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Research Article

Evaluation of Factors affecting Participation of Actors in Charcoal Value Chain in Benue State, Nigeria

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ABSTRACT

The study examined the factors affecting participation of key actors in charcoal value chain (CVC) in Benue state. A multistage sampling technique was used for the selection of 739 respondents, comprising charcoal producers, transporters, off-taker and consumers in seven local government areas and 14 communities. Descriptive statistics and principal factor analysis were used for data analysis. Results showed male dominance (62.47%) in the entire CVC, especially at the production (86.5%) and transportation (100%) nodes whereas female were mostly active at off-take (55.3%) and consumption (81.3%) nodes. Further, CVC sector was dominated mostly by young people (64.27%) averaged 37 years and about 66% of the respondents were married with 7.8 years of experience in the CVC. Results of factor analysis depicted that the Kaiser-Meyer-Olkin Measure (KMO) value of 0.882. Five common factors were extracted with cumulative variance proportion of 63.85% of the total variance, above the recommended percentage of 50-60% for social science research of 50-60% and Eigenvalues above 1. The five factors were labelled as 'Institutional and policy constraints' (accounted for 37.76% of the total variance), 'Production constraints' (8.29%), 'Financial and marketing constraints' (6.90%), 'Infrastructural constraints' (6.55%) and 'Technological constraint which accounted for 4.65% of the total variance. The study concludes that charcoal value chain in the State is open to both genders and is constrained mostly by institutional and policy factors. It was recommended that involvement of government agencies and community leaders in CVC would ensure effective policy formulation and implementation for a sustainable charcoal exploration.

Keywords: Evaluation; Participation; Charcoal; Value chain; Production; Actors

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INTRODUCTION

Charcoal is one of the most used energies for domestic and small industries in Third World Countries, particularly in Sub Saharan Africa (SSA) countries (Liyama *et al.,* 2014, Ndegwa *et al.,* 2016, Chiteculo *et al.* 2018, FAO, 2022). Because of its economic significance, the production of charcoal is at a crossroads in many sub-Saharan African (SSA) nations, despite the fact that it is considered destructive by nature. According to FAO (2017) charcoal and fuelwood can supply up to 90% of a country's key energy requirements as well as economic needs of sub-Saharan Africa countries (FAO, 2017). Studies has shown that 2.64 billion people around the world rely greatly on charcoal and fuel for cooking, boiling and sterilizing their water as well as heating their homes (Malla and Timilsina, 2014; FAO, 2017; Rose *et al.,* 2022). In SSA Rose *et al.* (2022) put the figure of people using

charcoal as their primary energy source at 195 million. Charcoal is also considered to be one of the major sources of household income in the SSA (Zulu and Richardson, 2013; Jones *et al.,* 2016; Ndegwa *et al.,* 2016; Chiteculo *et al.* 2018; Brobbey *et al.,* 2019).

According to FAO, (2018) it is believed that various stages involved in charcoal production and supply chain can contribute significantly to the attainment of sustainable development goals. Charcoal is linked to poverty reduction in many ways and at different magnitude. This is through, employment, and sustainable household income generation (Angelsen and Wunder, 2003; FAO, 2018; Rose *et al.* 2022). With the increasing demand for charcoal, employment and income opportunities in the sector are also on the increase. Large numbers of people are now being involved along the charcoal value chain (CVC), as there is stable demand, ease of access to raw materials (trees species) as well as low initial investment costs (Arnold *et al.* 2006; World Bank, 2009).

In contrast, charcoal making is linked with stories of ecosystems degradation, deforestation, and climate change (Chidumayo and Gumbo, 2013; FAO, 2017). However, it is believed that production of charcoal will increase at a pace of about 3% per year in the next thirty years, or until 2050 (Liyama *et al.,* 2014; UNEP, 2019). Many factors, including household socioeconomic conditions and the availability of alternative forms of employment, impact the reasons behind producing charcoal (Khundi *et al.,* 2011; Brobbey *et al.,* 2019).

