Original Research Article

ASSESSMENT OF CHAINSAW MILLING ENTERPRISE IN BENUE STATE,

NIGERIA

Abstract-.

The paucity of information on chainsaw milling enterprise has contributed to poor planning and development of timber resources in Nigeria. This study has accessed the marketing efficiency with a view of evaluating its potential contribution to the livelihoods and economic development of Benue State. Multistage sampling technique and purposeful sampling technique were applied to determine the study sample which was drawn from the three geopolitical zones in the State; Zone A, Zone B and Zone C. Applying a sampling intensity of 30%, seven (7) Local Government Areas (LGAs) were sampled from the 23 LGAs of the State for the study. Based on this arrangement 79 chainsaw millers were selected and interviewed on the trading activities. Data were collected and analyzed using descriptive statistics such as percentages and frequency distribution. Also gross margin analysis, marketing margin, marketing efficiency, Analysis of variance, T-test Statistics, Index of market concentration (IMC), and Rate of return on investment (RORI), Gross Ratio (GR) were used in the determining the profitability and the efficiency of chainsaw millers trading efficiency in the study area. The study revealed that the trade is male dominated having 100% of the respondents as males. Similarly, the indigenous groups dominated the chainsaw milling and with the Tiv having the majority of (65.8%), this was followed by the Idoma (13.7%), Igede, (12.5%) and Igbo (5.5%), Igala and Sura 1.4% each. The study identified 18 timber species that were marketed in the study area and that 2,411, 37,733, and 69,492 volumes were marketed in zones A, B and C respectively. The result of the gross margin and market efficiency showed that that the chainsaw milling activities are profitable and efficient. It revealed the mean monthly gross margin (GM) of 39,688.00, 128,730, and 84,000 with corresponding RORI of 84.19, 43.93, and 1.80 for the chainsaw millers. The Analysis of Variance (ANOVA) of GMs were significant with 0.013. The Total Revenue and Total Variable Cost (TVC) equally showed significance with 0.045, 0.000, 0.000. The IMC, Gini coefficient of 0.1891, 0.3218 and 0.1829, indicating that the concentration was low with income inequality but with a competitive market.

Keywords: Chainsaw milling, marketing efficiency, market concentration.

1   INTRODUCTION

Nigerian forests support a wide range of forest industries, both the formal and informal

sub-sectors, which a vast majority of the Nigerian populace depends on for their

39   livelihood (FAO, 2009; Akpabio *et al.,* 2013 (1,2). According to Fuwape (3) and FAO

40   (4), the sub sector has contributed significantly to the socio–economic development of

41   Nigeria; ranking among the highest revenue and employment generating sectors.

42   Ofoegbu, (5) and Bichi (6) asserts timber resources and timber trade has been a major

43   contributor to the national gross domestic product (GDP) and thus a formidable tool for

44   poverty alleviation. This is evident in the direct and far-reaching influences of the forest

45   to livelihoods as the available forests are continually diminishing in the presence of

46   rising human population and demand; this has unequivocally increase pressure on the

47   forest resource base of the nation. (7, 8, 9,10).

48   Chain sawmilling in Nigeria is a fully fledged economic informal sector that

49   generates income for a range of participants in the timber trade chain, including rural

50   people, transporters and urban traders (Wit *et al.,* 2010). Chainsaw milling is the

51   method used in log conversion into boards after felling at the stump site before

52   evacuation from the forest using the chainsaw machine. According to Popoola (2010),

53   chainsaw milling is unauthorized and illegal in Nigeria but the operators illegally gain

54   access to the forest, fell the trees, convert them to boards of various dimensions and

55   hurriedly hand-carry them to the nearest road for transportation to timber markets.

56   According to Muthike *et al.* (2013) chainsaw milling is a legal and important

57   subsector of the forest industry that supports rural livelihoods in some countries while

58   in many others, it is associated with illegal forest activities.

59   In Nigeria, though the system is illegal, it is permitted under some regulations,

60   restricted to domestic use only while in other countries it is only permitted for small-

61   scale commercial production. This operation is common mostly during illegal felling

62 and flitching activities especially in the rainforest zone of Nigeria. According to Sambe

63 (14), chainsaw milling is rampant and dominates the timber trade in Benue State

64 situated the guinea savanna zone. Its activities are often difficult to monitor due to the

65 large number of people involved and the small size and mobility of its operations even

66 when it is authorized (11).

67   Chainsaw milling operation though illegal has some advantages. The operation

68 requires little investment and the cost of purchase of equipment is very low compared to

69 that of establishing a sawmill. It could be used in conversion of low quality logs and

70 isolated trees. Aside that this operation is illegal; it is a wasteful practice that produces

71 low quality timber, reduces the revenue accruable to the government, causes a great

72 harm to the environment and loss biodiversity and sustainability of forest resources

73 (15,16).

74 The operation is very suitable in difficult terrain and areas that are inaccessible in the

75 forest while the use of heavy equipment like tractors, skidders, and the cost of other

76 installations are replaced by cheap and direct labour in the evacuation of sawn boards

77 (17). Chainsaw milling operations supplies cheap wood to local markets which in turn

78 sells them at cheaper prices. A study by Ogunsanwo *et al*, (18) revealed that sawn-chain

79 planks are sold at lower prices in local markets compared to those produced from

80 conventional sawmills. This effect could be attributed to the fact that the boards

81 produced from chainsaw milling operations are usually re-processed by consumers

82 before they could be used effectively in production. In most states of Nigeria, chainsaw

83 milling has been identified as an illegal enterprise, however in Benue State its use is

84 permitted under certain restrictions or regulations are adhered to.

85 Legislations that disapprove the activities of chainsaw milling operators are already

86 being compromised and standards have been lowered. Several factors that resulted in

87 this development were identified by Popoola (12) as:

88 • Depletion of timber resources that made investments in establishment of formal
89   sawmills unattractive.
90 • Rising transportation cost of logs to the sawmill
91 • Huge capital requirement for the establishment of formal sawmills have
92   increased by 1,000 – 5,000% since 1985;
93 • Unreliable power supply from the national grid and ever-increasing cost of
94   diesel and petrol;
95 • Increasing fees and charges paid by timber contractors and formal sawmilling
96   operators without commensurate returns; and corruption among forestry
97   officials.

