

# Breaking through traditions: The brick and tile industry in Ankole region, Uganda

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## ABSTRACT

The study investigates the manufacturing process, of bricks and tiles in the Ankole region of Western Uganda, focusing on improvised technology particularly the forming method, innovations, and firing process, together with kiln technology and the environmental issues. The main objective was to investigate how the brick industry has played a role in uplifting the social and economic development of Ankole region, both in rural and urban development. The study involved twenty (20) participants who were engaged in brick making. These were interviewed and later grouped in four (4) focus group discussions (FGDs) for the researcher to obtain a deeper appreciation, understanding of the experiences and opinions about brick and tile making. The findings indicated that brick and tile making have become a lucrative business, because of the high demand of the building products by both the rural and urban communities. However, these activities have had a devastating effect on the environment. In some places, these activities have created pools of stagnant water which have become breeding grounds for mosquitoes, which spread malaria in many parts of the region. In addition cutting wood for fuel to burn the products, it has also created a loss of vegetation cover leading to land degradation and extended drought in the region.

**Keywords:** Clay manufacturing process, shaping method, innovations, firing process, environment and social economic issues.

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## INTRODUCTION

The study investigates the manufacturing process of bricks and tiles in Ankole region, particularly the shaping method, innovations, and firing process, together with kiln technology and the environment issues. Ankole stands a stride the equator and its landscape is characterised by hilly lands of west and south, and the eastern grassland plateau. River Rwizi, which flows from the Western hills to the Eastern plains, has been a lifeline for people of Ankole. Its distributaries are covered with papyrus reeds and swamps which are rich in clay deposits. However, most of the natural vegetation has been destroyed by man's activities through farming and brick making activities. The current long dry spell, coupled with the global climate changes and massive environmental degradation, has presented new threats to the Ankole region resulting in shortage of food and

water for animals and people. It was reported by Taylor et al. (2014) that Uganda's 2010 to 2015 five-year National Development Plan (NDP) recognized that addressing the challenges of climate change was crucial to enhancing sustainable economic and social development. It was further observed that forestry, energy and agriculture would be affected most. According to Nampewo (2013) deforestation and forest degradation is one of the leading causes of greenhouse gas emissions. Trees capture carbon from the atmosphere; therefore, destroying forests increases carbon dioxide, which contributes to global warming and climate change.

Among the basic needs of rural and urban populations, shelter is perhaps most difficult for the poor and even the average people to afford in developing countries since most often it requires a life-time effort, even for a very

modest type of housing. It is not surprising, therefore, that the majority of people in developing countries still live in dwellings that do not provide a decent living by any standards. Housing is one of the core requirements of human existence. The ambition of all people to own or have access to decent shelter is not only a luxury but an absolute necessity (Ifeke, 2004).

In many developing countries, Uganda inclusive, the majority of the population, still live in rural areas. Poverty and lack of jobs in the countryside are powerful forces pushing people into towns and cities. Greater opportunities in the countryside are critical to stem the flow of migration to the cities and urban areas (IFAD Report, 2006). Poverty and low income are caused by several interwoven factors such as high birth rates, internal conflicts, lack of basic education for the majority of the population, low levels of resource utilization and scarcity of job opportunities (Gombe, 2002:76). With a population of about 39.6 million Ugandans, there is very high demand for housing facilities. This demand will continue because Uganda's population is growing faster each day. Construction is a fast-growing industry with a growth rate of 13 per cent, thus responding to the high demand for housing given a housing deficit of 550,000 units (Kasumba, 2011). Indeed, Harshemi (2015) observes the increasing gap between the supply of houses and what people can afford has pushed the prices up and has forced many people out of the housing market resulting in more demand for rental housing. He further states that that overcrowding is another major issue in Uganda. The average number of occupants in many houses, particularly in urban areas, is more than the international standards of two persons per room. The situation is more critical in Kampala where around 70% of houses use only one room for sleeping.

