Urban-Rural Differentials in Socioeconomic Characteristics, Agents of Modernity, and Natural Resource Utilization: Towards 'Greener' Families in Nigeria

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Abstract

This paper focuses on factors influencing natural resource utilization among households in Nigeria with a view to conserving natural resource and promoting 'greener' households in the future. Dependent variables included, house floor main materials, house wall main materials, house roof main materials, and type of cooking fuels. Key independent variables were, age, region, residence, education, household size, number of co-wives, type of work, and agents of modernity were household access to; electricity, frequency listened to radio, and frequency watched TV. Data analysis differentiated between 23,403 rural and 15,545 urban women aged 15-49 who participated in the 2013 Nigeria Demographic and Health Survey (NDHS) using logistics regression technique. Findings showed that odds of using finished materials for house compared to rudimentary/natural materials, or the odds of using refined vs. natural cooking fuel varied significantly in both rural and urban areas with respect to key background characteristics i.e. age, region, education, household size, type of work, and agents of modernity namely access to; electricity, radio, and TV. In addition, the odds were significant by number of co-wives, and husband's age only in the rural areas. These key determinants of household natural resource use need be factored into policies and programs tailored to achieve natural resource conservation in the long-run.

Key words: natural resource utilization, household resource, agents of modernity, greener families, rural-urban differentials, socioeconomic characteristics

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Introduction

Nigeria is a country with abundant natural resources with their use underpinning every facet of community life. These resources include traditional biomass fuel (wood, agricultural waste and animal dung), fossil fuel (natural gas, petroleum and kerosene) and renewable fuels (solar, wind and hydroelectric). What determines their utilisation at the household level has been the source of considerable debate among academicians, international observers and policy makers. Despite the vast renewable sources and their potential in Nigeria, majority of the demand of household energy has remained heavily dependent on traditional biomass and fossil fuels. The government is desperate to move household energy consumption towards renewable and environmentally friendly sources. However, the determining factors surrounding household decisions on fuel choice involves a number of complex issues, which go beyond mere policy initiatives (Eleri *et al*, 2012). This has meant that government policies are out of touch with the general thinking and the situation on ground at the community level. The general perception at the community level is that there is no incentive in embracing renewable sources, which is not well-developed and subsequently remain underutilised (Isma'il, 2012; Isma'il *et al*, 2014).

The reluctance to let go of the natural/rudimentary (biomass/fossil) fuels has limited Nigeria's ability to achieve its emission targets and to make significant progress in sustainable development. The United Nations Development Programme (UNDP) reports (UNDP, 2005 & 2011) on the Millennium Development Goals (MDGs), and by extension, the Sustainable Development Goals (SDGs) made two recommendations for countries like Nigeria. Firstly, each country's policy initiative should focus on shifting reliance from natural/rudimentary (biomass/fossil) fuels to renewable alternatives. Secondly, any policy on energy sources should consider the need of poor household (UNDP, 2005, 2011; Naibbi & Healey, 2014).

In an effort to address these issues, the Nigerian government have introduced a number of policy initiatives such as Renewable Energy Master Plan 2005; National Policy Guidelines on Renewable Electricity 2006; National Energy Master Plan 2006 (Baiyegunhi, & Hassan, 2014). Anozie *et al* (2007) in a review of these initiatives identified that the majority of the energy targets set by these initiatives remained unmet. The reasons for this were the lack of effective policy implementation, general lack of awareness from consumers of the compelling need to use alternative energy sources, and the lack of logistics and proper funding (Anozie *et al*, 2007; Naibbi & Healey, 2014).

Consequently, the demand for household energy requirements is more than the supply. While effective demand for household energy consumption is premised on socioeconomic factors, which is in turn influenced by the availability of the supply, competing demands upon the supply and access to sources of resources as evidenced by the fact that in 2013 over 40% of Nigerian households were without electricity. Apart from the general household consumption level, there is also a wide disparity in lack of access to electricity between rural and urban areas (66% versus

16% respectively), which has remained about the same since 2008 (Barnes *et al*, 1984; Olisaekee, 2014; NDHS, 2014).

In order for Nigeria to overcome these shortages, there is the need for an intentional investment to move the nation's household energy need towards renewable fuels as this is an important enabler of social and sustainable development. A transition towards cleaner and more efficient forms of energy is necessary in order to overcome the negative effects of traditional energy on human health and the environment, and to enhance the living conditions of the poor. Thus, understanding household fuel choice and factors influencing use is of vital importance in creating policies that support the fuel transition process (Kroon et al, 2013).