98 He posited that as result of these factors, many sawmills in Nigeria have resorted to

99 the use of chainsaws to the extent that they now seek to be recognized by their

100 respective State Forestry Departments. He also noted that while many are seeking to

101 legalize the operation of chainsaw milling in Nigeria, another West African country like

102 Ghana have placed a ban on it since 1998.

103 The income from chainsaw operations represents a substantial proportion of

104 household income which in some cases is much higher than income from alternative

105 work. This corroborates report by Popoola (12) in a study on chainsaw milling in Benue

106 State that though chainsaw milling is illegal in the state, it provides employment for

107 both families and hired labor, thereby improving household and social well-being. He

108 noted that, the wages earned compare favorably with those of the average skilled

109 worker, and are far higher than the less than US$1 on which more than 60% of

110 Nigerians subsist. According to Ten Brink *et al.,* (19) a healthy forestry sector can lead

111 to the attainment of long-term socio-economic development that can promote social

112 equity, poverty eradication, and human well-being of the people.

113 Studies on chainsaw milling activities are therefore invaluable and expedient in

114 providing information relevant in repositioning the sector and addressing the challenges

115 that chainsaw milling pose to sustainable development of the forestry sector of the

116 economy. Thus, developing the forestry sector requires market information on the

117 performance of marking activities of this industry. Hence the lack of regular market

118 information and data on the local, national and international markets is responsible for

119 inefficient market system timber trade in Nigeria and Benue State in particular.

120 Therefore, this impedes the drawing up of plans for sustainable forest management and

121 development. According to FGN, (20) inadequate data base remain a major constraint to

122 forest policy formulation, project planning and implementation of forestry development

123 program.

124 Thus information on income, market concentration, species and volumes marketed can

125 serve as a springboard for addressing inefficiencies in the marketing system and hence

126 stimulate policy measures for repositioning trade of timber in the state. It will also

127 encourage and trigger investment in the development of the sector, and stimulate policy

128 response for the sustainable management of forest resources. These considerations

129 therefore justify the need for this study.

130 **2   METHODOLOGY**

131 **The Study Area-.** The study was carried out in Benue State, located at longitudes 6°35'

132 E and 10°E and latitudes 6° 30' N and 8° 10' N within the guinea savanna area of

133 Nigeria with a total land mass area of 30,955 km^2 (21). The state has twenty-three local

134 government areas (LGAs) with a total population of 4,219,244 as against 2,780,398 in

135 1991 (22).

136 Benue State has a tropical sub-humid climate, with two distinct seasons, namely the wet

137 and dry seasons. The wet season lasts for seven months; from April to October while

138 the dry season lasts from November to March. The annual rainfall total ranges from 200

139 to 2,000 mm. Temperatures are generally very high during the day, particularly in

140 March and April. Along the river valleys, these high temperatures plus high relative

141 humidity produce clement/debilitating weather conditions. Benue State lies in the

142 southern Guinea Savanna. The natural forest types and their distribution show three

143 distinct types namely trees/woodland/shrubs, lowland rain forest and riparian forest.

144 However, the percentage coverage of this natural forest is very small relative to the

145 major land use in Benue state (23).

146 Dense forests are few and far apart, except in a few local government areas such as

147 Vandeikya, Kwande, and Okpokwu (24). In these forests, typical rainforest trees such as

148 *Khaya grandifoliola* (mahogany), *Terminalia superba*, (Afara) *Milicia excelsa* (Iroko),

149 *Triplochiton scleroxylon* (Obeche), etc. occur and are used for timber. Other economic

150 trees in these forests include *Dacroydes edulis* (African pear), *Irvingia gabonensis*

151 (bush mango or ogbono), bamboo, raffia palm, *Elaeis guineensis* (oil palm), orange, and

152 *Cocus nucifera* (coconut) (25).

153   The study population comprised chainsaw operators in Benue State. Multistage

154 sampling technique, purposive sampling and complete enumeration were applied to

155 determine the study sample drawn from the three geopolitical zones in the state; Zone

156 'A', Zone 'B' and Zone 'C'. Applying a sampling intensity of 30%, seven (7) LGAs

157 were sampled from the 23 LGAs of the state for the study. Thus two (2) LGAs in zone

158 A, two (2) in B and three (3) in zone C were purposively sampled based on the

159 concentration of timber markets and trading activities. These LGA's were Konshisha

160 and Kwande, in Zone A., Makurdi and Gboko in Zone B, Otukpo, Okpokwu, and Oju in

161 Zone C. From these LGAs, respondents from the population; chainsaw millers and were

162 sampled for data collection. Thus, Chainsaw millers were selected using 30% sampling

163 intensity in these locations. Based on this arrangement 79 chainsaw millers were

164 selected and interviewed on the trading activities.

165 **2.1 Data Collection Techniques-.**

166 Data were collected from two sources: The primary and secondary sources. The primary

167 sources included questionnaires, personal observations and focus group discussions. A

168 semi-structured questionnaire was designed and administered on chainsaw millers from

169 the sampled LGAs namely Kwande, Konshisha, Gboko, Makurdi, Otukpo, Okpokwu

170 and Oju to elicit relevant information for the study. Thus the chainsaw millers were

171 interviewed for the required information.

172 *2.1.1 Analytical Techniques-.* Combinations of statistical and budgetary tools were

173 used to analyze the data. The descriptive statistics: mean, percentage, tables, frequency

174 distribution, and standard deviation were used. Marketing Efficiency, The Rate of

175 Return on Investment (RORI), Gross Ratio, Gross Margin Analysis, Gini coefficient

176 and Lorenze curve and T-test and Analysis of Variance (ANOVA) and were used.

177   *2.1.1.1 Determination of marketing efficiency-*. Marketing efficiency refers to

178   maximization of the ratio of output in marketing. This study adopted Olukosi and Isitor

179   (26) technique in marketing efficiency. This is represented by equation 1 as:

180     $$\text{Marketing Efficiency} = \frac{Total\ Revenue}{Cost\ of\ Marketing} \times 100\% \dots\dots\dots\dots\dots\dots\dots\dots\ (1)$$

181   Total Revenue = Gross income
182   Cost of Marketing = Total Variable Costs.
183
184   *2.1.1.2 Gross margin-*. Gross margin is defined as the difference between Gross Income

185   (GI) and Total Variable costs (TVC). According to Tee (2007), the model is as follows.

186   GM= GI– TVC (2)

187   Where: GM = Gross Margin; GI = Gross Income, an equivalent of Total revenue;

188   TVC = Total Variable Costs (Transportation, Tariffs, Association levies,

189   permits, tax, loading/offloading etc.).