Charcoal production and supply involve various stages that contribute significantly to the attainment of sustainable development goals, especially in the attainment of business development and poverty reduction (Chauhan *et al*., 2022). Charcoal is linked to poverty reduction in many ways and at different magnitudes through employment creation, and sustainable household income generation (Rose *et al.* 2022, Chauhan *et al*., 2022, FAO, 2018). With the increasing demand for charcoal, employment and income opportunities in the sector, charcoal production is also on the increase. Large numbers of people are now being involved along the charcoal value chain (CVC), ostensibly as a result of stable demand, ease of access to raw materials (trees species) as well as low initial investment costs (Arnold *et al.* 2006; World Bank, 2009). Though, charcoal production is linked with stories of ecosystems degradation, deforestation, and climate change (Chidumayo and Gumbo, 2013; FAO, 2017), it is believed that its production will continue to increase at a pace of about 3% per year in the next thirty years until 2050 (Liyama *et al.,* 2014; UNEP, 2019). Many factors, including household socioeconomic conditions and the availability of alternative forms of employment, impact the reasons behind the production of charcoal. According to Assuming-Brempong *et al*. (2020) state that the socioeconomic factors affecting charcoal production and marketing also have an impact on local livelihoods, revenue creation, and potential for employment.

Therefore, any successful policy intervention in the charcoal and other fuelwood sector requires an understanding of the factors that either enable or prevent households from producing or trading in charcoal. This understanding is crucial for focusing policy interventions in areas such as livelihood enhancement, poverty reduction, and environmental conservation in relation to charcoal and other natural resources. It is especially important for designing and implementing policies and programs that aim to make charcoal production and trade in Nigeria and other SSA countries economically and environmentally sustainable. However, at present only few researches have looked into the factors that influence rural households in developing nations including Nigeria to produce charcoal or not.

MATERIALS AND METHODS

The Study Area

The study area is Benue State, Nigeria. The State is located within the Middle Belt of Nigeria on Longitude $7^{o}47'$E and $10^{0.}00'$E and between Latitudes $7^{0}21.97'$ and $8^{0}25.10'$N and has land mass of 34,059km^2 (Idoko *et al.,* 2023). Benue State share boundary with Taraba State in the Northeast, Nassarawa State in the North. Down south the state shared boundary with Enugu and Ebonyi in the Southwest, Cross River State in the southeast. In the west the state is bounded by Kogi State. The State also have an international Boundary with Cameroon around Kwande Local government axis (Fig. 1). The State has an estimated population of 6,141,300 in 2023 based on a 2.8% growth rate (NPC 2006). Benue State has 23 Local Government areas. The State is located in the southern guinea zone (Hula, 2010). The area is characterized by two distinct seasons; wet and dry season. The wet season occur

between April to October, and dry season between November to March. Benue Sate has an average of Seven (7) months of rainfall in a year. Mean annual rainfall is between 1200mm-2000mm (Iornongo *et al.,* 2019; Idoko *et al.,* 2023). Mean annual temperature ranges between 23°c to 32°c relative humidity is between 60% and 80% wet but decreases in the early months of dry season (Iornongo *et al.,* 2019). Benue State is located in the guinea savanna zone of the country (Dagba *et al.,* 2016). It is one of the largest vegetation zones in the country, the vegetation of Benue state is characterized by predominantly fewer trees, more shrubs and predominantly tall grasses up to 2m tall (Dagba *et al*., 2016) Riparian forests are found in low land areas and river banks. Some of the species found in the area includes: *Khaya senegalensis Daniella oliveri*, *Isoberlina doka*, *Parkia biglobosa,* Prosopsis *Africana, Vitellaria paradoxa Burkea Africana*, *pterocarpus erinaceus*, *Afzelia Africana, Borassus aethiopum, Bombax costatum, Anogeissus leiocarpa Irvingia gabonensis* (Hula, 2010; Adagba *et al.* 2016; Dagba *et al*., 2016). According to Hula and Ukpong, (2013) continue removal of the vegetation for farming, logging as well as bush burning have created regrowth and characteristic parklands which is attracting herdsmen to the state.

