# EVALUATION OF SOME FARM STRUCTURES IN SOUTH WESTERN NIGERIA

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## ABSTRACT

*A survey involving the use of questionnaires, personal communication, physical observation and photographic recording was undertaken in South western Nigeria comprising of Ekiti, Ogun, Ondo, Osun and Oyo states to identify the farm structures popularly used, materials used in their construction, their durability and maintenance culture adopted by the users.*

*Farmhouses, cribs, barns, platforms, warehouses, silos, pens, yards and sheds, deep litter houses, palm fronds woven baskets, hutches and cages were the popular farm structures identified. Although a catalogue of materials is available for construction, cost was found to be a major factor in the selection of materials. There was extensive use of locally sourced materials such as wood, natural fibers and earth for the construction of the identified structures.*

*The factors, which tend to reduce the service life and efficiency of these facilities, include roof leaks, abrasion of mud walls, decay and breakage of wooden members, corrosion of metal components, and pitting and cracking of concrete floors. Remedial measures taken include replastering of mud walls and cracked floors, addition of natural fibers to roofs and sealing of leaking points in galvanized roofing sheets, and replacement of broken wood components. These measures where adopted have proved quite useful in improving the efficiency and longevity of the structures.*

*A culture of regular inspection and timely repair of damaged components to prolong the service life and reduce maintenance cost is recommended.*

**Keywords**
construction materials, physical life, farm structures, livestock structures, maintenance culture.



## INTRODUCTION

Farm structures are facilities either originally designed and fabricated or converted for use within and occasionally outside an agricultural establishment. Farm structures comprise of sheltered facilities, which provide accommodation for the farmer, his livestock, farm produce and farm machinery and non-shelter ones such as roads and fences, which either allow access to the farm or provide security. Farm structures are a major factor in increasing agricultural production. This is achieved through the provision of better housing and recreational facilities to boost the farmer's productivity, improve livestock yield, enhance timely harvest and reduce post-harvest food losses and the development of farm transportation for the timely evacuation of harvested farm produce to the urban areas. Man has always recognized the role of farm structures in agricultural production and where they are not naturally available, he makes efforts within his economic and technical limitations to provide them.

Farm structures are as old as mankind. Natural caves and hollow trees were the earliest forms of farm structures as they provided partial shelter from inclement weather conditions and dangerous animals for the early man. The remoteness of some of these early farm structures from the sources of food and water where settlement was an advantage and increasing population prompted the early man to consider constructing farm structures. Man's effort at providing structures dates back to 10,000 BC and the early forms of farm structures constructed were mainly huts, sheds and bridges made of logs of wood and stone slabs, partly covered yards and primitive pens and fences made of stones, wood and hedges grown around pastures to protect livestock especially the sheep that was a wool provider from wild animals and restrain them from cultivated crops. (Cole and Ronning 1974, Owen 1981). Martin *et al* (1967) and Siguat (1988) reported the use of underground pits lined with clay, straw and baskets with as much as 2 million tonne capacity for the storage of grains by the Egyptians as far back as 5000BC.Fences made of rough stones, earth banks, planted hedges and solid walls used to mark the cultivated areas and keep away

animals, were also reported to be familiar features of farm sites from pre-historic time (Mohammed 1990).

The desire to meet the increasing demand for farm structures for increased agricultural production necessitated an improvement on what the early man had, hence over the years, farm structures have witnessed different innovations with tremendous improvement in the design, construction and use of various materials of construction. Although there is at present a catalogue of materials for the construction of farm structures, because of the technology and economic limitations in most farming communities in developing countries such as Nigeria, there is more emphasis on the use of locally available materials for the obvious reasons of cheapness and the available handling technology.