190   *2.1.1.3 Gross ratio* (GR)-. This is the total expenses divided by the gross income (GI),

191   given as:

192   GR = GC/GI or TVC/GI…………………………………………………… (3)

193   The ratio shows the percentage or proportion of total physical cost that constitutes the

194   gross income. A less than 1 ratio is desirable for any production business. The lower the

195   ratio the higher the return per Naira invested. The gross cost and gross income values

196   calculated above are applied in this equation for the determination of gross ratio.

197   *2.1.1.4 Rate of return on investment (RORI)-*. The Rate of Return on Investment (RORI)

198   depicts the level of profitability of an investment and is an important criterion in

199   determining the choice of investment. According to McCarthy (27), Arene (28) and

200   Alao and Kuje (29), it is given by the following relationship:

201   RORI = <u>TR – TC</u> x <u>100</u>   (4)

202   TC   1

203 where: TR= Total revenue, an equivalent of Gross income (GI)

204   TC= Total cost, an equivalent of Gross cost (GC).

205 Thus, Eq. (4) becomes:

206   RORI = $\underline{GI - GC}$ x $\underline{100}$ …………………………………………… (5)

207   GC   1

208 *2.1.1.4 Estimation Procedure for Market Concentration*

209 *Gini coefficient and Lorenz curve:* The Gini-coefficient along with Lorenz curve was

210 used to examine the market concentration of chainsaw millers that is, the measurement

211 of the level of their concentration in the market in order to determine the degree of

212 competition or monopoly in the market. Okereke and Anthonio (30), Bila and Bulama

213 (31) used Gini coefficient to determine the degree of market concentration of sellers of

214 grains markets in Eastern Nigeria and Maiduguri Cattle Market respectively by using

215 the formula:

216       $G = 1 - \sum x Y$ --- (6)

217 Where: G = Gini – coefficient;

218   X = Percentage of sellers per period of study; and

219   Y = Cumulative percentage of total sales (revenue)

220   *G* varies from 0 to 1 expressing the extent to which the market is concentrated. When

221 *G* is equal to zero, there is perfect equality in the size of the distribution of sellers

222 however, when G is equal to one (1), there is perfect monopoly in the market.

223 The Lorenz curve shows the level of concentration in the market. The value of the

224 coefficient is the same as the ratio of the area between the Lorenz curve and the 45° line

225 to the total area above or below the line. When there is perfect equality in the size of

226 distribution of sellers in the market, the curve coincides with the 45° line. The farther

227 away the curve is from the 45° line, the greater the level of concentration in the market.

228 A perfect equality in concentration (low) of sellers is expected if G.C tends towards

229 zero, while perfect inequality in concentration (high) of sellers is expected if *G.C* tends

230 towards one. If *G.C*= 1, market is imperfect and if *G.C*= 0, market is perfect and

231 competitive. Lorenz Curve was used to give a visualized nature of the sellers'

232 concentration in the markets through a graphical representation. The graph of

233 cumulative percentage of total sales is plotted against the cumulative percentage of the

234 sellers. It is used in economics to describe inequality in income or wealth (Damagaard

235 and Weiner, 2000). If all individuals are the same size, the Lorenz Curve is a straight

236 diagonal line (45°), called the line of equality, if there is any inequality in size then the

237 Lorenz Curve falls below the line of equality (45°).

238
239 **TABLE 1:** Socio Economic Characteristics of Respondents in the Study Area.

Variable/Category	Chainsaw Operators	
	Frequency	Percentage
Age (Years)		
≤ 30	27	37.0
31 – 40	32	43.8
41 - 50	12	16.5
≥51years	2	2.7
Total	73	100.0
Marital Status		
Married	55	75.3
Single	15	20.5
Widowed	3	4.2
Total	73	100.0

Gender		
Male	73	100.0
Female	0	0.0
Total	73	100.0
Educational Status		
No formal Education	4	5.5
Primary	15	20.5
Secondary	53	72.6
Tertiary	5	6.9
Total	73	100.0
Ethnic Composition		
Tiv	48	65.8
Idoma	10	13.7
Igede	9	12.3
Igala	1	1.4
Igbo	4	5.5
Sura	1	1.4
Total	73	100.0
Working Experience (years)		
≤ 5	22	30.1
6 – 10	29	39.7
11 – 15	16	21.9
≥ 16	6	8.2
Total	73	100.0

240

241 **3.   RESULTS AND DISCUSSION**

242   **3.1 Socio-Economic Characteristics of Respondents in Benue State-.**

243 The result on socio-economic characteristics of respondents is presented in Table 1. The

244 socio-economic variables studied were age, marital status, gender, educational status as

245 well as ethnic group and work experience.

246 The age distribution of respondents showed that 80.8 % fell within the age bracket of $\leq$

247 30 to 40 years, and the remaining 19.2 % were between 41 years and above.   Based on

248 gender, 100% of chainsaw millers were males.

249   Educational status distribution of the respondents shows that the highest proportion

250   (72.6%) of chainsaw millers had secondary education followed by those with primary

251   education (20.5%), tertiary education (6.9%0 while 5.5% had no formal education. In

252   terms of ethnic composition distribution a higher proportion (65.8%) of the chainsaw

253   millers were Tiv, 3.7% were Idoma, 12.3% Igede, 5.5% Igbo while Igala and Sura,

254   constituted 1.4% each. The distribution based on years of experience showed that

255   chainsaw millers, a greater proportion of respondents of 69.8% had ≤ 5 to 10 years

256   while 30.1% had more than 10 years of experience.

257

258   **3.2   Mean Monthly Volume of Trade by Chainsaw millers in the Three**

259   **Geopolitical Zones of Benue State**

260   Table 2 presents the mean monthly volume of timber trade by chainsaw millers in

261   Benue State. The highest mean volume (9,877m^3) of timber traded was recorded in

262   Zone C, this was followed by 6,188m^3 in Zone A and 5,804 m^3 in Zone B. Different

263   numbers of tree species were found among chainsaw millers across the study area. For

264   instance while only 9 and 11 tree species were marketed in Zones 'B' and 'C'

265   respectively, 18 species were marketed in Zone 'A'. Of the species marketed a greater

266   volume of 6,657m^3 from *Milicia excelsa* was traded in Zone 'C', followed by

267   *Gmelina arborea* (1,859m^3) in Zone 'B', *Daniellia olliveri* in Zone 'C' (1,386m^3),

268   *Gmelina arborea* (1,308m^3) and *Lennea bateri* (1,298 m^3) in Zone 'A', *Daniellia*

269   *olliveri* (1,243m^3) in Zone 'B', in that order. The least volume of timber species

270   marketed was *Anogeissus leiocarpa* with 5m^3 in Zone C.

