers including, trainers, researchers and pressure groups.

5.5 Recommendation to methodology

The influence of research strategy on the expected outcome of the study was observed during initial stages of building the models from pilot study of the housing process in Dar es Salaam. When formulating initial models, simulations lead to final expected results. The analysis of the survey and the initial models enabled identification of possible areas for reducing housing costs. Specifically, the analysis indicated that there are areas that have the potential to reduce housing cost, which could support the hypothesis of the study. The use of simulation models in the study provides a wider means of analysing different situations which gives clear view of the outcomes and therefore assisting in making the best decision. However, a wrong model will give a wrong solution; the models need to be realistic.

5.6 Area for Further Research

While conducting this research, the author considered **MODELLING THE DETERMINANTS OF HOUSING CONSTRUCTION COSTS IN TANZANIA in determining affordability.** For further Research the author recommends further study on the following aspects;

- Modelling the determinants of materials in determining affordability.
- Determine how to address the factors that hinder provision of low-cost housing so as to facilitate provision of low-cost housing.

REFERENCES

Ademiluyi, A. a. R. B., 2008. Public and private developers as agents in urban housing delivery in Sub-Saharan Africa: The situation in Lagos State.. *Humanity & Social Sciences Journal,* Volume 3, p. 143–150.

Alawi, M., 2015. *Spiralling demand makes Dar rents the highest in East Africa.* [Online] Available at: http://www.thecitizen.co.tz/magazine/businessweek/1843772-2659056-kfx94nz/index.html [Accessed 09 April 2017].

Anthony, J., 2003. The Effects of Florida Growth Management Act on Housing Affordability. *Journal of the American Planning Association,* Volume LXIX.

Anu, M., 1997. *Introduction To Modelling and Simulation.* [Online] Available at: http://acqnotes.com/Attachments/White%20Paper%20Introduction%20to%20Modeling%20and%20Simulation%20by%20Anu%20Maria.pdf [Accessed 12 July 2017].

Ashworth, A., 1999. *Cost Studies of Buildings.* New York: Addison Wesley Longman Ltd.

Blasi, A., 2001. *Principal Town Planner.* [Online] Available at: http://www.hdm.lth.se/fileadmin/hdm/alumni/papers/ad2001/ad2001-18.pdf [Accessed 24 June 2017].

Bourne, L., 1981. *The Geography of Housing,* Toronto: V. H Winston & Sons.

Case, K. E. a. S. R. J., 2003. Is there a bubble in the housing market? Brookings Papers on Economic Activity. Volume 2, pp. 299-362.

Cavalcante, L., 2016. *Rw-thinking the urban form of social housing in BRAZIL: A search for urban sustainability,* New York: RIP Scholar works.

Centre for Affordable Housing Finance in Africa, 2017. *HOUSING FINANCE IN AFRICA A review of some of Africa's housing finance markets.* Johannesburg: Centre for Affordable Housing Finance in Africa.

Curristine, T. &. Z. L., 2007. Improving Public Sector Efficiency: Challenges and Opportunities. *OECD Journal on Budgeting,* Volume VII, pp. 1608-7143.

Curwin, J. a. S. R., 1996. *Quantitative Methods for Business Decisions.* London: International Thomson Business Press.

DTZ Research, 2004. *Housing Costs and Affordability in New Zealand,* Aotearoa, New Zealand: Centre for Housing Research.

Erguden, S., 2001. *Low-cost housing: Policies and constraints in developing countries,* Nairobi: American Aid.

Finnigan, S., 2012. *NHC Housing Project to Benefit Low Income Earners,* Dar-es-salaam: Daily News.

Gichunge, H., 2001. *Factor That Contribute to The Cost of Provisions of Low-cost Housing in Nairobi, Kenya,* Nairobi: Unpiblished PhD Thesis.

Golland, A., 2006. Housing supply, profit and housing production. *Journal of Housing and the Built Environment,* Volume XI, p. 1.

Gopalan, K., 2015. Affordable housing: Policy and practice in India. *IIMB Management Review,* XXVII(2), pp. 129-140.

Hassanali, F., 2009. *Understanding reduced Private – sector participation in Low Income Housing delivery,* Nairobi: s.n.

Indrianingrum, L., 2017. *Housing Ownership and Affordability among Low-Income Society in the Poorest Sub-District of Semarang, Central Java, Indonesia ,* Central Java, Indonesia: American Institute of physics.

Kathleen, L. &. L. G., 2017. *KPMG.* [Online] Available at: https://home.kpmg.com/xx/en/home/insights/2017/11/housing-as-an-infrastructure-sector.html [Accessed 18 March 2018].

Kibuuka, P., 2015. *Linkedin.* [Online] Available at: http://www.isidoralaw.co.tz/read/towards-a-successful-mortgage-finance-market-in-tanzania [Accessed 8 June 2017].

Kibuuka, P., 2016. *Isidora & Company Advocates.* [Online] Available at: http://www.isidoralaw.co.tz/read/towards-a-successful-mortgage-finance-market-in-tanzania [Accessed 15 June 2017].

Kironde, J. M. L., 2002. *Impact of the Regulatory Framework on Access to Legal Shelter in Tanzania: The Case for Revision Base on Lessons from Kinyerezi". A Paper presented to Workshop on Access to Affordable and Adequate Shelter,* Dar es Salaam: Unpublished PhD Thesis.

Kombe, J. W., 1999. *Users Participation in Urban Infrastructure Design and Implementation: The Case of Hanna Nasif Dar es Salaam,* Lusaka: Unpublished paper presented at the Seventh Regional Seminar for Labour Based Practitioners.