According to Uganda Social Welfare (1990), housing is a sign of development in Uganda. It is a government priority to provide affordable houses for the poor in towns. In Uganda, most people who live in villages construct their own houses, although it is one of the government's priorities to develop rural housing schemes. Owning a personal home is vital for every Ugandan irrespective of one's social status.

Uganda's political stability and economic growth in recent years has been a welcome boost for a country previously governed from the centre. Unfortunately, despite investment in rural areas, there has been considerable rural-urban migration and many urban residents are suffering from overcrowding and lack of basic services. In the capital city, Kampala, residents live in an area designed for less than half its current population. Poor housing and nutrition, low literacy rates, increased unemployment and crime, and increasing numbers of street children and the destitute are all symptoms of the government's investment bias towards rural areas" (DFID and EC, 2002). Because of these reasons, many youths in Uganda have started brick and tile making to provide for the increasing demand and earn

a living. According to Five Talents International (2006), brick making in Uganda has helped poor people to raise their incomes and standards of living in a sustainable way. Bernard (2002) states that fired bricks are the main building materials in Uganda. Most brick making factories are by the road-side to ease transportation. Bricks are made from sandy loam that is usually found close to rivers. Solid and hollow bricks are made depending on the clay content. Different clays give different colours of bricks after firing, ranging from brown to vivid red.

According to Nsubuga (2002), the growing of the construction industry in Uganda made brick making a lucrative business. However, this brought an adverse effect on the country's wetlands, making them irreversibly destroyed in the process due to the activities that take place. Wetlands in and around urban centers such as Kampala, Jinja, Mukono, Masaka and Mbarara are worst hit (Figures 1 and 2). Everyone wants to invest in a house or commercial building, and most of them preferred using bricks. The demand for bricks was high and much money was being made by brick-makers.

It has been reported that as the world marks the Forest Day every year, there is little to celebrate in Uganda. Uganda's forests are disappearing at high rate of 2% per annum, the highest in the world. Six thousand hectares of trees are being cut down every month, 72,000 hectares in 2006 alone. At this pace, Uganda's forests will have gone in 50 years. Population pressure and poverty are the underlying causes. With 7.1 births per woman, Uganda has the second highest fertility rate in the world. Only Niger with 7.9 births per woman is higher. By 2050, according to the UN, Uganda's population will have soared to 130 million. Feeding, housing, creating jobs and incomes for so many people will inevitably eat into the forests. Presently, ninety-seven per cent of the population use charcoal and firewood for cooking. Encroachment on the central forest reserves is on the rise, with many people building houses, farming and grazing their livestock in the protected forest (Tenywa, 2007).



**Figure 1.** Brick making near Mukono town.



**Figure 2.** A pit of clay left behind filled with stagnant water.

## MATERIALS AND METHODS

### Study population

The study sample population included 20 participants from the districts of Sheema and Mbarara, whom we considered to have similar characteristics (Castillo 2009). We considered their knowledge and experience in the field of brick making. We also considered their knowledge about clays, firing process, kiln technology and environment issues.

### Methods

The study involved conducting interviews with brick and tile producers in Ankole region using an interview guide. In designing questions, cognisance was taken on the type of information the researcher required. To test experience or behavioural responses and opinions or values, follow up questions were necessary for greater depth of inquiry (Mayan, 2001:11-21).

The individual respondents were later grouped according to their experiences and interests to form 4 focus group discussions (FGD). By using these groups the researchers hoped to get more in-depth understanding of the issues that had been raised during individual interviews (Amin, 2005:187). This arrangement created an opportunity for the researchers get a deeper understanding of the participants' views and free expression about brick making and an assurance of a high degree of freedom of expression. The target group for the FGDs shared similar backgrounds and levels of understanding, which enhanced and generated debate on the issues under study.