271   Based on grand mean volume of the trade across the Zones , *Milicia excelsa*   with

272   2,287.67m^3, had the highest mean volume of timber species marketed per month,

273 followed by *Gmelina arboreal* (1,260.67m^3), *Daniellia oliveri* (1,192.00m^3),

274 *Pterocarpus erinaceus* (4,86.33m^3), *Tectona grandis* (439.33m^3), *Lennea bateri*

275 (432.67m^3), and *Parkia biglobosa* (273.67m^3). The least volume of tree species

276 marketed across the zones was *Afzelia africana* with 4.67m^3 per month. This was

277 available only in Zone 'A'.

278 On average 7,289.67m^3 of wood (timber) was traded by a timber dealer every month.

279 The highest volume of timber trade was in zone C represented by 9,877m^3. This was

280 followed by 6,1888m^3 and 5,804m^3 respectively in zones 'A' and 'B'. A total of

281 21,869m^3 of timber was traded monthly by the chainsaw millers.

282
283
284 TABLE 2: Mean monthly Volume of Timber Trade by Chainsaw millers across the
285 three Geopolitical Zones in Benue State Between August and October, 2013.

	Scientific Name	Zone A Mean Volume (m^3)	Zone B Mean Volume (m^3)	Zone C Mean Volume (m^3)	Total Volume	Mean of Means Across the Zones
1.	*Milicia excelsa*	62	144	6,657	6,863	2287.67
2.	*Gmelina aborea*	1,308	1,859	615	3,782	1260.67
3.	*Daniellia oliveri*	947	1,243	1,386	3,576	1192.00
4.	*Pterocarpus erinaceus*	436	352	671	1,459	486.33
5.	*Tectona grandis*	353	869	96	1,318	439.33
6.	*Lennea bateri*	1,298	0	0	1,298	432.67
7.	*Parkia biglobosa*	85	724	12	821	273.67
8.	*Syzgium guineese*	466	0	0	466	155.33
9.	*Khaya gradifoliola*	313	138	14	465	155.00
10.	*Dichrostachys cinerea*	0	394	0	394	131.33
11.	*Bombax constatum*	370	0	0	370	123.33
12.	*Anthocliesta djalonensis*	278	0	0	278	92.67
13.	*Ceiba patandra*	40	0	235	275	91.67

14.	*Vitex doniana*	28	0	152	180	60.00
15.	*Anogeissus leiocarpa*	48	81	5	134	44.67
16.	*Tripolchiton sclerexylen*	85	0	0	85	28.33
17.	*Erythrophloem suavolens*	0	0	34	34	11.33
18.	*Belinia gradiflora*	30	0	0	30	10.00
19.	*Terminalia ivorensis*	27	0	0	27	9.00
20.	*Afzelia africana*	14	0	0	14	4.67
	Total	**6,188**	**5,804**	**9,877**	**21, 869**	**7,289.67**

286 **3.3 Analysis of Income of Chainsaw millers in the study area-.**

287 The result of income of chainsaw millers is presented in Table 3. The monthly average

288 gross margin (GM) for chainsaw millers was obtained to be ₦39, 688.00, ₦ 128,730.00

289 and ₦ 84,480.00, for zones A, B, and C respectively. Chainsaw millers in zone 'B'

290 generated the highest mean GM followed by those in zone 'C' and then 'A'. This means

291 chainsaw millers in zone B generated higher incomes followed by those in Zone C

292 while chainsaw millers in Zone A generated the least. Similarly, chainsaw millers

293 RORI of zone A is the highest (84.19 %) but the lowest GR of 0.54 among the zones,

294 followed by those in zone C with a RORI of 61.80 % with the highest GR of 0.62 while

295 zone 'B' had the least RORI in the three zones with a corresponding higher GR of 0.56.

296 RORI measures the speed at which the capital invested is able to yield dividends or

297 profit, GR measures the proportion of the capital in hand that is utilized in off-setting

298 costs. In essence, RORI measures profit level, GR measures the entrepreneur or

299 producer's ability to minimize costs or efficiency in inputs utilization and other costs in

300 production to improve profit. The lower the GR the better is the business, conversely,

301 the   higher   the   GR   the   lower   the   profit   margin.

302   TABLE 3: Gross Margin Analysis of Timber Trade Participants in Benue State

Market Location	Mean Gross Income (₦)	Mean Total Variable Cost (₦)	Mean Gross Margin (₦)	Rate of Return to Investment	Gross Ratio
	Chainsaw millers	*Chainsaw millers*	*Chainsaw millers*	*Chainsaw millers*	*Chainsaw millers*
Zone A	86,828.00	47,140.00	39,688.00	84.19	0.54
Zone B	292,970.00	164,240.00	128,730.00	43.94	0.56
Zone C	221,170.00	136,690.00	84,480.00	61.80	0.62
Total					

303

3.4 Result of analysis of variance (ANOVA) Test for Gross Margin of Chainsaw Millers.

306   The result of chainsaw millers is presented in Table 4 showed a significant value of 0.013

307   at 5% level of significance. This means there is a significant difference (P<0.05) in the

308   gross income of chainsaw millers across the study area.

309   The implication of this result is that there is significance difference in the incomes of

310   chainsaw millers from timber trade is accepted. This means income of chainsaw millers

311   from timber trade across the study area are different; income from one zone being higher

312   than that from other zones. Thus the post- hoc multiple comparisons analysis presented in

313   Table 5 showed that income of chainsaw millers from zone B and is significantly

314   (P<0.05) higher than that of A. It also shows that income from zone B in turn is higher

315   than that of zone C but without a significant difference (P>0.05). From all the profitability

316   indices applied, it is evident that business in the study area was highly profitable.

317 TABLE 4 Results of one way ANOVA of Gross Margin of Chainsaw Millers

	Df	Sum of Squares	Mean Square	F	Sig.
Between Groups	2	9.513×10^{10}	4.756×10^{10}	4.591	0.013*
Within Groups	70	7.253×10^{11}	1.036×10^{10}		
Total	72	8.204×10^{11}			

318 Note: Ns = Not Significant at 5% Probability level.

319   * = Significant at 5% Probability level.