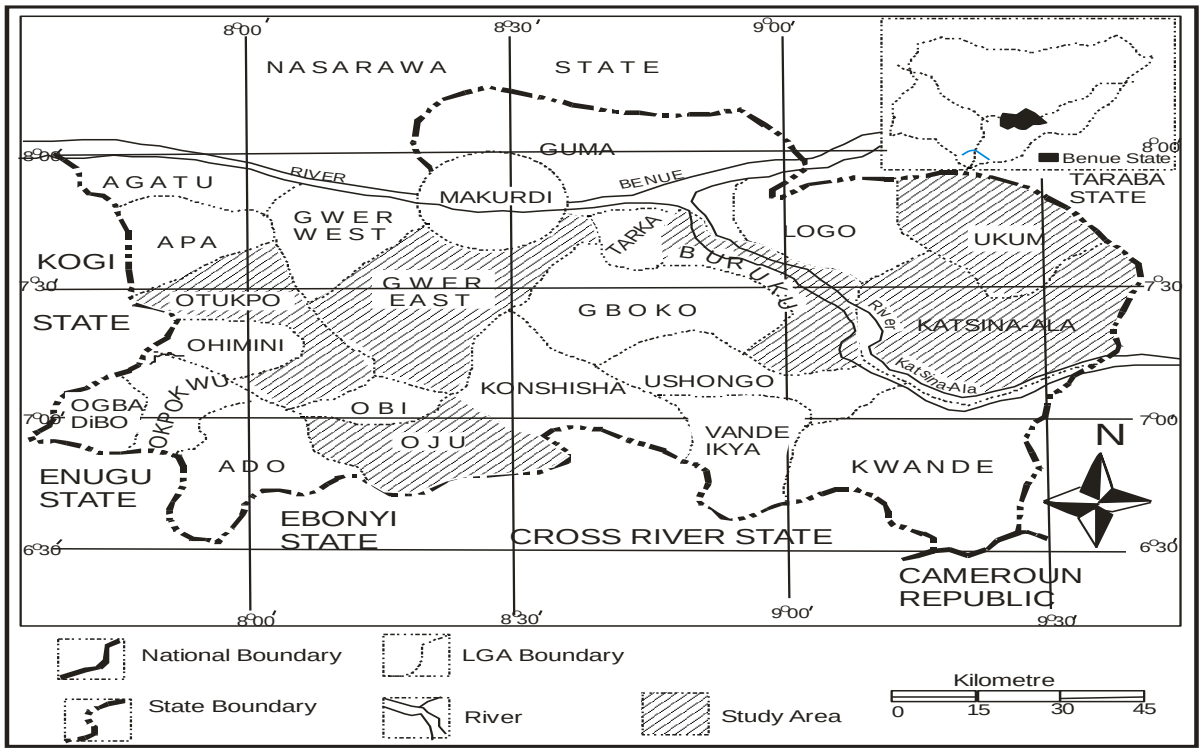

Fig 1. Map of Benue State showing study area

Source: Adopted from Ministry of Lands and Survey Makurdi (2015)

Sampling Procedure and Sample Size

Multi-sampling procedure was used to select from the diverse key actors in charcoal value chain in Benue State. The sampling procedure was based on the outcome of the recognisance survey across the State to obtain information about all the actors in the value chain as a guide for sample size selection. The recognisance survey delineated the charcoal production areas from non-charcoal production areas in an attempt to identify and profile key players in charcoal value chain across the State for the purpose of this study. Seven dominant charcoal production local government areas (LGA) in the State were purposive (Konshisha, Gwer East, Gwer West, Tarka, Apa, Agatu and Otukpo LGAs), using the volume and prominence of charcoal production as

indices for the selection. In each of the selected LGA two dominant charcoal production communities were purposive selected to obtain a total of 14 communities. A simple random sampling technique (with the aid of Yamane's and Bowley's proportion allocation formulae) was used to select a proportionate sample of 739 out of a sample frame of 155,506 across the diverse charcoal value chain actors. A total 157 of charcoal producers were drawn from a pool of 258 producers across the seven selected LGAs in the State using a simple random. Selection of charcoal transporters in the State followed the outcome of the reconnaissance survey of the transport system associated with the charcoal value chain. From a pool of 73 charcoal transporters, proportionate sample of 63 transporters was selected. Selection of Charcoal marketers was obtained from the registered list of marketers (159 marketers) in the selected LGAs and 114 respondents were selected.

Charcoal consumers were selected following a reconnaissance survey. Based on available statistics (NBS, 2018, NDHS, 2018), 12.7% of the populace are charcoal users (10.5% are in urban centres and 2.2% for the rural areas). In this regard, the selection of charcoal users included domestic/household, artisans and industrial usage, mostly in the urban areas of the State. Based on the projected population of the selected LGAs, the proportion of charcoal users (12.7%) was earmarked for the purpose of the study. Similarly, the Yamane's and Bowley's allocation formulae was applied to select a proportionate sample of 399±7 respondents out of 152,395 charcoal users.