Durability has been defined as the capability of a structure to maintain minimum performance over at least a specific time under the natural conditions of service (Sarga and Verikari 1996). The physical life of a farm structure is the number of years the structure is expected to perform the functions for which it was originally designed. During this period, minor repairs, replacement and maintenance are expected to be carried out but when these become major and excessive, the structure is assumed to have exhausted its physical life. This period vary from 2 to 5 years for very simple structures to over 50 years for very sophisticated ones but for most structures, an average of between 10 and 20 years is taken as physical life (Bengtsson and Whitaker 1986). The durability of a structure is affected by a number of factors, which include the environmental conditions under which it is used, materials of construction, stress level for load bearing members and the type of maintenance culture adopted. Under warm humid climate such as that of Nigeria, farm structures are exposed to the damaging effects of high temperatures and relative humidity, wind, rain, repeated cycles of wetting and drying and mechanical damage from imposed loads causing a progressive decay and reduction in the durability of the structures.

The vegetation of Southwestern Nigeria is forest even though long years of human activities has changed part of it especially towards the north to grassland while the annual rainfall vary from 1500 to 2000mm (Oyebamiji, 2001). These climatic conditions and vegetation favour the production of both cash and arable crops and the survival of a number of livestock. The area is a major producer of cassava, yams, grains and legumes, cocoa, Kola nut and tobacco while a good number of trypanosome- resistant animals such as poultry, goats and pigs are widely kept in the area .The need for good farm structures to harness the agricultural potentials of the region cannot be overemphasized.

The survey reported in this work was undertaken to identify the farm structures popularly used in the area, materials of construction, durability and the maintenance culture put in place to ensure their long-term use.

## METHODOLOGY

This survey was carried out in South Western Nigeria comprising of Ekiti, Ogun, Ondo, Osun and Oyo States. Information gathering was accomplished through the use of printed structured questionnaires administered during field visits while additional items of information were gathered through personal communication. Observation and photographic recordings were also made. Information sought included the type of structures and frequency of utilization, age of structure, major users, materials of construction, durability and maintenance culture. A total of 300 potential locations for crop storage and livestock handling activities selected from the agricultural map of the area of survey and ensuring even spread were visited. These locations comprise of hamlets, villages and smallholder farms (65%), medium to large scale private and government farms including farm settlements and research institutions (30%), and transit points and markets (5%) Although the usual survey bottlenecks of respondents' reluctance to provide information was experienced, this was considered inconsequential, as there were many respondents to interview and obtain similar information. Lack of record keeping was observed in many of the places visited and some of the information needed had to be obtained through personal communication.

## RESULTS AND DISCUSSION

The results of the survey are summarized in Tables 1 to 3 and Plates 1 to 5. They are analysed on the basis of availability, materials of construction, maintenance culture and durability.

### Available Structures

The farm structures identified in the surveyed area were farmhouses ranging from simple huts to enclosed buildings for human accommodation; barns, cribs, platforms, silos and warehouses for crop storage; palm fronds woven baskets, battery cages, deep litter houses for chicken; hutches for rabbits; pens, yards and sheds for goats, pigs, sheep and cattle. Bridges and culverts provided access over road obstructions.

Table 1: Materials of construction, problems and remedial measures for some Farm Structures found in Southwestern Nigeria