The researchers also made site visits in order to observe and document innovative processes in brick production at different sites. Sarantakos (1998:207) argues that observation is one of the oldest methods of

data collection. It is a method that employs vision as its main means of data collection and is open to all observable social phenomena. During the course of the study, cameras were used to document innovative activities in the field to provide documentary evidence, depicting material reality (Shank, 2006:33). Peterson et al. (2003) recommends the 'blending' of live observation to enhance both observational techniques. On the other hand, ethical issues had to be observed during the course of the study. Cohen (2000:292) argues that interviews have an ethical dimension; they concern interpersonal interaction which need informed consent and confidentiality, which is designed to protect the privacy of an individual and protect the individual from harm (Shank, 2006:118-20).

The research was conducted in the districts of Sheema and Mbarara, because of their diversity in brick production and proximity to each other which made my research activities to be easily carried out. While conducting this research, the importance and understanding of ethical considerations was quite vital and some fundamental considerations had to be acknowledged. This is because the conduct of ethically informed research should be a goal to all social researchers. These agreements were covered with the parties involved (Goddad and Melville, 2001:109; Blaxter et al., 2003:158).

## FINDINGS

Before going to the field, an individual interview guide was designed to help the researcher gather information from brick makers. Using the interview guide the researchers tried to investigate how long the brick makers had spent doing that trade. They came up with different answers, ranging from two to thirty years, making different types of clay products, which included bricks, face bricks, ventilators, decorating grills, roofing tiles and bottom brick plates. Most of the brick makers I interviewed had acquired the skills from the job, because there is no formal institution that trains brick making. 14 of the respondents interviewed worked in groups, 3 were registered companies and 3 worked in family businesses.

Four of the twenty people who were engaged in the clay production owned the land where they dug clay, the rest hired places where they worked from while one company which was involved in making bottom brick plates ferried clay from a distance of about 20 km. They used hired labour to dig the clay because it is a heavy duty industry. Most of the clay was considered to be good because it was plastic. However, one brick maker informed the researcher that at times he has to mix his clay according to the products he wants to make. He mixes different types of clay in different proportions depending on whether he wants to make roofing tiles, ventilators and the like. Sand helps him to reduce shrinkage and vitrifying during firing.

16 of the brick makers informed the researchers that forming was done manually using wooden moulds, however 2 brick makers who were involved in making face bricks used manually operated machine while another was using a different machine to make roofing tiles. One company informed this research that they were using metallic mould to make bottom brick plates. According to respondents, production was always done during the dry season, because the wares would dry fast, taking about three weeks before firing. However, the respondent who was involved in making tiles preferred producing during the rainy season because his wares would dry slowly for about a month before firing. This would ensure that his wares would not warp and they would fire with brilliant colours.

While investigating the type of kiln used to fire bricks / clay products, 19 respondents informed this study that they use field kilns while one respondent who was involved in making bottom brick plates used a built kiln. Firing took between 2 and 4 days on average to mature, depending on the type and quantity of wares being fired, and how dry they were. However, bottom brick plates took about 7 days.

All the respondents interviewed informed this research that the brick and tile production in this region has had a devastating effect on the environment. The extraction of clay has left stagnant water, which has become a breeding place for mosquitoes that cause malaria. The cutting of trees for firewood has caused deforestation and soil erosion, thus making the land unfertile for any agriculture activity and loss of grass cover for animals.

18 respondents informed the study that most of their products were consumed locally by individuals and institutions who were involved in the construction of houses. However, the respondent who was involved in making roofing tiles informed the study that his products are bought by Arkright Company in Kampala, in addition to local customers. The participants, who were involved in making bottom brick plates, informed the study that she uses her products in her steel rolling mill and the surplus is sold to other steel rolling mills in Jinja and Kasese. He further told the researcher that he pioneered brick and tile making on a small scale basis, using a wooden mould but he has advanced his technology to a manual operated machine which makes quality tiles. He has so far ventured in the construction of permanent kilns to fire clay products using firewood. He has also advanced his technology of firing his pottery products in a tailor-made kiln that matches with the quantity of the tiles he has for firing, which is economical in terms of energy.

