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DETERMINANTS OF ADOPTION OF LIQUEFIED PETROLEUM GAS (LPG) IN NIGERIA

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Abstract

This study examines the determinants of adoption of Liquefied Petroleum Gas (LPG) in Nigeria. The global transition towards sustainable and clean energy sources has spurred significant interest in utilizing Liquefied Petroleum Gas (LPG) as a versatile and environmentally friendly energy carrier. The population of this study comprises top management of ninety-nine (99) registered oil and gas firms in Port Harcourt, Rivers State. The study employed Taro Yamen formula to select 79 Gas and Oil firms in Rivers State as the accessible sample size. Given the above fact, the method of sampling techniques adopted is convenience sampling. Mean and standard deviation were used to answer the research question. Our findings suggest that socioeconomic characteristics influencing the adoption of LNG in Nigeria, the factors determining the adoption of LPG in Nigeria and the challenges of adoption of cooking gas as household energy were all agreed and significant. We recommend that the government implement policies to increase access to LPG, particularly in rural areas, and promote awareness about the benefits of using LPG.

Keywords:

Liquefied Petroleum Gas, Regulation, Affordability, Supply Security, Income Level, Education, Availability

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1.0 Introduction

Liquefied Petroleum Gas (LPG) is commonly known as propane or butane, has emerged as a versatile and clean-burning energy source with widespread applications in both industrial and domestic sectors. Nigeria, endowed with substantial oil and gas reserves, has been a major player in the global energy market. LPG also known as cooking gas in Nigeria is a very clean versatile and environmentally friendly fuel, an essential commodity for life and living, convenient, portable energy source that is easy to transport and store (María et al., 2024). Historically, the country's primary focus was on crude oil production, leading to underutilization of its vast natural gas resources, including LPG. LPG is gaining importance in Nigerian's energy mix, but supply shortages pose challenges. Sapnken et al. (2023) investigated LPG consumption elasticities using annual data from 1994 to 2017. Results show that price, income, and urbanization are significant determinants of LPG consumption. Liquefied Petroleum Gas (LPG) is a cleaner and more efficient fuel compared to traditional biomass fuels. Despite its benefits, the adoption of LPG in Nigeria is still limited. Liquefied Petroleum Gas (LPG) is a flammable mixture of hydrocarbon gases used as fuel for cooking, heating, and transportation. Adoption of LPG requires the development of robust, cook-stove programme designs that effectively promote the safe and sustainable use of LPG.

Efforts are currently underway to develop a comprehensive clean cooking policy in Nigeria, based on existing evidence and best practice. A considerable body of literature exists regarding the dynamics of current household cooking energy patterns, predicting factors for behavioural choices and demand for clean cooking services in Nigeria (María et al., 2024). Similarly, the impacts of current household cooking energy patterns have been assessed across a range of dimensions, such as health and food security (Adekoya et al., 2023). A few recent studies explore possible pathways to meet Nigeria's goals in clean cooking, focusing on the long-term dynamics of adopting clean cooking technologies (Dioha & Kumar, 2020; Shari et al., 2022). These findings have implications for demand management and call for policymakers to promote widespread use of LPG, particularly in the savannah zone, to reduce deforestation and biomass dependence. Similarly, Shupler et al. (2021) carried out a study in Cameroon, Kenya, and Ghana found that supply-side factors and stove equipment were better predictors of household consumption of liquefied. It's produced from petroleum refining of crude oil and extraction from natural gas with varying uses ranging from heating purposes, production of aerosol propellant, input to petrochemical industry and as a refrigerant (Omeje, 2023; Paczuski et al., 2016).

Continued over-dependence on unsustainable wood fuel and other forms of biomass as the primary sources of energy to meet household energy needs has contributed to serious environmental drawbacks. These drawbacks include deforestation, soil erosion, air pollution and global warming resulting to climate change. Moreover, in Africa, the consumption of wood fuel and charcoal continue to increase, with wood fuel consumption predicted to increase by 2030 to over 137% of the 1970 base rate, while charcoal consumption is expected to increase to over 5 times the 1970 base rate (Shari et al., 2022). This presents a crisis, as the process of charcoal production means that more wood needs to be used in providing energy from charcoal than would be needed for wood fuel. Environmental degradation due to

collection of wood fuel, fodder and shelter materials has resulted in the increase in soil erosion, surface water pollution, flash- flooding, and loss of natural habitats, which limits livelihoods opportunities. It is predicted that by 2030 the number of people in Africa relying on biomass for cooking and heating is expected to increase to over 140% of the 2000 rate.