| Structure | Materials of construction | Problems experienced | Remedial measures |
|---|---|---|---|
| Farm Houses | Those used by small holder farmers are of rammed earth floor and a thatched roof supported either by wooden poles or mud walls while for those in large scale farms, conventional building materials such as concrete floors, walls of sandcrete blocks, trusses from sawn timber and iron roofing sheets are used. | Problems are more experienced with those used by small holder farmers because of the materials used. These include the erosion of mud walls which occasionally develop to cracks, the thatching material is often attacked by termites in addition to drying and thinning resulting in leakage. | Cracks filling and plastering with mud at regular intervals and in a few instances cement mortar is used, replenishment of thatch materials |
| Cribs | Small diameter logs, palm fronds or split bamboo for the floor and walls, and a thatched roof rested on wooden columns or walls and floor of wire mesh, a roof of iron sheets supported by iron poles. | Where non-durable wood species are used, the supporting columns could be attacked by termites and decay, buckling is experienced where the structure is overloaded as is common with a number of farmers. This in some cases result in the total collapse of the structure | Decayed or broken components are often replaced |
| Barns | The floor is often bare and the wall is made of the stakes on to which the yams are tied. The outside of the structure is fenced with natural fibers including palm fronds and is completed with a thatched roof. | Although a few stakes dry up and break under heavy weight of yam supported, in most cases the stakes are from wood species that can establish so that they are not replaced every year. The problem is usually the fencing and roofing materials which decay and are also prone to fire | Where necessary broken stakes are replaced while the thatch and fence are replaced at the beginning of new harvest |
| Platform | The supporting platform is made from either sawn timber or small diameter logs raised on wooden columns. In some cases, the platform could be made of plant materials suspended on natural growing trees | Once the structures are not overloaded, there is hardly any problem experienced | Wooden members may occasionally be replaced |
| Warehouses | Usually of concrete floor, walls of sandcrete blocks and roof from corrugated iron sheets | Because of heavy traffic, if the concrete is not strong there may be crack, roof may leak | The floor if cracked is replastered while leaking points are closed with coal tar or putty |
| Silos | Mainly of steel or aluminum and in a few cases concrete ones are found | Moisture condensation and migration resulting in grain spoilage | Regular ventilation using heated air and where it is possible the stored produce can be turned from one silo to another |
| Hutches and cages for rabbits | The frame is made of sawn timber while the walls and floor are made of wire mesh. This is for effective ventilation through the walls and easy passage of faeces/urine through the floor. Corrugated iron sheets, bamboo or thatch could be used for the roof. | The urine of animals attack the wire mesh and with time tears. | Replacement of affected component is the common method adopted |
| Battery Cages. | Manufactured wholly from galvanized wire mesh to facilitate good ventilation and easy passage of droppings through the floor. They are arranged in steps attached to a metal frame. | With time the cage begin to corrode. | Washing and repainting is the method often adopted |

| Structure | Materials of construction | Problems experienced | Remedial measures |
|---|---|---|---|
| Deep Litter Houses | The floor could be paved or hard compacted soil overlain with a layer of sawdust, wood-shavings or other similar materials. The walls consist of a dwarf portion made from either timber or sandcrete blocks and completed to the eaves with wire mesh. A plastic sheet, which can be rolled over the wire mesh, is attached for the purpose of temperature regulation. Timber or iron columns and trusses provide a support for the corrugated iron sheet or asbestos roof. | Some floors were observed to crack and roof leaks especially around the nail points. This was common where corrugated iron sheets removed from old buildings are used for the construction. The wire mesh as it ages get torn. | Sealing of points of leakage with coal tar and putty and when it becomes too severe the sheets are replaced. Old and torn wire mesh are replaced while the floor is replastered if cracks becomes too severe |
| Yards and sheds | A yard is a piece of land fenced to restrain the movement of animals either temporarily or on a long term. The fences of the yards found were mainly from sawn timber, small diameter logs and split bamboo. Simple sheds made of wooden columns and thatched roofs or those from corrugated iron sheets may be provided within the yard to offer protection against sun and rain. The floor is of rammed earth. | There are usually no serious problems except that occasionally animals may damage part of the fence in an attempt to escape while some of the materials may give way due to old age after a long period of use | Replacement is usually the remedy |
| Pens. | The floor is of concrete and the dwarf wall could either be sawn timber, plywood or sandcrete blocks. The roof is corrugated iron sheet attached to timber truss. Where it is available, bamboo could also be used for the walls and roof. | Pitting and cracking of floors are in some instances experienced, Where wood serves as walls, it rots with time due to water for cleaning | Wood replacement and floor replastering are the remedial measures |
| Bridges | Rural communities make use of bridges constructed on roads passing through the area and where the need arises to cross a river that cannot be waded through, emergency pedestrian bridges are easily put in place by placing a log of wood or oil palm trunk across a river. The few bridges strictly meant for farming activities are mainly constructed by timber contractors for the haulage of logs and produce buyers then use such bridges. The bridges are constructed from logs and oil palm trunks. | Because the bridges are not properly constructed especially the assembly, the menbers are regularly displaced and in rare cases may break or fall off. | Whenever there is displacement, the logs are rearranged and if some are bad they are easily replaced with the components that can be obtained within the environment |
| Palm frond woven basket | Flat-bottom and arch-shaped housing type of basket woven wholly from fibrous palm fronds The bigger ones are used for transporting animals. | The component decay with time as a result of poultry droppings | Since the materials of construction are readily available, repairs are usually not considered and the structure is replaced whenever it can no longer serve its usefulness. |