This paper examines natural resource utilisation at the household level and factors having congruent effects on use and implications for the future. The paper looks into four types of natural recourse, which include house; floor materials, wall materials, roof materials, and type of fuel for cooking. The overall objective is to provide information that may enable more 'greener' households, and sustainable development in Nigeria.

Literature Review

An economic perspective of natural resource utilization is known as the energy ladder model (Heltberg, 2003), which argues that household income and relative fuel prices are the basis for fuel choice (Barnes et al, 2005; Naibbi & Healey, 2014). Based on household income, the energy ladder depicts a linear three-stage switching or choice process. The first stage involves a heavy reliance on traditional biomass fuels, while in the second stage a household moves to fossil fuels and in the third stage; they switch to the use of renewable fuels (Inayatullah et al., 2011; Naibbi & Healey, 2014).

Each stage on the ladder corresponds to the most commonly used fuel by a particular income group for a specific energy service. For example, for cooking; wood, animal dung and other biomass fuels are on the first stage, with kerosene on the second stage, and solar and wind power on the third stage. As a household moves up the ladder, in other words switches fuel, the energy released in a useful form increases while the emission of particulates and other combustion by-products decreases. The energy ladder concept is based loosely on the economic theory of household behaviour, and the assumption that renewable fuels are normal economic goods and that traditional biomass fuels are inferior goods. If this is the case then it can be expected that as a household's income increases, it will switch from relying on traditional fuels to fossil fuels and renewable fuels. By extension, higher-income households will make greater use of renewable fuels than low-income households (Reddy, 2000; Hosier and Kipondya, 1993; Clancy, 2006).

Several empirical works has been conducted in Nigeria in support of the energy ladder model. Adebulugbe and Akinbami (1992) examined the energy consumption pattern of 600 urban households in 5 states. Their findings confirmed the fact that disposable income was a major determinant of fuel choice for cooking. A cross-sectional analysis of households' decision in Ogun State revealed income among other factors determined household energy choice. Lower income households were associated with more patronage of natural/rudimentary (biomass) fuels.

These households only moved up the ladder to fossil fuel because their income improved (Shittu *et al*, 2004). Similarly, in a more recent work by Ibiang (2014), findings showed biomass as the most popular domestic fuels use among poor households in rural and urban areas of Cross River State.

Based on household income and price, encouraging fuel switch, thus a move up the ladder has a number of benefits both at the macro- and micro-levels. At the micro-level, making the transition up the ladder results in positive outcomes for the household: health gains (less indoor air pollution), time saving (from more convenient fuels) and potential cost savings for a particular activity (more efficient fuels). At the macro-level, there are environmental benefits to be gained from a reduction in biomass fuels and the subsequent reduction in deforestation (Clancy, 2006).

While there are a number of studies supporting the energy ladder model, there is a body of literature that argues for socioeconomic factors. The argument is that households often do not fully ascend the energy ladder but rather fuel stack, which means that with an increase in income, traditional fuels are not discarded completely, but are rather used in conjunction with modern clean fuels (Baiyegunhi, & Hassan, 2014). This then raises an interesting question as to whether the types of fuel used by households is merely a question of income and price or are there more complex issues involved? To answer this question are the body of literatures that argue that household decision on natural resource utilisation goes beyond economic considerations to include non-economic factors (Clancy, 2006).

The socioeconomic perspective on the other hand argues that household decision on fuel consumption is complex with no single factor as the only determinant. The reason to switch from biomass to fossil fuels for cooking rests on the fact that households have to make choices about expenditures. While the economic perspective tends to see households as a homogeneous entity making rational choices based only on income and price, the socioeconomic perspective incorporates individual background, gender and other factors. For instance, in examining factors determining household fuel consumption in Imo State, age, gender, farm size, marital status, main occupation, and educational level were the determinants for fuel choice (Onyeneke *et al*, 2015). In households where there are adult men and women, the gendered division of labour generally allocates women the responsibility for cooking energy provision related to their spheres of influence in the household, while the men take-up other forms of resource. In addition, when energy is to be purchased, men enter the decision-making process, for example men will often decide on the stove technology if it is to be purchased. Men also make important decisions on other factors that influence cooking and kitchen comfort, for example material for kitchen walls and roofing (Dutta, 1997; Tucker, 1999; Clancy, 2006).

Comparatively, women may actively choose not to use an energy form they find impractical. For instance, they may find that cooking with kerosene is cheaper than wood, but prefer wood fuel for three reasons. First, the power output of the kerosene stove is significantly lower than the traditional wood fire and so cooking takes longer; second, the kerosene stove may not support the round-bottomed cooking pots used in the area, which tends to overbalance during the frequent stirring necessary with local staple foods; and third, the kerosene stoves are not robust (Clancy, 2006).