In spite of these developments in the brick and tile industries, the respondents informed the study that they faced some challenges. They were buying clay, firewood and hiring vehicles to transport them to their work shops, because they did not own land. Secondly, the respondent who was involved in making roofing tiles faced challenges in making slabs for making tiles. He wished

he could get a machine which could roll the slabs rather than using feet and crude tools to make slabs. In addition, the respondents were challenged with marketing their products because they did not have uniform prices. Anybody could sell his bricks at any price so long as he could make a small profit. The respondents informed this research that in order to overcome these challenges, they needed to form an association so that they could have enough capital and buy their own land with clay. In addition, this would enable them to control the price of their products and also buy a truck that can enable them ferry clay and firewood to fire their wares.

The World Bank report (2001:61) emphasised that poor people need local markets because that is where they sell their products. Well organized markets are vital for generating growth opportunities for the poor people. Even when market friendly reforms have taken hold, there is much that countries can do to improve the benefits that markets offer to the poor. To reach poor people, many reforms need to be accompanied by institutional support, investment in infrastructure, and complementary reforms at the micro level. Meanwhile, Kabbaj (2003:25-26) argues that there should be adequate infrastructure in order to have a successful rural transformation. Rural feeder roads should be properly developed if we are to attain physical transformation. The absence of communication results in segmented rural markets and poor information flow, which adversely affect the performance of rural markets.

Respondents also observed that brick making had evidently improved the housing conditions of many people by providing affordable building materials, thus, lifting the living conditions in many parts in Ankole. Many schools, dispensaries, churches and health centres had been constructed using locally produced building materials. Tiled roofs, which were previously thought to be for people of high social status, could now be afforded by many because tiles are produced locally. The respondents further informed this research that they have had an improvement in their living conditions because they had some income to meet their social needs in addition to pay fees for their children.

## **EXCAVATION OF CLAY**

Any discussion of brick production must begin with the establishment of the materials used; the prospecting of clay and its preparation, followed by forming and firing technology. During the course of the study, the authors documented extraction of clay for making bricks, ventilators and tiles in Bushenyi (Figure 3). The potters used hired labour to extract clay in large quantities and it was ferried to the workshops using light trucks. However, there were brick makers whose workshops were located near the source of clay. After extraction of clay, the pits were left open which was hazardous because they were



**Figure 3.** Extracting clay for making bricks and tiles.



**Figure 4.** A pool of water left behind after extracting clay.

potential breeding places for mosquitoes, although one potter informed the researcher that he was reserving the pits fish farming (Figure 4).

We documented the extraction of clay near Mbarara town, where brick making has taken place for almost one hundred years. At that site, clay was extracted at a depth of about six metres using hoes (Figure 5). The constant excavation of clay at this site had caused pools of stagnant water, which had become a menace to the people living in the surrounding area. These activities had lowered the water table around and the stagnant water left behind had become a breeding place for mosquitoes (Figure 6).

## FORMING METHODS

The clay was mixed with water. To achieve an appropriate uniformity, the moist clay was left to mature overnight before being moulded to forms. Then this clay was worked, trampled upon until it was thoroughly homogeneous. Wet forming was the common methods used in forming bricks. The potter prepared his clay and left it covered for about a week. He then filled the wooden mould with clay and compressed it using his hands. Later, he slid it on a flat wooden board which had been attached to a heap of clay, called (*emeeza*) table. He turned the mould and slid the second surface to make it smooth. When both surfaces were smooth, he pressed the clay using a piece of flat wood with a handle, called a *kaboy* (Figure 7). The brick came out on a flat surface, where it was left for about two days to dry, depending on the weather. Eventually, it was turned to ensure even drying. The potter covered the bricks with grass to make sure that it dried slowly to avoid cracking. After about five days, they had become leather hard; the potters piled them up, leaving some spaces through which the air could circulate. They were covered with grass to prevent them from rain or excessive sunshine, and they were left to dry slowly and evenly for almost a month (Figure 8).