Table 2: Availability and major users of some Farm Structures in South Western Nigeria

| Structure | % of sites where found | Major users | Frequency of use |
|---|---|---|---|
| Farm Houses | 70 | This is used by all categories of farmers although there is a difference in the standard between those for small holder farmers and large scale farms | They are usually permanently occupied |
| Cribs | 60 | The use is more with the small holder farmers as it enables them to harvest at high moisture content, reduces field infestation and release land for replanting. | Many of them are continuously in use but some are left idle some years when the harvest is either poor or the farmers pay less emphasis to crop stored in them in particular years |
| Barns | 20 | Mainly used by small holder farmers and in the yam producing area of Oyo state | Idle years in-between in the life span of the structures is very common occasioned by low harvest or a break in the cultivation of the crop |
| Platform | 25 | Very common in small holding farms and markets. | Almost permanently in use |
| Warehouses | 20 | Mainly large scale private and government farms and industries | Most of them are continuously in use for as long as ownership remain unchanged especially as processing activities can also be carried out in them. |
| Silos | 15 | Mainly large scale private and government farms and industries | There is no consistency as the availability of grains determines their utilization. Those owned by grain producers and non-governmental organizations are more in use than those belonging to government |
| Hutches and cages for rabbits | 20 | Mainly government farms and research institutes although a few individual users were also identified. | It was observed that at commencement, the zeal to raise the animal is high and the structures are continuously in use and after about five years the structures are abandoned and about two or three years later when the zeal is rekindled, they are revived and the continuous use commences |
| Deep Litter Houses | 60 | Found in large scale farms, among small holder farmers and households | Some are continuously in use while others are intermittent because of owners' attitude to poultry keeping from time to time |
| Yards and sheds | 45 | Households backyards, markets, transit points and large scale farms | For as long as the owner keeps his animals, the structures are continuously in use. |
| Battery Cages. | 50 | Mainly in large scale private and government farms | Most of them are continuously in use for as long as poultry keeping is practiced |
| Pens. | 25 | Mainly large scale private and government farms | Continuously in use until abandoned |
| Bridges | 15 | Timber contractors and middle men | Continuously in use |
| Palm frond woven basket | 85 | Used by all categories but is more common with small holder farmers, rural and urban households who keep a few chicken | It is continuously used till when it either rots or torn and discarded. The structure is cheap and replacement is not a serious problem |



Farmhouses were widespread across the survey area and among the various groups involved in agriculture. Some of the medium to large-scale private and government farms are residential and decent accommodation is a necessity in such farms. In many places, the small holders' farms are located between 15 to 20 km from the home villages of the farmers and what some farmers do is to spend some days on the farm especially at peak periods of land preparation or harvesting and return to the village at weekends or market days. During such periods on the farm, the farmers need a shelter.

