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# DEVELOPMENT OF AN IMPROVED DUG CANOE FOR ARTISANAL FISHERY

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## ABSTRACT

*A dug canoe similar to the one commonly used by artisanal fisherfolks 4.82M (LOA) was designed and constructed using locally available materials, as an alternative to hardwood that is becoming very scarce. The canoe have least cost, easy construction, adequate stability, light weight and easy manoeuvrability, as its attributes. The light displacement (weight empty) was 37kg which is light enough in relation to craft of same size commonly used by fishermen. The capacity of the canoe was 210 kg (3 persona) and total production cost of N 18,400 which is not beyond the reach of an average fisherfolk. The craft is small and fall among the category of crafts that account for the greater percentage of national fish landing. The canoe also closely resembles the local fishing crafts, hence easy acceptance by local fisherfolk.*

*Keywords: Canoe, plywood, hardwood, alternative.*

## INTRODUCTION

A canoe is described as a small open vessel whose beam (width) is shallow relative to its length, having pointed bow and stern. The traditional boat operating on kainji lake are easily damaged by the turbulent water condition due to the fact that they are built through concentrating the joint along the same location (Omorodion, 1983) . The traditional dugout canoe and catamaran used for fishing and marine transportation require high-quality hardwood. With deforestation of many tropical coastal areas, these strong, workable, long-lived woods are increasingly scarce in many areas of the world, finding the type of timber needed to build a good quality wooden boat is becoming a problem hence boat construction is a growing problem for many small scale fishermen. Flat bottom crafts are the easiest and cheapest to design and construct, they are also best for use on calm or peaceful and shallow waters (Omorodion, 1983). The fishing crafts used in small scale fisheries in the Nigerian inland and coastal water are mostly wooden canoes. They include dugout, planked and the planked dugout (half dugout canoes). The useful life spans become drastically reduced by pest due to negligence of wood preservative (Udolisa et al; 1998, 1999). In absence of the dugout canoes, local fishermen commonly use the flat bottom crafts due to the fact that it is about the only design the local boat builders can afford to build, it also resembles the traditional dugout canoe, hence they are easily accepted. In recent times, various accidents had occurred in Lake Kainji due to leakages in wooden crafts that have been badly damaged leading to losses of lives, fishing gears and fish catch (Ahmed et al; 2007). Small crafts design should be based on the traditions of a given region, radical departure from the traditional hull designs may not gain local acceptance (NRC, 1988). High quality timber and planks may be replaced by laminated wood composites (ply woods) preserved and sealed with resins. Plywood pieces can be wired together with galvanized soft irons wire and then sealed with epoxy resins in the stitch and glue technique as plywood crafts are strong, light and are used in many parts of the world.

**OBJECTIVES:-** The objectives of this work are to:

- Produce a modern craft that closely resembles the dugout canoe in performance, affordable, watertight and adequately reinforced, to save the fishermen from spending their precious fishing time on bailing out water.
- Find alternative material for production of artisanal fishing crafts as a replacement for hard wood that is becoming increasingly scarce.

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## MATERIALS AND METHODS

### Design

The material used for the design work were the basic drawing tools and materials such as drawing board, HB pencil, T-square Set, square, curve battens of various sizes, meter rule and drawing papers. The construction was achieved with materials such as: 12mm Plywood, 24mm hardwood, fastening glue (top bond), binding wire, wire Nail, accelerated resin, catalyst (hardener) and basic carpentry tools such as hand saw, jig sawing machine, chisel, smooth planner, measuring tape, spirit level, and bevel square, harmer were used for the construction work. A design data was obtained from the freehand sketch of the canoe, which was drawn with a HB pencils, putting in place all the required design lines and making all necessary adjustments. Meter rule was then used to measure the specification of the freehand sketch as described by love (1979). The design data was used to draw the canoe to scale (1: 15.25), with the drawing instruments. The design guide line according to Abubakar (2007) quoting Chappelle (1956), which state that: Beam = length / 5, Depth = ½ beam, and Draft = length / 10 or 20, were adopted to achieve the design. The canoe's layout was drawn on one sheets of plywood maintaining the required sizes and shapes of each part needed to be put together to make the complete canoe. The points were connected with lines using iron square and wooden curve batten to aid marking of proper straight and curved lines respectively with HB pencil.

### Construction

The plywood carrying marked layout was placed on a work table ready for cutting. A jig saw was used to saw along the marks then the pieces for the sides and bottom were cut out of one plywood. 4 strips for side and 3 for the bottom strip making 7 pieces were produced. The sides strips were joined with glue first, and then the 3 pieces for the bottom were also joined. 3 pieces of 25mm hard wood were cut with 60 degrees flair to the sides then fixed to the bottom strip. The 2 full sides were fixed to the bottom strip by drilling holes (3mm) along the edges then 2mm binding wire was used to join the part together twisted with the aid of a player. To the seams a paste of glue and saw dust was applied to seal them off for water tightness and to make the joints stronger. The gunwales were made of 21 x 21 mm batten and fixed with glue and wire nail. After completing the main construction, the hull was fully coated with resin inside and outside. The hull of the craft was sanded off thoroughly then cleaned with a rag to prepare a good surface for painting. After sanding, three coats of oil gloss paint were used to paint the craft allowing one coat to dry before applying the next.

### Determination of specifications

The light displacement (weight empty) was determined by direct measurement of weight of the boat after construction using a spring weighing balance. The capacity of the canoe was determined by direct addition of weight to the boat while floating on water until it carried the maximum weight it could carry.