**Figure 5.** Extracting clay at a quarry for brick making.



**Figure 6.** A clay quarry with stagnant water.

Although rain delayed drying, it helped them produce quality bricks because they could dry slowly with minimal cracking.



**Figure 7.** Brick making using a wooden mould.



**Figure 9.** UPE building constructed with bricks contributed by parents.



**Figure 8.** Stack bricks covered with grass.



**Figure 10.** A church under construction using bricks.

In many parts of Ankole, brick houses have gradually replaced mud and wattle houses, which is a sign of development caused by improved economy and modernization. But obviously, the population of Uganda has almost doubled to over 39.6 million people, from 15 million 18 years ago (Country meter 2016). Today people appreciate the need for permanent houses. Brick making has helped in the construction of schools and other social infrastructure. With the establishment of UPE, parents have been contributing building materials, especially bricks, while the government providing iron sheets. I documented a school in Bushenyi which was built which had been constructed with bricks provided by the parents (Figure 9). This has helped the government in fulfilling the Millennium Development Goals, particularly providing free education to all, aiming at eradicating illiteracy. In addition, churches and health centres in rural areas have been constructed using bricks (Figure 10).

## INNOVATIONS IN THE CLAY INDUSTRY

Meanwhile, in Ankole region some brick makers have advanced their technology by making clay roofing tiles. The once thought to be a roofing material for the rich, has become affordable for many because it is produced locally. Tile making was originally a work for men, but women have also been attracted to the industry.

During the course of the study, the researcher documented the making of tiles at Bugongi in Sheema district. The potter placed some clay on a wooden bench and trod on it with his feet to make slabs. When the clay was compact, she got a sharp metallic tool and leveled it in the form of a slab. The slabs were piled in a big hip of about 100, where she picked one by one, placed it on a machine which had a dye for making tiles. It was lined with a thin polythene paper, soaked with diesel, to prevent it from sticking to the tile. Another thin plastic

sheet of paper was placed on top of the slab and the machine was closed. The potter turned a lever which caused the machine to compact the clay with high pressure. Later, the machine was opened and the potters trimmed the tile and put it on a wooden drier, which was placed under shade (Figure 11). This type of machine was operated manually and it could produce different designs of roofing tiles depending on the dye (mould) fixed on it. It could also be used to produce high quality bricks, but potters did not consider it economically viable since there were many people who produced bricks at a cheaper cost using wooden moulds.

The researcher were informed that the machine was obtained on a cost sharing scheme through European Development Fund (EDF) Micro-projects Programme in mid 1990s, to help rural people improve their housing conditions. Since then, there has been a tremendous improvement in tile production at this site, from using a wooden mould to a manual operated machined. The potter could produce 200 tiles in a day, so long as there were ready made slabs. Tiles take time to dry and should dry from indoors because when exposed to excessive heat, they warp. The potters made quality tiles during the rainy season because of the favourable temperature. When tiles dry under room temperature, they appear white after firing, but when they are exposed to sunshine, they change colour to red. To ensure that tiles do not crack, they have to be dried indoors. The availability of roofing tiles at this site has improved the quality of housing in Ankole region. People no longer travel long distances to Uganda Clays to buy tiles. For instance, we documented a house near this site which was roofed with locally made tiles (Figure 12).

In the neighborhood, they made face bricks using a hand operated machine. They filled the machine with clay and pounded it to make it compact with minimum air pockets. They turned the machine manually as the clay was extruded in a sheet form on the other side. The machine was mounted with cutting wires placed in equidistant positions. The person on the other side of the machine cut the extruded sheet, and later, arranged the face bricks on a wooden drier. Once the drier was filled, he took it to a shade for drying. They produced about twenty-five face bricks from a box filled with clay. The same method was used to produce ventilators, except that the machine was different. It could produce ventilators with different designs depending on the design of the dye (Figure 13).