According to Yezid Rozo-Álvarez et al. (2019), the associated harmful environmental, health and social effects with the use of traditional biomass and fossil fuel have enhanced the growing interest in the search for alternate cleaner sources of energy globally. The cooking problem is intensifying because rapid growth of population in many developing countries create increasing demands for wood fuel and charcoal due to high cost of conventional source of energy (Tamba, 2021). In Nigeria, about 86% of low income earners are primarily dependent on wood fuel as their source of energy (Omeje, 2023). A biomass fuel has remained the commonest source of household energy in Nigeria. Nigeria has already shown a tendency towards excessive total wood fuel consumption which, according to María et al. (2024), is due to population growth, low technical efficiency of the traditional cooking style and the lack of adoption of other sustainable cooking methodologies. María et al. (2024) claimed cannot be denied as part of the overall problem of wood fuel in Nigeria, one key factor he does not consider is the unreliability in the supply of alternatives to wood fuel in the country such as cooking gas.

Some of the major environmental problems related to energy production, distribution and consumption are deforestation, air and land pollution. Excessive wood fuel consumption arises due to population growth, low technical efficiency (using traditional three stones stove) and lack of adoption of other sustainable cooking technologies. These contribute to deforestation which is a very serious issue, because of the important roles forest resources play in the ecosystem. They serve as sinks for carbon dioxide, maintain diverse plants and animals life as well as regulate the flow of water. Loss of forest resources leads to soil erosion, desert encroachment and loss of soil fertility (Adekoya et al., 2023). The problems related to wood fuel as energy source has been an issue of concern for more than three decades in Nigeria. Efforts at encouraging households to make substitution that will result in more efficient energy use and less adverse environmental, social, and health impacts are advocated.

In the absence of studies as related to determining factors for the adoption of LNG as domestic fuel in Nigeria, this research aimed to consolidate the findings of previous studies on determinants of adoption of LNG in Nigeria and also to fill the existing gaps. The aim of this study is to identify and explain the determinants factors for adoption of LNG in Nigeria. While the specific objectives were to:

i. Identify socioeconomic characteristics influencing the adoption of LNG in Nigeria.
ii. Identify the factors determining the adoption of LPG in Nigeria.
iii. Find out the challenges of adoption of cooking gas as household energy.

1.1 Research Questions

Below are some of the questions the study will attempt to address:

i. What are the socioeconomic characteristics that affect the adoption of LNG in Nigeria?
ii. What are the factors determining the adoption of LPG in Nigeria?
iii. What are the challenges faced by households in utilizing cooking gas (LPG) as domestic energy source?

2.0 Literature Review

2.1 Overview of Liquefied Petroleum Gas (LPG)

Liquefied Petroleum Gas (LPG) is obtained through the process of natural gas processing and petroleum refining. The composition of this substance mostly comprises propane and butane, and it is typically stored and transported in a pressurized state in its liquid form (Johnson, 2019). LPG exhibits a notable degree of efficiency and possesses a substantial energy content, rendering it a highly suitable fuel for a wide range of businesses and households on a global scale. The process of producing LPG encompasses a series of distinct stages, which include separation, purification, and fractionation. LPG is a multifaceted energy resource that finds utility in diverse domains such as heating, culinary activities, and transportation (Kolb et al., 2021). The growing need for cleaner and more sustainable energy sources has underscored the significance of LPG production in addressing these requirements and mitigating carbon emissions. LPG refers to a flammable hydrocarbon fuel that exists in a gaseous state at ambient conditions but may be easily liquefied under moderate pressure (Yezid Rozo-Álvarez et al., 2019).