Kombo.H, T. &., 2015. *Assessment of The Contribution of Housing Co-Operatives in The Provision of Affordable Housing.* Dar-es-salaam, unpublished Msc Thesis.

Kothari, C., 2014. *Research Methodology Methods and Techniques.* 3rd ed. Mumbai: New Age International Publisher.

Kroes, H., 1987. Homelessness in Industrialised Countries. In: 1st ed. Hague: IFHP, pp. 32-41.

Kumar, R., 2005. *Research Methodology: A Step-by-Step Guide for Beginners.* 2nd ed. Mumbai: SAGE Publications.

Kwanama.E.M, 2015. *The Present Housing Challenge in Tanzania And Efforts Towards Provision of Affordable Housing.* Dar-es-salaam, National Housing & Building Research Agency.

Kyessi, A. G., 2002. *Community Participation in Urban Infrastructure Provision, Servicing Informal Settlement in Dar es Salaam,* Dortmund: Unpublished Msc Thesis.

Lallan, P. &. G. S., 2011. *Management Principles and Practices.* 1st ed. Mumbai, India: Excel Books India.

Lerise, F., 1996. *Planning at the End of the River: Land and Water Use Management in Chekereni, Moshi District, Tanzania,,* Copenhagen: Unpublished PhD thesis.

Linn, J., 1983. *Cities in the Developing World: Policies for their Equitable and Efficient Growth.* Oxford: University of Oxford.

Luvuba, J., 2016. *HABITAT III NATIONAL REPORT,* Dar-es-salaam: The Ministry of Lands, Housing and Human.

Macaloo, C., 2015. *The Relevance of Kenyas Urban Settlement Policies for Independent South Africa*.. [Online] Available at: http//egs.uct.ac.za/sagi/ Macoloo80 (2).htm [Accessed 15 September 2017].

Makoba, N., 2001. *Financing Mechanism for Home Ownership in Tanzania,* KU Leuven: Unpublished MSc Thesis.

Makoba, N., 2008. *ENABLING AFFORDABLE HOUSING For Low-income Households in Tanzania: An Integrated Cost Modelling Approach,* Turkey: s.n.

Maria, A. a. L. Z., 1997. *Probability Distributions.* 1st ed. New York: SUNY.

Marja, C., 2008. *Subsidizing Housing Finance for the Poor ,* Pennsylvania: Development Initiatives Group.

Mukama, W. C., 2002. *Key note address for workshop on regulatory frameworks for affordable shelte,* Dar es Salaam: Unpublished.

Mumtaz, B., 1996. *Meeting the Demand for Housing. A Model for Establishing Parameters.* London: DPU.

Nabutola, W., 2004. *Affordable Housing in Kenya: A Case study of Policy on Informal Settlements, Land Administration and Housing Issues in Informal Environments.* Jakarta, 3rd FIG Regional Conference, Indonesia..

Nachmias, H. a. N. F., 1996. *Research Methods in Social Sciences.* London: St. Martins Press.

Nelson, C. A., 2002. *The Link Between Growth Management and Housing Affordability.* USA: The Brookings Institution.

Nnkya, T., 1996. *Planning in Practice and Democracy in Tanzania.,* Copenhagen: Unpublished PhD thesi.

Nnkya, T., 2014. *FINANCING AFFORDABLE HOUSING IN TANZANIA: POLICY, INITIATIVES, CHALLENGES AND OPPORTUNITIES.* Washington, DC, Global Housing Finance Conference.

Oladapo, O., 2014. Housing delivery system, need and demand. *Environment, Development and Sustainability,* XVI(1), pp. 46-69.

Olusola, O., 2012. *Housing delivery system, need and demand.* [Online] Available at: https://core.ac.uk/download/pdf/81163838.pdf [Accessed 9 January 2017].

Ondiege, P. O., 2012. *An Analysis of Land Markets in Nairobi Urban management in Kenya. Proceedings of African research Network for Urban Management (Arnum) Workshop,* Nairobi: s.n.

Payne, M., 2002. The politics of systems theory within social wor. *ournal of Social Work*, Volume 23, pp. 269-92.

Rewel.K.M, 2014. *Factors Influencing Provision of Low-cost Housing in Nairobi County, Kenya,* Nairobi: unpubished Msc Thesis.

Robinson, J. T. &. V., 2006. Political foundations of the resource curse. *Journal of Development Economic,* Volume LXXIX, p. 447–468.

Saul, M., 2018. *Maslow's Hierarchy of Needs.* [Online] Available at: https://www.simplypsychology.org/maslow.html [Accessed 4 february 2018].

Semboja, J. a. T. O., 1994. *Service Provision under Stress in East Africa,* Copenhagen: Centre for Development Research.

SMETS, P., 1999. *Housing Finance Trapped in a Dilemma of Perceptions: Affordability Criteria for the Urban Poor in India Questioned,* Mumbai: Housing Studies.

Smith, M., 2008. *Displinary perpectives linked to middle range theory.* 2nd ed. New York: New York Springer Publishing company.

Steven, A., 2004. *Issues in the Establishment of Asset,* Washington: International Monetary Fund.

Stone, M. E., 1993. *Shelter poverty: New ideas on housing affordability.* Philadelphia: Temple University Press.

Tanzania invest, 2015. *Tanzania Real Estate.* [Online] Available at: https://www.tanzaniainvest.com/construction/realestate/tanzania-real-estate-sector-report [Accessed 9 July 2017].

Tipple, G., 2000. *Extending Themselves: User-initiated Transformations of government-built housing in developing countries,* Liverpool: Liverpool University Press.

Trading Economics, 2016. *Trading Economics.* [Online] Available at: https://tradingeconomics.com/tanzania/wages [Accessed 9 April 2017].