Evidence from quantitative, and qualitative studies across Nigeria showed gender (Adepoju et al, 2012), age (Onyeneke *et al*, 2015), household size (Ogwumike *et al*, 2014), region (Naibbi & Healey, 2014), convenience (Ogunniyi et al, 2012), and level of education (Ibiang, 2014), deforestation (Ajah, 2013) are factors influencing household resource utilization. Other key determinants of resource use are, affordability (Shittu *et al*, 2004; Ibiang 2014), and availability (Ogunniyi et al, 2012). For instance, in Ogun State, the result from a survey study showed that over 53 per cent of respondents use wood for cooking, 54.6 per cent used charcoal for cooking and 79.2 per cent use kerosene. In the final analysis most households vary use of different energy sources. Those who use a combination of two, either combine wood and charcoal or wood and kerosene. Male-headed households were less likely to use wood for cooking than female-headed households (Adepoju et al, 2012).

Modernity is a third dimension in household resource utilization. Modernity is a force of change that could bring about development (Mohsin, 2014), and transition from non-renewable to renewable resource utilization (Showers, 2011) in Nigeria and other sub-Saharan Africa countries. Key agents of modernity such as electricity, television, and radio, employed in this study, have untoward influence on the attainment of renewable resource utilization in Nigeria. Electricity is a symbol of modernity and its absence in households signals a major departure from civilization and access to modern complex technology (Silvast and Virtanen, 2014). Indonesia under the leadership of Soeharto used electrification as a vehicle of modernity and development of the rural areas with the 'Doctrine of National Electrification Development,' (Munasinghe, 1988; Mohsin, 2014) which propelled interests and investment of many international development agencies in mass electrification of countries of Asia, Africa, and Latin America in the 1970s to 1990s (McCawley, 1978; Mohsin, 2014). A contemporary house with modern technology links electricity to gadgets such as fridge, freezer, heating and cooking appliances, phone, credit cards, computer, dishwasher, Internets and several others, and assuring reality in the age of Internet of things.

Television is another agent of modernity. Its veritable force is evident from the neutralization of the Soviet ideology by the American culture during the cold war (Zhuk, 2014) through series of movies and soap operas. It influenced the social change and fabric of the Singaporeans modern society, especially among youth and women (Chua, 2012). Another tool of modernity is the explosion of ICT, a key vehicle of modernity in sub-Saharan Africa, and other parts of the world. Aside its job creation potential in Nigeria and other countries in the sub-region, ICT especially mobile phone is viewed as positive development towards economic development in the sub-region (Kyem and LeMaire, 2006; Kyem, 2012). This study examines the relationships and interplay between these key agents of modernity and natural resource utilization in Nigeria.

Nigeria's natural resource depletion is a major concern considering its fast growing population, and its increasing encroachment on available arable land. In 2000 population of the country was 122.87 million, a growth rate of 2.53%, and population per square kilometre of 135. By 2010, the country's total population increased to 159.42 million, with increased growth rate of 2.69%, and population per square kilometre of 175. Current population figure is estimated at 186.98 million with a slightly declined growth rate of 2.63%, and increased density per square kilometre of 205

(united Nations, 2016). Nearly 70 precent of the population are poor household that are most likely using biomass fuels, and other natural/rudimentary household materials. It is important therefore to examine factors influencing natural resource utilization in the country with a view to increase more 'greener families', and thus preserve the natural resource and the environment, and contribute to sustainable development goals of the country.

Data & Methods

The 2013 National Demographic and Health Survey (NDHS, 2013) is a nationally representative data collected in all the 36 states in Nigeria and Federal Capital Territory (FCT). The purpose of the NDHS was to provide information on population and health indicators that may help in the development planning efforts in Nigeria. The survey employed stratified 3-staged cluster sampling design with data conducted at each state, Local Government Authority (LGA), locality and Enumeration Area (EA) levels. Forty thousand three hundred (40,320) households were selected from 896 sample points, from which 38,904 eligible households were visited, and 38,522 of these were successfully interviewed with response rate of 99%. Of the 39,902 women aged 15-49 in the households, 38,945 (98%) were interviewed successfully.

Respondents Basic Characteristics

Women's basic characteristics: Over half of the women who participated in the NDHS survey were aged 29 or younger (56%), lived in the northern regions (58%), mostly of rural residence (60%), and had primary or no education (54%). The majority of respondents were married or living with a partner (70%), had a large household of 5 or more (67%), did not have co-wives (66%), were not working/engaged in none office work (58%), and were of the middle or poorer/poorest wealth category (57%).

