UNIVERSITY OF NIGERIA, NSUKKA

FACULTY OF ENGINEERING

CIVIL ENGINEERING DEPARTMENT

A RESEARCH PAPER ON:

THATCHED ROOFING AND ITS INTEGRATION INTO MODERN STRUCTURES

BY

CHUKS-ONAH, STEPHEN IFEANYICHUKWU (2017/246754)

TITLE PAGE

THATCHED ROOFING AND ITS INTEGRATION INTO MODERN STRUCTURES

A PROJECT/THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR'S DEGREE (B.ENG)/BACHELOR OF ENGINEERING IN CIVIL ENGINEERING TO THE DEPARTMENT OF CIVIL ENGINEERING. FACULTY OF ENGINEERING, UNIVERSITY OF NIGERIA, NSUKKA.

SUPERVISOR: ENGR (DR.) UZOR ONYIA

DECEMBER, 2023

I, Chuks-Onah, Stephen Ifeanyichukwu, an undergraduate student of the Department of Civil Engineering, University of Nigeria, Nsukka , with the registration number 2017/246754 do declare that this paper is an original work and has never been submitted in full or in part for a Diploma or Degree in this university or any other university

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Chuks-Onah, Stephen Ifeanyichukwu

Student

APPROVAL PAGE.

This research work titled Thatched roofing and its integration into modern construction meets the regulation governing award of Bachelor of Engineering and has been approved by the department of Civil Engineering, Faculty of Engineering, University of Nigeria, Nsukka.

BY

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Engr (Dr.) Uzor Onyia Engr (Prof.) C.C. Ikeagwabini

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External Examiner Internal Examiner

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Engr. Prof Emenike Ejiogu

To excellence in the pursuit of engineering.

Acknowledgments.

To my supervisor Engr. (Dr.) Uzor Onyia for imparting the skills of research and taking the time out to revise all the drafts of this paper and to the Department of Civil Engineering and indeed the whole Faculty of Engineering for aiding greatly in the continued process of becoming learned in the profession.

Table of Content.

Chapter 1.

Introduction.

It is fair to speculate that when man started to build houses about 12000 years ago, he must have used thatched roofing. However, the oldest surviving thatched buildings are from the 13th century [1]. Naturally, plants occurring in all parts of the world could be adopted for roof coverings [2]. It is likely that the earliest roofing was done by surrounding a central stake such as a tree stem with tree branches and laying rough hay on top of the resulting round framework [2]. In Europe thatched roofing was used in buildings of all economic classes through the dark ages, with newer roofing techniques starting to appear in the century after, with the emergence of new found wealth [2]. In the lands of Saxon, there are archaeological excavations of large huts dating back to the iron age. Anecdotal evidence suggested that they were coated [4]. British Celt houses used to be of the round house type and can be traced back to the iron ages as well. They were born of the necessity to protect livestock, store fodder and protect their grain pits and they tended to employ thatched roofing. There were several fire incidents in England in the early ages 1077, 1087, 1135, 1136 and 1161.

A major fire at Glastonbury's in 1184, Chichester's in 1187, Worcester's in 1202 and at Chester in 1140 and 1180. A large part of Blandford in 1278. Palm Sunday's in 1644 started by soldiers of the Royalist Army of Prince Maurice who are believed to have deliberately fired their muskets into the thatched roofs and in two hours burnt 144 of the estimated 200 dwelling houses, also in 1645 and 1684 and a disastrous fire less than 40 years later on 8 June 1684. At the London Assize an ordinance was passed:

"whosoever wishes to build, let him take care, as he

loveth himself and his goods, that he roof not with

reed, nor rush, straw, nor stubble, but with tile

only, or shingle, or boards, or, if it may be, with

lead, or plastered straw within the city and

portsoken. Also that all houses which till now are

covered with reed or rush, which can be plastered,

let them be plastered within eight days, and let

those which shall not be so plastered within the

term be demolished by the alderman and lawful men

of the venue."

The result was that more fireproof materials started to be used and more primitive roofing techniques phased out.

Other towns passed similar edicts and they had similar effects but these laws were not always carried out to the letter. The whitewashing of thatch in less densely populated areas was felt to be a sufficient fire deterrent and this method was practiced in Wales until this century. The prosperous farming population of the south preferred tile roofing and this also phased thatched roofing in the region but in 1610, Bishop Hall was still able to observe them. After the Fire of London in 1666, thatch was forbidden in most towns of Britain. Some thatched villages disappeared before this date and the cause can often be directly attributed to the Black plague. [5]

The Indus valley civilization consisted of brick walls, slabbed roofs and well-built cities, a prosperous and utilitarian civilization. The Indus valley civilization came to an end for following unrestrained exploitation of their fertile lands sometime around 2 BC and the trader population of well-built cities was replaced by the Vedic people, a nomadic pastoral community who wrestled for their living from the fields and forests, they are an offshoot of the Indo-Aryan migration, and upon settling in these lands became semi-pastoral and agricultural. Their architecture comprises materials sourced from nature, such as thatch, reeds and bamboo. It was from these people that Indian architecture took root. Till today, some Bengali still carve their habitations from bamboo. The roofing evolved into a barrel shaped roof which consisted of bamboo held with a chord like a bow and then covered with thatch. This feature barrel shaped thatched roofing was going to influence the architecture that followed. An example of thatched roofing and serving as a springboard for architectural development and producing readily available building options for populations in lack. [15]

In Japan houses and towns with thatched roofs like Ouchi-juku formed along the roads to the Emperor's palace. Chiefs of fiefdoms used these roads for their biannual trips to the Emperor's, with attendants of up to 4 000, such that the passing of a feudal lord could generate up to forty thousand in today's dollars for a single night. Enough to last a year till another visit. These buildings had turned to tin roofing but in 1970's, they were designated as Preservation District for a Group of Important Traditional Buildings and once again restored to thatched roofing, and just like in the past, they serve again to generate tourist revenue. Other Judenken include the hamlet of Maesawa, thatched sites like the isolated Mitaki-en restaurant developed for tourism. [16] This is another view of thatched roofing as a foreign revenue earner.

Figure 1: A figure showing Japanese houses and towns with thatched roofs ©Alex Kerr 2022

Africa is a large continent with thousands of indigenous peoples. Malcolm McLeod, the head of the British Museum has described Susan Denyer's attempt to classify African traditional buildings as well worked and potentially an important contribution to the field. Her classification system includes the following:

1. Round plan, free-standing; diameter less than height; walled with mud and/or stone; often with stone foundations; thatched roof (conical or trumpet-shaped); arranged in clusters of buildings, usually on the ring pattern, with buildings part of enclosing wall or fence.

Examples: Birom, (northern Nigeria); Bandiagara escarpment (Mali); Tamgué Mountains (Senegal and Guinea); Atakora Mountains (northern Togo and Benin); Baya-Kaka

(Central African Republic).

2. Round plan, free-standing; diameter approximately equal to height; roof of

poles leaning against central framework; poles sometimes encased in dry

stone work at base; thatching of grass or turves.

Examples: parts of Eritrea (Ethiopia); Wanji (Tan-zania).

3. Round plan, free standing; diameter equal to or greater than height; walls of mud and/or wattle, bamboo or palm fronds; thatched conical roof (convex or concave profile); often with verandah full or part way round; arranged in clusters of buildings within surrounding fence, hedge or wall. Tiv, Nupe, Jukun, (Nigeria); settled Fulani (Guinea, Nigeria, Cameroon); Dourou, Tikar, Toupouri, Massa (Cameroon); Kinga, Safwa, Nyamwezi (Tanzania); Grebo (Liberia); Tonga, Venda (South Africa); Gurage, Galla (Ethiopia); Ila (Zambia); Da-gomba, Konkomba (Ghana);

4. Round, oval or rectangular plan with hemispherical or lozenge-shaped profile; basic framework of hoops; covering of skins, mats and/or thatch of grass, leaves or mud over brushwood; can usually be dismantled; often found in association with cattle kraals; usually arranged symmetrically.