Un-Habitat, 2001. *Global Report on Human Settlements,* Cities in a globalizing world.: United Nations.

UN-Habitat, 2001. *United Nation Organazation.* [Online] Available at: UN. Istanbul+ 5. The United Nations Special Session of the GeneralAssembly for an Overall Review and Appraisal of the

Implementation of the Habitat Agenda. New York : s.n., 2001 [Accessed 12 August 2017].

UN-Habitat, 2006. *Istanbul Declaration on Human Settlements.* [Online] Available at: https://unhabitat.org/wp-content/uploads/2014/07/The-Habitat-Agenda-Istanbul-Declaration-on-Human-Settlements-20061.pdf [Accessed 15 June 2017].

UN-Habitat, 2015. *Urban Solutions. United Nations Human Settlements Programme, Nairobi 2015,* s.l.: UN-Habitat.

weber-knecht, 2016. *5 Ways To Reduce The Cost Of A Land Survey.* [Online] Available at: http://weber-knecht.com/2016/01/29/5-ways-to-reduce-the-cost-of-a-land-survey/ [Accessed 7 May 2017].

Well, S. S., 1999. *Housing and building materials in low-income settlements in Dar es Salaam,* Dar es Salaam: University of Dar es Salaam.

Wilson, W., 2010. *Key Issues for the Parliament.* [Online] Available at: http://www.parliament.uk/documents/commons/lib/research/key_issues/KeyIssues-Supplyand-demend.pdf [Accessed 2 september 2017].

Worrall, L. C. S. P. I. F. M. &. D. M., 2017. *BETTER URBAN GROWTH IN TANZANIA A Preliminary Exploration of the Opportunities and Challenges,* Dar es Salaam, Tanzania: World Resources Institute..

Yin, R. K., 1994. *Case Study Research: Designs and Methods.* 2nd ed. California: SAGE Publications.

APPENDIX 1

COST DATA BASE

COMPILED WORK SECTIONS PRICE LIST:

BB/SfB REF:	DESCRIPTION	UNIT	MATERIAL PRICE (in TAS)	LABOUR PRICE (in TAS)	PROFIT/ OVHDS (in TAS)	UNIT RATE (in TAS)
(11/1)Vu3	Insectside treatment for soil	m^2	1,200	300	500	2,000
(13/1)Ln2	500 gauge polythene sheet	m^2	1,200	300	500	2,000
(13/1)Bp1	Brick paved walkway	m^2	24,000	6,000	10,000	40,000
(13/1)Cp1	100mm Thick plain concrete bed	m^2	12,000	3,000	5,000	20,000
(13/9)Bh	Concrete blinding, 50mm	m^2	5,400	1,350	2,250	9,000
(16/2)Ef2.10	Mass concrete footing (1:3:6)	m^3	120,000	30,000	50,000	200,000
(16/4)Ef2.10	Reinf. Concrete Pad Fdn	m^3	171,000	42,750	71,250	285,000
(16/4)Ef2.20	Reinf. Concrete Strip Fdn	m^3	171,000	42,750	71,250	285,000
(16/4)Ef2.30	Reinf. Concrete Fdn Beam	m^3	171,000	42,750	71,250	285,000
(16/4)Pf2	Water resistant plastering for fdn	m^2	6,000	1,500	2,500	10,000
(16/6)Jh5	Earth rod	nr	240,000	60,000	100,000	400,000
(21/2)Ri4	6mm plywood; 1.2 x 2.4m	m^2	6,000	1,500	2,500	10,000
(21/3)Hi	Timber wall structure	m^2	72,000	18,000	30,000	120,000
(21/3)Xt6.10	Timber wall; 6" x 1" nailing	m^2	72,000	18,000	30,000	120,000
(21/3)Xt6.11	Timber wall; offcuts nailing	m^2	72,000	18,000	30,000	120,000
(21/4)Ef2.10	Cement Sand Rendering	m^2	4,800	1,200	2,000	8,000
(21/4)Pf2.10	15mm thk wood float ext. plaster	m^2	4,800	1,200	2,000	8,000
(21/4)Pf2.11	13mm thk steel trowel int. plaster	m^2	4,800	1,200	2,000	8,000

(21/4)Pf2.12	Tyrolean rendering	m^2	7,800	1,950	3,250	13,000
(21/4)Pf2.13	Pointing to masonry abv ground	m^2	4,800	1,200	2,000	8,000
(21/4)Pf2.14	Pointing to brickwall; mix 1:3	m^2	4,800	1,200	2,000	8,000
(21/4)Pf2.15	Pointing to HCB wall; mix 1:3	m^2	4,800	1,200	2,000	8,000
(21/4)Pf2.16	Pointing to stone wall; mix 1:3	m^2	4,800	1,200	2,000	8,000
(21/7)Ln2	DPC for walls	m	1,200	300	500	2,000
(23/3)Ef2.10	Reinf conc susp slab; 100mm thk	m^2	17,100	4,275	7,125	28,500
(23/3)Ef2.11	Reinf conc susp slab; 150mm thk	m^2	25,650	6,413	10,688	42,750
(23/3)Ef2.20	Reinf conc susp slab; 200mm thk	m^2	34,200	8,550	14,250	57,000
(23/4)Ef2.10	Reinf conc grd floor slab (conf 86)	m^2	25,650	6,413	10,688	42,750
(23/4)Ef2.11	Reinf conc grd floor slab (conf 257)	m^2	25,650	6,413	10,688	42,750
(23/4)Ef2.12	Reinf conc steps and staircases	m^3	17,100	4,275	7,125	28,500
(23/4)Ef2.13	Reinf conc landings; 100mm thick	m^2	17,100	4,275	7,125	28,500
(23/4)Ef2.14	Reinf conc roof slab; 100mm thick	m^2	17,100	4,275	7,125	28,500
(23/9)Bi.10	Formwork to soffites of slab	m^2	12,000	3,000	5,000	20,000
(23/9)Bi.11	Formwork to edges; 75-150mm	m	2,700	675	1,125	4,500
(23/9)Bi.20	Formwork to beams	m^2	12,000	3,000	5,000	20,000
(23/9)Bi.21	Formwork to risers; 75-150mm	m	2,700	675	1,125	4,500
(24/2)Xf2	Reinf conc staircase element	m^3	12,000	3,000	5,000	20,000
(24/2)Xi	Staircase with wooden elements	m^3	2,700	675	1,125	4,500
(27/1)Hi	100 x 50mm wall plate	m	171,000	42,750	71,250	285,000
(27/1)Xt6	Roofing nails	kg	3,600,000	900,000	1,500,000	6,000,000
(27/2)Ln2	500 gauge polythene sheet for roof	m^2	3,600	900	1,500	6,000