Husband's basic characteristics: Most husbands/partners were aged 35 or older (73%), had primary or no education (57%), and were not working/engaged in none office work (99%).

Agents of modernity: Results (Table 1) show that a little above half (53%) of the respondents reported that their household had electricity at the time of interview. With respect to radio, 26% listened to radio less than once a week, and 39% listened at least once a week. On exposure to TV, 20% of respondents watched less than once a week, while 36% watched at least once a week.

Household Natural Resource Use: Results in Table 1 show that main materials used for flooring most houses of study respondents were of natural/rudimentary materials (83%), likewise wall materials were mainly natural/rudimentary (99%), while main roofing materials were finished materials (77%). Results of composite measure of response on materials used in building a house i.e. combination of floor, wall, and roofing materials showed that houses in Nigeria were mostly of natural-rudimentary materials (99%). Natural/rudimentary materials defined by the NDHS include earth/sand, dung, wood planks, and palm/bamboo. Natural/rudimentary wall materials include cane/palm/trunks, dirt, bamboo/mud, and stone with mud, plywood, cardboard, re-used

wood and metallic zinc. While natural/rudimentary roofing materials include thatch/palm leaf, rustic met palm/bamboo, wood/plank, and cardboard paper. Results of this study showed that the majority of respondents (78%) used natural-rudimentary materials for cooking including coal lignite, charcoal, wood, straw/shrubs/grass, agricultural crops, and animal dungs. Natural-rudimentary materials are unprocessed, of low quality materials with the tendency for short-term depletion and demand for replenishment with consequences on the environment.

In addition, NDHS data suggest that the majority of household used natural fuel for cooking (78%). Natural fuel include coal lignite, charcoal, wood, strew/shrubs/grass, agricultural crops, and animal dungs.

Multivariate Results

Rural Households & Resource Utilization

Five dependent variables are used to measure natural resource utilization in this study namely; (1) main materials used for house floor (natural/rudimentary = 0 vs. finished materials = 1), (2) main materials used for house wall (natural/rudimentary = 0 vs. finished materials = 1), and (3) main materials used for house roofing (natural/rudimentary = 0 vs. finished materials = 1). Other dependent variables are; (4) composite measure including the three types of materials (mostly natural/rudimentary = 0 vs. finished materials = 1), and type of cooking fuel (natural = 0 vs. refined fuel = 1). The models in Table 2 present the relationships between household natural resource use and key predictors. The explained variances (Nagelkerke R^2) of 32% to 52% are quite robust for this study, and the full model chi-square and -2log likelihood are best fit for these analyses.

Results in Table 2 show that the odds that respondents in the rural areas in Nigeria used finished materials for their house flooring decreased significantly by age, varied by region, increased by level of education, number of other wives, age of husband, and by educational level of husband. The odds that rural respondents aged 30-34 used finished materials for flooring was 0.79 times (p-value = 0.01) as those aged 15-19, and was 0.79 times (p-value = 0.01) for older respondents aged 35-39 compared to the reference category. The odds that respondents in the northeast used finished materials for house flooring was 0.54 times (p-value = 0.001) as their counterparts in the north-central region, and the figures for northwest, southeast, and southwest were 0.43, 1.18, and 0.83 (all p-values = 0.001) compared to the reference category respectively. The odds that respondents with primary education used finished materials for flooring their house was 1.26 times as their counterpart who had no education, and the odds increased to 1.80 times for respondents with secondary education, and 3.83 times for those with higher education (all p-values = 0.001). The odds that respondents who had 5 to 8 member of household used finished materials for house flooring was 0.91 times (p-value = 0.05) as those who had 1 to 4 member of household. The odds that rural respondents reported flooring of their house with finished materials were 1.22 times (p-value = 0.001) for those who had a co-wife, and 1.71 times (p-value = 0.001) for those with two or more co-wives compared to their counterparts in a monogamous relationship. In addition, materials used for house flooring was significantly related to type of work. The odds that rural respondents who engaged in none-office-work used finished materials

in their house flooring was 0.82 times (p-value = 0.001) as likely as those not working, and for respondents in office related work, the odds was 1.44 times (p-value = 0.01) compared to the reference category.

