

## Contribution of Mortar and Pestle Production to Rural Livelihood in Southwest Nigeria

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**Abstract:** Traditional knowledge of wood utilization as cookware is acknowledged in nature and science but evidence relating to its direct contribution to livelihoods and household income is often overlooked. Mortar and Pestle (M&P) production contributes to livelihood improvement and household incomes in most rural areas adjoining natural forest and forest reserves. However there is paucity of information on its contribution to rural livelihood. This study provides such information on production and trade of M & P in southwest, Nigeria. Primary data was generated mainly from pre-tested structured questionnaires and field observations among producers and marketers. The results showed that majorities (73.3%) of the producers were married, which made M & P production a stable enterprise in the study area, 40% of the respondent families were as large as 6-9 in number, 22.2% (1-5) and 26.7% (10-14), about 89% of the respondent fell within the age group 18-50 years. More than half (55.6%) of the respondents had no formal education, while the rest had formal education: primary (33.3%), secondary (6.7%) or post-secondary education (4.4%). Wood species used include *Milicia excelsa*, *Vitellaria paradoxum*, *Daniella olliveri*. The study further revealed the mean annual profit to be ₦40, 260.33. This implies that investment in M & P production is worthwhile. In addition, the cost benefit ratio (CBR) in the study areas was 1.79. While the mean RORI for the three years was 78.07%, this value indicates the profit potentials of the enterprise. Apart from generating income to local artisans, M & P production facilitates long-term locking-up of carbon in utilized wood thereby contributing to carbon sequestration; it is also an important material for indigenous food preparations.

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### 1. Introduction

A mortar is a cylindrical-shaped wood bowl with a hollowed-out interior cut out of the stem used to pound boiled yam to produce pounded yam and grinding of other food substances among many tribes in Nigeria. A pestle is a club-shaped 2–3 meters long tree stem with 3–6 centimeters diameter used together with a mortar to prepare pounded yam. Mortar and pestle can also be used to bash, crush or grind fresh herbs, dried herbs, spices, garlic, nuts and pepper (Schick *et al.*, 2008, Njoh *et al.*, 2014). Mortar and pestle are made from tree stumps and logging waste after harvesting of timber natural forests. Okrah (2002) noted that carvers used to log trees from farms and the surrounding villages and carve into mortars, combs, wooden cooking utensils, drums and other traditional products like stools and ayò (a traditional game). While (Ogunsanwo *et al.*, 2007) observed that tree species such as *Milicia excelsa* Welw. C.C Berg, *Chenopodium ambrosioides*, *Vitallaria paradoxum* are used in making mortar and pestle in southwest Nigeria.

Mortar and Pestle (M&P) are important in the culture of many tribes in southwest Nigeria. They are used for crushing, pounding or grinding substances among local communities and traditional herbalist in preparation of food and drugs respectively. They are

used for the processing of cereal foods, soup ingredients and condiments. They are made in different designs and sizes using different wood species obtained from natural forests. M & P making sometimes classified as part of wood carving is an important economic activity in Southwest Nigeria (Aiyeloja, 2007) providing full time employment to several people especially the Hausa Fulani who are predominant in the production. Unlike in many parts of Nigeria, where the use of traditional pounding and girding instruments has given way to electronic pounding and grinding type of food utensils, most areas in southwest Nigeria still have a rich cultural food preparation tradition using M & P. In Cameroon it is used in the pounding of millets and maize, dried cassava to cassava flour, *Gnetum africanum*, *Colocasia sp* “Achu” and pounding cassava “water fufu” (Njoh *et al.*, 2014) . While in Ghana carbohydrate-rich food such as maize, cassava, yams, cocoyam and plantains are processed for considerable duration via repeated kneading and/or pounding with M & P (Mensah *et al.*, 2012).

Mortar and pestle have been observed as major wooden cookware in urban and rural areas in Nigeria. However, most studies on mortar and pestles have been largely directed towards biological structure (wood) which produced them rather than the

contribution to livelihood. Literature is replete of the impact studies of wood carving, mortar and pestle production on the forest ecosystem (Okrah, 2002; Aiyelaja, 2008; Njoh *et al*, 2014). Preferences for specific wood species use in mortar and pestle by suppliers, manufacturers, retailers and consumers (end-users) have been reported by Mensah *et al*, (2012). The density, population structure and regeneration status of six tree species utilized for M & P were investigated in Cameroun (Njoh *et al*, 2014).