(27/2)Nf5	Precast conc interlocking tile+batterns	m^2	3,000	750	1,250	5,000
(27/2)Nh3.10	GCI sheet gauge 32	m^2	9,000	2,250	3,750	15,000
(27/2)Nh3.20	GCI sheet gauge 30	m^2	6,000	1,500	2,500	10,000
(27/2)Nh3.30	GCI sheet gauge 28	m^2	4,200	1,050	1,750	7,000
(27/2)Nh3.31	Metal sheet gauge 28 coping dw=450mm	m	6,000	1,500	2,500	10,000
(27/2)Nh3.50	GI sheet gauge 28 ridge cover dw=500mm	m	6,000	1,500	2,500	10,000
(27/2)Nh4.10	Corrugated aluminium sheets gauge 22; 2.5 x 1m	m^2	9,000	2,250	3,750	15,000
(27/2)Pf2.10	Three layers of asphalt; 20mm	m^2	24,000	6,000	10,000	40,000
(27/2)Pf2.20	Two coats of aluminium paint	m^2	4,800	1,200	2,000	8,000
(27/3)Hi.10	Hardwood truss top and bottom chord; 50 x 150mm	m	5,400	1,350	2,250	9,000
(27/3)Hi.11	Vertical and diagonal members of truss 50x150mm	m	5,400	1,350	2,250	9,000
(27/3)Hi.20	70 x 50mm swd timber purlin	m	2,700	675	1,125	4,500
(27/3)Hi.30	100 x 50mm member of rafter	m	3,600	900	1,500	6,000
(27/7)Ri.10	Horizontal fascia board with oil paint	m	15,000	3,750	6,250	25,000
(27/7)Ri.11	Slanting fascia board with oil paint	m	15,000	3,750	6,250	25,000
(28/2)Ef2.10	Reinf conc tie beam (100mm thk)	m^3	171,000	42,750	71,250	285,000
(28/2)Ef2.11	Reinforced concrete (C-10)	m^3	171,000	42,750	71,250	285,000
(28/2)Ef2.15	Reinforced concrete (C-15)	m^3	171,000	42,750	71,250	285,000
(28/2)Ef2.20	Reinforced concrete (C-20)	m^3	171,000	42,750	71,250	285,000
(28/3)Ef2.25	Reinf conc column (C-20)	m^3	171,000	42,750	71,250	285,000
(28/4)Pf1	Plastering tie beam; mix 1:3	m^2	4,800	1,200	2,000	8,000

(28/9)Bi	Formwork to columns or beams	m^2	12,000	3,000	5,000	20,000
(31.4/2)Ro1	5mm clear glass panel	m^2	18,000	4,500	7,500	30,000
(31.4/2)Ro2	4mm clear glass panel	m^2	15,000	3,750	6,250	25,000
(31.4/2)Ro3	3mm clear glass panel	m^2	9,000	2,250	3,750	15,000
(31.4/2)Ro4	Frosted clear glass panel	m^2	27,000	6,750	11,250	45,000
(31.5/2)Rh2	Partical board flush door; 900 x 2100mm	nr	180,000	45,000	75,000	300,000
(31.5/2)Rh3	Hardwood panel door; 1050 x 2550mm	nr	450,000	112,500	187,500	750,000
(31.5/2)Ri.10	Plywood flush door; 900 x 2100mm	nr	180,000	45,000	75,000	300,000
(31.5/2)Ri.11	Solid core timber door; 900 x 2100mm	nr	270,000	67,500	112,500	450,000
(31.5/2)Ri.12	Batterned door; 800 x 2550mm	nr	270,000	67,500	112,500	450,000
(31.5/2)Ri.12a	Batterned door; 700 x 2100mm	nr	270,000	67,500	112,500	450,000
(31.5/2)Ri.13	Hardwood casement window leaf	m^2	150,000	37,500	62,500	250,000
(31.5/2)Ri.15	Plywood flush door; 900 x 2550mm	nr	180,000	45,000	75,000	300,000
(31.5/7)Xt7.10	3 lever mortice lockset	nr	75,600	18,900	31,500	126,000
(31.5/7)Xt7.11	2 lever mortice lockset	nr	45,000	11,250	18,750	75,000
(31.5/7)Xt7.20	50 x 12mm door stop	nr	3,000	750	1,250	5,000
(31/1)Ef2.10	Lintel; 100 x 200, C-20	m	630,000	157,500	262,500	1,050,000
(31/1)Ef2.11	Lintel; 150 x 200, C-20	m	720,000	180,000	300,000	1,200,000
(31/1)Ef2.12	Lintel; 200 x 200, C-20	m	810,000	202,500	337,500	1,350,000
(31/2)Xh2.11	Metal window frame; 800 x 1000mm	m^2	102,000	25,500	42,500	170,000
(31/2)Xh2.12	Steel glazed sash	m^2	36,000	9,000	15,000	60,000
(31/2)Xh2.13	Metal door frame; 900 x 2100mm	no	180,000	45,000	75,000	300,000
(31/2)Xh2.14	Metal door frame; 700 x 2100mm	no	126,000	31,500	52,500	210,000

