
Modern Nigeria Building Technology Using Traditional Fashioned Tools

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ABSTRACT

Development within the environmental movement is understood by the early tradition in human civilization. Indigenous people who have practical experience of the fact that human are dependent on the earth's life support system and traditional cultures. This is recognized in the importance of utilizing the resources provided by nature and available techniques.

With regard to construction, traditional communities have always used the natural materials in their immediate environments for construction, and the resultant buildings have been well integrated in the natural environment.

This study is a survey of the different types of tools and implements used for building operations in the Minna traditional Architecture of Nigeria. They were all examined alongside their roles and efficiencies in traditional building construction works. Also examined were the dual roles of some of these implements (as both tools and building materials), and their prospects in the drive towards fashioning a modern, home based, house construction technology for Nigeria.

KEYWORDS: *Traditional, Construction Tools, House.*

INTRODUCTION

Given the great diversity of ethnic groups (and the attendant multiplicity of cultural practices), a comprehensive study of the traditional built form in Nigeria is obviously awkwardly large for this paper. An attempt will, however, be made to give an overview of materials, forms and techniques generating the traditional forms of architecture – especially with respect to the three major ethnic groups.

The Hausa, in the north, constitute the largest cultural group in that part of the country. Traditionally, they are characterized by large social aggregations (as evidenced by such cities as Zaria and Kano), and are arable farmers (growing cotton, groundnuts and food crops), as well as big-time traders (trading in agricultural produce, textiles, leather-work and basketry). They are predominantly Muslims, with religious dictates conditioning mode of dressing, social interactions, and even affecting spatial disposition in their traditional architecture.

Hausa indigenous architecture is famed for its ribbed vaulting, doming and sculpted and painted external murals. The buildings are composed of individual egg shaped units of adobe (locally termed tubali) which have been earth-plastered, presenting a monolithic appearance. A typical homestead comprises both rectilinear and circular spatial units, linked together by wall segments constituting a perimeter wall. Roofing, essentially, consists of linking shallow domes and vaults (evolved from an intricate arrangement of lengths of palm tree timber,

termed azara, overlaid by processed laterite) together by small stretches of earth, laid relatively flat; rain-water run-off is led out of corrugated metal spouts fitted into the framing parapet wall.

The essentially agrarian Yoruba, in the southwest, have traditionally lived in large urban social groupings, even before colonization (Laitin, 1986). They are famous for their art works particularly bronze casting, terracotta and wood sculpting. Traditionally animists, they have largely embraced Christianity; however, the practice of traditional religions and Islam is amicably accommodated alongside. Since the southern parts of Nigeria were readily penetrated by the British colonialists, Yoruba land profited early by western imports of construction materials, techniques and tools. A typical compound is angular in its disposition, generally approximating a rectangle, but could be very irregular in outline. As with Hausa architecture, there is a clearly defined entrance into the homestead, but with the Yoruba, there is invariably another (back) entrance, leading to ancillary facilities such as lean-to sheds used as kitchens and conveniences. Mud obtained by swish pudding is mainly used in construction in the Southern states (Olotuah, 2009), properly cured earth is used as wall fabric and elephant grasses are used for roofing over termite resistant timber (such as various palms). Roofs are invariably high pitched hipped or hip and gable.

The Igbo, in the southeast of the country are well known to be industrious and for being particularly enterprising in the area of trade and general business. Traditionally, they live in small clan based settlements with political administration necessarily decentralized. (However, since the colonial intervention, very large commercial towns have evolved, such as Aba, Onitsha and Enugu). Though the system of “indirect rule” the British applied elsewhere in the country did not work with them (Laitin, 1986), the same immediate benefits generally enjoyed by the south, were available to them. Apart from trading, they are prolific farmers, producing yams, cassava and palm oil in large quantities. Igbo architecture is very similar to that of the Yoruba in terms of material options and construction techniques. However, in terms of spatial configuration, there are marked differences. Yoruba traditional compound favours massing, a typical Igbo homestead is composed of discrete units ranked in importance which is based on their relative disposition to the Obi, the compound head’s hut.