(Lesotho). Examples: Shuwa rab (Chad, Nigeria); Somali (Somali Rep.); Gheleba, some Galla, Bileni (Ethiopia); some Tuareg (Niger); Songhai (Mali, Niger); Sotho.

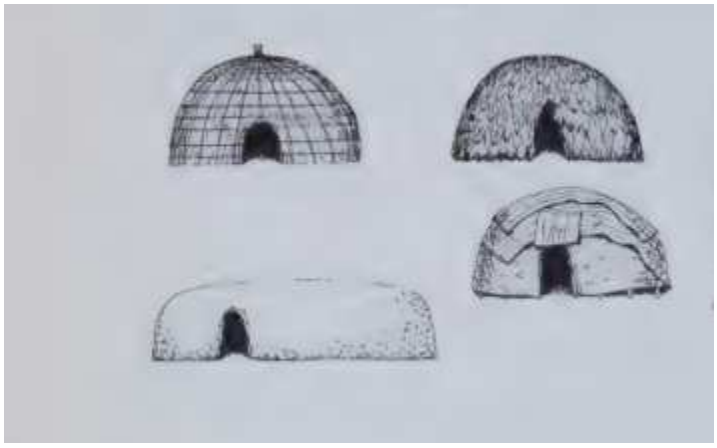


Figure 2: Round, oval or rectangular plan with hemispherical or lozenge-shaped profile ©Susan Denyer 1978

5. Rectangular plan, free-standing; framework of 1-4 parallel arches strengthened by horizontal cross-pieces resting at ends on poles between forked posts; covering of plaited mats; very often used as portable tent; large versions sometimes immobile. Example: Some Tuareg (Niger).

6. Rectangular plan tent; framework of two to four rows of parallel forked sticks surmounted by horizontal cross-pieces; occasionally arches instead of middle sets of poles; covering of skins or blankets under tension. Example: Some Tuareg (Niger); nomadic pastoralists (Sudan, Ethiopia, Somali Rep.).

7. Round plan, free-standing; conical roof and no walls; framework of straight sticks (guinea-corn stalks, bamboo); sometimes thatched. Examples: Fulani dry-season houses (northern Nigeria); Kinga area (Tanzania); Lutoko (Sudan); some Saho (Ethiopia).

8. Round plan, free-standing; framework of flexible poles embedded in ground at base and tied at top under tension; known as ‘beehive’ type; usually slightly convex profile; thatch sometimes of banana leaves but more usually of grass or reeds, either stepped or plain; sometimes low perimeter wall inside building; sometimes central support; often divided internally by partitions;

same design as house; often with porch. Examples: Kanuri (Nigeria, Chad, Niger); Dorze, Sidamo (Ethiopia), Kamba (Kenya); Luguru (Tanzania); Tubu (Chad).

9. Round plan, free-standing; two-story high; walls of roughly dressed stone set in mud mortar;

wooden lattice windows; drip course between each story; slightly domed mud and pole ceiling, thatched roof. Example: some Tigre (Ethiopia).

10. Round plan, free-standing; two storeys high; walls of small round boulders set in mud mortar; second storey reached by external stone staircase; within, walled courtyard with two-storey entrance porch; thatched roof. Example: some Tigre (Ethiopia).

11. Round plan, free-standing; flat roof; walls of mud or mud and straw; flat roof of poles and mud and straw; found in tight clusters, usually built into surrounding wall; painted and incised decoration on walls common. (Granaries often had thatched covers.) Examples: some Dogon (Mali); Lobi, Nankanse, northern Ghana; southern Upper Volta (around Po); northern Upper Volta (around Ouahigouya).

12. Round plan, free-standing; ‘shell’ mud roof and no walls; slightly convex profile; sometimes embossed patterns on exterior; arranged in clusters within surrounding wall. Example: Mousgoum (northern Cameroon); Tallensi grinding rooms (Ghana); Bangadji kitchens (Chad).

These among thirty other groups. [18]

The wave of change in Africa since the 19th century has meant that many styles and features of thatched construction have been quickly fading [19]. And this will be the concern of this project.

Chapter 2.

Literature review.

The following is the trend of research on thatched roofing, using google scholar data. These are the visualizations of the search: thatch~ roof~:

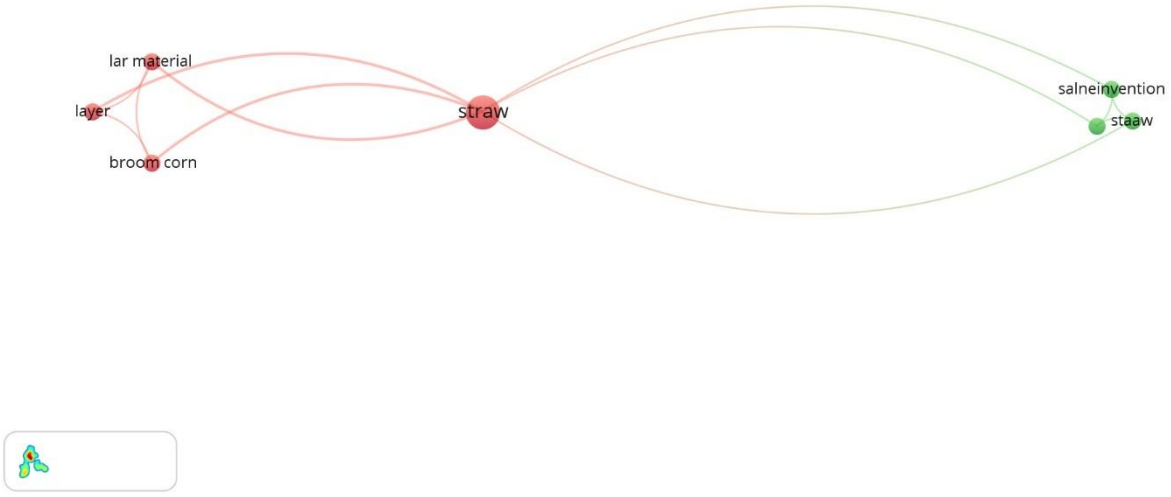


Figure 3. Figure showing trends of research in the field of thatching between 0 – 1900 AD.