While respondent's age had inverse relationship with the use of finished materials for house flooring, husband's age showed direct positive relationship. The odds that rural respondents whose husband aged 25-34 used finished materials for flooring of house was 1.40 times (p-value = 0.01) as those whose husbands aged 15-19. Likewise, respondents whose husbands aged 35-49, 50-59, and 60+ were 1.42, 1.38, and 1.51 times (p-values = 0.01, 0.5, and 0.01) as the reference category respectively. Education of husband showed similar direction of effects on type of material used for house floor. The odds that husbands with primary education will use finished materials for the floor of their house was 1.44 times as those without education, and for secondary and higher education, the odds were 1.73, and 2.53 times (all p-values = 0.001) respectively.

Results on the relationships between the dependent variables; house wall materials (Model 2), house roof materials (Model 3), composite measure of house materials (Model 4), and basic characteristics of respondents/husbands' were similar to those with house floor materials in Model 1. Model 2, shows the odds that rural respondents used finished materials for the wall of their house decreased with age, husband type of work, and it increased by level of education, number of wives, age of husband, and educational level of husband, and varied significantly by region compared to their respective reference categories. Model 3 shows the odds that respondents used finished materials for their house roofing decreased significantly by age, varied significantly across regions, and increased by educational level, number of household member, number of co-wives, type of work, age of husband, and educational level of husband compared to their respective reference categories.

Model 4 examined the odds that respondents used finished materials for flooring, wall, and roofing of their house with respect to respondents/their husband's key basic factors. Results in Table 2 show the odds that respondents used finished materials for their house decreased significantly by age, and by husband's work, and it increased significantly by educational level, number of co-wives, husband's age, and husband's educational level, and varied significantly by region compared to their reference categories.

Model 5 (Table 2) examined the relationship between household cooking fuel and basic characteristics of rural respondents and their husbands. Results show the odds that rural respondents used refined fuel as against natural fuel for cooking in their house varied significantly by region, and it increased by educational level, and husband's educational level, and decreased significantly by household size, and type of work compared to their respective reference category. The odds that respondents in northeast used refined fuel for cooking was 0.10 times as their counterparts in north-central region, and for northwest, southeast, south-south, and southwest regions the odds were 0.33, 1.49, 6.16, and 3.92 times (p-values = 0.001, 0.001, 0.05, 0.001, 0.001) respectively compared to their reference categories. The odds that rural respondents with primary education used refined fuel for cooking was 1.94 times (p-value = 0.001) as their counterparts not educated, and for those with secondary, and higher education, the

odds were 3.19, and 5.08 times (both p-value = 0.001) respectively. The odds that rural respondents used refined fuel for cooking was 0.56 times (0.001) as those with 5-8 household size, and 0.28 times (p-value = 0.001) as respondents with 9 or more household member compared to those with 1-4 household size. On type of work, the odd that rural respondents who did none-office-work used refined cooking oil was 0.59 times (p-value = 0.001) as their counterpart not working. Similar to respondents' education, use of refined fuel for cooking increased with husband's education. The odds that rural respondents whose husband had primary education used refined fuel for cooking was 1.67 times (p-value = 0.05) as those not educated, and for those with secondary and higher education, the odds were 2.52 and 3.47 times (both p-value = 0.001) compared to their reference categories respectively.

Rural Households, Resource Utilization & Agents of Modernity

This paper examines the extent to which agents of modernity influenced household natural recourse utilization through its main agents-- electricity, radio, and TV. In general, the results were positive suggesting that rural respondents exposed to modernity used finished materials to build their house. In Table 2, the odds that rural respondents who had electricity at home used finished materials for flooring their house was 2.41 times (p-value = 0.0010) to their counterparts who had no electricity. The odds that respondents who listened to radio at least once a week used finished materials for flooring their house was 1.50 times (p-value = 0.001) as those who did not listen, and it was 1.31 times for rural respondents who listen at least once a week (p-value = 0.001) compared to the reference category. The odds that respondents who watched TV less than once a week used finished materials for their house floor was 1.40 times (p-value = 0.001) as their counterparts who did not watch TV, and 1.72 times (p-value = 0.001) for those who watched at least once a week compared to the reference category.