320

321 TABLE 5: Post Hoc Multiple Comparisons Test of Gross Margin of chainsaw millers in

322 the Zones

(I) ZONE	(J) ZONE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
ZONE A	ZONE B	-8.90356E4*	3.01928E4	.015	-1.6389E5	-14185.9921
	ZONE C	-44788.25388	2.68249E4	.272	-1.1111E5	21531.4586
ZONE B	ZONE A	89035.58583*	3.01928E4	.015	14185.9921	163885.1796
	ZONE C	44247.33195	3.05321E4	.390	-31375.0004	119869.6643
ZONE C	ZONE A	44788.25388	2.68249E4	.272	-21531.4586	111107.9663
	ZONE B	-44247.33195	3.05321E4	.390	-1.1987E5	31375.0004

323 Note * = The mean difference is significant at the 0.05 level

324 **3.5 T-test for profitability of Chainsaw milling in Benue State**

325 **3.5.1** *T-test for profitability of Chainsaw milling in Zones of Benue State-.*

326 The result of chainsaw millers for Zone A, revealed a significant difference (p<0.05) in

327 the gross incomes and Gross Cost of chainsaw millers in zone 'A'. This means income

328 from chainsaw milling is significantly higher than the gross cost from this operation in the

329 three zones of the study area, Table 6.

330   The result of chainsaw millers revealed a significant difference (P<0.05) in the gross

331   incomes and Gross Cost of chainsaw millers in zone 'B'. This means income from

332   chainsaw milling is significantly higher than the gross cost from this operation in the

333   three zones of the study area (Table 6).

334   The result of chainsaw millers in Zone 'C' revealed a significant difference (P<0.05) in

335   the gross incomes and Gross Cost of chainsaw millers in zone 'C'. This means income

336   from chainsaw milling is significantly higher than the gross cost from this operation in the

337   three zones of the study area (Table 7).

338   TABLE 6: T-Test for Chainsaw Millers in Zones A, B and C of the Study Area.
339   Hypothesis: there is no significant difference between Incomes and Costs.

Zone	Mean	N	Std. Deviation	Std. Error Mean	T	Df	Sig. (2-tailed)
Zone A							
Gross income	86828	24	108691	22186.54121			
Total variable cost	47140	24	39067.52460	7974.62507	1.123	23	0.045*
Zone B							
Gross income	292970	24	268903	54889.63052			
Total variable cost	164240	24	186644	38098.45155	5.429	23	0.000*
Zone C							
Gross income	221170	25	254778	50955.57841	4.391	24	0.000*
Total variable cost	136690	25	180085	36016.91501			

340   Note: Ns = Not Significant at 5% Probability level.

341   * = Significant at 5% Probability level.

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345 **3.6   Market Concentration of Chainsaw Millers in Benue State-.**

346 For chainsaw millers the Gini- coefficient values were 0.18912 or 18.91% for Zone A,

347 0.321828 or 32.185 for Zone B and 0.18289 or 18.28% for Zone C (Table 7). This shows

348 low market concentration of timber traders. This reveals an economically fairly equitable

349 distribution of volume of trade among chainsaw millers in the study area. However, based

350 on the values of Gini-coefficient in each case, trade in zone C was less un-equally

351 distributed followed by zone A and lastly B. The size and distribution of sales of timber

352 10flictches or planks from timber traders is presented in Tables 8, 9 and 10. The

353 illustration of this distribution by the Lorenze curve shown in figures 1, 2 and 3 does not

354 skew far away from the line of equal distribution (LED).

355 TABLE 7: Gini Coefficient Values of Timber Marketers in Benue State

Type of Marker	Gini Coefficient Value	Standard Error (STE)	Lower Bound Gini Coefficient	Upper Bound Gini Coefficient	Confidence Level
Chainsaw millers					
Zone A	0.18912742	0.05081262	0.08953651	0.57378351	95
Zone B	0.32184737	0.14255092	0.04245269	0.60124204	95
Zone C	0.18289433	0.05110957	0.08272141	0.28306724	95

356
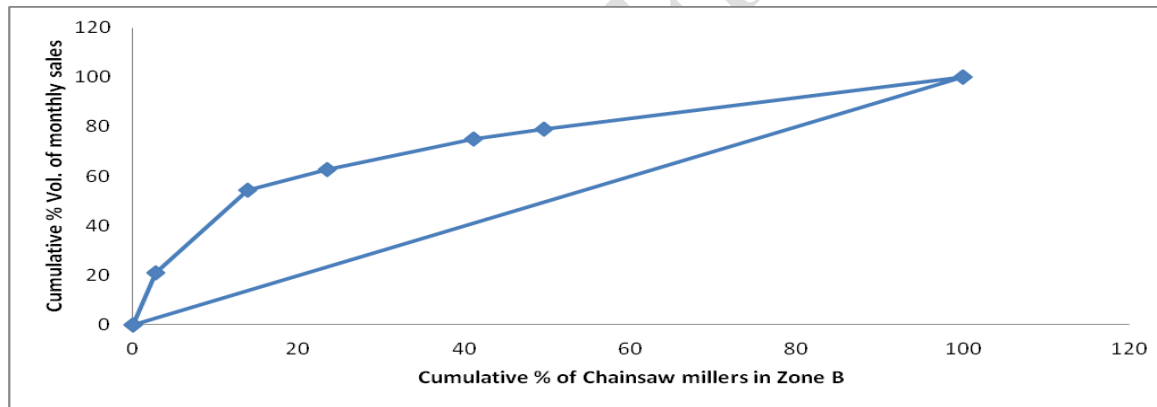
357

358

359 TABLE 8: Distribution of Chainsaw Millers' by Size of Monthly Sales in Zone A, Benue State

Sales ₦	Frequency of Sellers	Percentage of Sellers	Cumulative Percentage of sellers	Total sales (₦)	% Sales	Cumulative % of Sales
<= 50000.00	11	45.8	45.8	339000.00	16.3	16.3
50000.01 - 150000.00	10	41.7	87.5	832000.00	39.9	56.2
150000.01 - 250000.00	2	8.3	95.8	365000.00	17.5	73.8
450000.01+	1	4.2	100.0	548000.00	26.3	**100.0**
Total	**24**	**100.0**		**2084000.00**		