Crop storage structures especially the crib, barn and platforms were common among the smallholder farmers in most of the areas even though there were slight variations in the frequency of use. Silos and warehouses were limited to medium to large-scale farms. Food crops are major sources of income for the farmers and hence their processing and storage both for family consumption and sale at off-season period when they attract higher economic returns are given adequate attention

Although a few individuals especially in urban areas attempt to provide livestock shelter

either within or at the back of the house for their livestock, many smallholder farmers who keep a small livestock population within the household don't provide any special facilities for the animals kept. Most of them are kept on free range and at best tolerated to sleep on the veranda during inclement weather conditions. Most of the facilities for livestock are mainly used by the large-scale private and government farms, research institutions, markets and transit points. However the palm fronds woven basket is widely used in many households for the keeping and transportation of a few chickens

Rural communities make use of bridges constructed on roads passing through the area and where the need arises to cross a river that cannot be waded through, emergency pedestrian bridges are easily put in place by placing a log of wood or oil palm trunk across a river. The few bridges strictly meant for farming activities are mainly constructed by timber contractors for the haulage of logs and produce buyers then use such bridges. The bridges are constructed from logs and oil palm trunks.

**Materials of construction**

The materials of construction identified include natural fibres for roofing and fencing, earth for flooring and walls, wood products for suspended floors, beams, columns and roof trusses while plywood are used for partition and walls; and cement for walls and flooring. Wire nets are mainly for walls to aid ventilation and suspended floors to allow passage of animal droppings. Corrugated iron sheets are for roofing. In general, availability and cost govern the choice of building materials. The various materials were observed to be subjected to one form of deterioration or the other while in service. Walls of farmhouses constructed of either poured mud or adobe blocks were subjected to rain erosion and in some cases cracks develop leading to total collapse of some buildings. Natural fibres are prone to fire hazards arising from indiscriminate bush burning especially during the dry season while hunting. They also decay due to weathering and insect attack. In most cases the materials thins out resulting in roof leaks. Wood products because of their availability in most places and ease of working are substantially used and problems identified were breakages and decay. Some of the wood species used are not naturally durable and are often used untreated and even when in service, no attempt is made to apply any preservatives. Such components are often attacked by insect leading to decay. Those used as stanchions or columns for cribs and platforms are prone to either buckling or breakage due to either overloading or the animals charging or leaning on them. Concrete floors crack and pit and this was found to be a combination of poor aggregates, lean mix such as 1:3:6 as against 1:2:4 for livestock floors. (Bengtsson and Whitaker 1986) Animal urine which is acidic also aids concrete floor deterioration. Where they are used, corrosion is a common problem with metal roofing sheets especially around the nail point, which becomes a point of leakage.

**Maintenance culture**

Farmers in the surveyed area recognize the need for farm structures to be in good conditions for maximum efficiency and hence various attempts are made to achieve this. Maintenance culture for farm structures is in three stages. These are repairs, replacement of component and reconstruction of the entire facility. The method used depends on the degree of deterioration or damage that may require attention. In practice the same structure undergoes the three stages though at different times as it ages. At the beginning of a new harvest, some farmers carry out thorough inspection of their crop storage structures and effect necessary repairs while for those for livestock, this is done when a new stock is to received. For mud walls subjected to annual abrasion by rain splash, some farmers have formed the habit of replastering with mud either annually or biannually and in a few instances some farmers have used cement mortar to provide a rather permanent solution. Some have mixed soil with cow dung for floors to increase adhesion and allow for easy cleaning without removing the compacted soil. The method adopted for cracked concrete floors is to remove and replaster but it was found that the same problem reoccurs because the replastering is often done with the same inferior materials with which the original job was done. Roofs of natural fibers are annually replenished with more materials. The common remedy for wood component is replacement particularly for small diameter logs, which are easily available. Painting and repainting is the panacea for metal products while the use of coal tar and putty for punched roof is practiced. Cutting of fire traces around farm structures particularly in non-residential farms is a very common practice against fire hazard.

**Durability**

Durability in this work was to be assessed from the physical life of the structures after which it is either abandoned or has to be reconstructed to provide further service. Table 3 is a summary of the ages and conditions of the existing structures.

Plate 1: Farm house of mud wall and thatch roof

Plate 2: A livestock yard

Plate 3: A traditional crib

Plate 4: Platform for crop storage

Plate 5: Oil-palm trunk bridge

Structures get abandoned not necessarily because they cannot function but in most cases this is due to change in the crop or animal of interest, which renders a popularly used structure redundant. During the survey, a number of functional livestock buildings were found abandoned because the owners have withdrawn from livestock farming and attempts to either sell or rent them out have proved abortive.