Rudofsky (1994) states that nature is being tamed by modern design implementation but that traditional architecture embraces and integrates as a continuum aspect of nature. Norberg Schultz (1984) supports the same argument that traditional buildings relate to the existing characteristics of the site. This characteristic of architectural elements is supported by the choice of materials of construction and techniques that respond to the environment. Traditional building materials have the added advantage of being cheap and easily accessible. There has been wide use of such materials across Nigeria. Mud wall and stone wall construction for houses is one such example. Wood is not only used for roof trusses and doors but also to erect buildings. In swampy areas along river niger, timber has been used for piling to suspend buildings above water, as well as for frames, walling and ceiling.

The attention of this study is focused on tools and implements in the traditional building operations of Minna, Niger state in northern Nigeria, a sub region where the indigenous Rammed Earth Technology constituted the main option for walls in pre colonial housing delivery systems, till date, remains the most affordable to the majority of the rural and low income urban populace. The result of this study could be the take-off of modern Nigerian building technology using locally/traditionally fashioned tools. It is an attempt at understanding the past with the object of coping with the present and possibly preparing for the challenges of the future.

METHODOLOGY

At initial, study area was localized to Tunga, Minna but the attempt failed as most of the builders available there had had their building apprenticeship (learnt their trade) during the present era of “modern bricklaying”; an era when traditional methods had been rejected in preference to new imported techniques. Consequently, a visit to one builder led in succession to another, in search of builders trained in the traditional skills in five randomly selected Minna settlements. The chain of visits in the course of the survey, eventually covered builders and building sites in Tunga-sabon titi road, Maitumbi, Unguwan daji, Bosso and Shakwatu along Sarkin power road. Except in Shakwatu, where the building site was visited at the stages of foundation and walling, other sites were visited during one of the walling or roofing stages. In all the study areas, building operations (from foundation to the head course) are often carried out at five day intervals; and whole buildings are often completed within two three months.

At each of the area/sites visited, indigenous builders were interviewed and inventory of any available indigenous tools taken. In a few of the areas as in Shakwatu and Maitumbi some of the tools were in practical use at on-going traditional building projects as at the time of visit. Mud walls to be covered with metal roofing sheets in all the areas and thatch in some of the farmhouses as in Unguwan daji and Shakwatu.

In the series of discussion with the mostly, elderly builders, the Student sought to know, in the respondent’s opinion, some of the followings: -

- Which of the tools remained relevant to “modern” traditional building processes?
- Which of the tools, in their reckoning, have been outclassed by some modern alternatives for the rammed earth technology?
- What innovative improvements are possible to update the relevance of any of the tools?
- What are the notable shortcomings in any of these age long tools?
- What is the current level of acceptance of these tools for traditional building operations?

RESEARCH FINDINGS

From the result of the survey, there was a sufficiently adequate range of tools for carrying out building operations in the traditional Architecture. This range include cutlasses, hoes, diggers, axes, ropes, plumb stave, spade, locally fashioned mallet (rammer), tying (metal) straps, shells (from earthenware pots). For convenience, these tools and implements and their uses are discussed under the different building stages.

Foundation: Traditional building operation starts with site clearing and setting out (putting the outline of the proposed building on ground). Traditional tools for these includes; Cutlasses and axes for cutting and clearing of bushes and felling of trees. Ropes are tied to upper trunks of trees and pulled towards the direction desirable for the trees to fall. They are also together with hoes, pales and pegs (wooden) used to mark out bounds and maintain straight lines and building edges. Diggers and hoes are used for digging out trees from their roots, grubbing out foundation trenches and softening, turning and mixing building earth. Trenches are dug to the size/thickness of the foundation of rooms, and other functional spaces and are measured out. Measuring modules include step (foot), stride, ankle and palm lengths which are often calibrated out in long plumb poles for use throughout this building and other similar future operations.