360

361
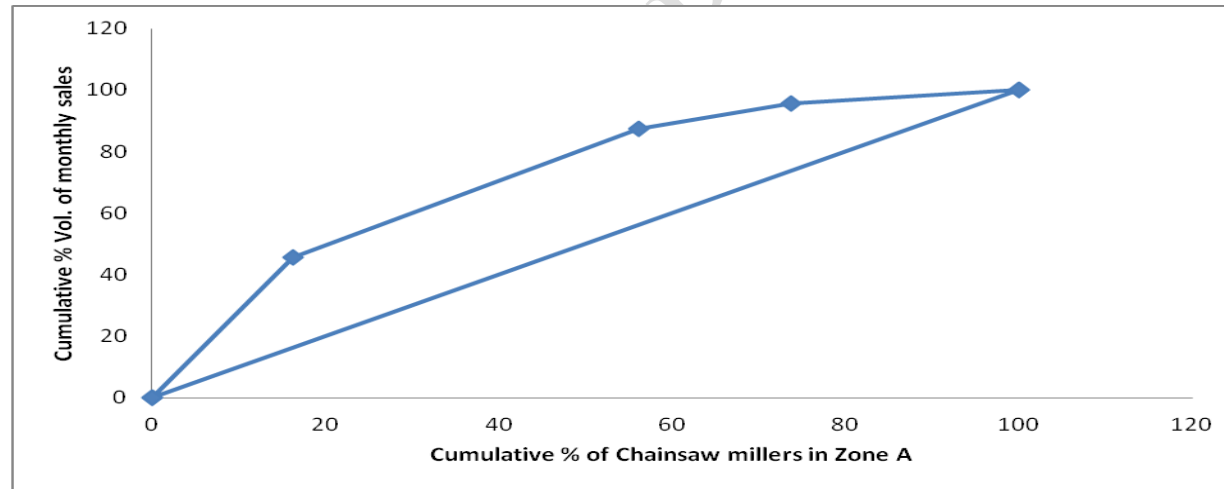
362

363 FIG. 1 Lorenze curve for Chainsaw millers in Zone A, Benue State

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367   TABLE 9: Distribution of Chainsaw Millers by Size of Monthly Sales in Zone B, Benue State
368

Sales ₦	Frequency of Sellers	Percentage of Sellers	Cumulative Percentage of Sellers	Total Sales (₦)	% Sales	Cumulative % of Sales
<= 50000.00	5	20.8	20.8	195000.00	2.8	2.8
50001.00 - 200000.00	8	33.3	54.2	779000.00	11.1	13.9
200001.00 - 350000.00	2	8.3	62.5	667000.00	9.5	23.4
350001.00 - 500000.00	3	12.5	75.0	1240000.00	17.6	41.0
500001.00 - 650000.00	1	4.2	79.2	600000.00	8.5	49.5
650001.00 - 800000.00	5	20.8	100.0	3550000.00	50.5	**100.0**
Total	**24**	**100.0**		**7031000.00**		

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371

372   FIG. 2 Lorenz curve for Chainsaw millers in Zone B, Benue State

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TABLE 10: Distribution of Chainsaw millers by size of monthly sales in Zone C, Benue State

Sales ₦	Frequency of Sellers	Percentage of Sellers	Cumulative Percentage of Sellers	Total Sales (₦)	% Sales	Cumulative % Sales
<= 50000.00	5	20.0	20.0	170000	3.07	3.07
50001.00 - 150000.00	10	40.0	60.0	777000	14.04	18.11
150001.00 - 250000.00	2	8.0	68.0	386000	6.98	24.09
250001.00 - 350000.00	1	4.0	72.0	338000	6.11	30.20
350001.00 - 450000.00	3	12.0	84.0	1170000	21.14	51.34
450001.00 - 550000.00	2	8.0	92.0	940000	16.98	68.32
650001.00 - 750000.00	1	4.0	96.0	673000	12.16	80.48
750001.00+	1	4.0	100.0	1080000	19.52	100
Total	**25**	**100.0**		**5534000**	**100 .0**	

Source: Field Data, 2013
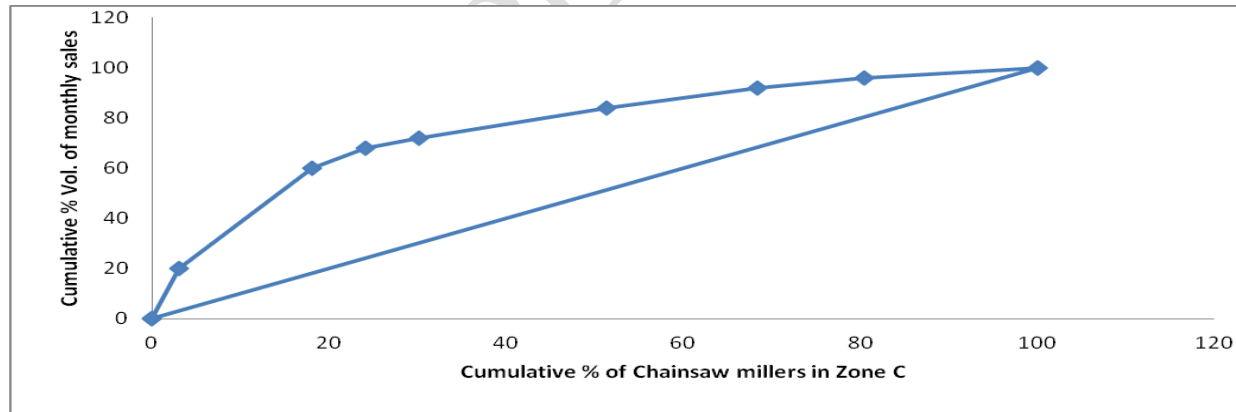
FIG. 3 Lorenze curve for chainsaw millers in Zone C, Benue State.

3.7 Chainsaw millers marketing efficiency in Benue State-.

The result of chainsaw millers marketing efficiency in Table 11 revealed that chainsaw millers in zone 'A' received the total sum of as 86,828.00 average gross revenue per month. The mean total marketing costs was ₦ 47,140 representing 54.29% of the mean gross income. A breakdown of the marketing costs revealed that loading and offloading had the highest cost (30.35), followed by expenditure on timber (25.38%), wages (19.24%), and transport (16.93%). The least cost of 0.75% was incurred on others.

For zone B the average gross revenue per month for Zone B was 292,970.00 while the cost was N164,240 representing 56.06% of the mean gross income. Expenditure on timber (33.01%) possessed the highest cost followed by wages (30.35%), transport (19.66%) and taxes (5.99%) while the least cost was incurred on others. Similarly the study showed that all chainsaw millers sampled in Zone C received the total sum of ₦ 221, 170.00 average gross revenue per month while the mean total costs was ₦ 136,690.00 representing 61.80% of the mean gross income. In the same vein expenditure on timber (30.64%) possessed the highest cost followed by transportation (25.79%), wages (22.10%), loading and offloading 18.48% while the least cost of 0.83% was recorded on dues.