Displacement was determined as:  $D = LD + DW$ , (Abubakar and Adamu, 2010),

Where:

D = Displacement,

LD = Light displacement, and

DW = Deadweight

The cost of the canoe was estimated based on the local market price of the materials used for the construction in respect of their sizes and specifications. After completion the canoe was conveyed from the college boat building workshop to Kigera III reservoir for testing. It was gently placed on water then allowed to float empty, while being observed for leakage, stability and draft. The capacity was then tested for by allowing one person at a time, until it carried the maximum weight it could carry.

## RESULTS AND DISCUSSION

The specifications of the canoe (Table 2) indicates that the breadth overall (BOA) is 0.65metre which is about 13.48% of the length overall (LOA), while the depth was 0.16metre about 24.61% of the BOA. These specifications are within the range of design guidelines as described by Abubakar (2007), the construction

resulted to the production of a canoe that has the fore and aft look alike. The canoe is light in weight (37kg) in relation to its size, such that one person can carry without difficulty. The light weight gives the canoe increased dead weight, as it floats at a shallow draft leaving greater part of the canoe above the water line as free board thereby increasing its capacity to carry more loads. The construction process utilized a sheet of ply wood leaving no leftovers, so the work achieved maximum utilization of materials. The cost of construction (Table 3) was N18, 400 which is affordable in relation to the cost of local canoe of same size based on the National Survey of fishing crafts (NIFFR, 2002). The canoe carried a maximum of 3 persons (plate 5) with average weight of 70kg and was easily maneuvered when propelled by paddling as it floated at a shallow draft; this makes the canoe adequate for use on shallow water bodies such as ponds, reservoirs and lakes. Such easily maneuvered craft can also be used on pond or reservoirs for recreation which include, sport fishing and canoeing.

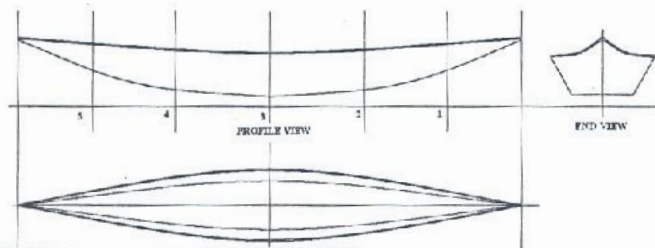


FIGURE 1: DESIGN SKETCH

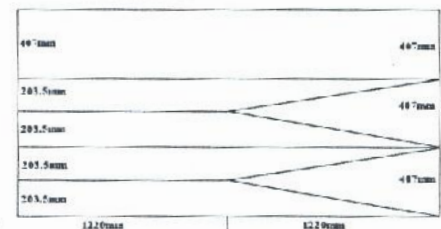


FIGURE 2: DESIGN LAYOUT

Table 1: Design data(m)

Design ordinates	Sections				
	1	2	3	4	T
Keel/chine HA/B	0.46	0.052	0.026	0.052	0.46
Chine H/B	0.14	0.156	0.195	0.156	0.14
Sheer HA/B	0.46	0.43	0.39	0.43	0.46
Sheer H/B	0.14	0.235	0.28	0.235	0.14

Table 2: Specifications of the Canoe

Length overall (LOA)	4.82m
Breadth overall (BOA)	0.65m
Moulded depth	0.16m
Draft	6cm
Light displacement	37kg
Deadweight (capacity)	210kg (3 persons)
Displacement	247kg
Scale	1:15

Table 3: Scantling sizes and cost

Material	Size	Quantity	Unit	Amount N
Plywood	12mm	1sht	2,500.00	2500.00
Hardwood	25X25mm	1No	1200.00	1200.00
Binding wire	2mmroll	3rl	100	300.00
Wire nail	Assorted	1lb	200.00	200.00
Glue	1kg	3kg	400.00	1200.00
Gloss paint	gal.	2gl	2250.00	4500.00
Resin and reagents		5kg	1000	5000.00
Sanding disc	No	2	250	500.00
Labour cost				3,000.00
Total cost				N18, 400.00

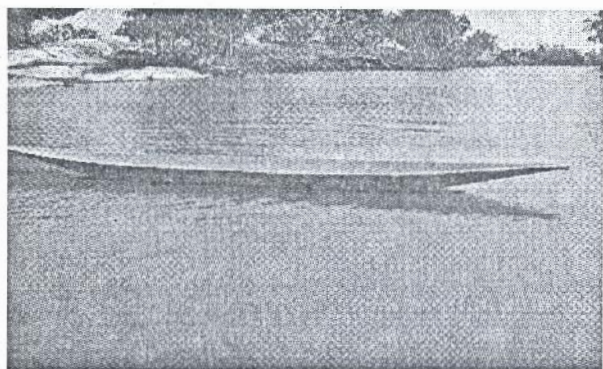


PLATE 1: COMPLETED CANOE PLACED ON WATER



PLATE 2: THE CANOE WITH THREE PEOPLE ON BOARD

## CONCLUSION AND RECOMMENDATIONS

The canoe, have light weight, least cost, ability to float at a Shallow draft, adequate stability and easy maneuverability as its attributes. These important qualities are adequate for an artisanal individual fishing craft needed for activities on inland water bodies.

This craft is recommended to replace the local fishing canoes and also for use on fish ponds, reservoirs and any other large aquaculture system.

It is recommended that same technology be used to construct larger canoes for use on bigger water bodies, to replace those local canoes that are characterized by short lifespan and low capacities.

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