Walling: Walls are built on, and along the foundation trenches. Relevant tools here include diggers and hoes for digging, turning and mixing of the earth respectively. Other tools at this

stage include the “wall spade” and guiding or plumb stave. Two slightly different fashions of wall spade were observed. The first fashion of this tool, found in Anguwan daji, is a rectangular spade like metal blade with a long wooden handle (Fig.1). The second type seen in a site in Maitumbi and Sabon-titi road has a triangular metal blade fitting into a cylindrical posterior, which the long wooden handle is inserted and nailed (Fig.2). In whatever fashion, wall spade is used in peeling off excess mud from walls (before they harden) to maintain a uniform wall thickness. In a number (majority) of the sites visited, cutlasses were improvised in place of wall spades for this purpose. It is however, generally admitted that wall spade is more efficient than the cutlass for peeling off wet earth. By virtue of its long handle, it covers a wider range and can be used from any position around the wall, especially a top a high one. It is less taxing to use as it has a much higher mechanical advantage.

Fig. 1 Wall spade A (source: Authors field study 2011).



Fig. 2 Wall spade B (source: Authors field study 2011).

It is used for cutting off hardened walls in small bits, especially when preparing walls to receive plasters. The guiding or plumb stave is a long, straight, sawn plank, carried by the builder to guide the casting of the wall along a straight line (Fig.3).



Fig. 3 Plumb stave (source: Authors field study 2011).

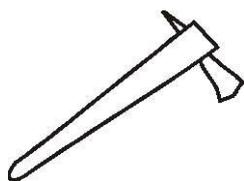


Fig. 4 Axe or Gatari (source: Authors field study 2011).

The “Gatari”, (Fig.4), is a small axe like tool used to chip off bigger lumps of hardened mud wall, especially when door and window frames are to be inserted in place. Straps are long, flat strips of metal inserted at intervals across the middle of the top wall courses, folded around, lapped and nailed to the wall plate above the topmost wall courses, thereby fastening the wall plate to the walls. Rafters are then nailed to the wall plate with appropriate nail sizes. In much older times, when roof thatches were in vogue, ropes were used in place of these metal straps and nails.

Roofing: In the older traditional architecture, roofing was done of leaf and reed thatches on a skeleton of pales and stakes tied together with ropes. Other roof covering type included the shallow domes and vaults, reinforced by palm timber (Azara) each slit into uniform sizes and arranged according to specific intricate details, then overlaid by processed laterite and laid

relatively flat.

In present times, metal sheets are fastened with nails to purlins over rafters that have also been nailed in place.

Flooring: Solid domestic floors were once achieved with moist lateritic soil (sand and clay) in the approximate ratio of 3 and 2 respectively and sometimes Cow dung is added for strengthening. These were rammed into place with wooden mallet or rammers fashioned from the tree branches.

Finishes and Decoration: Finishes can be applied on walls, floors and roofs. In this traditional architecture, finishes are common on walls and floors and carving on posts, doors and windows in King's palaces and religious buildings. Floor finishes still include rough effects of rammed laterite floors. It could also be tiling with palm kernel or earthenware shells.

Wall finishes include plastering with stabilized clay, chalk and earthenware shell patterning.

OBSERVATIONS AND DISCUSSIONS

Generally, majority of the traditional tools and implements are today no longer in popular use. In Shakwatu, local builders described the wall spade and Gatari with utmost familiarity, referring to them as the most important traditional building tools that till date have no better replacements for wet earth constructions, even in modern times. They express resentment at builders without these tools taking commissions on earth buildings. Little wonder, they reasoned, that recent mud structures are weaker and mostly crooked unlike those of older times. When researcher suggested the possibility of the use of formworks to achieve straight and even walls instead of wall spade, the idea was scorned. The majority of them argued that the introduction of formwork as replacement for wall spade (or an improvised cutlass) would unreasonably increase the cost of materials (timber and nails) and labour of earth building operations.

Building and decorating with earthen pots patterning, clay and chalk, from this survey, appear to have been generally discontinued entirely.

The use of plumbing stave to achieve straight and level walls and ropes, now in the form of strings and twines, for transferring buildings to the ground, are still without better replacements even in modern bricklaying.