The coefficient or marketing efficiency of chainsaw milling was highest for Zone A, followed by 184.19% for Zone B 179.38% and 161.80% for Zone C, Table 11. The implication of this result is that in Benue State, chainsaw milling is highly efficient.

413   TABLE 11: Profitability and Marketing efficiency of Timber Trade by Chainsaw Millers in Benue state

	Total Revenue B (₦)	Expenditure on Timber (Wood) (₦)	Transportation (₦)	Taxes (₦)	Dues (₦)	Loading/ Offloading (₦)	Wages	Other Costs* (₦)	Total Marketing Cost C	Net Margin (₦)	Efficiency $\frac{B}{C} \times 100$ (%)
ZONE A	86,828.00	11,963.71 (25.38)	7.979.34 (16.93)	1,554.20 (3.29)	1,915.27 (4.06)	14,303.87 (30.35)	9,069.00 (19.24)	354,07.00 (0.75)	47,140.00 (100)	39,688.00	184.19
ZONE B	292,970.00	54,210.70 (33.01)	32,292.00 (19.66)	9,833.30 (5.99)	1,558.30 (0.95)	16,470.90 (10.03)	49,854.00 (30.35)	20.83 (0.01)	164,240.00 (100)	128,730.00	179.38
ZONE C	221,170.00	58,738.00 (30.64)	49,440.00 (25.79)	2,020.00 (1.05)	1,582.00 (0.83)	35,418.00 (18.48)	42,372.00 (22.10)	2,120.00 (1.11)	136,690.00 (100)	84,480.00	161.80

414   Source: Computed from Field Data, 2013.

415   NB: (1) *Others Miscellaneous (Monetary and material gifts given to the village heads, Informants on timber species are available in the
416   forests, road expenses, dues).
417   (2) Values in bracket are components of costs in rows as a proportion of total marketing cost 'C'.
418

4. DISCUSSION

4.1 Socio Economic Characteristics of Timber dealers in Benue State, Nigeria-. This study revealed that all of the chainsaw millers that were male were involved in the timber business enterprise. It is thus a male- dominated occupation. The lack participation of female in timber business could be attributed to the tedious nature of the business. This finding corroborates the earlier view expressed by Kalu and Ani (33) and Sekumade and Oluwatayo (34), that dominance of the trade by men is due to the fact that it's operation is tedious, and this tends to discourage most women from engaging in the enterprise.

The fact that the majority of the timber merchants fall within the active age distribution of 30 -40 years further justify the above claim. These youths are gainfully employed and can earn their livelihood from timber business in spite of the enormous strength and energy required for this kind of business; their youthful exuberance can match the toils involved. The study revealed that a greater proportion of the timber traders, chainsaw millers were married. The larger proportion of married families implies that timber trade is perhaps a secured livelihood activity in the area; and could sustain their responsibilities to wives, children, and other family members under their care.

The relatively larger proportion of literate respondents over the illiterate in timber business seems to be a blessing. According to Aiyeloja *et al. (*35) timber business requires some degree of literacy due to measurements and simple calculation involved in plank processing from round wood into different sizes. The respondents would also be more amenable to development policies required to be implementable. This also implies that timber trade is perhaps a profitable venture that engages the educated and provides alternative source of income and employment.

The implication is that greater proportions of these market actors are educated and can communicate in English. The higher profitability and income from the enterprise may have attracted individuals with higher educational status to get involved in the enterprise compared to income from white collar jobs that in most cases do not guarantee above average quality of life in Nigeria (36).

Data on the ethnic composition implies that timber market is dominated by the indigenes. The relatively dominant proportions of the Tiv, Idoma, and Igede, could be attributed perhaps

449 to their familiarity with the terrain and locations of raw timber. Furthermore, the formation of
450 co-operative societies by timber dealers will also give them more enablement to source for
451 credit facilities. This agrees with the finding by Sidiku and Oyerinde (37), on the analysis of
452 sawn timber market in Ondo State that sawn timber traders solely depend on personal
453 savings.
454 The relatively larger proportion of timber merchants with moderate trading experience of less
455 than 10 years; and very few with 10 years and above, is an indication that timber business has
456 been in existence in Benue State for a long time now. However, only recently that many
457 people, including non-indigenes, are getting into the business.

458 **4.2 Volume of Timber Trade in Benue State-.**

459 Variations were observed in the volume of timber traded across the three geopolitical zones
460 in Benue State. These observed variations were attributable to species availability and
461 settlement pattern. For instance the higher number of timber species marketed in Zone B
462 were because of the urban nature of the sampled LGAs, high population density and large
463 market for timber products coupled with higher incomes of the urban dwellers in these
464 zones. The study ostensible trade in species regarded as Non-timber tree species was due to
465 the scarcity of the timber species and growing demand for timber for construction works and
466 others services.

467 The larger volume of *Daniellia oliveri* marketed in Benue State was partly due to its relative
468 abundance from the forests in Benue State and partly due to extensive demand for its wood in
469 the construction industry. The relatively larger volume marketed of species like *Gmelina*
470 *arborea, Khaya grandifoliola, Pterocarpus erinaceus and Tectona grandis* among others was
471 due primarily to demand for their wood. These species possess preferred qualities like
472 strength needed for construction works in Benue State. They were mainly imported into
473 Benue State from neighbouring states. Ogunwusi, (38) noted that in nearly all ecological
474 zones, the wood species mostly found in the timber market are those widely available within
475 the forest zones. He also stated that *Irvingia gabonensis* wood is very popular in the planks
476 markets in the south east and south west zones while *Prosopis africana* and *Detarium*
477 *senegalense* are now very prominent in markets in the Northern parts of the country.

According to the classification of timber species by Arowosage (39), the following are commonly used species; *Khaya grandifoliola*, *Afzelia africana*, *Mansonia altissima*, *Ceiba patandra*, *Milicia excelsa*, *Tectona grandis*, *Anogeissus leiocarpa*, *Isoberlinia doka*, *Terminalia ivorensis*, *Terminalia ivorensis*, *Ceiba patandra*, *Tripolochiton scleroxylon*. These are used for ends uses as building construction and flooring, furniture construction and decoration, veneer and house fitting, roofing, doors, window frames, stair cases, boat building, coarse packing and form work.