0 – 1900 AD

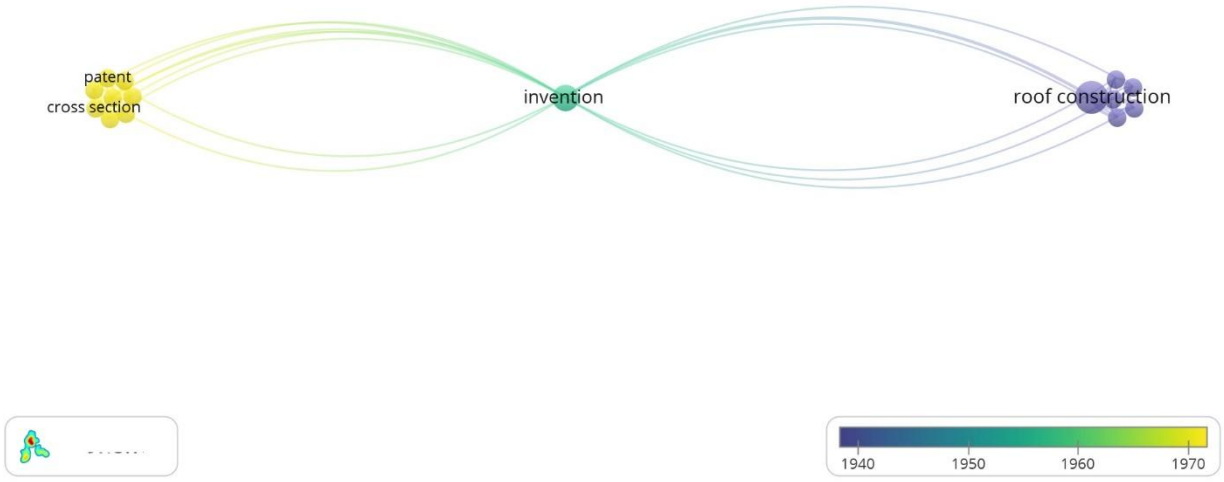


Figure 4. Figure showing trends of research in the field of thatching between 1900 – 2000 AD.

1900 – 2000 AD

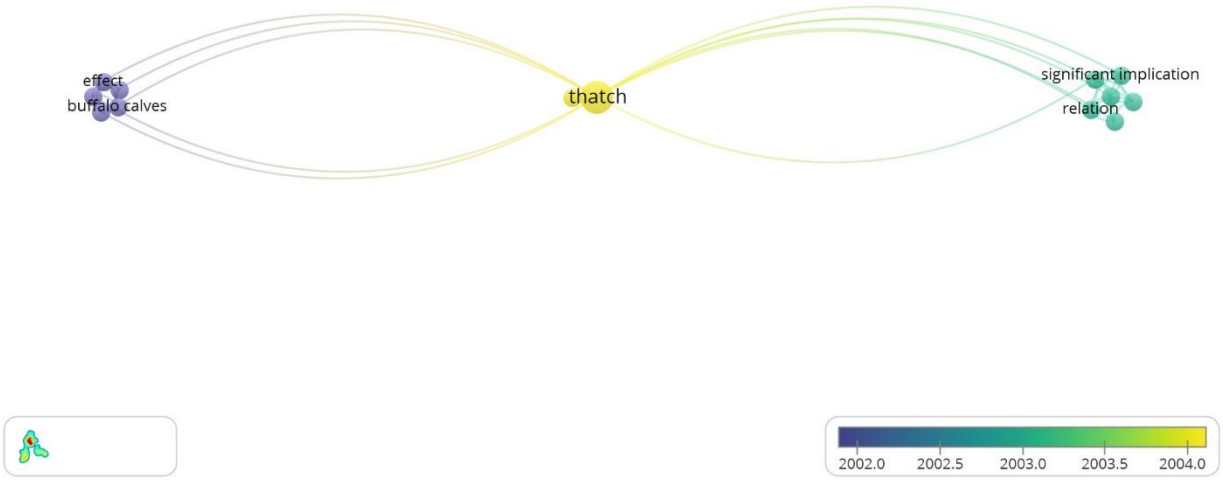
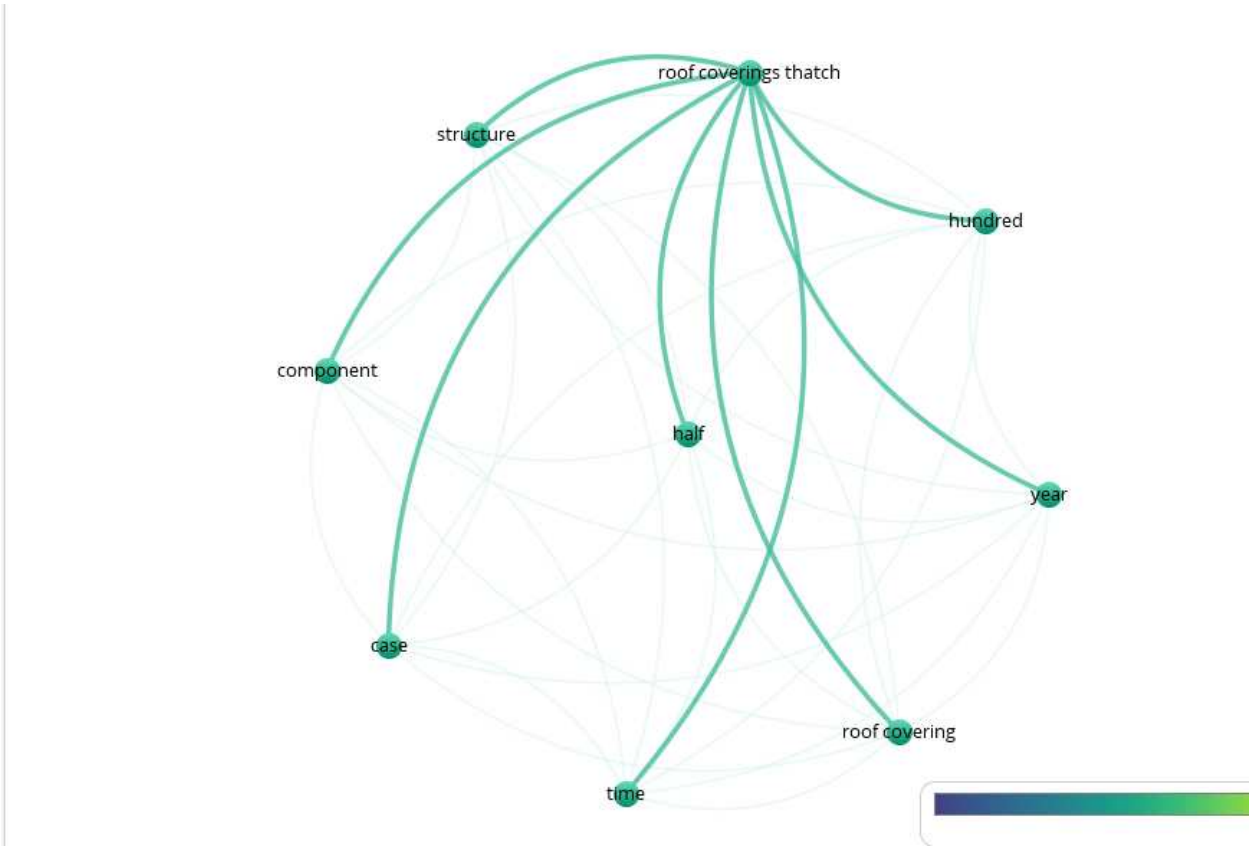


