

The potential of local building materials in the development of low cost housing in Uganda

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ABSTRACT

In Uganda, limited availability of building materials, rapid population growth and limited household incomes cast a serious challenge to low-income earners' access to decent shelter. The supply of decent shelter is hampered, among others, by constrained access to appropriate and affordable building materials and designs, security of land tenure, inappropriate building by-laws, standards and regulations. In examining problems of low cost housing in Uganda, the study focuses on the use of local building materials' potential to improve low-income earners' access to decent shelter. The study is based on primary and secondary data from around the country, literature and archival reports, and interviews of key personnel in the building sector. The study concludes with the view that local materials have potential to positively contribute to improving access to decent housing by low income earners. It observes that demand for housing cannot be met by solely using imported materials. On the other hand, results indicate that most local building materials are of poor quality. The study advocates improving the quality of local materials and their standardisation as a way of improving their potential use in the development of housing in the country. It also recommends sustainable exploitation and commercialisation of the production of the materials as a way of attaining affordable decent shelter.

Keywords: Indigenous building materials, affordable housing, decent housing.

1.0 INTRODUCTION

In the last half a century, Uganda's population increased from 4.96 million in 1948 to 25.3 million in 2003, and it is estimated to have reached 30.7 million in the National Household Survey 2009/2010. This has since grown to 34.1 million (2012), 35.4 million (2013) and it is estimated to reach 38 million people by 2015 (Uganda Bureau of Statistics (UBOS), 2010; 2012; 2013). Rapid population growth, poor state of the national economy, constrained access to appropriate and affordable building design and materials, limited access to land, inappropriate building by-laws, standards and regulations have had the effect of concentrating low-income earners in poor housing conditions that lack planning and servicing (UBOS, 2010). In an environment of wide spread poverty and increased demand for housing there is a need to increase the supply of decent housing to all income categories in the country.

Uganda is listed among the seven countries in sub-Saharan Africa that are in need of low cost building projects (International Centre for Science and High Technology (ICS), 2008). Many Ugandans face an uphill task accessing decent shelter. This is more widely experienced among low-income earners who find it costly to develop housing using contemporary building materials that are often imported or transported long distances from the manufacturer to sites of construction. With limited options, low-income earners often resort to locally available materials for house construction. 71 per cent of the housing stock in Uganda is constructed of local materials that are temporary in nature (UN-Habitat, 2010). However, most of these local building materials are of poor quality, as they are unprocessed, non-standardised and their properties not well understood.

Under this background, this paper examines the potential of local building materials in the development of low-cost housing in Uganda.

2.0 MATERIALS AND METHODS

The study examines the potential of using local building materials to develop affordable and acceptable, decent shelter in Uganda. The methods used were limited to evaluation of literature which consisted of both qualitative and quantitative data, official/government documents and archival documents about local building materials. This was supplemented by information gathered through field observation in the four regions of Uganda - west, east, south and central, interviews of some key personnel in the building sector – contractors, local builders and artisans, to while focusing on its potential of local building materials in the context of Uganda. This information from the field was used to gather responses on the use, and potential local materials in filling the gap of materials that can be used in the housing construction sector in Uganda.

3.0 RESULTS

The results here discussed are outlined in four sections – use of local materials, their acceptability, cost and sustainability.

3.1 USE OF LOCAL OF LOCAL BUILDING MATERIALS IN UGANDA

Use of local building materials is examined with respect to the major building component of the house – roof, wall and floor. Table 3.1 shows the use of building materials in the country.

Table 3.1: Distribution of households by main type of construction materials, residence and survey period (%)

Materials	2005/06			2009/10		
	Rural	Urban	Uganda	Rural	Urban	Uganda
Roof						
Iron sheets	55.9	82.7	60.6	56.7	84.1	61.8
Thatched	43.2	14.2	38.2	42.6	12.0	36.9
Other roof	0.9	3.1	1.3	0.7	4.0	1.3
Wall						
Bricks	48	79.2	53.4	50.9	83.9	57.1
Mud and	47.2	17.2	42	45.7	12.4	39.4
Other walls	4.8	3.6	4.6	3.4	3.8	3.5
Floor						
Earth	82.8	29.6	73.5	82.1	25.2	71.4
Cement	16.5	68.6	25.6	16.9	70.8	27.
Other floor	0.7	1.8	0.9	1.0	4.0	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: UBOS (2010: 114).