The production of roofing tiles, face bricks and ventilators has become a popular activity in this area since mid 1990s, because it has attracted many youths from other areas of Ankole and beyond to join the clay industry. Production of these building materials mainly involves young men, who are still strong to operate the machines. However, some women have also started penetrating the industry because of their financial needs. Unlike other sites, clay producers at this site have brought two locally fabricated machines to produce the



**Figure 11.** Making roofing tiles.



**Figure 12.** A house built and roofed using locally made bricks and tiles.

wares. This has enabled them to produce quality work which competes with industrial manufactured products from Uganda Clays, which used to be a government parastatal. Their products are affordable and of good quality, although many people in the area do not use roofing tiles because they associate them with the well-to-do. In addition to providing employment to the youths, and providing a stable income to those involved, the industry has improved the living conditions among the potters. However, potters at this site rent places where they get clay and work from, apart from one potter who owns the land and a tile making machine.

The making of bottom brick plates used in a steel rolling mill has been a new innovation in the brick industry. Production of bottom brick plates is a new technology, which came as a response to the increasing demand for steel bar for the building industry in Uganda. Unlike the workshops we visited, the management of this company bought extracted clay from Nyeihanga, a distance of about 30km from the workshop. This is



**Figure 13.** Production of face bricks using a manual operated extruder.



**Figure 14.** Forming process of bottom brick plates.

because the workshop was situated in a place where there are no clay deposits. Clay was transported to the site by trucks, where it was slashed manually, and using metallic rods, to make it homogeneous. This process is different compared to developed countries where they use a pug mill. Later, it was cut into small lumps and put on the forming tables. Unlike other sites we had visited, the potters used metallic moulds fastened with bolts and a rod in the form of a shaft (Figure 14). All moulds were made out of metal to avoid wear and tear, which would lead to lose of precession. In addition, they could serve longer than the wooden ones before being recycled, which is not the case with wooden moulds.

Seven different types of brick were made and each type was produced by a separate team of workers. These were: centre bricks, sleeves, funnels, long runners, distributors, end distributors and end stoppers. To begin

with, the potter assembled the metallic mould and inserted some kind of a shaft smeared with diesel to prevent clay from sticking to it. The shaft had a handle at the end which was turned to create a hole through the brick. The potter placed clay in the mould and compacted it using a wooden pestle. He later flattened it using a flat metallic bar. He turned the mould to fill the second side. However, he scraped off some portion of clay suspected to be wet with diesel, because diesel does not allow clay to stick together to form a brick. The potter turned the handle of the shaft, and then removed it to create a hole in the brick. Meanwhile, if the potter wanted to make an end distributor, he would push a short pipe with handles on top of the hollow brick after removing the shaft. A short pipe was used to make a hole on top of the brick. The brick was removed by opening the metallic mould, which had been fixed with bolts, and carried to the





**Figure 15.** Different moulds used in making bottom brick plates.

shelves for drying. Each type of brick had its own mould (Figure 15).

To produce a funnel, he placed the metallic mould on the ground and oiled its sides with diesel using a sponge. He filled the mould halfway with clay and made a mark in the middle of the clay with a finger. He used an oiled model, in the shape of a funnel, and pounded it in the middle, displacing some clay upwards. The potter continued the process until the model reached the bottom level. Afterwards, he cut off excess clay using a knife and took the funnel piece for drying. All products were trimmed when they were leather-hard to allow the molten metal to flow freely when the bricks were in use. Whereas most of the production processes were done by men, the trimming process was done by women at this workshop (Figure 16). After trimming, the bricks were piled carefully in the shed, leaving some spaces to let them dry properly before firing. The establishment of the bottom brick industry at this site has helped many people earn a living. Most of the people who worked at this site could manage to pay school fees for their children, a major concern to every Ugandan, and meet other basic needs. In addition, many women were able to earn some income minimizing dependency on their husbands, breaking the cultural norms, “the dependency syndrome.”