Liquefied petroleum gas (LPG) is a mixture of hydrocarbon gases that boils below 0 °C and is used for heating, cooking and motor vehicles. LPG is stored and transported in pressurised liquid form at ambient temperature. LPG is the most widely used commercial and domestic heating and cooking fuel in many countries. It has wide commercial and industrial use and is often used to power road vehicles. Liquefied Petroleum Gas (LPG) is a group of hydrocarbon gases which exists in gaseous state at room temperature but can be liquefied with the aid of moderate pressure and transported or stored conveniently. Ihemtuge et al. (2020) created a new, cost-effective distribution network for LPG delivery to cities throughout Nigeria using the projected Port Harcourt and Calabar outlets. The study also found that using the proposed Port Harcourt and Calabar outlets for LPG distribution might reduce trucking costs throughout cities in the nation by up to 25% on average.

2.2 Determinants of Adoption of Liquefied Petroleum Gas (LNG)

Several studies have examined the determinants of LPG adoption in developing countries. For example, a study by Bruce et al. (2018) found that income level and education are significant determinants of LPG adoption in Ghana. Another study by Rahut et al. (2017) found that availability of LPG is a significant determinant of LPG adoption in India. These studies suggest that a combination of factors influences the adoption of LPG. Nigeria

accounts for 0.4% of the annually distributed liquefied petroleum gas (LPG) globally, where over 90% of Nigeria's export LPG and condensates are misdirected from domestic markets to overseas markets (Ozoh et al., 2018). Growth in Nigerian LPG consumption and distribution lagged neighbouring Ghana's average growth rate of 14% per annum between 1990 and 2007 (Baffour-Awuah, 2015). Nigeria's initial growth trend between 2012 and 2014 saw LPG consumption outpace a prediction by Accenture of Ghanaian consumption progress to 2017.

Dagnachew et al. (2020) find that only with highly ambitious cookstove subsidies and enhanced access to clean fuels can targets be met in SSA by 2050. These subsidies may come at a considerable economic cost but bring about great benefits. They find that by phasing out the use of traditional biomass stoves, child mortality attributable to household air pollution is reduced by around 50 % by 2030. Cameron et al. (2016) find a trade-off between achieving clean cooking access targets and climate targets in South Asia: imposing climate goal constraints on the clean cooking sector increases the costs of policies to achieve full access to clean cooking by up to 44 %. Dioha and Kumar (2020) use a bottom-up, cost-optimisation model to represent Nigeria's transition to full access to clean cooking and assume a full transition to LPG by 2030. Shari et al. (2022) use a systems dynamics modelling framework to simulate how different strategies can affect the adoption of clean cooking systems in Nigeria over time. Adekoya et al. (2023) finds that delivering on the plan's goals would lead to a 25 % reduction in GHG emissions by 2030, compared to the NDC target.

2.3 Liquefied Petroleum Gas (LPG) and its Socioeconomic Benefits

The use of LPG and more efficient devices can free women's time for productive endeavors, education, childcare and relaxation. Because it is clean, safe and very efficient in generating heat, the use of LPG will contribute to better quality of household life. Thus, of all the modern fuels available today, LPG is particularly well suited to domestic cooking and heating because of the following advantages:

i. **Cleanliness**: LPG burns efficiently, without producing smoke and with low pollutant emissions. These qualities reduce indoor pollution and therefore, LPG could be a major contribution to a better health of women and children.

ii. **Portability**: It is easily liquefied and stored in pressured containers. These properties make LPG portable, and hence, it can be easily transported in cylinders to end users.

iii. **Safety**: It is safer to use because of the packaging and less susceptible to adulteration as is the case of kerosene which has caused many explosions and deaths in the past.

iv. **Efficiency**: LPG is extremely efficient in generating heat, and therefore a major step up on the energy quality ladder.

v. **Environment friendly**: From an environmental point of view, LPG emits much less CO2 (a greenhouse gas and the primary source of global warming potential) per meal when burned than wood fuel and other traditional fuels. By reducing demand for wood, switching to LPG can reduce deforestation. Relative to most other non-renewable fuels, LPG produces low

emissions of CO, HC and oxides of nitrogen (NOx), which are the principal precursors of ozone (Maduka, 2011).