Roofing materials

Examination of the houses in Uganda shows that there is a limited choice in the use of roofing materials. Construction of roofs for low cost housing in the country has largely been restricted to the use of iron sheets, thatch and in some cases salvaged materials. According to UBOS (2010), at a national level, use of iron sheets rose from 60.6 per cent (2005/06) to 61.8 per cent (2009/10) and that of thatch reduced from 38.2 per cent to 36.9 per cent in the same period respectively. Although iron sheets are the most commonly used roofing materials on houses in Uganda, their affordability and supply sustainability are in question. Uganda still imports iron sheets and the few industries that manufacture the material locally rely heavily on imported raw materials and scrap. Scrap contributes 70 per cent of the raw material for Uganda's iron and steel industry (Senfuka et al, 2011). Steel, a major construction material in the country is mostly imported. The demand for steel in Uganda stands at 140,000MTpa. The installed production capacity for the local mills is 123,500MTpa, yet actual production is at a mere 57,200MTpa, giving a deficit of 66,300MTpa. On the other hand, Uganda has enough iron ore to meet the country's demand and leave 50 per cent of the production for export (*ibid*). This is an indication of unexploited potential.

The use of other roofing materials such as clay tiles did not have any significant change between 2005/06 and 2009/10. Because of its high cost and limited production, despite its good construction properties, the use of clay tiles is still limited to a small proportion of the overall housing stock in the country. Clay tiles are largely used in high grade housing and other non-residential constructions. It is, however, important to note that these are considered as cladding materials. Predominantly, timber, whether processed or unprocessed is used as the structural frame for the roof. The complex nature of choosing building materials is further surmised upon in the observation made by Government of Uganda (2010:131) that posits that "*Construction materials indicate the durability of a dwelling unit and denote the economic status of the household*". Apart from influential factors identified by UN-Habitat (2010) as durability, scarcity of material and personal choice other issues such as cost, acceptability and local building regulations also play a role. For example, in Kampala, building regulations do not permit the use of thatch in urban areas as it is considered to be a temporary, non-standardised material and a fire risk. Musoke, one the local artisans who was interviewed in the study stated that many of his colleagues and the clients they work for look upon thatch as a backward building material whose use should be restricted to rural areas. Unless protected, thatch is a non-durable material in Uganda's hot and humid climate. It is susceptible to rot, termite attack and fire. The material is also becoming scarce and expensive in the urban environment, where vegetation is steadily disappearing due to other human activities. Interview with residents in northern and western parts of the country stated that on average thatch on a local dwelling is changed every three years. On the other hand, use of thatch can be improved by growing the raw material to increase supply, use of fireboards and chemical treatment to improve its resistance to vermin and fire attacks, use of high roof pitches to facilitate easy run off of water to avoid leakage and good workmanship to achieve quality work (CSIR-CBRI, 2011).

Walling materials

Bricks and mud and poles are the major walling materials for constructing residences in Uganda. Use of bricks rose from 53.4 per cent (2005/06) to 57.1 per cent (2009/10) while mud and pole reduced from 42 per cent (2005/06) to 39.4 per cent (2009/10) (Table 3.1). This situation points to the potential these local materials have and the need to improve them for house construction. However, the use of mud and pole construction may also be affected by factors earlier mentioned, including depletion of forest cover leading to rising cost of poles and timber, building regulations that do not allow use of mud constructions in urban environment, people's attitude to the material, its durability and so many others.

In Uganda, there are three types of bricks used mainly in the construction of houses. These are adobe bricks (burnt and un-burnt), clay bricks (burnt and un-burnt) and cement sand bricks. Many are non-standardised, of varying sizes and structural properties. In addition, use of stabilised bricks has become popular of recent. These may be compressed or uncompressed. Nonetheless, their application is still looked upon (often wrongly) by residences with suspicion, and the technology used as being foreign, expensive and un-sustainable. Adobe and clay bricks are the most used options. In the urban setting, other non permanent options used include salvaged tins, polythene sheets, timber and other vegetable materials (fig. 1-2).