Diggers, hoes, and rammers, may have found good replacements in excavators (excavating machines), soil burrows, shovels, spades, concrete mixers, soil grubbers (grubbing machines) and compactors (electrical and mechanical). These replacements are not only heavy duty in nature, they are much cost intensive and require infrastructure facilities (roads, rails) and services (constant electricity supply, potable water), all of which are to a large extent, still a luxury even in Nigerian urban centres. Thus, they are not viable replacements for low cost construction that is so much the problem with the majority of Nigerians.

Earth construction all over the world consists of any of these five basic forms. These forms are; Adobe – sun dried earth brick, Wattle and Daub – earth covering over wooden skeleton, and Cob or Swish Pudding – wet, plastic earth balls, shaped into monolithic wall courses. Others are Tubali, a hand-made, pear-shaped earth brick with grass binders, and Poured Adobe - or Puddle Mud poured between wooden frameworks (Akande 2007).The construction of any of these forms involves a similar operational process which includes site clearing and grubbing; foundation trenching which includes excavation and preparing, harvesting and processing of earth material for the walling process. The relevance of wall

spade as a building tool is in the peeling off of excess mud from freshly made walls. It is thus a viable tool in the earth construction of Cob or (Swish Pudding) and Wattle and Daub forms. All other tools evaluated in this study are not only relevant but also applicable and complimentary to all forms and techniques of modern earth construction.

CONCLUSIONS AND RECOMMENDATIONS

Before the introduction of modern European architecture and imported building materials, Nigerian traditional communities built their houses to meet their social, cultural and religious needs.

Building materials comprised mainly mud, wood, stone, palm, grass and other appropriate vegetable materials. Much modern equipment abound the functions of some traditional building tools. Such equipment includes the excavators, scoopers and spades/shovels that can replace the digger and the hoe in the digging and scooping of earth. The concrete mixer also enables proper mixing without the use of traditional hoes. However, these equipments are designed for use in modern concrete buildings. They are not yet adaptable to wet earth construction. The concrete mixing machine may mix but cannot thread earth into the consistent sticky required for the indigenous earth walls.

More specifically, there has been no economically viable replacement for traditional building tools. Where adaptable, burrowing excavating and scooping machines is cost intensive for use in the desirable low cost traditional building methods. They also require availability of infrastructure facilities and services, which are not only in short supply but also unaffordable especially in rural communities where this method (earth construction) is most populous. Rammed earth has been built for long in Morocco using formwork of wooden shutters with standardized widths and lengths. They are designed so that they can be readily dismantled and moved forward for the next section of the wall (Spence, Cook 1983). An improvement on this can be adapted to the traditional layered (or coursed) earth walls. Roughly, this would entail adjustable sets of vertical stands in steel or timber, to which could be mounted horizontal sheets of timber or steel, designed to the height of the mud wall courses or layers.

The only advantage of modern technologies is in the labor saving but cost impact on a building. If the pool of talented local builders and craftspeople had access to improved techniques, the results could be dramatic and effective. They would do more for less and everyone would be a winner in the process.

REFERENCES

- Akande F, Odiaua I (2007). *Earth Construction: Adapting an Ancient Material to Applications in Small and Medium Housing Needs*. Faculty of Environmental and Design and Management, Obafemi Awolowo University, Ile-Ife.
- Atolagbe AMO, Adeyemi A.Y (2000). *Cost Effectiveness of Local Building Materials on Mass Housing Projects: An International Journal for the Review of Growth and Change*.
- Laitin, D.D. (1986), *Hegemony and Culture: Politics and Religious Change among the Yoruba*, University of Chicago Press, Chicago.
- Rudofsky, B. (1994), *Architecture without Architects: A Short Introduction to Non-Pedigreed Architecture*, Academy Editions, London.
- Olotuah A.O, Ajenifujah A.O (2009), *Architectural Education and Housing Provision in Nigeria*, CEBE Transactions, ISSN: 1745-0322 (Online).
- Spence RJS, Cook DJ (1983). *Building Materials in Developing Countries*, John Wiley and Sons, New York.