(31/3)Hi.10	Hardwood door frame; 40 x 125mm	m	15,000	3,750	6,250	25,000
(31/3)Hi.11	Hardwood door frame; 45 x 150mm	m	21,000	5,250	8,750	35,000
(31/3)Hi.12	Hardwood window frame; 40 x 125mm	m	15,000	3,750	6,250	25,000
(31/3)Hi.13	Hardwood mullion; 40 x 125mm	m	15,000	3,750	6,250	25,000
(31/3)Hi.14	Rail wooden frames; 50 x 45mm	m	21,000	5,250	8,750	35,000
(31/3)Xi.13	Timber framed window	m	21,000	5,250	8,750	35,000
(31/3)Xt7.10	100mm brass butt hinges	prs	9,000	2,250	3,750	15,000
(31/3)Xt7.11	100mm brass barrel bolt	nr	4,500	1,125	1,875	7,500
(31/7)Jh2.10	16mm dia burglar proof bars	m	90,000	22,500	37,500	150,000
(31/7)Jh2.11	Galv expanded metal weldmesh	m^2	7,200	1,800	3,000	12,000
(31/7)Jh2.12	Ornamental grilles for opening	m^2	66,000	16,500	27,500	110,000
(31/7)Jh4	Aluminium fly screen	m^2	8,400	2,100	3,500	14,000
(31/7)Jn6	Nylon mosquito gauze	m^2	3,600	900	1,500	6,000
(31/7)Ri3	Hwd louvre blade; 5 x 125mm	m	21,000	5,250	8,750	35,000
(31/7)Ro1.10	Glass louvre blade; 6 x 100mm	m	3,000	750	1,250	5,000
(31/7)Ro1.11	Glass louvre blade; 6 x 150mm	m	4,800	1,200	2,000	8,000
(31/7)Xh4	Aluminium louvre carrier frames, 10 clips	prs	9,000	2,250	3,750	15,000
(31/7)Xh5	Steel louvre window, 10 clips	nr	18,000	4,500	7,500	30,000
(31/7)Xn7	Plastic louvre carrier frame, 10 clips	nr	36,000	9,000	15,000	60,000
(32.5/2)Ri	Internal timber door	nr	270,000	67,500	112,500	450,000
(34/0)Ef2	RHS 50x50mm rail for stair; h=900mm	m	150,000	37,500	62,500	250,000
(34/0)Ef2.10	Balustrade; blockwork; 900mm high	m	36,000	9,000	15,000	60,000

(34/0)Ef2.11	Balustrade; timber; 900mm high	m	120,000	30,000	50,000	200,000
(34/0)Ef2.12	Balustrade; metal; 900mm high	m	150,000	37,500	62,500	250,000
(41/2)Sg3	Ceramic wall tiles; 6 x 150 x 150mm	m^2	36,000	9,000	15,000	60,000
(41/2)Sg4	Mable wall tiles	m^2	48,000	12,000	20,000	80,000
(41/4)Vv1	Water based painting	m^2	6,000	1,500	2,500	10,000
(41/4)Vv2	Whitewash painting	m^2	4,800	1,200	2,000	8,000
(41/4)Vv5	3 coats emulsion paint	m^2	4,800	1,200	2,000	8,000
(41/4)Vv6	Varnish to fairface brick	m^2	4,800	1,200	2,000	8,000
(41/4)Vv6.1	Varnish to timber surfaces	m^2	4,800	1,200	2,000	8,000
(41/4)Vv7	External wall plastic paint	m^2	4,800	1,200	2,000	8,000
(41/4)Vv8	Paint to int and ext plaster	m^2	4,800	1,200	2,000	8,000
(41/4)Vv9	Gloss paint to timber surfaces	m^2	4,800	1,200	2,000	8,000
(41/4)Vv10	Varnish to timber frames	m	1,200	300	500	2,000
(41/4)Vv11	Gloss paint to timber frames	m	1,200	300	500	2,000
(43/2)Ef2.10	38mm cement / sand screed	m^2	9,000	2,250	3,750	15,000
(43/2)Ef2.11	48mm cement / sand screed	m^2	9,000	2,250	3,750	15,000
(43/2)Ef3.10	20mm terrazzo to floors	m^2	24,000	6,000	10,000	40,000
(43/2)Ef3.11	Terrazzo skirting; h= 100mm	m	3,600	900	1,500	6,000
(43/2)Ef3.12	15mm thk parquet floor + bedding	m^2	105,000	26,250	43,750	175,000
(43/2)Ef3.13	Cement tile skirting; h= 100mm	m	6,000	1,500	2,500	10,000
(43/2)Ef3.14	2mm pvc floor tiles	m^2	36,000	9,000	15,000	60,000
(43/2)Ef3.15	pvc skirting	m	6,000	1,500	2,500	10,000
(43/2)Ef3.16	20mm marble tile floor + bedding	m^2	48,000	12,000	20,000	80,000
(43/2)Ef3.17	20mm marble tile skirting; h= 100mm	m	6,000	1,500	2,500	10,000
(43/2)Ef3.18	Granite paving	m^2	72,000	18,000	30,000	120,000