Several works subsume mortar and pestle in wood carving in their assessment of its contribution to household income (Belcher *et al* 2002, Chibnik 2003, Obara, *et al* 2004 and Ruiz-Pérez *et al* 2004). Wood carving provides significant household income for about 300 000 dependents in Kenya, and in South Africa and Central Valley area of Oaxaca, Mexico it contributes around USD 500-2000 and USD 2500 per year respectively (CIFOR, 2002). Wooden mortars and pestles making is an important livelihood activities in most of the communities in the Takamanda rainforest (Njoh *et al*, 2014). NTFPs have marked cultural significance and value in their lives (Shackleton and Shackleton, 2004), they also provide financial returns from trade depending on resource type and hours worked, they provide an important contribution that complements the diverse livelihood strategies within a household, especially for the poorer

sectors of rural society (Shackleton and Shackleton, (2000), Larinde and Olasupo (2011), and Larinde, *et al* 2013).

Wood carving apart from providing source of income to local artisans worldwide facilitates long-term locking-up of carbon in carved wood thereby mitigating climate change. Continued use of mortar and pestle in the making of pounded yam in southwest Nigeria, has raised concern about the supplies of the tree species used for making these forest product, the socio-economic impacts and the ecology of the natural forests where they are exploited. A key concern by food scientist and technologist is that despite the advent of pounders and grinders which are automated machines, most consumers of pounded yam still prefer the one made from mortar and pestle, thus keeping the producers in business. The need to address the concern provided the impetus to carry out this study. Without such analyses, it is impossible to ascertain their contribution to poverty alleviation as a small scale forest enterprise. As such, it is important to evaluate their contribution to the economy as a prerequisite for developing sustainable use and management strategies for the raw material (wood species).

## 2. Materials and Methods

### 2.1 Study Area

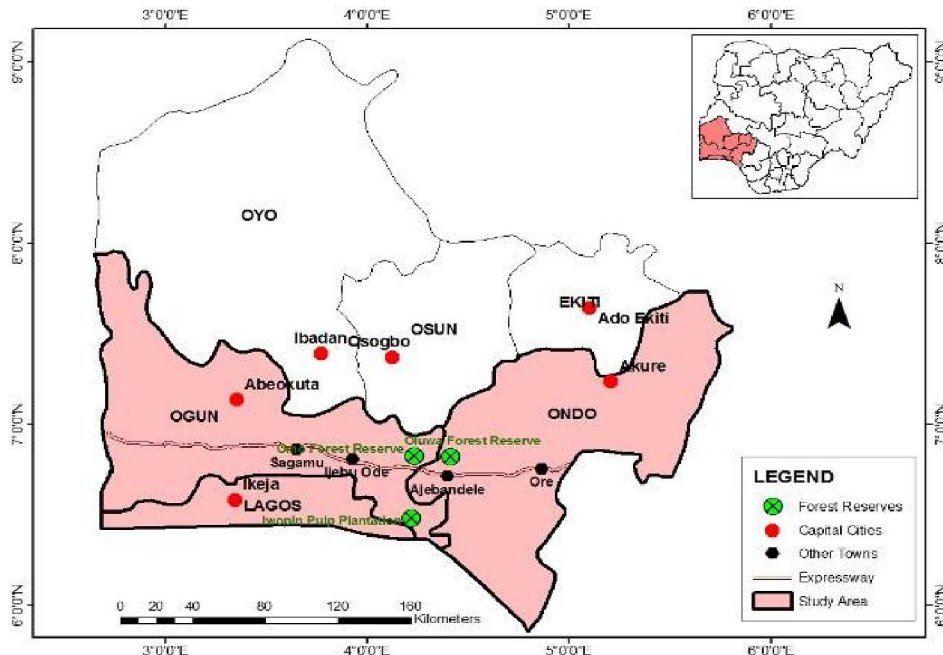


Figure 1: Map of South-west Nigeria showing the study area.