Fig. 1: Timber used for constructing temporary structures



Fig. 2: Papyrus used for constructing temporary structures

Conversely, other materials such as stone have not been considered as important although they are widely used both in residential and non-residential construction in the country. Stone is widely used either dressed or undressed in many ways. For example, as a walling material in water logged places, a permanent, maintenance free, water proofing and decorative material as well (Fig. 3-4).



Fig. 3: Use of thatch and stone for a simple dwelling in Mbarara, western Uganda.



Fig. 4: An example of stone used as a maintenance free building material.

Achieving decent shelter sometimes requires simple but innovative design and construction interventions to ensure durability of the house. These interventions may include; improvement of functioning of roofs by ensuring proper roof; protection of floors and walls from rain and water by the use of roof overhangs, burnt clay bricks around openings, use of lintels to span openings, use of plaster or other material on the external walls, construction of splash aprons, damp-proofing foundations, and allowing for proper drainage of water away from the building; improvement of lighting and ventilation by ensuring cross-ventilation and use of glass windows and vents to allow in light and ensuring adequate ceiling heights.

3.2 ACCEPTABILITY OF LOCAL BUILDING MATERIALS

The use of local building materials is wide-spread not only in rural areas, but also in urban areas of the country. Despite this wide use, formal acceptability of the materials is still yet to be achieved. In urban areas of Uganda, the use of indigenous materials, such as thatch, mud and wattle, sun dried bricks, is not recognised by the local authorities (SSA:UHSNET, 2014). Just like in Kenya, in Uganda even stabilised soil blocks are not yet integrated in the local planning standards, and are looked at with suspicion (UN-HABITAT, 2005). On the other hand, the UN-Habitat identifies the need to encourage growth and regularisation of the informal sector and informal building materials as one of the interventions in the rapidly growing urban housing market (UN-Habitat, 2010).

3.3 COST OF LOCAL MATERIALS

A large proportion of contemporary building materials in Uganda are imported. Even materials such as roofing sheets and paint that are locally manufactured are made from imported raw materials, thereby significantly raising their production costs. In addition, rising fuel costs have also drastically contributed to high costs of building materials. For example, in Kampala, transportation costs of a truck of sand are about 20-25 times the cost of the material. At the same time, both costs are expected to continue to rise as current sources of the local materials near building sites gradually get depleted. This means that it may be possible in certain circumstances to reduce the cost of construction of a house by using indigenous materials that can be procured within the locality of construction. On the other hand, the cost of some of the indigenous materials such as timber, thatch, papyrus and local bricks is also rising owing to unguided and unsustainable exploitation of the materials.

Table 3.2: Changes of average building materials costs in Kampala

DESCRIPTION	UNIT SIZE	COST (UGX) 1USD ≈ 2500 UGX		
		DEC 2008	APRIL 2009	JANUARY 2010
CEMENT	50 kg	22,000	23,800	26,500
Cement Hima (Portland pozolanic)	50 kg	23,000	23,800	27,000
Cement Tororo	40 kg	33,000	42,000	45,000
LIME				
Building lime white (Kenya)	25 kg	13,500	14,000	15,000
Tiger Lime Uganda	50 kg	13,500	14,000	15,000
ROOFING				
Mangalore Tiles (Selected)(16Pcs/sqm)	pc	1,540	1,540	1,540
Mangalore Tiles (Standard)(16Pcs/sqm)	Pc	1,340	1,340	1,500
New Portuguese Tiles (16 Pcs/sqm)	Pc	2,140	2,140	2,500
Roman Tiles(35 pcs/sqm)	Pc	1,340	1,340	1,500
CLAY BRICKS				
Selected Bricks (215X105X65mm) (120pcs/sqm)	Pc	491	500	550
Standard Bricks (215X105X65mm) (120pcs/sqm)	Pc	415	440	450
Local Bricks (90pcs/sqm)(215X105X65mm)	Pc	120	135	150
GALVANISED IRON SHEETS				
G32 (0.18mmBC/0.215mmAC)	Pc	12,300	19,500	20,000