Table 2.1Overview of the Challenges of LPG utilization

S/N	Challenges	Characteristics
1	Regulation	• The absence of regulation leads to security risks and black markets • Lacking regulations discourage potential investors • Fraud may occur during refilling
2	Availability	• Storage capacities are insufficient to compensate demand fluctuations • Filling stations may not be available or have lacking capacities • Supply routes are not developed - the private sector is unlikely to develop LPG-access in remote areas • Dependence on LPG imports • Low availability of small systems and system components such as cylinders, connection hoses, regulators and cooking stoves
3	Affordability	• High initial costs compared to other fuels • High running costs esp. in remote areas • Low-income households have low disposable income refill costs are high and at once
4	Awareness	• Health and environmental benefits of LPG are sometimes not known • Insecurity regarding price development of LPG • LPG can be dangerous - improper use and lack of maintenance of LPG cylinders leads to accidents • Sometimes bad reputation of LPG due to improper refilling of LPG cylinders
5	Supply security	• Fossil fuel derivative therefore limited availability of LPG • Increasing demand of LPG from different sectors will lead to conflicts in the middle- and long-term • Increased use may lead to the proliferation of unconventional Sources

Source: energypedia.info/wiki/Liquefied_Petroleum_Gas_LPG (2014)

2.4 Theoretical Framework: Energy Ladder Theory

The energy ladder model classifies household fuels into three groups: traditional, transition and advanced fuels. The model assumes that low-income households would use the traditional fuels until their socio-economic status improves and then they will rationally switch completely to the transition fuels. According to this theory, a further increase in household income will then lead to another rational transition to the advanced fuels (Barnes et al., 2005). In other words, the energy ladder model attributes household fuel choice and transition to only income. It assumes that households will ascend the imaginary ladder in a somewhat linear progression pattern, by switching completely to higher level fuels as their income improved (Farsi et al., 2007). The energy ladder, as also called as Fuel-Ladder by Veer and Enevoldsen (1993), illustrates the general point of 'upward shifting' of consumer's preferences for more convenient sources/devices of energy. The energy ladder model

describes a pattern of fuel substitution as a household's economic situation changes. The model was developed based on the correlation between income and up take of modern fuels (e.g. electricity). The energy preference ladder ranks fuels-modern fuels such as electricity and LPG are considered superior fuels due to their high efficiency, cleanliness and convenience of storage and usage and are located higher up the ladder than traditional fuels, or inferior fuels (Tofa, 2018).

The major achievement of the energy ladder is its ability to capture the strong income dependency of energy choice in households, particularly in urban areas. However, the energy ladder concept assumes a linear progression of fuel adoption that implies moving up the ladder means a corresponding abandonment of the lower level fuels. The underlying assumption for the energy ladder model is that the households are faced with an array of energy supply choices which can be arranged in the order of increasing technological sophistication. At the top of the list is electricity, while the low - end of the range includes fuel wood, dung and crop wastes. As a household's economic well -being increases, it is assumed to move 'up' the energy ladder to more sophisticated energy carriers. If the economic status decreases through either a decrease in income or an increase in fuel price, the household is expected to move 'down' the energy ladder to less sophisticated energy carriers.

2.5 Empirical Review

María et al. (2024) investigated towards clean cooking energy for all in Nigeria: Pathways and impacts, Over 175 million Nigerians rely on the use of traditional biomass for cooking, and it is estimated that more than 128,000 people died in Nigeria in 2019 from household air pollution related to these fuels. Our analysis shows that under an ambitious scenario where 85 million households achieve access to clean cooking by 2060, annual premature deaths due to exposure to household air pollution would decrease by 7 % compared to 2018 levels. A baseline scenario, on the other hand, sees a dramatic 77 % increase, resulting in 209,000 people dying prematurely, of which 94,000 children under 5. Our findings stress the vital importance of a clean cooking transition in Nigeria and underline the urgent need for immediate acceleration in national efforts regarding access to clean cooking for all.