Yamane's formula for determining sample size is expressed as:

$$n = \frac{N}{1 + N(e^2)}$$

Where:

n= Sample Size

N= Population of the study

e= Margin of error (5%)

The Bowley's proportion allocation formula is expressed as:

$$n_i = n\frac{N_i}{N}$$

Where:

n_i = Sample size for the i^{th} stratum

n= Total sample size

N_i= Population for the i^{th} stratum

N= Total population

Methods of Data Collection and Analysis

Data for the study were collected using different sets of questionnaires, designed with respect to each of the key actors in the charcoal value chain (Charcoal Producers, Charcoal Transporters, Charcoal intermediary/marketers, and Charcoal consumers). The study used interview schedule method where distinctive questionnaires were administered to the proposed 739 respondents across the diverse value chain actors. Data for the study were analysed using descriptive statistics and Factor analysis. Data analysis were performed basically with the use of two analytical software: The Statistical Package for Social Sciences (IBM SPSS) Statistics 23® and FAO Value Chain Analysis Tool (FAO VCA-Tool) version 3.2.

Factor analysis

The use of Factor analysis to uncover the latent structure or dimensions of a set of variables is aimed at reducing the attribute space from a larger number of variables (factors) to a smaller number of factors (Lorenzo-Seva, 2013). The application of factor analysis is in twofold: to reduce the number of variables and to detect structure in the relationships between variables. However, in this research, factor analysis was employed to reduce the number of variables affecting charcoal value chain to common factors (Lorenzo-Seva, 2013).

The algebraic expression of factor analysis model renders each variable as a linear combination of underlying *common factors say* $f_1, f_2, \ldots, f_m$, with an accompanying error term to account for that part of the variable that is unique (not in common with the other variables). The Eigenvalue will be used to determine suitability of a factor. If the eigenvalue will be greater than one, it would be considered a factor and vice versa. For $y_1, y_2, \ldots, y_n$ in any observation vector **y**, the model is as follows:

$$\begin{cases} y_1 = \lambda_{11} f_1 + \lambda_{12} f_2 + \lambda_{13} f_3 + \cdots \dots \dots \dots \lambda_{1m} f_m + \varepsilon_1 \\ y_2 = \lambda_{21} f_2 + \lambda_{22} f_2 + \lambda_{23} f_3 + \cdots \dots \dots \dots \lambda_{2m} f_m + \varepsilon_2 \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ y_n = \lambda_{n1} f_1 + \lambda_{n2} f_2 + \lambda_{n3} f_3 + \cdots \dots \dots \dots \lambda_{nm} f_m + \varepsilon_n \end{cases}$$

Where,

$y_1 - y_n$ = vector of observed or known variables

$f_1 - f_m$ = unobservable or unknown factors

λ_{ij} = are referred to as *loadings* of variable y_i on factor f_i, depicting how each y_i individually depends on depicting how each y_i individually depends on f_i.

$\varepsilon_1 - \varepsilon_n$ = independent error terms

RESULT AND DISCUSSION

Socio economic Characteristics of Charcoal Value Chain Actors in Benue State

The result of study as presented in Table 1 indicated that charcoal sector generally was dominated by male (62.5%) while 37.5% were female. Male dominance was evident in charcoal production (86.5%) and transportation (100%). On the hand, more than half (55.3%) of the off-takers and 81.3% of charcoal consumers were female. The finding of this study agrees with the submission of Eniola *et al.* (2018), Aduloju *et al.* (2020), Ndegwa *et al.* (2020), Tassie *et al.* (2021), Fasoro and Ajewole (2023) in Oyo State Nigeria who asserted that charcoal production processes is men dominated occupation. This assertion is attributed to the strenuous and energy-demanding activities associated with charcoal production. Other studies (Ahmed *et al.,* 2021, Isyaku *et al.,* 2023, Omoyeni *et al.,* 2023) in Nigeria also showed that charcoal production is male occupation. The dominance of male in transportation of charcoal in Benue State could be linked to the tedious nature of the work occasioned by bad nature roads, the nature of vehicles and motor bike used for charcoal transportation which could cause transporters to spend nights on the road when there is breakdown of vehicles (Siakchoma, 2021). The domination of female in charcoal marketing in Benue State was similar to the works of Olugbire and Aremu (2014) and Fasoro and Ajewole (2023) in Oyo State Nigeria, Kazimoto (2015) in Tanzania and Tassie *et al* (2021). Additionally, the high domination of women in the consumption of charcoal in Benue State could be linked to the fact that women are more aware of their new role and its effects on family relations and energy consumption decisions (Awuor *et al.,* 2022). It was established from the study as presented in Table 1 that, 64.27% of CVC actors in Benue State were below 40 years old. This was an indication that the sector in dominated by young active people who are actively and gainfully employed in the sector. The result of this study is consistent with research carried out by Olarinde and Olusola (2018) in Oyo State, Nigeria, Siakachoma (2021) in Zambia, Tassie *et al* (2021) in Ethiopia and Omoyeni *et al.* (2023) in Ekiti States, and Ahmed *et al.* (2023) in Zamfara State.