(43/2)Ef3.19	Precast concrete paving slabs; 80mm thk	m^2	24,000	6,000	10,000	40,000
(44/2)Ef2.10	Terrazzo tread; 300 x 30mm	m	10,800	2,700	4,500	18,000
(44/2)Ef2.11	Terrazzo risers; 150 x 30mm	m	4,800	1,200	2,000	8,000
(44/2)Ef2.12	Marble tread; 300 x 30mm	m	14,400	3,600	6,000	24,000
(44/2)Ef2.13	Marble risers; 150 x 30mm	m	6,000	1,500	2,500	10,000
(44/2)Ef2.14	Cement screed tread; 300 x 30mm	m	2,400	600	1,000	4,000
(44/2)Ef2.15	Cement screed risers; 150 x 30mm	m	2,400	600	1,000	4,000
(44/2)Ef2.16	30mm terrazzo to landing	m^2	24,000	6,000	10,000	40,000
(44/2)Ef2.17	30mm cement screed to landing	m^2	9,000	2,250	3,750	15,000
(44/2)Ef2.18	Varnishing to risers and treads	m^2	9,000	2,250	3,750	15,000
(45/2)Rj1.20	Hardboard; 6mm + brandering	m^2	19,380	4,845	8,075	32,300
(45/2)Rj7	Suspended ceiling	m^2	36,000	9,000	15,000	60,000
(45/4)Vv6.10	Painting ceiling; 2 coats	m^2	3,300	825	1,375	5,500
(45/4)Vv6.11	Painting ceiling; 3 coats	m^2	4,200	1,050	1,750	7,000
(52.3)Hf2.10	Open drain channel dia 400mm	m	18,000	4,500	7,500	30,000
(52.3)Hf2.20	Open drain channel dia 200mm unlined	m	12,000	3,000	5,000	20,000
(52.3)Hf2.20.1	Open drain channel dia 200mm with stone/concrete lining	m	36,000	9,000	15,000	60,000
(52.3)Hf2.30	Open drain channel; 550 x 300mm, unlined	m	24,000	6,000	10,000	40,000
(52.3)Hf2.30.1	Open drain channel; 550 x 300mm, stone/concrete lined	m	36,000	9,000	15,000	60,000
(52.3)Hf2.40	Drain channel; 550 x 300mm with metal grills	m	72,000	18,000	30,000	120,000
(52.3)Hf2.50	Drain channel; dia 300mm with	m	42,000	10,500	17,500	70,000

	stone cover					
(52.3)Hf2.60	Drain channel; 450 x 250mm with stone cover	m	48,000	12,000	20,000	80,000
(52.3)Hf2.70.1	500mm Dia culvert, 3m long	nr	120,000	30,000	50,000	200,000
(52.3)Hf2.70.2	750mm Dia culvert 3 m long	nr	144,000	36,000	60,000	240,000
(52.3)If2	Installed sewer connection	m	300,000	75,000	125,000	500,000
(52.3)X.10	Connection to sewerage	nr	480,000	120,000	200,000	800,000
(52.3)X.20	Soakpit 7m^3 for15-30 persons	nr	2,160,000	540,000	900,000	3,600,000
(52.3)X.20.1	Soakpit 7m^3 for 5-15 persons	nr	1,560,000	390,000	650,000	2,600,000
(52.3)X.30	Septic tank 7m^3 for15-30 persons	nr	1,890,000	472,500	787,500	3,150,000
(52.3)X.30.1	Septic tank 7m^3 for 5-15 persons	nr	1,440,000	360,000	600,000	2,400,000
(52.3)X.40	Manhole with cast iron cover	nr	135,000	33,750	56,250	225,000
(52.3)X.50	Installed inspection chamber	nr	81,000	20,250	33,750	135,000
(52.5)Hh	G-28 rainwater gutter	m	5,100	1,275	2,125	8,500
(52.5)Ih	G-28 rainwater down pipe; painted	m	8,370	2,093	3,488	13,950
(53.1)I	Installed garden water post	item	600,000	150,000	250,000	1,000,000
(53.1)Ih2.10	Galv m.s pipe 15mm dia	m	2,700	675	1,125	4,500
(53.1)Ih2.11	Galv m.s pipe 20mm dia	m	3,120	780	1,300	5,200
(53.1)Ih2.12	Galv m.s pipe 25mm dia	m	5,100	1,275	2,125	8,500
(53.1)Ih2.13	Galv m.s pipe 32mm dia	m	6,900	1,725	2,875	11,500
(53.1)Ih2.14	Galv m.s pipe 40mm dia	m	9,900	2,475	4,125	16,500
(53.1)Ih2.15	Galv m.s pipe 50mm dia	m	12,600	3,150	5,250	21,000
(53.1)Ih2.16	Galv m.s pipe 80mm dia	m	16,800	4,200	7,000	28,000
(53.1)Ih2.17	Galv m.s pipe 100mm dia	m	21,000	5,250	8,750	35,000
(53.1)Ih2.18	Galv m.s pipe 150mm dia	m	24,000	6,000	10,000	40,000
(53.1)In6.20	pvc pipe; 50mm dia	m	1,800	450	750	3,000
(53.1)In6.21	pvc pipe; 110mm dia	m	11,220	2,805	4,675	18,700