Unlike most brick makers we visited, the production at this site was unique. They used metallic moulds instead of wooden ones. In addition, the bricks were not used directly as already discussed in this chapter, but they were used as part of the apparatus in the metal fabrication industry. The production of bottom brick plates at this site has been enabled by the advancement in the technology of kiln construction that has enabled the potters to raise and control the temperature to and above 1000°C. Generally, there has been advancement in the brick forming technologies. New products which used to be imported have emerged.

In addition, the activities at this site have brought employment to the people within the community, both males and females. This has resulted in social and economic development in the area. The workers are able



**Figure 16.** Trimming bottom brick plates.

to earn a wage which they spend on their daily needs. Similarly, those who are not directly employed by the factory can also benefit from the increasing purchasing power of the workers. Workers buy food items, pay for accommodation and other social services. The company was planning to extend electricity to this site, so that they can use it in preparing clay, if they acquired a pug mill. It was hoped that the members of the community would also benefit from the power supply for their domestic use, and in the long run, start small scale industries.

## FIRING TECHNIQUES

During the field study, we documented firing of bottom brick plates in Mbarara. When the bricks were completely dry, they were stacked in a built kiln. During the arrangement, some spaces were left between the bricks to allow heat to rise from the bottom upwards. Firing started slowly with pre-heating for a day, to allow water of formation and chemical water to escape. The fire was increased gradually by adding firewood in the kiln (Figure 17). Firing took four days, and thereafter, the fire mouths were sealed with bricks and clay. The kiln burnt for seven



**Figure 17.** Firing bottom brick plates in a built kiln.



**Figure 18.** Stacking ventilators on a field kiln.

days to reach a temperature of about 1000°C before the potters opened the sealed fire-mouths to let the bricks cool. Later, bricks were offloaded with a long stick, while selecting those which had been damaged during firing. All good bricks were placed in the shade, ready for delivery to the steel rolling mill.

The clay producers in Sheema did not use built kilns to fire their products. We had an opportunity to find them stacking a kiln with ventilators and decorative grills (Figure 18). They first arranged solid bricks on a flat surface, similar to field kiln, reaching above the arches. They leveled the bed where they arranged the ventilators and decorative grills. In addition, they arranged the green ware, leaving some spaces (*esimu*) to allow heat to rise during firing. According to Hammer (2016) stopping all air leaks and controlling the kiln opening size allows better control of air flow speed and direction to improve combustion. The wares were then covered with a layer of bricks, which formed an insulation to control loss of heat. After the kiln had been completely protected with bricks, at the sides and on the top, the potters covered the top with grass. They fired their wares slowly with dry firewood, increased the fire gradually using extra firewood, after pre-heating for almost 12 h. This process continued overnight, until the second day, when they sealed off the fire-mouths with bricks and clay. The kiln burnt until the grass on top caught fire, an indicator that the fire had gone through and the wares were completely burnt. This complements Sentance's (2004) argument on constant supervision of heat atmosphere by colour and texture (Figure 19). This firing method was done by all brick makers at this site, including those who produce roofing tiles, because it was economical with fuel. When the ventilators had completely cooled, they were offloaded and sorted according to designs, and piled separately for the market (Figure 20).

The fuel used to fire clay products was fire wood which was obtained from distant places because most of the forest around had been destroyed by the brick making



**Figure 19.** Firing ventilators in a field kiln.



**Figure 20.** Offloading and selecting face bricks and decorative grills.

activities, and a few brick makers made efforts to plant

new plantations. However, Hashemi and Cheshmehzangi (2015:7870) argues that whereas burned brick is considered as a durable material; it is environmentally harmful due to its low quality, very inefficient production processes and the use of local wood in brick kilns which contribute to deforestation and air pollution. According to FAO (2016:49) report, forests contribute to the resilience of agricultural systems in many ways. At landscape level, they contribute to water and temperature regulation and provide habitats for important species such as pollinators. Maintaining forest ecosystems in a healthy state is the most straightforward action to retain their resilience. Healthy forests are better able to cope with stress, recover from damage and adapt autonomously to change.