The timber species and volumes traded have serious implication on the sustainable supply of timber resources in Benue State especially in the long run. This is because the market demand far outstriped the supply. Agbeja and Opii (23), reported that the plantation establishment target of 400 ha per year of stands from 1999 to 2003 was a far cry from reality as only 335.5 ha of *T. grandis, G. arborea, E. guineensis, A. occidentale, and K. grandifoliola* were planted in the span of five years. They further stated that the demand and supply of wood in Benue State shows a deficit in supply; and this portend a danger especially for sawnwood and veneers for industrial development of the state. The consequence of such deficit will be increased pressure on the existing forests. The increasing timber logging activities in the savanna region spells doom for timber supply in Nigeria if adequate and more serious measures or decisions are not taken. Deliberately injecting external funds in to the system to replenish timber stock as they are removed will ensure its sustainable development and supply in the state, and the country.

4.3 Comparisons of Income from Timber Trade in Benue State-. Gross margin measures (GM) the level profit generated from a business or any production activity, after all expenses are deducted.

The results revealed that the trading activities in timber marketing in Benue State were profitable. At the end of every month of trading, a chainsaw miller goes home on average with ₦39,688.00, ₦128,730.00 and ₦84,474.00 in zones A, B and C respectively. The GM values are far higher than the national minimum wage. This justifies timber trade as a viable enterprise for sustainable livelihood. Based on the gross margins (GMs), and their trend in all the timber traded, the study revealed that timber merchants in zone 'B' had the highest

507 average GM which implies that the timber market in the zone is more efficient compared to

508 trader in timber markets. This could also be attributed to its high population and

509 cosmopolitan nature of the zone compared to the other zones. This could result to higher

510 demand, construction activities and higher magnitude of trading activities which could in turn

511 lead higher rates of returns. This in turn is followed by timber traders in one 'C' and then 'A'.

512 This means, all things been equal timber traders in zone 'A' generated higher profits from

513 sales compared to those in zones and A and B. The RORI and GR values also support the

514 above conclusion. Therefore, GR of 0.54 for timber traders in zone 'A' means 54% of the

515 total income generated is used in off-setting marketing costs. By implication the profit made

516 from timber sales is 46% over the capital invested. That is one naira invested will generate

517 fifty kobo or 0.46 naira as profit thus raising the amount invested to ₦1.46. The result

518 showed low values of GR and high values of RORI but the GM was positive and high.

519 The implication of these results is that, high profit margin does accrue to timber merchants

520 because the low GR value implies that not too much expenses were incurred in offsetting

521 marketing costs; transportation, loading, off-loading, taxes, purchasing costs among others

522 except for zone B. This cost gulped as high as 54% of the gross benefits realized by timber

523 trader.

524 Now based on the GR, RORI and GM concepts together with their observed values, it can be

525 safely concluded that, the observed differences in the level of profit generated and hence

526 efficiency in marketing across the three market segments is due to the interaction between

527 quantities of wood supplied, producer prices and marketing cost components. These factors

528 are the parameters that can affect returns from any marketing activity.

529 Generally, the marketers had a fair profit margin, but relatively those in Zones A and B

530 realized higher profit margins as the GM indicates. This is similar to Bichi's (6) findings in

531 Kano State which revealed that timber business can generate between N5, 000 to 450,000 per

532   month and can generate even one hundred thousand naira per day based on demand and

533   season. According to the findings by Popoola (12) in Benue state, incomes from chainsaw

534   milling range between $2.50 and $80 per day, and range between $75 and $2,400 per month.

535   This captures mean income from this study of ₦39,688 which amounts to $110.24 per month.

536   Akinyemi *et al.* (40) also made a similar observation from the study on profitability, prospect

537   and constraints of Sawmill Industry in Kaduna State. His finding revealed a monthly net

538   income to be ₦118,789.40 while the rate of return on investment was calculated to be

539   50.18%. This is therefore an indication that timber business is generally profitable in Benue

540   State.

541   Based on the magnitude of GMs of chainsaw millers in the zones, the zone A is more

542   efficient followed by zone B and then zone C. This means that all things being equal, timber

543   traders in zone A generated higher profits from their sales compared to traders in other zones.

544   This variation in the gross margin between the zones could be attributed to greater risk and

545   differences in costs incurred, high demand and high turnover rates. From the profitability

546   index applied, it is evident that the enterprise in the study area was highly profitable for

547   lumber marketers.

548   **5.6 Concentration and Efficiency of Timber Trade in the Study Area.**

549   Market concentration in market structure is concerned with the organizational characteristics

550   of a market which influence the nature of competition and pricing within the market.

551   According to Tee (41) an efficient marketing system is relevant in stimulating and producing

552   forestry development and economic growth. According to Todaro (42), for economic

553   variables with relatively equitable distribution, the Gini coefficient value should be between

554   0.20 and 0.35.

555 UNDP (43) reported that Gini-coefficient with high inequality typically lie between 0.5 and

556 0.7. This suggests that saw miller and chainsaw operators were not able to control large

557 shares of wood supply or sales in the study area. As such none could influence supplies by

558 increasing or decreasing the quantity supplied. Each of the participant's output was an

559 insignificant part of the volume of trade in the market such that it could not affect market

560 price.

561 The low Gini coefficient value of 0.2885 showed that small sawmills were evenly

562 distributed in Benue State and none of the market participants have control on significant

563 proportion of the timber market. Similarly the Gini coefficient of chainsaw millers in zone B

564 also revealed that none had significant control since both market actors had their Gini

565 coefficient value within the same range. In the same manner the result of the analysis showed

566 that among the chainsaw millers in the zones, none of the market actors also had control of

567 the market. This implies that timber market is monopolistic competitive in structure in the

568 study area. Thus the concentration of sales volume among chainsaw millers was low

569 although higher than the others. This shows that none of the timber market actors controlled

570 significant proportion of the timber trade.

571 The overall structure of timber market indicates that there are many small-scale dealers

572 such that none could control the market. This type of market structure is competitive, because

573 the individual dealers have little influence on the market price. Tee (41) and Enete (44) made

574 similar observations with *Borassus aethiopum* in North-Eastern Nigeria and charcoal in Abia

575 State Nigeria respectively.

576 The results of marketing efficiency of timber trader indicates timber trade in the study area

577 provides a profitable market where the all the market actors and traders get a high return on

578 their investments. This finding is in conformity with the results obtained by other researchers

579 on marketing margin and efficiency of agricultural and forestry products (45,46).

580 **CONCLUSIONS and RECOMMENDATIONS**

581 Chainsaw milling is economically important and viable, it is a profitable and efficient

582 business enterprise with good financial returns to the marketers. The structure of timber trade

583 in Benue State exhibited features that were competitive. Thus the distribution of the volume

584 of the trade was economically equitable. Hence, Benue state government should development

585 policy framework ploughing backs some of the profit in developing the timber resource in the

586 state.

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