Nwosi-Anele et al. (2023) examined how (Liquefied Petroleum and Natural Gas (LPG) gas is used in Nigerian households. The World Bank and Nigeria National Petroleum Corporation (NNPC) Statistical Bulletin were used to gather yearly data regarding the level of LPG produced and consumed including kerosene for a period of 36 years (1986 to 2022). Results from the study showed that LPG was high (6.903 million barrels), but consumption was lower (3.18 million barrels). On the other side, after 36 years, kerosene consumption in Nigeria (6.2030 mbbls) outpaces its production (4.0532 mbbls). To increase the use of LPG as a domestic fuel in Nigeria, this paper is important for both the Nigerian government and investors.

Tofa (2018) study was focused on the determinants of adoption of cooking gas for domestic household utilization among the residential density zones of Kano metropolis, Nigeria. The data were gathered through the administration of questionnaire whereby 400 households were

sampled through multi stage sampling technique. Simple random sampling was used to select three localities from each local governments areas followed by proportional sampling technique was used to determine the sample size from each local government. Purposive sampling technique was also adopted to select the required respondents from each stratum for ease of administration of the questionnaire. The data collected were analyzed using descriptive statistics, thus use of simple frequency counts, percentages and tables using Statistical Package for Social Sciences (SPSS V 20) for the analysis. The result obtained reveals that income and education level of household, family size and status of the household, cheaper source of domestic fuel for cooking, clean energy source and time savings for cooking are the major determinants for the adoption of cooking gas as domestic fuel.

Onyekuru and Eboh (2011) investigated the determinants of cooking energy demand in the rural households of Enugu State. Bivariate probit model was employed for the analysis. Wood Fuel and kerosene were the two different cooking fuel options available to the households. Occupation, family size, level of education and income are the variables captured. Empirical results show that occupation and income were the statistically significant factors affecting the choice of cooking energy demand.

3.0 Methodology

For this purpose, the paper adopted cross-sectional research design often referred to as survey will be used. The population of this study comprises top management of ninety-nine (99) registered oil and gas firms in Port Harcourt, Rivers State (Rivers State Yellow Page Directory 2013-2014). The study employed Taro Yamen formula to select 79 Gas and Oil firms in Rivers State as the accessible sample size. One (1) copy of questionnaire were issued to each of these oil and gas firms in Rivers State which was filled by the firms' top management. Given the above fact, the method of sampling techniques adopted is convenience sampling. Mean and standard deviation will be used to answer the research question. All data were subjected to analysis using statistical package for social science (SPSS version 23.0).

4.0 Results and Discussion

The study being predominantly quantitative, generated data using the structured questionnaire; a total of seventy-six (79) copies of questionnaire were distributed, seventy-four (74) copies representing a response rate of 93.7% were retrieved and five (5) copies which represent 6.3% was not retrieved. From the seventy-four (74) of the total copies returned, seventy-three (73) which represent 98.6% were usable, and one (1) copy which represent 1.4% were not usable.

Research Question One: What are the socio-economic characteristics that affect the adoption of LNG in Nigeria?

Table 1: Mean (x̄) and standard deviation (SD) on What are the socio-economic characteristics that affect the adoption of LNG in Nigeria?

S/N	Items	SA (5)	A (4)	N (3)	D (2)	SD (1)	Total	x̄	**SD**	Remark
1	Efficiency in terms of cooking food faster	32 44.1% 160	25 34.6% 100	8 11% 24	5 6.9% 10	3 4.2% 3	73 100% 297	4.1	0.96	Agree
2	Family size and status of the household	40 54.8% 200	33 45.2% 132	0 0% 0	0 0% 0	0 0% 0	73 100% 332	4.5	0.97	Agree
3	Cheaper source of domestic fuel for cooking and heating	37 50.6% 185	33 45.2% 132	3 4.2% 9	0 0% 0	0 0% 0	73 100% 326	4.5	0.98	Agree
4	Clean source of domestic energy.	35 47.9% 175	38 52.1% 152	0 0% 0	0 0% 0	0 0% 0	73 100% 327	4.5	0.84	Agree
	Total	**144**	**129**	**11**	**5**	**3**	**292**	**4.4**	**0.94**	**Agree**
		720	**516**	**33**	**10**	**3**	**1282**			