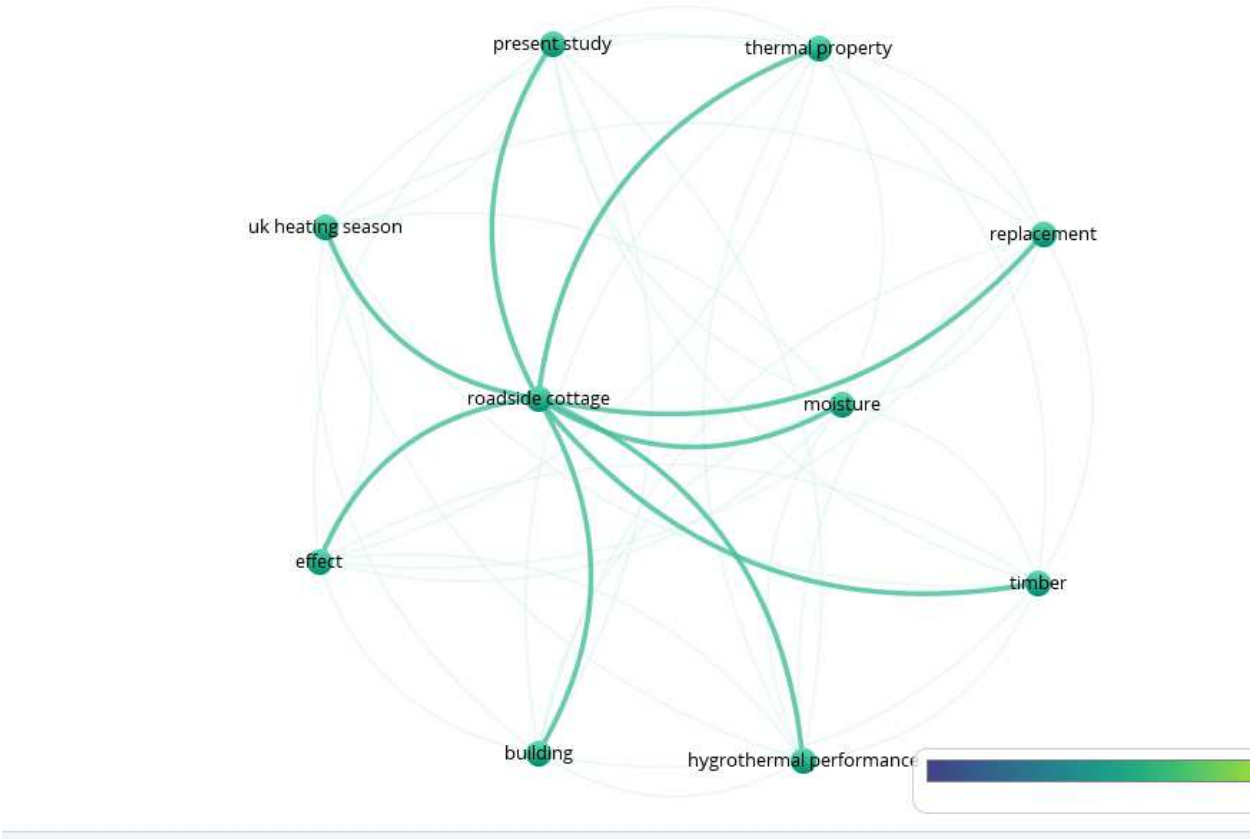
Figure 5. Figure showing trends of research in the field of thatching between 2000 – 2010 AD.

2000 – 2010 AD



2010 – 2020 AD

Figure 6. Figure showing trends of research in the field of thatching between 2010 – 2020 AD.



2020 – 2023 AD

Figure 7. Figure showing trends of research in the field of thatching between 2020 – 2023 AD.

The trend shows research in the field of thatching took the directions of construction early on, invention in the 20th century, value considerations in the early 2000's, a consideration of the past in the 2020's and then some signs of revision in the current period.

Since about the middle of the twentieth century, rapid urbanization has brought about great changes in the ways physical environments have been built in the developing world, and Africa has been no exception. [20]. In Europe, it is likely that thatched roofing over wooden supports continued till the iron age, when stone may have started to be used in places where wood was scarce. Thatching techniques tend to become fairly unchanged after a while and in some cases carry on to the modern day with little changes [21].

Regional History of Thatch Roofing

India has a history of civilization dating back thousands of years. [8] In Kyarda Doon of the Himalayas, there are examples of ancient dwellings where the inhabitants evacuated for yet to be known reasons. Among others, the Labana and Koli settled in their place. For the Labana, thatched house consisted of the superstructure, of four wooden logs of equal height, with forked tops on the plinth, at each of the four corners. Two similar but taller logs are planted in the middle of each lateral span. A ridgepole is placed on the taller logs, and similar horizontal logs are secured to the forked ends of the verticals planted on the corners. Rafters of wood or bamboo rafters are spanned on this setup. Then a prefabricated thatch roof is placed on the rafters and then a bamboo wall stuffed with thatch or an earthen wall is placed underneath.

Figure 8. An inside view of a thatched roof. © OC Handa.

In some variations, purely earthen walls are used without wooden pillars, earthen pillars are used to form the gable in these cases.

Figure 9. Labana Thatched building © OC Handa.

The longer walls reach the desired height, which is normally about 2m.

The shorter sidewalls are constructed to be one to two meters higher, to form the gable. These kinds of earthen walls are known as matkanda. A gap for the main door is usually left in the middle of one of the long walls. Air and lighting get in through the space between the roof and the gable. A round wooden pole is placed on the earth pillar or side wall as the case may be to serve as the ridge pole. It is sometimes supported to prevent sagging. Rafters are then positioned, with their top ends resting on the ridgepole and the lower ends resting over the longer walls, extending beyond the wall by at least half a meter, to a form projected gable-end. Usually sal or bamboo is used for the rafters and are held in place with vines. Split bamboo battens are firmly tied with the vines to form the formwork. Once the framework is complete, the actual roofing

process is then started. Normally this work is done by family members themselves, but the people skilled in laying thatched roofs are also available.

These varieties of grass are widely available in the area. The 3cm thick base layer which is about 3 cm thick is systematically arranged, then a 15 cm thick layer of grass is spread in a similar manner. Sometimes a framework of bamboo is overlaid to make the thatch compact. The whole arrangement is tied down to the formwork underneath. [9] The thatched roof is also used for cowsheds and other buildings. [10] In the Vedic period (c. 1500-800 b.c.), following the incursion of the Northern Aryan nomadic invaders the new population, now distributed in small settlements in plains and mountains used readily available materials, including bamboo and thatch to construct their buildings. [11] The earliest form of Buddhist temples to enclose objects of veneration on which worshippers were to worship was of wood and thatch, it was in the Mauryan period that sculptural replicas of these enclosings began to appear. [12] Buddhist and other religious rock-cut sanctuaries were also roofed with thatch in the early Buddhist period. [14]

Early homes built by the Saxons tended to have heavy timber inclined on each other at the four corners of the foot area of the building, with a log tied across the resulting triangular frame, forming the ridge that will support the roof a hole was made in the roof for airing out smoke. Eventually wooden walls started to be added for extra head space. These inclined logs will eventually evolve to be arched for more head room and then eventually result in the cruck design modern Saxon buildings have.

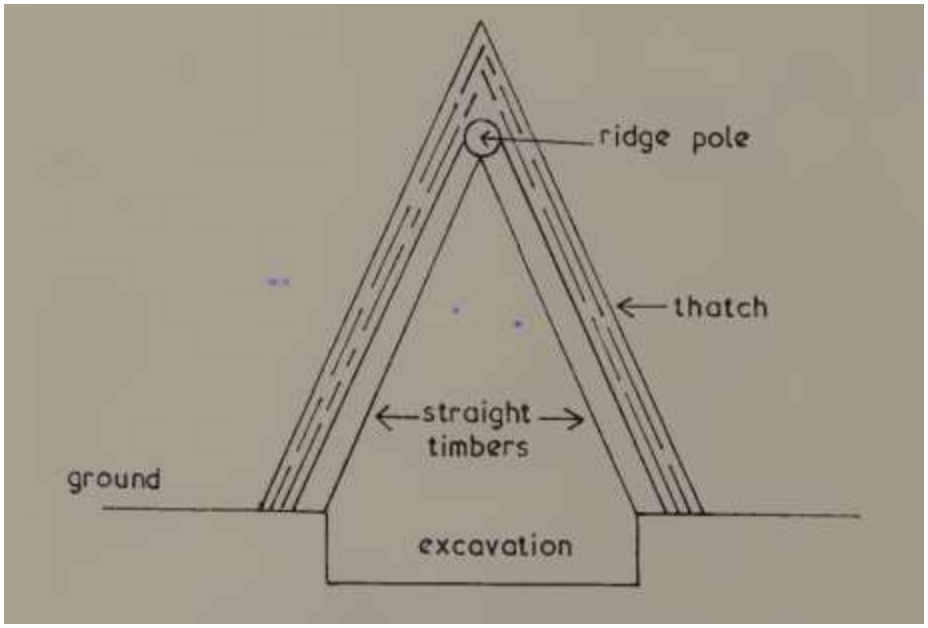


Figure 10: Early Saxon thatched roof © Billet, Michael 1979.