It was also observed that the replacement of some structures especially farmhouses and those for crop storage is not necessarily as a result of the expiration of the physical life.

Farmers claim that the replacement of structure is more or less a decision of the farmer rather than the expiration of the physical life. Increase in family population and improvement in family income often dictate the desire for the replacement of farmhouses rather than the expiration of physical life and when there is change in the crop of interest, a particular. Storage structure may be idle for sometime unless if it can be readily converted for other uses. While farm houses made wholly from natural fibres can be used for between 6 to 12 years, those of mud walls and regularly patched have been used for over 20 years; most crop storage and livestock structures serve for between 10 to 15 years before requiring any major repairs; wooden bridges have also performed well for between 8 and 13 years.

A comparison between a new construction and continuous repair was considered relevant in this work and it was attempted but a conclusion could not be drawn because of non-record keeping culture by most farmers including large scale ones. Most farmers don't even know their investment on farm structures talk less of maintenance.

## CONCLUSIONS

The farm structures commonly used in South Western Nigeria include cribs, barns, platforms, warehouses and silos for crops, and deep litter houses, battery cages, pens, sheds and yards for animal house and farmhouses for the farmers and their household. Farm houses and facilities for crop processing and storage were widespread in the area but structures for livestock were more concentrated in large scale farms as many keepers of small animal population don't consider the provision of animal housing important. Materials of construction are

substantially those readily available within the locality. The various materials are prone to deterioration including erosion of mud walls, weathering and decay of natural fibers and breakage of wooden components. Some attempts are made to solve these problems to ensure their continuous use. Despite the problems associated with the structures and their materials of construction they are quite durable and are likely to remain in use for the obvious reasons of cost and simple handling technology for as long as the technical and economic situations of the farming communities remain unchanged.

## RECOMMENDATIONS

a) Due attention should be paid to the selection of good quality aggregates and correct mix for concrete work
b) There should be adherence to the application of appropriate stress level to guide against structural failure arising from overloading especially in cribs
c) Wood will for quite some time continue to be a major material of construction in farm structures. The use of durable species and efforts to preserve them both before and while in service will protect them against decay.
d) A culture of regular inspection of facilities and not necessarily at the beginning of harvest or when new animals are to be added to existing stock should be cultivated so that problems can be detected at very early stages and rectified at minimum cost.
e) A record keeping culture of farm activities and finances should be developed by all categories of farmers. This will provide appropriate information in planning for the expansion of the farm.

**Table 3: Age and conditions of some Farm Structures in South Western Nigeria**

| Structure | Age of structures in years ( % belonging to each group) | | | Conditions of structures (% belonging to each group) | | |
|---|---|---|---|---|---|---|
| | <10 | 10 to 20 | >20 | Serviceable and in use | Serviceable but unutilized | Unserviceable and abandoned |
| Farm Houses | 10 | 25 | 65 | 80 | 15 | 5 |
| Cribs | 25 | 70 | 5 | 75 | 10 | 15 |
| Barns | 55 | 45 | - | 70 | 30 | - |
| Platforms | 30 | 60 | 10 | 75 | 20 | 5 |
| Warehouses | 10 | 30 | 60 | 70 | 15 | 15 |
| Silos | 5 | 50 | 40 | 40 | 45 | 15 |
| Hutches | 30 | 70 | - | 75 | 15 | 10 |
| Deep Litter Houses | 25 | 60 | 15 | 70 | 25 | 5 |
| Yards and sheds | 40 | 45 | 15 | 70 | 25 | 5 |
| Battery Cages. | 40 | 45 | 15 | 60 | 35 | 5 |
| Pens. | 35 | 50 | 15 | 55 | 30 | 15 |
| Bridges | 40 | 50 | 5 | 85 | - | 15 |

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