The study also revealed that the sector was controlled (65.76%) by married in Benue state, this could due to the fact married people have more responsibilities. The result of the study was in conformity with the submission that married people have more obligations such education of their family, provision of food and health for the families, this could be the reason behind the control of CVC by married people (Fasoro *et al.* 2021 and Fasoro and Ajewole 2023). It was established that 91.49% of CVC in Benue State had one from of education of the other. The study demonstrated that educated people were getting more involved in CVC (Omoyeni *et al.,* 2023). This could be linked to the absence or limited paid jobs in the area. This view is supported by Siakachoma (2021) that educated people are getting involved charcoal industry to supplement their meagre incomes. Also, it is shown that traders were more in the user of charcoal compared to set of people in the area this could be due to various uses put charcoal into (Nuru *et al.*, 2015). Result of years of experience in CVC showed the average years of 8, indicating that charcoal value chain actors and the business in its entirety is just gaining popularity in the State as compared to other parts of Nigeria (Adeniji *et al.,* 2015).

Table 1: Socio-economic attributes of charcoal value chain actors in Benue State

S/No	Variable	Producers (n = 156)		Off-takers (n = 114)		Transporters (n = 63)		Consumer (n = 406)		Pooled (n=739)		
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	$\bar{X}$
Sex	Male	135	86.5	51	44.7	63	100	76	18.7	325	62.47	
	Female	21	13.5	63	55.3	-	-	330	81.3	414	37.53	
Age (years)	<=20	1	0.6	1	0.9	2	3.2	17	4.2	21	2.84	36.90
	21-30	23	14.7	15	13.2	18	28.6	153	37.7	209	28.28	
	31-40	59	37.9	48	42.1	29	46.0	109	26.8	245	33.15	
	41-50	58	37.2	38	33.3	12	19.0	87	21.43	195	26.39	
	51-60	12	7.7	11	9.6	1	1.6	34	8.4	58	7.85	
	>=60	3	1.9	1	0.9	1	1.6	6	1.5	11	1.49	
Marital Status	Married	116	74.4	82	71.9	41	65. 1	247	59.6	486	65.76	
	Single	28	17.9	21	18.4	17	27.0	138	34.0	204	27.60	
	Divorced	6	3.8	7	6.1	4	6.3	3	0.7	20	2.71	
	Widow/widowers	6	3.8	4	3.5	1	1.6	18	4.4	29	3.93	
Education Level	None	14	9.0	7	6.1	1	1.6	41	10.1	63	8.53	
	Primary	22	14.1	23	26.2	7	11.1	46	11.3	98	13.26	
	Junior Secondary	22	14.1	10	8.8	17	27.0	39	9.6	88	11.91	
	Senior Secondary	78	50.0	55	48.2	31	49.2	208	51.2	372	50.34	
	Tertiary	20	12.8	19	16.7	7	11.1	72	17.7	118	15.96	
Occupation	Charcoal Producers	33	21.2	27	23.7	7	11.1	-	-	67	9.07	
	Civil Servants	8	5..1	10	8.8	1	1.6	47	11.6	66	8.93	
	Farming	99	63.5	22	19.3	30	47.6	74	18.2	225	30.45	
	Schooling	7	4.5	3	2.6	3	4.8	70	17.2	73	11.23	
	Trading	9	5.8	52	45.6	21	33.3	210	51.7	292	39.51	
	Pension/others	-	-	-	-	1	1.6	5	1.2	6	0.81	
Years of Experience	=<5	51	32.7	77	67.5	46	73.0	153	37.7	327	44.25	
	6-10	74	60.3	29	25.4	17	25.0	231	56.9	351	47.50	7.77
	=>11	11	7.0	8	7.0	0	0	22	5.42	21	5.55	

Source: Field survey, 2023

Constraints influencing Key Actor Participation in Charcoal Value Chain in Benue State

Result of principal component analysis showed that there were five common factors and their cumulative variance proportion accounted for 63.85% of the total variance which is above the percentage recommended to be satisfactory for social science research (Bagheri and Fami, 2016) with Eigenvalue above 1 (Table 2). The extracted factors exclude those factors loadings whose values were less than 0.40. The extracted factors were named as 'Institutional and policy constraint', 'Production constraint', 'Financial and marketing constraint', Infrastructural facilities constraint', and 'Technological constraint.