Table 2, (Model 2) presents results on the effects of agents of modernity on type of materials used for wall of house. The odds that rural respondents who had electricity used finished materials for the wall of their house was 3.62 times (p-value = 0.001) as those who had no electricity. The odds that respondents who watched TV less than once a week used finished materials for the wall of their house was 1.75 times (p-value = 0.001) as those who did not, and 1.91 times (p-value = 0.001) for respondents who watched TV at least once a week compared to the reference category. On house roofing (Model 3), the odds that respondents who had electricity at home used finished materials to roof their house was 4.65 times (p-value = 0.001) as those who had no electricity. The odds that respondents who listened to radio at least once a week used finished materials for roofing their house was 1.18 times (p-value = 0.001) as those who didn't listen at all. The odds that respondents who watched TV less than once a week used finished materials to roof their house was 2.00 times (p-value = 0.001) as those who did not watch TV, and for those who watched TV at least once a week, the odds was 2.42 times (p-value = 0.001) compared to the reference category. The results for the composite measure of resource utilization were quite similar to the single measures. The odds that respondents who had electricity at home used finished materials for their home was 3.97 times (p-value = 0.001) as those who had no electricity. With respect to TV exposure, the odds that respondents who watched TV less than once a week used finished materials for their house was 1.82 times (p-

value = 0.001) as those who did not watch TV, for those who watched TV at least once a week, the odds was 1.96 times (p-value = 0.001) compared to the reference category.

Model 5 shows results of the relationship between agents of modernity and materials for cooking fuel. The odds that respondents who had electricity at home used refined cooking fuel was 2.28 times (p-value = 0.001) as their counterparts who had no electricity. The odds for respondents who listened to radio less than once a week was 0.77 times (p-value = 0.05) as those who do not listen to radio. The odds that respondents watched TV less than once a week was 3.26 times (p-value = 0.001) as those who do not watch TV, and for respondents who watched TV at least once a week, it was 3.86 times (p-value = 0.001) compared to the reference category.

Urban Households & Resource Utilization

Similar to rural areas analysis, the five dependent variables employed in this analysis of urban respondents are. (1) Main materials used for house floor (natural/rudimentary = 0 vs. finished materials = 1), (2) main materials used for house wall (natural/rudimentary = 0 vs. finished materials = 1), and (3) main materials used for house roofing (natural/rudimentary = 0 vs. finished materials = 1). Others dependent variables are; (4) composite measure of house materials comprising the three types of materials in 1 to 3 above (natural/rudimentary = 0 vs. finished materials = 1), and type of natural cooking fuel (natural = 0 vs. refined fuel = 1). The models in Table 3 are on the relationships between natural resource use and explanatory variables. The explained variances (Nagelkerke R^2) ranging from 28% to 52% are quite robust, and the full model chi-squares, and -2log likelihoods compared to their reduced models are best fitted for the analyses.

Results in Table 3 show that the odds that respondents in the urban areas used finished materials for their house flooring increased significantly by age, level of education, and husband's level of education, and it decreased by number of household member, number of co-wives, and husband's type of work, and it varied significantly across region. In Model 6, the odds that respondents aged 35-39 used finished materials for flooring was 1.56 times (p-value = 0.05) as those aged 15-19. The odds that urban respondents in the northeast used finished materials for house flooring was 1.34 times (p-value = 0.05) as their counterparts in the north-central region, and for northwest, southeast, south-south, and southwest the odds were 0.38, 0.52, 0.70, and 4.36 times (p-values = 0.001, 0.001, 0.05, and 0.001) respectively. The odds that urban respondents with secondary education used finished materials for flooring their house was 2.03 times (p-value = 0.001) as their counterpart who had no education, and the odds increased to 3.66 times (p-value = 0.001) for respondents with higher education. The odds that urban respondents who reported 5 to 8 member of household used finished materials for house flooring was 0.79 times (p-value = 0.01) as those of the reference category, and for respondents who reported 9 or more members of household, the odds was 0.75 times compared with the reference category. Findings in Table 3, Model 6 shows that the odds that urban respondents who engaged in none-office-work used finished materials for house flooring was 0.65 times (p-value = 0.001) as those who did not work.

With respect to husband's characteristics, based on the results in Model 6 the odds that urban respondents whose husbands had secondary education used finished materials for the flooring of their house was 1.43 times (p-value = 0.001) as those without education, and for those whose husband had higher education, the odds was 1.47 times (p-values = 0.01) compared to the reference category. The odds that urban respondents whose husband engaged in none-office-work used finished materials for flooring their house was 0.37 times (p-value = 0.01) as those whose husband did nothing, and for respondents whose husband did office related work the odds was 0.49 times (p-value = 0.05) as the reference category.

The types of relationships established in Table 3 between the dependent variables; house wall materials (Model 7), house roof materials (Model 8), composite measure of house materials (Model 9), and basic characteristics of respondents were in the same direction as those established with house floor materials in Model 6. Model 7, shows that the odds that urban respondents used finished materials for the wall of their house decreased significantly with age, varied significantly by region, and it increased significantly by level of education, and husband's level of education. Model 8 showed that the odds that urban respondents used finished materials for their house roofing decreased significantly by number of household member, varied significantly by region, and increased significantly by level of educational, age of husband, and husband's education compared to their respective reference categories.