In the Medieval era, they started to build better houses, but thatch continued to be used. In the sixteenth century, the hipped roofing style became more common, due to the difficulty of constructing gable style roofs with thatch. Between the seventeenth to the nineteenth century, it became unfashionable to use thatched roofing, due to the predominance of roofing tiles. It was not until the middle of the nineteenth century that thatch began to be used to roof cottages, with supports of vertical timber. It was at this time that regional tastes started to develop: rounded gables, sharp edged gables. Barns and hay stacks were also roofed with thatch as well [23], Reed, straw, tuft, wood shavings and many other materials are used in thatch construction. In older constructions, thatch was made of locally available material and when economic considerations come into play, the same holds to this day. [24] Some like the Norfolk reed roof are expected to last thirty to sixty years [25]. The construction of thatched buildings in the lands of Saxon gained sophistication over time and started to feature equipment specialists with tools like liggers, spars, sways and hooks. Such that these days thatch is approaching the costs of luxury in some cases. [26]

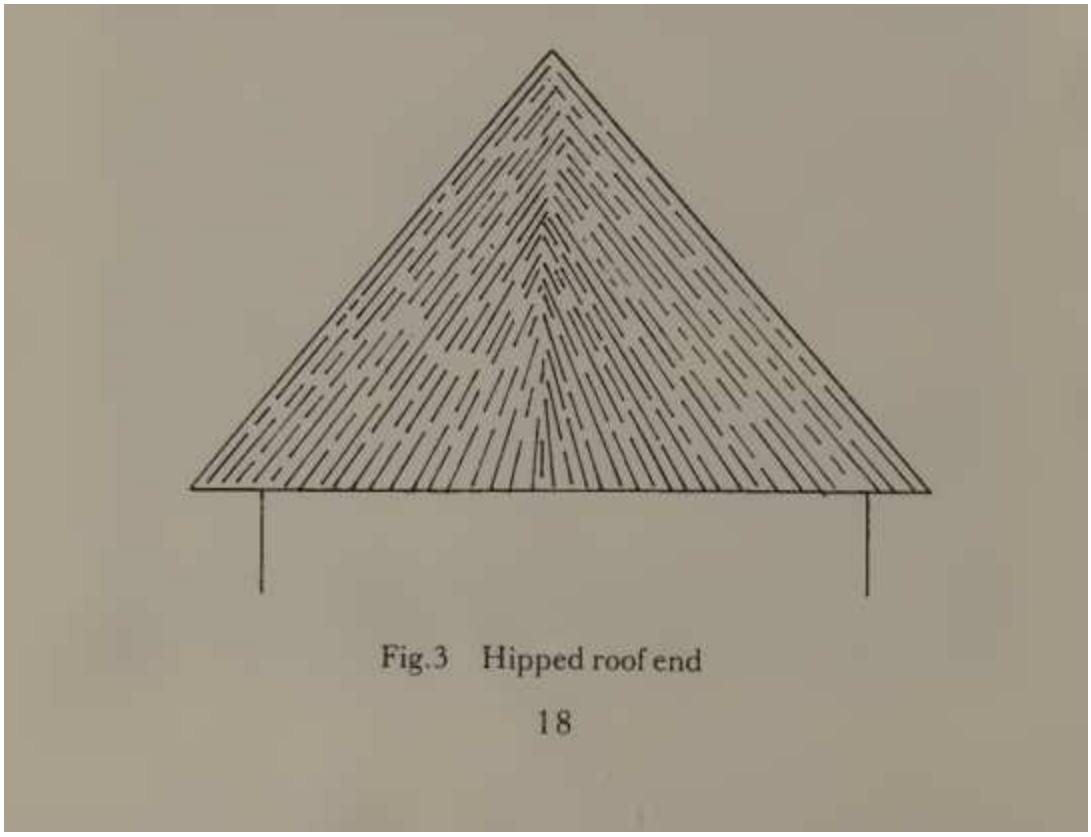


Figure 11: Sixteenth century Saxon hipped thatch roof © Billet, Michael 1979.

In a number of places, thatched roofing never really went away. [22].

According to agricultural classification, African thatched buildings can be documented under two broad classes. Sedentary and nomadic thatching. [16]

From prehistoric paintings, it can be seen that the tent frameworks match those used by sub-saharan nomads to this day. These tents have been documented in the writings of early Greek and Roman scholars from as early as 200 AD, under titles such as Mapalia. They are covered with skin and sometimes weavings of animal hair or suitable plants. Armatures could be used to support building of skin or mat. With tensile and non-tensile designs. [27]

For the herders, their materials for constructing their tents tend to be movable: leather, fabric, wood and grasses. They are used for the assembly, disassembly, transportation and reassembly of the houses at new locations.

African tents can be broken down structurally into two basic types: tensile structures and armatures. The tensile type consists of velum and a set of central poles, dependent on each other for structural support, while the armature types are covered with mat or weavings. . With the tensile type more predominant in the northern parts, and the armature type to the south, with animal weavings predominant in the west and skin predominant to the north.

The type in the classic “Bantu” hut far south of the desert consists of four concentric vertical arches as is the case with some Somali and Danakil.

Figure 12: Nomadic house © Prussin, Labelle 1995.

In rural Africa's past, little material culture went beyond a single lifetime, with every generation having to start over for the most past. This is because of a limited selection of natural resources [26].

Africa is inhabited by thousands of tribes. These are the broad classification of the thatched roofing types for sedentary dwellings, according to Denyer’s classification [31]:

1. Conical or trumpet-shaped thatched roof:

Examples: Koalib,Heiban, Tira, Moro, Mesakin, Korongo, Tullishi (Sudan); Rift Valley wall, Engaruku (Tanzania); Matakam, Kirdi, Kapsiki, Namchi (northern Nigeria, northern Cameroon); Angas, Ron, Birom, (northern Nigeria); Bandiagara escarpment (Mali); Tamgué Mountains (Senegal and Guinea); Atakora Mountains (northern Togo and Benin); Baya-Kaka (Central African Republic).

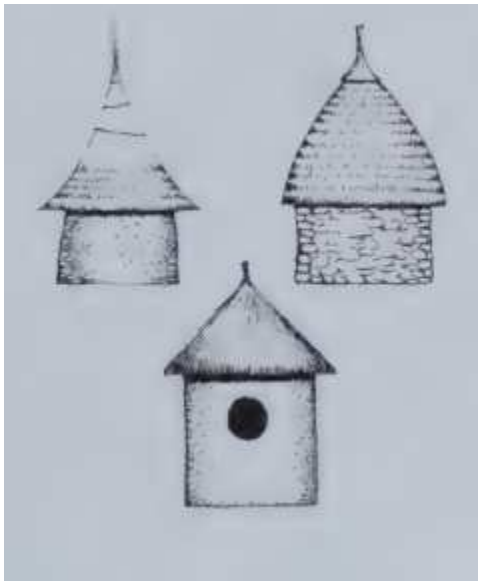


Figure 13: A figure showing the conical or trumpet-shaped thatched roof, in the Susan Denyer classification ©Susan Denyer 1978.