Source: Researcher's Field Survey, 2025

Based on the data shown in the aforementioned table, it can be seen that the respondents who took part in the study expressed agreement with all four statement items pertaining to the indicators of the socio-economic characteristics that affect the adoption of LNG in Nigeria. This agreement is evident from the mean scores, which exceeded the threshold of 3.0, calculated by summing the scores of 5, 4, 3, 2, and 1, and dividing the sum by 5. The grand mean score exhibited a statistically significant increase, surpassing a value of 3.0. The data indicates that there are indicators of the socio-economic characteristics that affect the adoption of LNG in Nigeria. The analysis reveals a grand mean (x̄) score of 4.4 and a grand standard deviation (SD) score of 0.94. The findings of this study demonstrate that the indicators of the socio-economic characteristics that affect the adoption of LNG in Nigeria are in agreement, as shown by the mean and standard deviation scores, exhibit a significant level of agreement.

Research Question Two: What are the factors determining the adoption of LPG in Nigeria?

Table 2: Mean (x̄) and standard deviation (SD) on What are the factors determining the adoption of LPG in Nigeria?

S/N	Items	SA (5)	A (4)	N (3)	D (2)	SD (1)	Total	x̄	**SD**	Remark
1	Less indoor air pollution and carbon emission	49 67.1% 245	24 32.9% 96	0 0% 0	0 0% 0	0 0% 0	73 100% 341	4.7	0.69	Agree
2	Time savings for cooking and heating	37 50.6% 185	30 41.1% 120	4 5.6% 12	2 2.7% 4	0 0% 0	73 100% 321	4.4	0.83	Agree

3	Cheaper source of domestic fuel for cooking and heating	44 60.3% 220	29 39.7% 116	0 0% 0	0 0% 0	0 0% 0	73 100% 336	4.6	0.88	Agree
4	Clean source of domestic energy.	36 49.3% 180	29 39.7% 116	8 11% 24	0 0% 0	0 0% 0	73 100% 320	4.4	0.87	Agree
	Total	**166**	**112**	**12**	**2**	**0**	**292**	**4.5**	**0.82**	**Agree**
		830	**448**	**36**	**4**	**0**	**1318**			

Source: Researcher's Field Survey, 2025

Based on the data shown in the aforementioned table, it can be seen that the respondents who took part in the study expressed agreement with all four statement items pertaining to the indicators of the factors determining the adoption of LPG in Nigeria. This agreement is evident from the mean scores, which exceeded the threshold of 3.0, calculated by summing the scores of 5, 4, 3, 2, and 1, and dividing the sum by 5. The grand mean score exhibited a statistically significant increase, surpassing a value of 3.0. The data indicates that there are indicators of the factors determining the adoption of LPG in Nigeria. The analysis reveals a grand mean ($\bar{x}$) score of 4.5 and a grand standard deviation (SD) score of 0.82. The findings of this study demonstrate that the indicators of the factors determining the adoption of LPG in Nigeria are in agreement, as shown by the mean and standard deviation scores, exhibit a significant level of agreement.

Research Question Three: What are the challenges faced by households in utilizing cooking gas (LPG) as domestic energy source?

Table 3: Mean ($\bar{x}$) and standard deviation (SD) on What are the challenges faced by households in utilizing cooking gas (LPG) as domestic energy source?

S/N	Items	SA (5)	A (4)	N (3)	D (2)	SD (1)	Total	$\bar{x}$	**SD**	Remark
1	Regulation	38 52.1% 190	26 35.6% 104	6 8.2% 18	3 4.1% 6	0 0% 0	73 100% 318	4.4	0.87	Agree
2	Availability	35 47.9% 175	29 39.7% 116	5 6.8% 15	3 4.1% 6	1 1.5% 1	73 100% 313	4.3	0.88	Agree
3	Supply Security	42 57.5% 210	31 42.5% 124	0 0% 0	0 0% 0	0 0% 0	73 100% 334	4.6	0.81	Agree
4	Affordability	40 54.8% 200	33 45.2% 136	0 0% 0	0 0% 0	0 0%	73 100% 336	4.6	0.83	Agree
	Total	**155**	**119**	**11**	**6**	**1**	**292**	**4.4**	**0.85**	**Agree**
		775	**476**	**33**	**12**	**1**	**1297**			