Model 9 examined the odds that urban respondents used finished materials for three key aspects of their house i.e. floor, wall, and roof with respect to respondents/their husbands' basic characteristics. Results show that the odds for urban respondents that used finished materials for key aspects of their house increased significantly by age, education, and husband's education and it varied significantly by region compared to their respective reference categories.

Table 3, Model 10 shows the relationships between urban household type of fuel used for cooking and urban respondents/their husbands' basic characteristics. Results show that the odds that urban respondents used refined fuel as against natural fuel for cooking in their households increased by age, level of education, and husband's level of education, varied significantly by region, and decreased significantly by household size, number of co-wives, type of work compared to their respective reference categories. The odds that urban respondents aged 25-29 used refined fuel cooking was 1.69 times as their counterpart aged 15-19, and for those aged 30-34, and 35-39 the odds were 1.94, and 1.91 times (both p-value = 0.001) respectively. The odds that urban respondents in the northeast used refined fuel for cooking was 0.23 times (p-value = 0.001) as their counterparts in north-central region, and for those in the northwest, south-south, and southwest regions the odds were 0.69, 3.13, and 4.12 times (all p-values = 0.001) compared to their reference categories respectively. The odds that respondents with primary education used refined fuel for cooking was 1.89 times (p-value = 0.001) as their counterparts not educated, and for those with secondary, and higher education, the odds were 3.44, and 5.57 times (all p-value = 0.001) respectively. The odds that urban respondents who had 5 to 8 household size used refined fuel for cooking was 0.53 times (p-value = 0.001) as those with 1-4 household size, and for those who reported 9 or more household size it was 0.25 times (p-value = 0.001) compared to the reference category.

Likewise, respondents with one co-wife were 0.64 times (p-value = 0.001) as those who had no co-wives to use refined fuel for cooking. On type of work, the odd that respondents who did none-office-work used refined cooking oil was 0.42 times (p-value = 0.001) as their counterpart that were not working, and for those engaged in office-related-work, the odds was 0.81 times as the reference category. Study results show that household use of refined cooking increased with level of husband's education. The odds that urban respondents whose husbands had secondary education used refined cooking oil was 1.85 times (p-value = 0.001) as those whose husband were not educated, and for those whose husband had higher education, the odds was 1.72 times (both p-value both 0.001) compared to their reference categories respectively.

Urban Resource Utilization & Agents of Modernity

This paper examines the influence of modernity in household natural recourse utilization through its key agents of electricity, radio, and TV. In general, the results were suggestive that urban respondents exposed to modernity used finished materials to build their house. Table 3 shows the odds that urban respondents who had electricity at home used finished materials for their house floor was 3.32 times (p-value = 0.001) as their counterparts who had no electricity. The odds that urban respondents who listened to radio at least once a week used finished materials for flooring their house was 1.32 times (p-value = 0.01) as those who did not listen. The odds that urban respondents who watched TV less than once a week used finished materials for their house floor was 1.50 times (p-value = 0.001), and for those who watched at least once a week, it was 1.79 times (p-value = 0.001) compared with their counterparts who did not watch TV.

Results for the relationships between house wall, roof, and composite measure of house materials (Models 7, 8, and 9) and agents of modernity were similar to those on house floor materials in Model 6. Model 7 shows the odds that urban respondents who had electricity used finished materials for the wall of their house was 5.10 times (p-value = 0.001) as those who had no electricity. The odds that urban respondents who watched TV less than once a week used finished materials for the wall of their house was 1.73 times (p-value = 0.001) as those who did not, and 2.20 times (p-value = 0.001) for respondents who watched TV at least once a week compared to the reference category who did not watch. In Model 8 the odds that urban respondents who had electricity at home used finished materials to roof their house was 3.41 times (p-value = 0.001) as those who do not have electricity. The odds that urban respondents who watched TV less than once a week used finished materials to roof their house was 1.82 times (p-value = 0.001) as those who do not watch TV, and for those who watched TV at least once a week, the odds was 2.81 times (p-value = 0.001) compared to the reference category. In Model 9, the odds that urban respondents who had electricity at home used finished materials for their home was 5.03 times (p-value = 0.001) compared to their contemporary who had no electricity. On TV exposure, the odds that urban respondents who watched TV less than once a week used finished materials for their house was 1.69 times (p-value = 0.001) compared to those who did not watch TV, and for respondents who watched TV at least once a week, the odds was 2.16 times (p-value = 0.001) compared to the reference category.