(53.1)X	Connection to water supply mains	item	600,000	150,000	250,000	1,000,000
(53.1)Xh6	Brass stop cork	nr	6,000	1,500	2,500	10,000
(53.5)X.10	50 litre Dubai type geyser	nr	228,000	57,000	95,000	380,000
(53.5)X.11	80 litre Dubai type geyser	nr	300,000	75,000	125,000	500,000
(53.5)X.12	100 litre Dubai type geyser	nr	480,000	120,000	200,000	800,000
(53.5)X.13	100 litre pressure RSA type geyser	nr	570,000	142,500	237,500	950,000
(53.5)X.14	150 litre pressure RSA type geyser	nr	720,000	180,000	300,000	1,200,000
(61)In6.10	pvc conduits 3/4"	m	900	225	375	1,500
(61)In6.11	pvc conduits 1"	m	1,200	300	500	2,000
(61)In6.12	pvc conduits 3"	m	9,000	2,250	3,750	15,000
(61)X.10	Installed distribution board	nr	507,000	126,750	211,250	845,000
(61)X.11	Connection power to distr box	item	300,000	75,000	125,000	500,000
(61)X.12	Consumers meter unit	nr	240,000	60,000	100,000	400,000
(61)X.13	1pc main switch 50 amps/1p	nr	72,000	18,000	30,000	120,000
(61)X.14	1pc of acb 20A/1p	nr	3,600	900	1,500	6,000
(61)Xn6.10	2pc of acb 10A/1p	nr	3,600	900	1,500	6,000
(61)Xn6.11	5pc of acb 16A/1p	nr	3,600	900	1,500	6,000
(61)Xn6.12	2pc of acb 20A/1p	nr	3,600	900	1,500	6,000
(62)X.10	Installed power point; socket	nr	36,000	9,000	15,000	60,000
(62)X.11	Earthing incl wiring + cond 10A/1p	nr	60,000	15,000	25,000	100,000
(62)X.12	Earthing incl wiring + cond 16A/1p	nr	60,000	15,000	25,000	100,000
(62)X.13	Ditto for water heater incl switch	nr	72,000	18,000	30,000	120,000
(62)X.14	Ditto for stove 29A/p	nr	3,600	900	1,500	6,000
(63)X.10	Installed light point; fluorescent tube	nr	27,000	6,750	11,250	45,000
(63)X.11	Installed light point; bulb type	nr	13,200	3,300	5,500	22,000

(63)X.12	Circuit breaker		48,000	12,000	20,000	80,000
(63)X.12	single phase	nr	27,000	6,750	11,250	45,000
(63)X.13	three phase	nr	90,000	22,500	37,500	150,000
(63)Xn6.10	Light point wiring incl switches	nr	90,000	22,500	37,500	150,000
(63)Xn6.11	Switch point excl wiring work	nr	4,200	1,050	1,750	7,000
(63)Xn6.12	Ditto but two ways	nr	4,680	1,170	1,950	7,800
(63)Xn6.13	ditto but double pole	nr	6,900	1,725	2,875	11,500
(64)X10	Bell call point incl wiring	nr	150,000	37,500	62,500	250,000
(64)X11	Tel outlet in 19mm conduit	item	1,800	450	750	3,000
(73.2)Xh3.10	Kitchen sink 1000 x 500mm	nr	72,000	18,000	30,000	120,000
(73.2)Xh3.11	Installed kitchen sink	nr	30,000	7,500	12,500	50,000
(73.2)Xh3.12	Terrazzo sink 50 x 40mm	nr	180,000	45,000	75,000	300,000
(74.22)Xg3	Installed bath tub	nr	480,000	120,000	200,000	800,000
(74.23)Xg3	Hand wash basin 570 x 470mm	nr	360,000	90,000	150,000	600,000
(74.44)Xg3.10	Installed vitreous China WC	nr	300,000	75,000	125,000	500,000
(74.44)Xg3.20	Installed Armitage WC	nr	300,000	75,000	125,000	500,000
(74.44)Xq3.21	Water Storage 1000 litres	nr	102,000	25,500	42,500	170,000
(74.44)Xq3.22	Water Storage 2000 litres	nr	210,000	52,500	87,500	350,000
(74.44)Xq3.23	Water Storage 5000 litres	nr	510,000	127,500	212,500	850,000
(74.7)Ro7	Polished glass mirror	nr	36,000	9,000	15,000	60,000
(74.7)X	Toilet paper roll holder; 150 x 150 x 25mm	nr	12,000	3,000	5,000	20,000
(74.9)X.10	Chrome plated towel rail	nr	15,000	3,750	6,250	25,000
(74.9)X.11	Installed cobra shower	nr	30,000	7,500	12,500	50,000
(76)Xi	Inbuilt wardrobe	item	900,000	225,000	375,000	1,500,000
(76)Xii	Kitchen cupboard	item	1,500,000	375,000	625,000	2,500,000
(76.9)X	Cupboard lock	nr	4,500	1,125	1,875	7,500
(94/4)Es1.10	Bitumen double sealing 25mm	m^2	51,000	12,750	21,250	85,000