Factor 1 (F1) 'institutional and policy constraint': F1 named 'institutional and policy constraint', loaded from nine-factor loadings accounted for 37.7% of the total variance showing that charcoal value chain is concerned with issues bordering on community guidelines on forest regulations, policy regulations to access to woodland/forest, state and local government policies, absence of protected species, availability of environmental safety nets, taxes and levies, ambient business environment and security concern (Table 2). The study indicated that CVC actors were worried about institutional and policy issues concerning charcoal sector in the state. This is in line with the submission by Mwampamba *et al.* (2023) that, the absent of institutional and sound charcoal policy is the reason behind inabilities of countries in Africa to achieve sustainable charcoal production as well as missing opportunities for greening´ the charcoal value chain. Sanders *et al.* (2013) opined that political economy of the charcoal sector has been blamed for some states' inability to regularize and formalize the industry, leading to a large difference between the *de facto* and *de jure* governance. Scholars believed that forestry sector in many African countries has been characterized as being disorganized and regulated by contradictory laws, many of which disregard the importance of charcoal to the livelihood of the people and formal governing authorities may not have the means or ability to carry out formal governance, which leads to the continuation of illegal forest exploitation (Doggart and Meshack, 2017; Sola *et al.,* 2019).

Additionally, it has been stated that great number of small-scale informal producers involved in the value chain leads to a sector that is controlled by people who lack the authority and capacity to demand and negotiate for more favorable treatment (Doggart and Meshack 2017; Mabele, 2020). Governments may therefore be seen as being "at war" with important participants in the value chain, especially producers and dealers (Mabele, 2020). the effective integration of informal institutions may promote improved forest governance quality. According to Schure *et al*. (2013), licenses and quota systems are employed in Central Africa countries such as Cameroon, Central Africa Republic, Congo, and DRC and West Africa countries like Burkina Faso, Mali, Niger, and Senegal to control the charcoal industry. But because of poor regulatory framework and shoddy permit system execution, the restrictions are weak and ineffectual.

Factor 2 (F2), named 'production constraint': This was considered a constraint', loaded from seven-factor loadings and explained by 8.3% of the total variance revealed charcoal valuechain actors were worried about ownership and management of forest, proximity to forest, knowledge of the sources of deforestation, preferred species for charcoal production, girth size of the trees, training programmes on charcoal production, and the quantity and sustainability of charcoal production. This was a critical constraint because of the increase pressure on the already fragile Benue ecosystem as savannah. CVC actors, especially producers, noted that there was sharp decline in tree availability in the State causing them to travel distances in search of tree species for production. This was also evidence by the high use of soft wood species like *Parkia biglobosa, Mangifera indica* among others. This is likely to increase cost incurred of production as they may be made to pay for tree species to be used to the locals where those species are found, because once they leave their communities their right to land is restricted. This line of though aligns with the work of Brobbey (2019) in Ghana and Vargas-salgado *et al.* (2022) who believed that high level of charcoal production is resulting into fast deforestation which is causing a sharp decline in the supply of tree species for charcoal processing.

Factor 3 (F3) 'financial and marketing constraints': F3 loaded from four-factor loadings accounted for 6.90% of total variance, borders on competition and availability of alternative products, price of charcoal, access to market that are consumer driven, and availability of capital to support the business were the four major factors that affect charcoal business in Benue State. It is observed that Nigerians'