G28 (0.29mmBC/0.305mmAC)	Pc	18,750	25,500	26,000
G26	Pc	27,150	42,000	42,500
STEEL				
Mild steel round R6 40'X6mm	Pc		7,300	10,500
Mild steel round R10 40'X10mm	pc		12,000	14,000
Mild steel twisted Y12 38'X12mm	pc		25,500	35,500
Mild steel twisted Y16 38'X16mm	Pc		42,000	55,000
Mild steel twisted Y20 40'X20mm	Pc		70,000	95,000
TIMBER AND BOARDS				
Block Boards (Local)(8'X4'X1")	pc	70,000	80,000	85,000
Soft Board (Kenya)(8'X4'X1")	pc	25,000	29,000	31,000
Pine Timber Machine cut (4"X2"X14")	pc	7,000	9,000	11,000
Pine Timber Machine cut (6"X2"X14")	pc	12,000	16,000	17,000
Cypress Timber Machine cut (12"X1"X14")	pc	25,000	27,000	28,000
Seasoned Mahogany-Masindi (12"X2"X14")	pc	50,000	65,000	80,000
AGGREGATES				
Lake sand	7 ton trip	110,000	120,000	150,000
Plaster sand	7 ton trip		110,000	140,000
Hand crushed aggregates ½"	7 ton trip	160,000	175,000	180,000
Machine crushed aggregates ½"	7 ton trip	245,000	280,000	320,000

TRANSPORT around Kampala for a 7 ton & 15 ton tipper ranges from shs.70,000 and 120,000-150,000 respectively depending on distance.

Source: Adopted from UN-Habitat, 2010:137-8.

Examination of the building materials for the major house construction components in Uganda (Roof, Wall and Floor) indicate that the country still lacks variety of these materials, and that the situation did not change much between 2005 and 2010 (table 3.2). Cost of average building materials has been on the rise in recent years. For example, between 2008 and 2010 the cost of cement (Tororo) rose from Shs.23,000 (2008) to Shs.27,000 (2010); Mild steel twisted Y12 38'X38'X12mm Shs.25,000(2009) to Shs35,000 (2010); pine timber machine cut from Shs 12,000 (2008) to Shs. 17,000 (2010) and lake sand from Shs.110,000 to Shs.150,000 (2010) Table 3.2. This tends to limit the capacity of low-income earners to access decent shelter.

3.4 SUSTAINABILITY OF LOCAL BUILDING MATERIALS

Depletion of raw materials

Poor and unsustainable utilization of the natural resources have had a major impact to the disappearance of some of the natural resources. It is, therefore, imperative to develop systems of exploiting the resources in a sustainable manner (UN-Habitat, 2012). In Uganda, many indigenous materials are available in abundance, although of recent some are becoming scarce. For example, owing to environmental degradation, timber has become scarce in the northern and south-western parts of the country. In the past 10 years, the price of timber has risen by four folds. For example, timber harvesting by licensed pit-sawyers in Uganda increased from 51,000m³ (1997/98) to 90,000m³ (2004/05), round wood harvest increased from 215,723m³ (2003) to 258,522m³ (2007) yet forest cover is reducing fast. According to National Development Plan, forest cover in Uganda reduced from 4.9 million hectares in 1990 to 3.6

million in 2005 (Government of Uganda, 2010). At the present, much of the timber used in the construction industry in Uganda comes from the Democratic Republic of Congo. This puts its sustainable supply in question. Rising scarcity and increased demand for the building materials, have in turn, led some individuals to compromise the quality of the materials. For example, in a number of cases suppliers of building timber have harvested young trees and of poor quality for use, cement adulterated for money, and poor quality materials imported into the country (Mwesigwa, 2012; Sseremba et al, 2011). All these factors negatively impact on the quality of housing supplied.

Standardisation of the materials

In addition to the threat of depletion, many local building materials in the country are still used in their raw form, in ways that subject them to the elements, consequently rendering them temporary, as they may be used for a short time. There is also lack of research in the standardisation and improvement of some of these materials (Alinaitwe et al, 2006). For example, local earth bricks are not standardised, and the improved cement earth blocks have not yet been accommodated in the country's building by-laws despite their wide potential and practical application.