(94/4)Es1.20	Asphalt pvg 2kg/m^2 base and 1kg/m^2 surf cource	m^2	36,000	9,000	15,000	60,000
(94/4)Sf2	Dressed stone pavement; 100mm	m^2	24,000	6,000	10,000	40,000
(94/4)Sf2.10	Precast concrete paving slabs; 25 x 600 x 600mm	m^2	24,000	6,000	10,000	40,000
(94/7)Hf2	Stone kerb; 120 x 300mm	m	15,000	3,750	6,250	25,000
(98)Cp.00	Prepare land for grassing and flowering	m^2	1,800	450	750	3,000
(98)Cp.01	Creeping grass, flowers and manuring	m^2	6,000	1,500	2,500	10,000
(99)Cp.00	Top soil excavation	m^2	1,080	270	450	1,800
(99)Cp.01	Excavation up to 1500mm	m^3	2,400	600	1,000	4,000
(99)Cp.10	Disposal of excvtd materials	m^3	3,600	900	1,500	6,000
(99)Cp.10.1	Earth backfilling	m^3	13,500	3,375	5,625	22,500
(99)Cp.11	Trench excvtn up to 1500mm	m^3	2,400	600	1,000	4,000
(99)Cp.20	Hardcore filling; 150mm thick	m^2	7,290	1,823	3,038	12,150
(99)Cp.21	Hardcore filling; 250mm thick	m^2	9,000	2,250	3,750	15,000
(99)Cp.22	Crashed aggregates for road	m^2	9,000	2,250	3,750	15,000
(99)Ef2.10	Insitu concrete, C-7 for blinding	m^2	168,000	42,000	70,000	280,000
(99)Ef2.11	Insitu reinf conc C-15 (280kg/m^3)	m^3	168,000	42,000	70,000	280,000
(99)Ef2.20	Insitu mass conc C-20	m^3	168,000	42,000	70,000	280,000
(99)Ef2.21	Insitu reinf conc C-25 (360kg/m^3)	m^3	168,000	42,000	70,000	280,000
(99)Ef2.22	Insitu reinf conc 150mm, C-20	m^3	168,000	42,000	70,000	280,000
(99)Ef2.31	Bell call point incl wiring	nr	150,000	37,500	62,500	250,000
(99)Ef2.32	R.C C-20 200kg steel	m^3	168,000	42,000	70,000	280,000
(99)Jh2.10	Reinforcement, d=6mm	kg	1,800	450	750	3,000
(99)Jh2.11	Reinforcement, d=10mm	kg	1,800	450	750	3,000
(99)Jh2.12	Reinforcement, d=12mm	kg	1,800	450	750	3,000

(99)Jh2.13	Reinforcement, d=16mm	kg	1,800	450	750	3,000
(99)Jh2.14	Reinforcement, d=20mm	kg	1,800	450	750	3,000
(99)Vv6	Two coats ronseal on wood	m^2	4,800	1,200	2,000	8,000
(99)Xt6.10	2" wire nails	kg	1,800	450	750	3,000
(99)Xt6.11	3" wire nails	kg	1,800	450	750	3,000
(99/1)Ce1	Select material base coarse 25mm	m^2	9,000	2,250	3,750	15,000
(99/1)Cp	Ditto but 150-300mm	m^2	9,000	2,250	3,750	15,000
(99/1)E	Well compacted surface	m^2	9,000	2,250	3,750	15,000
(99/2)Fe1.10	230mm brick wall	m^2	19,200	4,800	8,000	32,000
(99/2)Fe1.11	100mm brick wall	m^2	16,050	4,013	6,688	26,750
(99/2)Fe1.12	150mm brick wall	m^2	16,800	4,200	7,000	28,000
(99/2)Fe1.13	230mm Unburnt clay blockwall	m^3	7,200	1,800	3,000	12,000
(99/2)Fe1.14	100mm Unburnt clay blockwall	m^4	4,800	1,200	2,000	8,000
(99/2)Fe1.15	150mm Unburnt clay blockwall	m^5	6,000	1,500	2,500	10,000
(99/2)Ff2.10	100mm solid concrete blockwork	m^2	17,010	4,253	7,088	28,350
(99/2)Ff2.11	150mm solid concrete blockwork	m^2	19,440	4,860	8,100	32,400
(99/2)Ff2.12	230mm solid concrete blockwork	m^2	20,700	5,175	8,625	34,500
(99/2)Ff2.13	100mm hollow concrete blockwork	m^2	19,395	4,849	8,081	32,325
(99/2)Ff2.14	150mm hollow concrete blockwork	m^2	19,950	4,988	8,313	33,250
(99/2)Ff2.15	230mm hollow concrete blockwork	m^2	21,900	5,475	9,125	36,500
(99/2)Fg2.12	100m thk facework, (200 x 100 x 100mm)	m^2	36,000	9,000	15,000	60,000
(99/2)Fg2.13	50mm thk facework (200 x 100 x 50mm)	m^2	33,600	8,400	14,000	56,000
(99/3)A.00	Precast concrete columns; 100 x 150 x 2400mm	nr	22,680	5,670	9,450	37,800

(99/3)A.01	Precast concrete columns; 100 x 150 x 3000mm	nr	28,350	7,088	11,813	47,250
(99/3)B.00	Metal gate including gate posts and accessories; 1500 x 2400mm	nr	720,000	180,000	300,000	1,200,000
(99/3)B.01	Timber gate including gate posts and accessories; 1500 x 2400mm	nr	900,000	225,000	375,000	1,500,000
(99/4)C.01	Electrical poles	nr	300,000	75,000	125,000	500,000
(99/4)C.02	Wiring four lines	m	14,400	3,600	6,000	24,000

APPENDIX 2

ELEMENTAL COST

COST CALCULATION

Code	Element	Price/Unit	Unit
(00)	Fixed land cost/plot	39,000.00	plot
(00)	Variable land cost	10,761.60	m^2
(00)	Land cost infrastructure	10,000.00	m^2
(13)	Ground Floor	53,200.00	m^2
(16)	Foundation Ext (normal)	108,736.40	m
(16)	Foundation Int	103,940.00	m
(21)+	Ext Walls (normal)	65,700.00	m^2
(22)+	Int Walls	63,150.00	m^2
(23)	Susp. Floor	140,690.00	m^2
(24)+	Staircase	663,928.52	m^2
(27)	Roof (Courtyard)	352,302.01	m^2
(31)	Windows	2,010,000.00	m^2
(32)	Doors	1,066,068.99	m^2