households often utilize a combination of energy sources in their household which can be classified as traditional (wood and agricultural scraps), intermediate (charcoal and kerosene), or modern (liquefied petroleum gas (LPG), biogas, and electricity (Adekoya *et al.,* 2023; Baraya *et al.,* 2023). Mhache (2021) opined that, due to charcoal's accessibility and affordability, more people are choosing to utilize it rather than LPG or electricity. Adamu *et al.* (2020) stressed that, access to electricity in Nigeria is limited, hence it affected it utilization. This confirmed that, availability of alternative products could be a factor affecting participation in charcoal business in Benue State. Nabukalu and Giere (2019) submitted that, world over, electrified areas continue to use charcoal as a source of energy, despite the fact that charcoal consumption is frequently associated with a lack of contemporary options. This may be due to the high cost of these other sources of energy which are often beyond the reach of many people, agreeing with the submission by Muazu *et al.* (2022) that charcoal can be used in place of other energy sources. When the cost of other energy sources rises, households will turn to charcoal as an alternative since it is more affordable other energy sources. According to Rose *al.* (2022) the demand for charcoal will continue to go up, because it supplies is more consistent and it is cheaper compared to other sources of energy.

Factor 4 (F4), named 'infrastructural facilities constraint': Factor 4 was loaded from three-factors centred on access to feeder roads, availability of transportation means, and affordable means of transport which accounted for 6.55% of the total variance in charcoal production. Insufficiency of basic amenities in rural areas may trigger charcoal production. Charcoal Value chain actors in Benue state believe that 'infrastructural facilities decay is state is not helping the business. Due the poor roads network in the state resulting in the high cost of charcoal transportation in the state. This was consistent with the findings of Ayodeji (2020) who rated poor road network and transport cost as major challenges of charcoal business in Ekiti state. Studies (Obiri *et al.,* 2014, Teyie, 2021) indicated that vehicles used for charcoal transportation are usually old ones, resulting into frequent breakdown on the road while conveying the products for Off-takers to markets. This constitutes security challenge owning the insecure nature of the State.

Factor 5 (F5), named, 'technological constraint': F5 loaded from two-factor loadings accounted for 4.65% of total variance showed that charcoal production is constrained on issues concerning technical skills and the quality of charcoal production equipment. The result is not surprising because charcoal production processes in Benue State are dominantly the traditional earth kiln technology. The conversion efficiency of earth kiln technology is often low, ranging from 10-27% (Chidumayo, 2013; FAO, 2017). Due to the strenuous physical labour involved in producing charcoal using earth kiln technology, the position has been referred to as a "safety net" or a means of employment for rural impoverished people "without alternative economic opportunities" (Arnold *et al.*, 2006).

Table 2: Rotated Component Matric of Factors influencing Key Actors Participation in CVC

Rotated Component Matrix[a]					
	Component				
	F1	F2	F3	F4	F5
Community guidelines on forest regulations	.826				
Policy regulations to access to woodland or forest	.769				
State policies	.741				
Local government policies	.671				
Absence of protected species	.670				
Availability of environmental safety nets	.634				
Taxes and levies	.589				
Ambient business environment	.568				
Security/crime rate	.535				
Ownership and management of woodland/forest		.871			
Proximity to actual woodland or forest		.785			
Knowledge of the sources/severity of deforestation		.703			
Preferred species		.643			

Girth size of the trees		.633			
Training programmes on charcoal production		.632			
Quantity and sustainability		.599			
Competition and availability of alternative products			.772		
Price of charcoal			.610		
Access to markets that are consumer driven			.504		
Availability of capital to support the business			.489		
Access feeder roads				.783	
Availability of transportation means				.696	
Affordable means of transport				.646	
Technical skills					.828
Quality of charcoal producing equipment					.851
Eigen values	10.196	2.237	1.862	1.688	1.257
% of variance extraction	37.764	8.287	6.896	6.552	4.654
Kaiser-Meyer-Olkin test	**0.882**				
Bartlett's Test of Sphericity ($\chi 2$) (df: 120)	6.97e3	0.000***			

Source: Field survey, 2023

CONCLUSION

Charcoal is key in the energy sector as provides fuel for over half of urban households and revenue and income for a large number of rural households. The study showed that a number of key actors; charcoal producers, transporters, marketers and consumers are dominant participants in charcoal value chain in Benue State. Holistically, CVC in Benue State is dominated by male, however, the female gender was actively and dominantly involved charcoal marketing and consumption. The study also established the involvement of active and virile young people in CVC. Further, it is evident that CVC was constrained principally by five (5) common factors namely; 'institutional and policy constraint', 'production constraint', 'financial and marketing constraint', infrastructural facilities constraint', and 'technological constraint'. Therefore, addressing these constraints, especially the institutional and policy factors through inclusive involvement of government agencies and community leaders as regulators in CVC would ensure effective policy formulation and implementation for a sustainable charcoal exploration.

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