## ENVIRONMENTAL ISSUES

Wetlands cover 30,000 square kilometers of Uganda's total surface area, and are home to many unique birds, reptiles and plant species. Many of them have clay soils, which are ideal for making bricks. The wetland inspection department has warned that unless the government enforces the laws and guidelines on utilization of wetlands, they would all soon be destroyed. Improperly management of clay pits can cause injuries to brick makers and it can also cause soil erosion thereby making land unsuitable for farming (The Cadimus group, 2013). A lot of vegetation and biodiversity have been lost as a result of man's activities through farming and brick making. Similarly for Zake (2011), the high requirements for firewood in curing bricks and the associated scarcity of firewood has pushed some communities in Wakiso, Mukono, and other parts of Uganda to use fruit trees such as mangoes and jack fruits. This phenomenon is worrying because the process of curing bricks is associated with loss of trees and forest. This has negative impact on the climate since it has an effect on rainfall patterns, resulting in droughts, crop failures, and limited access to firewood for household energy use.

It has also been noted by Hamner (2016) that the clay brick production industry is a major source of air pollution in developing countries. The Cadimus group (2013) supports it by saying that excess fuel consumption increases air pollution. If wood is used as fuel, excess consumption often contributes to deforestation and associated environmental impacts. Increased air pollution, particularly from incomplete combustion, can cause and worsen respiratory illnesses in workers and the surrounding community. Depletion of fuel wood adversely affects communities, particularly women and girls. Nyakairu et al. (2002:132) complements that brick manufacturing is associated with a number of environmental implications, some of which are beneficial, while others are potentially detrimental. Traditionally, bricks have been made and are still produced in factories adjacent to the source of clay. The loss of ignition of

chemical analysis not only includes water and carbon dioxide but also other harmful elements such as sulfur dioxide, chlorine fluorine, and nitrogen oxide, which escape as acid gasses during firing unless mineralogical reactions retain them in bricks (Heller-Kallai et al., 1990).

Tracing out argument for the local perspective, Karani (2010) posits that building technologies expected to revolutionise the construction of low cost housing are coming up, with new breakthroughs now offering up to 60 per cent cost reduction. Cement, which makes up three per cent of the blocks, is mixed with soil, the main raw material and water. Cement to soil ratio varies according to soil type and can be determined by testing the soil for shrinkage. The Interlocking Brick Making Technology has potentials of transforming housing gaps in developing economies like Kenya, a technology which involves production of earth blocks (Wanjohi, 2015). The technology has an advantage over the traditional brick making, because the bricks are made from the site which minimises breakages. There is no firing involved because the bricks are hardened by curing the blocks using water, which makes it environmentally friendly. This technology is being adapted in Uganda to construct schools in refugee camps because of its advantages.

## CONCLUSION

In conclusion, it can be said that many brick makers in the Ankole region still use traditional methods of making bricks, right from the excavation of clay to making bricks. Wooden moulds for making bricks, still dominate, although there has been an advancement in the forming technology where simple manual operated machines have been secured to aid in the making of face bricks and clay roofing tiles. The field kiln for firing the wares still dominate, although a built kiln for firing bottom brick plates has been introduced in the region. The brick and tile making industry has improved the housing conditions of many people by providing affordable building materials, thus, lifting the living conditions in many parts of Ankole. Many schools, dispensaries, churches and health centres have been constructed using locally produced building materials. Tiled roofs, which were previously associated with people of high class, can now be afforded by many because tiles are produced locally. In addition, the clay industry had improved the living conditions of the people in the area because they have some income to meet their social and economic needs in addition to pay fees and hospital bills for their children. However, the brick making industry has had a devastating impact on the environment. This can be intervened by adapting to new technologies which are environmental friendly like adapting to *hydraform* interlocking blocks. In addition, the government should enforce tree planting programmes to replace the lost vegetation and to cope with the increasing demand for trees in the clay industry.

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