Although consumption of cement has increased in the country significantly in the last 10 years, its supply is still below the market demand, and a significant amount of the material is imported. In Uganda, the two major companies that produce cement are Tororo Cement and Hima Cement. They have a combined capacity of 1.9 million tons, which is expected to increase to 3.6 million tons by 2014. Tororo Cement and Hima Cement contribute 51 percent and 9 percent of the total share of cement in the country's market respectively. This means that the remaining proportion of 40 per cent is imported. As a result of the huge demand and that is not met by the supply, the price of a 50kg bag of cement increased from \$10 in 2010 to \$12 in 2012 (Muchira, 2013).

Other non-conventional building materials such as compressed earth block, adobe, thatch stabilised cement and soil bricks whose standards are not yet established in the country lack information about them, despite their use in the country's construction industry.

Timber is one of the building materials that are used widely in Uganda. Despite that, there are over forty five species on the market without quality control measures and grading of the material is mainly visual and subjective, leaving the material un-standardised to date (Zziwa et al, 2009).

Sustainable exploitation of local materials

According to Moreal et al (2001) local materials have the potential to drastically reduce the environmental impact of construction. Materials selection, design and construction play a major role in minimizing the environmental impact of new buildings. For example, in France adopting local materials for house construction reduced the energy used by up to 215% and the impact of transportation by 453% (*ibid*). Use of local materials, if rationally implemented, also contributes to mitigating negative impacts of climate change (UN-Habitat, 2012).

Development of local building materials in a sustainable way has a number of economic, environmental and health merits. It reduces the house production costs, a very important aspect for the successful access to decent housing by low-income earners; it protects the eco-system, and it contributes to the improvement of the living environment of a given community through the prudent use of local resources. Oktay (2002:1003) observes that, "*Each region has its own climatic conditions and cultural patterns, which must be the basis for the solutions in each individual case*".

In Uganda where resources are limited, poverty is rampant and the building industry largely undeveloped sustainable exploitation of the local building materials is a vital component for

the development of low-cost housing. Sustainability does not stop at rational utilisation of the materials, but it entails developing and applying strategies of replenishing those materials that can be re-stocked. Uganda needs to industrialise its construction sector as a way of improving the supply of housing to its citizens. This industrialization includes developing and standardizing local materials. As observed by Alinaitwe et al (2006:222) "*Industrialisation assumes that most materials are standardised that materials and components can be manufactured in several places but they can fit in the final product without discrimination based on origin*".

4.0 CONCLUSIONS

Accessing decent shelter in Uganda is still a challenging issue, especially, for low-income earners. The country is having a growing demand for housing that cannot be met by the current supply mechanism, partly owing to the growing cost of housing development arising out of a scarcity of affordable building materials. This deficiency is of both quality and quantity.

The poor state of local building materials has greatly contributed to the development of substandard housing in the country. With high and escalating costs of imported materials, indigenous materials are viable alternative building materials for the majority of the country's citizens.

Indigenous constructions have the potential of supporting sustainable development of decent, low-cost housing through the use of locally available building materials and designs, that require little input in terms of labour, technical knowledge and skills, further facilitating more efficient energy use and energy conservation systems. For long, this potential has remained latent and untapped by the formal construction sector. Because of this situation, little has been done to develop local building materials. In exploiting this potential, it is imperative to do so in a sustainable manner to ensure that the finite resources are used rationally.

The use of local building materials in Uganda has the potential of increasing access to decent housing through reduced housing costs, especially for low-income earners. While local building materials are abundantly available, their efficient utilisation in developing decent housing is still a challenge as they are largely unprocessed, underdeveloped and un-standardised, limiting their potential. All these factors lead to inefficient and unfavourable exploitation of the materials and manifest themselves in low acceptability, unstable cost of local building materials in Uganda and put their sustainability in question.

5.0 RECOMMENDATIONS

In order to improve access to decent shelter, there is a need to reduce the house development costs through the use of improved local building materials. The country should employ initiatives and incentives for scaling up production of improved local building materials through industrialisation and use of more efficient technologies to take advantage of economies of scale. In partnership with the private sector, government should develop interventions for processing local building materials to products with better properties and value for improved acceptability. While doing so, effort should be focused on favourable and efficient exploitation of the materials to ensure sustainability of their use.

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