The study was carried out in Lagos, Ogun and Ondo State areas of the South-Western zone of Nigeria. South-Western Nigeria lies between longitude  $2^{\circ} 12'E$  and  $6^{\circ}E$  and between latitude  $6^{\circ} 21'N$  and  $8^{\circ}$

$37'N$  (Agboola, 1979) with a total land area of  $77,818\text{km}^2$ . The predominant vegetation in Southwestern Nigeria ranges from Coastal belt of mangrove swamp forest especially Ogun water-side

area, Igbokoda, Ilaje and Ijaw in Ondo State and Epe area in Lagos State through tropical rainforest that spread across southern part of Ogun, Oyo, Ondo and Ekiti states and covered by savanna in the northern parts of Oyo, Osun and Ekiti States. The area which has 85 constituted forest reserves with a forest area cover of 842,499 hectares is endowed with natural forest resources and mineral deposits with extensive fertile soils (FORMECU, 1998). The area is bounded in the East by Edo and Delta states, in the North by Kwara and Kogi states, in the West by the Republic of Benin and in the south by the Gulf of Guinea. While the climate is tropical in nature and it is characterized by wet and dry seasons, the temperature ranges between 21°C and 34°C while the annual rainfall ranges between 1500mm and 3000mm. The wet season is associated with the Southwest monsoon wind from the Atlantic Ocean while the dry season is associated with the northeast trade wind from the Sahara desert.

## 2.2 Data collection

Purposive sampling technique was used to select the areas well noted for the sale of mortar and pestle. The respondents that were sampled for the study comprise of artisans who produced mortar and pestle in the village farms. A multistage sampling technique was used to sample the targeted marketers. Three Local Government Areas (LGAs) were randomly selected in each State; while 5 respondents were selected from each of the three LGAs making a total number of 45 respondents. Snow balling technique through referrals by early respondent was used to locate the 5 respondents from each of the local government areas.

Primary data was generated from pre-tested structured questionnaires and field observations. Information was obtained on the demographic characteristics of the respondent, economic value of the product and sustainability of trade in mortar and pestle. This information was supplemented with secondary data from journals, books and institutional documentaries. The main problem of the study was that little has been done on this field in Nigeria so it was difficult to find related literature to support the evidence gathered. In addition, there are no documented figures on quantities of production and sales by forestry department in Nigeria.

## 2.3 Data Analysis

Data collected were analyzed with non-parametric statistical methods (descriptive statistics like percentage and frequency). The viability of the business was determined using the Benefit-Cost analysis at 14% discount rate. The formula is represented by;

$$B/C = \frac{\sum_{t=0}^{t=n} \frac{R_t}{(1+r)^t}}{\sum_{t=0}^{t=n} \frac{C_t}{(1+r)^t}}$$

Where, R<sub>t</sub> = revenue over time t

C<sub>t</sub> = cost over time t

r = discount rate

1 = constant

t = 3 years.

The profitability of the business was determined using Net Income (NI) method while Rate of Return on Investment (RORI) was used to determine how quick the money invested on the enterprise could be realized. The formulae are represented by;

Net Income (NI) = Total Income (TI) – Total Cost (TC)

$$RORI = \frac{TR - TC}{TC} \times \frac{100}{1}$$

Where, TR = Total Revenue

TC = Total Cost

## 3. Results

### 3.1. Socio- economic Characteristics

The results showed that majority (73.3%) of the producers were married, 15.6% were single, while (8.9%) were widowed and 2.2% divorced. This means that married people were more involved in mortar and pestle production and are likely to receive assistance from their spouses and children in carrying out some activities such as moving logs from the forest to the homestead or finished products to market place on the road side. This was further confirmed by the family size (Table 1), 40% of the respondent families were as large as 6-9 in number, 22.2% (1-5) and 26.7% (10-14), some of the children were involved in sand-papering to smoothen mortar and pestle, and they also assisted in cutting and debarking of wood used in pestle making. Also in Table 1, the modal age group was 18-40 years with frequency of about 49%. Specifically, 6.7% were aged 18 years or less; 40% were in the age group 41-50 years and 4.4% were above 50 years. This implies that about 89% of the respondent fell within the age group of 18-50 years. This conforms to expectation that a young man of 18 years is old enough to fend for himself; also the age bracket is an indication of the years when farmers and rural dwellers are more active and productive. In terms of education background (Table 1), more than half (55.6%) of the respondents had no formal education, while the rest had formal education: primary (33.3%), secondary (6.7%) or post-secondary education (4.4%). This implies that learned people were not too involved