2. Roof of poles leaning against central framework; poles sometimes encased in dry stone work at base; thatching of grass or turves. Examples: parts of Eritrea (Ethiopia); Wanji (Tanzania).

Figure 14: A figure showing the roof of poles leaning against a central framework, in the Susan Denyer classification ©Susan Denyer 1978.

3. Thatched conical roof (convex or concave profile); often with verandah full or part way round. Examples: Kipsigis, Nandi, Luo Kikuyu (Kenya); Mangbettu (Zaire); Tiv, Nupe, Jukun, Nigeria); settled Fulani (Guinea, Nigeria, Cameroon); Dourou, Tikar, Toupouri, Massa (Cameroon); Kinga, Safwa, Nyamwezi (Tanzania); Grebo (Liberia); Tonga, Venda (South Africa); Gurage, Galla (Ethiopia); Ila (Zambia); Dagomba, Konkomba (Ghana); Kisi, Susu (Guinea); Azande, Shilluk, Bari (Sudan); Mandinka (Mali, Senegal, Guinea, Ivory Coast); Yalunka (Sierra Leone).

Figure 15: A figure showing the thatched conical roof, in the Susan Denyer classification ©Susan Denyer 1978.

4. Thatch of grass, leaves or mud frameworks of hoops with round, oval or rectangular plan. Examples: Masai (Tanzania, Kenya); Twa (southern Cameroon, Zaire); Herero, Ambo (Namibia); Namaquo,Pondo, Zulu, Thembu, Xhosa (South Africa); Swazi(Swaziland); Shuwa Arab (Chad, Nigeria); Somali(Somali Rep.); Gheleba, some Galla, Bileni (Ethiopia);some Tuareg (Niger); Songhai (Mali, Niger); Sotho (Lesotho)

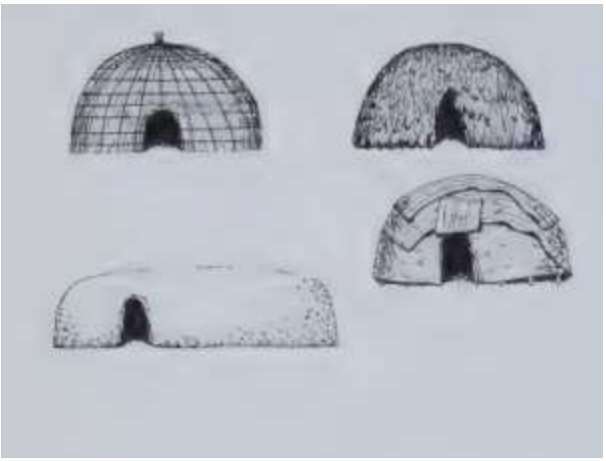


Figure 16: A figure showing the thatch of grass, in the Susan Denyer classification ©Susan Denyer 1978.

5. Round plan thatched conical roof with no walls: Examples:Fulani dry-seasonhouses (northern Nigeria); Kinga area (Tanzania); Lutoko (Sudan); someSaho (Ethiopia).

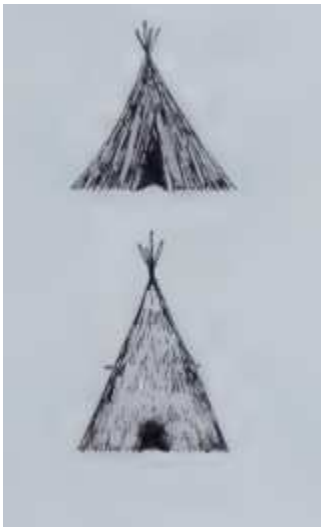


Figure 17: A figure showing the round plan thatched conical roof with no walls, in the Susan Denyer classification ©Susan Denyer 1978.

6. Round plan thatch on an armature of flexible poles: Examples: Dinka (Sudan); haya, Chagga, Pare (Tan-zania); Ruanda(Ruanda); some Acholi , Ganda(Uganda); Rundi (Burundi); Fulani (Nigeria); Kanuri(Nigeria, Chad, Niger); Dorze, Sidamo (Ethiopia), Kamba (Kenya); Luguru (Tanzania); Tubu (Chad).

Figure 18: A figure showing the round plan thatch on an armature of flexible poles, in the Susan Denyer classification ©Susan Denyer 1978.

7. Asymmetrical peaked thatched roof supported by conical mud pillar and mud arch; Examples: some Kagoro, Jaba, Katab, Ikulu, Moroa(northern Nigeria).

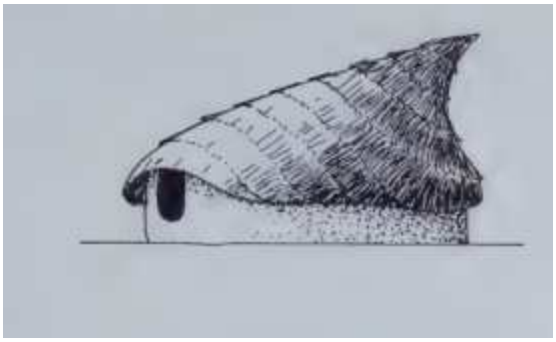


Figure 19: A figure showing the asymmetrical peaked thatched roof supported by conical mud pillar and mud arch, in the Susan Denyer classification ©Susan Denyer 1978.

8. Thatched saddle-back roof with semi-conical ends; Examples: pockets of coastal areas and lake shores of southern Liberia, Guinea Bissau, Senegal, Tanzania; central Ivory Coast , Nyasa (Tanzania).

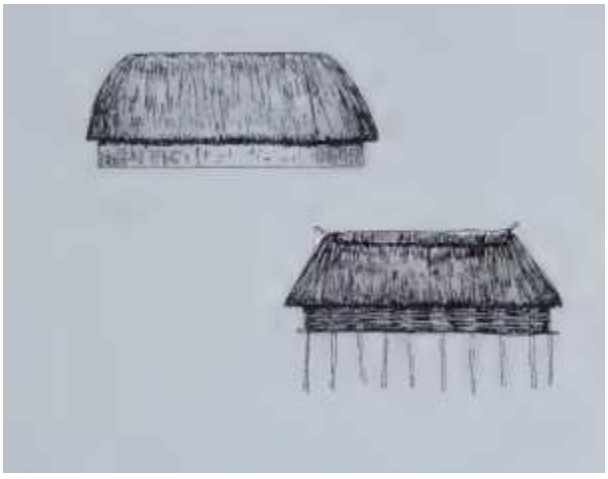


Figure 20: A figure showing the thatched saddle-back roof with semi-conical ends, in the Susan Denyer classification ©Susan Denyer 1978.

9. Thatched saddleback roof. Examples: Diola (Senegal); Manjak, Papcis (Guinea Bissau); Dida, Guro, Gagu (Ivory Coast).

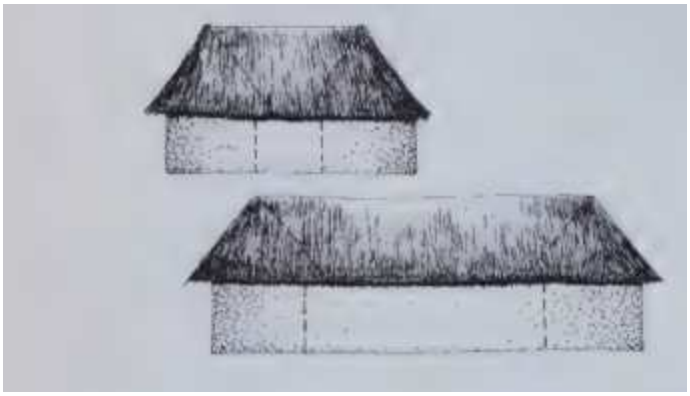


Figure 21: A figure showing the thatched saddleback roof, in the Susan Denyer classification ©Susan Denyer 1978.