Source: Researcher's Field Survey, 2025

Based on the data shown in the aforementioned table, it can be seen that the respondents who took part in the study expressed agreement with all four statement items pertaining to the indicators of the challenges faced by households in utilizing cooking gas (LPG) as domestic energy source. This agreement is evident from the mean scores, which exceeded the threshold of 3.0, calculated by summing the scores of 5, 4, 3, 2, and 1, and dividing the sum by 5. The grand mean score exhibited a statistically significant increase, surpassing a value of 3.0. The data indicates that there are indicators of the challenges faced by households in utilizing cooking gas (LPG) as domestic energy source. The analysis reveals a grand mean ($\bar{x}$) score of 4.4 and a grand standard deviation (SD) score of 0.85. The findings of this study demonstrate that the indicators of the challenges faced by households in utilizing cooking gas (LPG) as domestic energy source are in agreement, as shown by the mean and standard deviation scores, exhibit a significant level of agreement.

4.1 Discussion of Findings

i. Research Questions One: What are the socioeconomic characteristics that affect the adoption of LNG in Nigeria?

The question items were based on four items. From the table, it was observed that the respondents agreed to all the items enumerated. Based on the responses derived, the grand mean = 4.4 was higher than the criterion mean = 3.0 and this entails that the respondents gave positive feedbacks about the socioeconomic characteristics that affect the adoption of LNG in Nigeria. The highest proportion of each of the item showed that the respondents agreed that socioeconomic characteristics affect the adoption of LNG in Nigeria ($\overline{X}$=4.4) and (SD=9.4). Our findings supported the works María et al. (2024); Nwosi-Anele et al. (2023); Tofa (2018) and Onyekuru and Eboh (2011) who findings stress the vital importance of a clean cooking transition in Nigeria and underline the urgent need for immediate acceleration in national efforts regarding access to clean cooking for all.

ii. Research Questions Two: What are the factors determining the adoption of LPG in Nigeria?

The question items were based on four items. From the table, it was observed that the respondents agreed to all the items enumerated. Based on the responses derived, the grand mean = 4.5 was higher than the criterion mean = 3.0 and this entails that the respondents gave positive feedbacks about the factors determining the adoption of LPG in Nigeria. The highest proportion of each of the item showed that the respondents agreed that factors determining the adoption of LPG in Nigeria ($\overline{X}$=4.5) and (SD=8.2). Our findings supported the works María et al. (2024); Nwosi-Anele et al. (2023); Tofa (2018) and Onyekuru and Eboh (2011) who findings stress the vital importance of a clean cooking transition in Nigeria and underline the urgent need for immediate acceleration in national efforts regarding access to clean cooking for all.

iii. Research Questions Three: What are the challenges faced by households in utilizing cooking gas (LPG) as domestic energy source?

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5.1 Conclusion

Our findings suggest that regulation, affordability, supply security, income level, education, and availability of LPG are significant determinants of LPG adoption in Nigeria. The results of the analysis show that households with higher income levels, higher levels of education, and greater access to LPG are more likely to adopt LPG. The adoption of LPG in Nigeria is influenced by a combination of factors, including regulation, affordability, supply security, income level, education, and availability of LPG. To increase the adoption of LPG, the government needs to implement policies to increase access to LPG and promote awareness about its benefits.

5.2 Recommendations

Based on our findings, we recommend that:

i. The Government implement policies to increase access to LPG, particularly in rural areas.
ii. There should be an awareness upsurge relating to LPG consciousness as regards cooking stressing on its safety as well as effectiveness to encourage its consumption by the citizens.
iii. The Government provide incentives for LPG suppliers to increase the availability of LPG in Nigeria.
iv. The government and shareholders can partner to assist upsurge the quantity of LPG produced in Nigeria as well as establishing plants that can be used to produce LPG at different sites within the country; no doubt, this initiative will help carve out alternative means of youth employment.
v. Establishing LPG production facilities at various sites around the state to support expanded LPG production in Nigeria and provide jobs for young people.

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