in mortar and pestle production because the mode of learning the skills is informal, which is in support of a priori belief that educated ones tend to migrate to the cities in search of white collar jobs while the illiterates remain in the village and live on the forest resources

both timber and non-timbers. The respondents' level of education is no doubt a pointer to the continued use of rudimentary and primitive tools despite the fact that wood turning lathe machines can effectively do the production even at a faster rate.

Table 1: Demographic Characteristics of the Respondents in the Study Area

Demographic Characteristics		Frequency	Percentage
Marital Status	Single	7	15.6
	Married	33	73.3
	Divorced	1	2.2
	Widow	4	8.9
	Total		100
Family Size	1-5	10	22.2
	6-9	18	40.0
	10-14	12	26.7
	14 and above	5	11.1
	Total		100
Age (years)	Under 18	3	6.7
	18-40	22	48.9
	41-50	18	40.0
	51 and above	2	4.4
	Total		100
Education	Non formal education	25	55.6
	Primary education	15	33.3
	Secondary education	3	6.7
	Technical college	2	4.4
	Tertiary education	-	0
	Total		100

Table 2: Economic Analysis of Mortar Making

Year	Cost(₦)	Benefit(₦)	Annual Profit(₦)	(1+r) <sup>t</sup> -14%	Discounted cost(₦)	Discounted Benefit(₦)	ROR (%)	B/C
2010	0	0	0	1.14	0	0	-	1.79
2011	48860	85070	36210	1.299	63469.14	110505.93	74.11	
2012	51432	91549	40117	1.48	76119.36	135492.52	78.00	
2013	54139	98593	44454	1.69	91494.91	166622.17	82.11	
TOTAL	154431	275212	120781	5.609	231083.41	412620.62		
Mean	51477	91737.33	40260.33				78.07	

Table 2 showed the analysis of cost and benefit from mortar and pestle production between 2011 and 2013. The average cost on M & P production was ₦48860, ₦51,432 and ₦54,139 in 2011, 2012 and 2013 respectively while the average benefit was ₦85,070, ₦91,549 and ₦98,539 respectively. While the mean cost for the period under study was ₦51,477 and mean benefit was ₦91,737.33. The study further revealed the mean annual profitability of ₦40,260.33. This implies that investment in M & P production is worthwhile. In addition, the cost benefit ratio (CBR) in the study areas was 1.79. Since the cost benefit ratio is greater than 1, M & P production is viable. The rate of return on investment (RORI) was 74.11, 78.00 and 82.11 percent for the year 2011, 2012 and 2013 respectively, while the mean RORI for the three years

was 78.07%, this value indicated the rate at which money invested could be realized.

**3.2. Wood Species Use in Production**

Despite the abundance of different species of wood in the study area, not all species of wood are used in production, evidences suggest that suitability and not availability of species is the most important influence on choice of wood for the manufacture of M & P. The main determinants of preference of these species apart from availability are durability (plates 3 and 4), workability and customers demand. The producers were of the view that these species are durable and are able to withstand harsh weather and insects attack. Producers harvests timber from farmland, free forest areas and natural forest. Both straight and crooked wood is useful. Results showed



that wood species used include *Milicia excelsa*, *Vitellaria paradoxum*, *Daniella ollivera* (Table 3).

Table 3: Tree Species used in Production of Mortar and Pestle in the study area

S/N	Species	Family	Trade name	Articles Produced	Other uses
1	<i>Milicia excelsa</i>	Moraceae	Iroko	mortar and pestle,	Timber/ Axe handle
2	<i>Nauclea diderrichii</i>	Rubiaceae	Opepe	mortar and pestle	Timber/ Ladle
3	<i>Pterocarpus soyauxii</i>	Fabaceae	Camwood	mortar and pestle	Timber/Medicinal
4	<i>Irvingia gabonensis</i>	Irvingiaceae	Bush mango	mortar and pestle	Condiment/medicinal
5	<i>Vitellaria paradoxum</i>	Sapotaceae	Shea butter	mortar and pestle	Condiment/Medicinal
6	<i>Daniella ollivera</i>	Caepinaceae	Iya	mortar and pestle	Wooden spoon

### 3.3. Wood Quality Requirement for Production

Due to the tremendous repetitive stress placed on the mortar by the force of impact of a pestle during use, mortar requires extremely hard and durable wood capable of absorbing the applied force without developing cracks. The ideal pestle were made from wood that possesses tremendous strength, have high durability and exhibits low sensitivity to moisture. The wood must also be fungi and insect resistant.