10. Thatched roof of grass or reeds on square plan. Examples: Bamileke, Bamoun (Cameroon); Abadja Ibo (Nigeria).

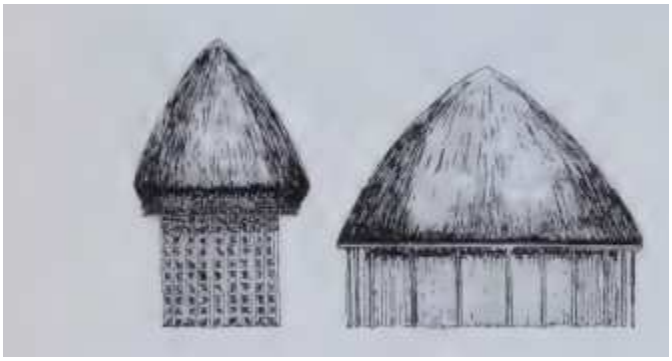


Figure 22: A figure showing the thatched roof of grass or reeds on square plan, in the Susan Denyer classification ©Susan Denyer 1978.

11. Hipped roof thatched with grass or reeds.Examples: Lozi (Zambia); Pende (Zaire); Tikar (Cameroon).

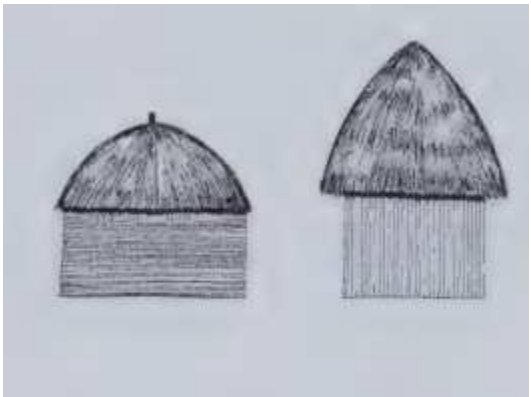


Figure 23: A figure showing the hipped roof thatched with grass or reeds, in the Susan Denyer classification ©Susan Denyer 1978.

12. Thatched hipped roof framework of flexible poles embedded in ground at base and tied at apex under tension with slightly convex profile. Examples: Holo, Suku (Zaire, Angola).

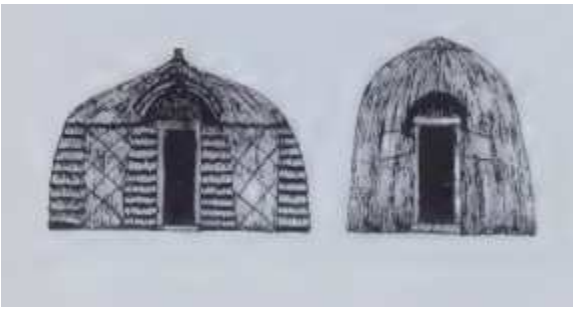


Figure 24: A figure showing the thatched hipped roof framework of flexible poles embedded in ground at base and tied at apex under tension with slightly convex profile, in the Susan Denyer classification ©Susan Denyer 1978.

13. Hipped thatch roof, sometimes with two long sides lapped over other two; Examples: coastal regions of Kenya, Tanzania, Nigeria, Benin Rep. ; lake shores (Zaire, Tanzania); central Zaire.

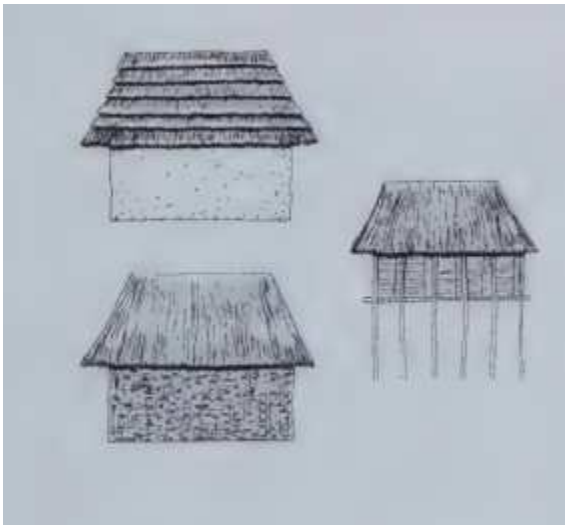


Figure 25: A figure showing the hipped thatch roof, in the Susan Denyer classification ©Susan Denyer 1978.

14. Tall Pyramid thatched roof.

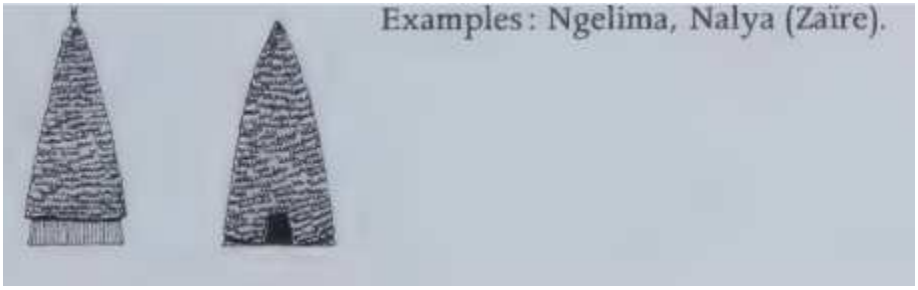


Figure 26: A figure showing the tall Pyramid thatched roof, in the Susan Denyer classification ©Susan Denyer 1978.

In most parts of Africa, traditional construction techniques are being replaced by more modern ones [32].

Chapter 3.

Research methodology.

Introduction.

The research methodology employed in this research was qualitative methods, particularly grounded theory. The primary sources used for the research were interviews. In this chapter, an attempt will be made to examine the research methodology, sample, sampling technique, sample size, spread and data analysis to achieve the study's goals and objectives.

Sample.

The sample consisted entirely of members of the Obukpa community and people on the University of Nigeria, Nsukka campus.

Sample Size.

In keeping with standard practice in grounded theory, we iterated the interviews until the research questions began to yield redundant results.

Sampling Technique.

Random sampling was employed although the subjects were located mostly along the main road

through the community except when the interviewer was referred to particular locations.

Data Collection Instrument.

Interview was used to collect data from the participants.

Chapter 4.

Analysis.

The interview was conducted in two batches, with subjects randomly selected at the University of Nigeria's main campus and in the nearby Obukpa community. The sample consisted of twenty-four individuals: fourteen males and ten females, two of whom were over the age of 56. The interviews were administered in person, except for one case that was conducted over a call. The sessions were recorded, transcribed, and then analyzed for trends. Most interviews began by inquiring about the benefits of thatched housing. In the single case where the subject was asked about the correlation between owning a thatched structure and financial status as the first question, the subject repeatedly answered in the affirmative and repeated that "nothing would suggest more about your financial status than owning a thatched house" even when asked about benefits of thatched roofing, this seemed to indicate a negative bias; further exploration, however, is beyond the scope of this paper.

The three elderly subjects spoke excitedly about thatched housing, with the general sentiment being, "Can you take in all the advantages?" The state of publication supports the view that it is simplistic to assume that these structures are merely mud and grass; they were, in fact, tailored to solve local challenges such as standing on inclines and enduring in riverine areas[33]. Only one male claimed to have never spent time in a thatched structure, and he appeared to be concealing something, according to the interviewer's evaluation. All interviewees over the age of 41 had lived in thatched roof structures. All female respondents, except for one, stated they would not consider owning a thatched roof structure. While this is of interest to the researcher, it is also beyond the scope of this paper.

Twelve of the twenty-two respondents cited fire hazard as a disadvantage of thatched roofing. Another twelve mentioned the cool ambiance as a benefit of thatched roofing; interestingly, these were not the same twelve who cited the fire hazard. Three people shared the opinion that thatch could be used in roofing various places. Two stated that you needed to be wealthy to afford thatched housing, citing the cost of getting enough material and in one case, skilled craftsmen, while twelve indicated that living in a thatched-roof structure signified poverty, and three saw no relationship.

The subjects offered their perspectives, ranging from farmers and young women to a man of marrying age and an employer of labor. For instance, an employer of labor pointed to the low labor requirement as an advantage of thatched roofing, a farmer spoke of the need for government assistance to help people transition from thatched roofing, and a thirty-year-old man considered the prospect of owning a thatched structure from the standpoint of getting married. The commonly cited concern about fire hazards aligns with the literature, as this was the primary reason thatched roofing was banned in England [5] and why thatched roof structures are costly to insure[26]. It also matches the literature that individuals over the age of 56 likely lived in thatched houses, as harsh survival conditions in the past led to little development in material culture transmitted between generations until the last century[26]. However, the literature does not concur with the popular interview opinion that ownership of thatched roofing equates to poverty, with specialized restaurants, inns, and relaxation homes being among the users of thatched roofing[16] [26]. This supports the claims of those who believe there is not necessarily a correlation. The common observation that thatched roofing provides a cool ambiance without energy consumption is a significant finding that the author recommends for consideration by decision-makers.

The fact that over fifty percent of the subjects had never lived in a thatched roof structure testifies to the significant change that has occurred in just a century. The randomly selected sample may be representative of the wider university population, in one of the largest university campuses in one of Africa’s most populous countries. The reluctance of the female sample population to own a thatched roof structure is notable, but this topic is outside the scope of this paper. The university setting may explain why opinions on nomadic thatched roofing were not sampled.

Several interviewees had to ask what thatched roofing was, which further suggests that the technique is no longer widespread[34]. Only three individuals were disinclined to discuss the subject, indicating some level of affinity or at least interest in the topic among the majority. The charts demonstrate that the subjects' opinions were greatly varied, suggesting that their views are unique. There are no signs of widespread indoctrination on the topic, which would have resulted in fairly skewed-looking charts.

From the sampled population, people appear to be receptive to thatched roofing, especially for outdoor locations. If the fire hazard is addressed, it may become a more popular choice for homeowners.

Chapter 5.

Conclusion.

In summary, the research work agrees with the existing literature in the following:

1. Thatched roofing is currently prone to fire hazards.
2. Thatch used to solve real problems for its inhabitants.
3. Thatched roofing has decreased in popularity since the 20th century in Africa.

The following additions are considered noteworthy by the author:

1. People are in general not fully opposed to the use of thatched roof structures, particularly in the outdoors.
2. Thatched roofing solves temperature regulation challenges, without the increment of energy bill.

It is the author's opinion that this should be put into the considerations of decision makers in situations where thatched roofing might be a viable option, as not everything about traditional architecture is wrong.

Thatched roofing is one of the early construction techniques.Its cultural, thermoregulation and readily available materials have meant that it continues to find use cases to this day, from tourist sites in japan, to summer houses in europe, and sit outs in Nigeria. Like every other engineering solution, it should be considered holistically when possible use cases are found for architectural propositions, for durability, maintenance, cost savings and convenience and when it fulfills enough of the design criteria, it should be adopted.

Longer lasting roofing materials like Norfolk reed could be domesticated, to make their usage more likely. The savings in electrical bills for air conditioning should be added to the lifetime costing of the structure.

The writer would recommend that thatched roofing should be employed when it meets the criteria of a project after full consideration, as some things about traditional architecture are right.

References.

1. Nash, J. (1981). "Thatchers and Thatching." Page 12.
2. Billet, M. (1979). “Thatching and thatched buildings.” Page 11.
3. By Hendricks Architecture, A History Of Thatch Roofing, https://www.hendricksarchitect.com/architecture/a-history-of-thatch-roofing, accessed on 04/10-2023.
4. Nash, J. (1981). "Thatchers and Thatching." Page 13.
5. Nash, J. (1981). "Thatchers and Thatching." Page 13 -16.
6. By resources for history, Celtic Round Houses https://resourcesforhistory.com/Celtic_round_houses.htm#gsc.tab=0, accessed 04/10/2023.
7. 77% of Benuelites live in mud houses with thatched roof while all mansions and luxury homes are owned by strangers - Benue man laments by LindaIkeji’s blog < https://www.lindaikejisblog.com/2021/1/77-of-benuelites-live-in-mud-houses-with-thatched-roof-while-all-mansions-and-luxury-homes-are-owned-by-strangers-benue-man-laments-2.html>.
8. Handa, O. (2020). Himalayan Traditional Architecture With special reference to the Western Himalayan Region Page 4.
9. Handa, O. (2020). Himalayan Traditional Architecture With special reference to the Western Himalayan Region Page 132 - 138.
10. Handa, O. (2020). Himalayan Traditional Architecture With special reference to the Western Himalayan Region Page 330.
11. Roland, B. (1967). The Art and Architecture of India Page 20.
12. Roland, B. (1967). The Art and Architecture of India Page 66.
13. Roland, B. (1967). The Art and Architecture of India Page 71.
14. Brown, P. (1965).Indian Architecture (Buddhist and Hindu Periods) Page 3.
15. null.

16. Kerr, A. (2023). Hidden Japan An Astonishing World of Thatched Villages, Ancient Shrines and Primeval Forests.
17. Tomklinson, J. et at (2022) Architecture and politics in Africa.
18. Denyer, S. (1978). African Traditional Architecture Pages 133 -142.
19. Denyer, S. (1978). African Traditional Architecture Pages 3.
20. Moughtin, JC. (1985). Hausa Architecture Page 3.
21. Billet, M. (1979). “Thatching and thatched buildings.” Page 14.
22. Billet, M. (1979). “Thatching and thatched buildings.
23. Billet, M. (1979). “Thatching and thatched buildings.” Pages 17-28.
24. Billet, M. (1979). “Thatching and thatched buildings.” Pages 38.
25. Billet, M. (1979). “Thatching and thatched buildings”.
26. Billet, M. (1979). “Thatching and thatched buildings”.
27. Prussin, L. (1995) African nomadic architecture: space, place, and gender Pages 5-6.
28. Prussin, L. (1995) African nomadic architecture: space, place, and gender Pages 6 – 58.
29. Prussin, L. (1995) African nomadic architecture: space, place, and gender Pages 17.
30. Prussin, L. (1995) African nomadic architecture: space, place, and gender Pages 16.
31. Denyer, S. (1978). African Traditional Architecture.
32. Dioma, B. et al (2018) African Vernacular Architecture,Culture and Modernity:An Investigation Among theLamba People of Chief Mushilion the Copperbelt Province of Zambia.
33. Denyer, S. (1978). African Traditional Architecture Page 4.
34. Denyer, S. (1978). African Traditional Architecture Page 192.
35. Denyer, S. (1978). African Traditional Architecture Page 193.

Appendix.