Wood used in the production of mortar are usually hard wood species but easy to hollow out and carve into a desired shape without damage; medium-heavy in weight thus easy to carry (portable) and withstand pounding effects; easy to sundry without warping and cracking; stable fiber and colouration unblemished to substance being pounded. Above all it must be available in the vicinity where production takes place. The wooden mortars and pestles are made in different sizes and shapes based on the use, basically into large, medium and small sizes (Plates 1 and 2). The larger mortars and pestles are used in pounded yam by food vendors and in processing and grinding of millet, maize and other grains while the medium and smaller sizes are used for spices preparation and medicine crushing.

### 3.4. Tools use in Production

In most situations input costs are low, other than labour and in some instances transportation. M & P are worked and carved using small hand tools—small and long axes, cutlass, chisel scraper, pocket knife, etc.

### 3.5. Trade and marketing

Wooden mortars and pestles making provides full and part time employment for the local inhabitants. There are no distinction between producers and marketers in all the tree state studied except for Lagos state where we have marketers who are not producers, the reason may be as a result of depleted forest resources in Lagos state due to cosmopolitan nature of the state, Lagos state was the former capital of Nigeria and is still the commercial nerve of Nigeria. In order to meet the need of users of M & P, the product market route is the Ore/Ijebu-ode

express way to Lagos hence most producers from Ondo and Ogun states display their products along the express way for end users.

Sales of M & P takes place in local and regional markets, including within communities and between neighbouring states, e.g. roadside. The producers sell directly to users. Most producers have been in the business for a limited period and tend to view it as additional occupation outside farming. Sometimes they are manufactured in roadside stalls; they have flexible working hours and undertake much of their production at or near home.

### 4. Conclusion and Recommendation

The economics of M & P production is a veritable part of local value chains which are characterized by a limited number of stages between production, trade, and end use. These phenomena coupled with small start-up capital makes it easy to establish by would-be entrepreneurs. The viability of this venture is not in doubt. This has been succinctly shown by this study that M & P production in the study area is profitable. Mortar and pestle production provides livelihood benefits because the producers and marketers have been able to secure a living for themselves, albeit marginal, without support from government. They have been able to look after their families and meet their basic needs. They represent a few hundred people who would have being unemployed. Hence it is important not to underestimate the role they play in easing poverty and providing additional options for income generation or in meeting specific cash needs such as school fees for the children. Those involved in the trade have an independent source of income; they have their pride and dignity in being able to provide for themselves and their families. Based on the findings of this study, it is recommended that skill acquisition and development centers should be established by the government and Non-governmental Organizations (NGOs) where modern wood working tools will be available and producers could go for refresher courses from time to time in order to enhance their technical capability.



Plate 1: Marketing of Mortar along the express way

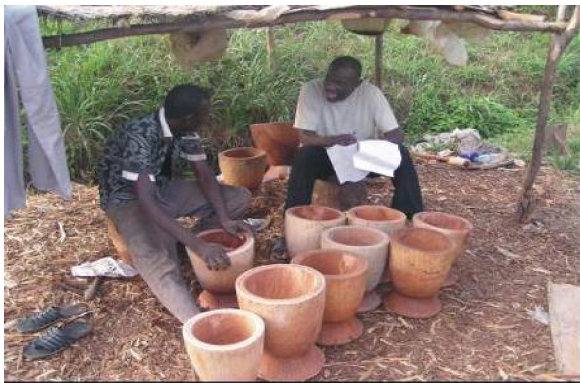


Plate 2: Production of Mortar



Plate 3: 10 year old Pestle



Plate 4: 10 year old Mortar and Pestle

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