Model 10 shows the results on the relationships between agents of modernity and materials for cooking fuel. The odds that respondents who had electricity at home used refined cooking fuel was 2.51 times (p-value = 0.001) as their counterparts who had no electricity. The odds that urban respondents who watched TV less than once a week used refined cooking oil at home was 2.17 times (p-value = 0.001) compared to those who do not watch TV, and for respondents who watched TV at least once a week, it was 2.86 times (p-value = 0.001) compared to the reference category.

Discussion

This study examines factors influencing natural resource utilization among households in Nigeria with a view to reducing resource utilization towards greener households and reduction in deforestation in the country. Basic characteristics of women in households, who were the principal unit of analysis and agents of modernity, were the key explanatory factors. The analysis controlled for residence just to have deeper insights on rural-urban differentials in the dynamics of resource utilization in the household. Resource utilization employed in this study are of two types; (1) house building materials dichotomized primarily into finished materials vs. natural/rudimentary materials, and (2) household natural fuel for cooking dichotomized into natural vs. refined fuel. The underlining argument is that households that used finished or refined natural resource are likely to consume less in the long-run, thus contributing to reducing deforestation, and cleaner environment (Clancy, 2006). Aside the differences in quality of life, finished materials are likely to last longer than natural/rudimentary materials and thus, less demand for replacement in a rapidly growing population.

Results of this study suggest some variations in urban-rural differences in the factors influencing natural resource utilization in households. In general, more explanatory factors were significant across the five dependent variables in the rural than the urban areas. Key significant explanatory factors cutting across most dependent variables in the rural areas were age, region, and education, household size, number of co-wives, type of work, husband's age, husband's educational level, and the agents of modernity including electricity, radio, and TV. While key significant explanatory variables for urban areas were age, region, educational level, household size, husbands' education level, electricity, and TV. The results of this study accentuate rural-urban gaps in access to renewable energy identified in the literature (UNDP, 2011; Naibbi & Healey, 2014). The implications are that more efforts will be needed in the rural than the urban areas to address these key factors in programs geared towards reducing natural/rudimentary resource utilization and transition to renewable energy in the rural compared to urban areas.

Findings corroborate other studies that age is a key explanatory factor of natural resource utilization (Onyeneke, et al., 2015). While age was inversely related to the dependent variable in the rural areas, it had the opposite relationship in the urban areas. In rural areas, the odds that respondents in the older ages used finished materials for their house or refined fuel for cooking

declined with age, but in the urban areas, it increased with age. The difference in the results may be connected to cultural differences, beliefs, coupled with poverty that makes rural older people less inclined or less receptive to change. The results in the urban areas may be linked more to poverty among the younger population. Policies and programs will need to focus more on older rural respondents and younger urban respondents with customized information on the importance of using finished materials for their houses, and the health benefits of refined fuel for cooking and their health implications.

The odds that respondents in the rural southern regions compared to their northern counterparts used finished materials for their houses and used refined fuel for cooking was clear except in southwest regions that behaved more like northern regions except for fuel used for cooking. Results for the urban areas were quite different. Urban respondents in all regions except southwest used less finished materials for their houses and less refined fuel for cooking compared to other regions. Likewise, the odds that urban respondents in all regions (except the southwest) used finished materials for their house decreased compared to the north-central and other regions. The odds of using refined fuel for cooking increased substantially in south-south and southwest regions compared to the north-central and other regions. These results suggest that policy and programs addressing natural resource utilization need to consider region specific differences and perhaps, state specific variations as well in order to be more effective in reducing natural/rudimentary resource use and thus, averting deforestation and other health hazards in the regions.

Results of this study corroborate others that education is a strong and consistent determinant of natural resource use in Nigeria (Ibiang, 2014; Onyeneke et al., 2015). Results both in rural and urban areas consistently showed that educated respondents and their husbands were more likely than the uneducated to use finished materials for building their houses and refined fuel for cooking. These results imply that government policy and programs should focus more attention on awareness campaign (Anozie et al., 2007; Naibbi & Healey, 2014) for the uneducated segments of society both in the rural and urban areas to reduce use of natural/rudimentary materials for building house, and discourage use of natural fuel for cooking which are mostly hazardous to health.

Having a co-wife increases the chances of rural respondent's use of finished materials to build their house, but this factor was largely insignificant in the urban areas. Co-wife may indicate some measure of wealth in the family, which may have contributed to the means to use finished materials for house, and refined fuel for cooking. Although the odds of using finished materials to build house increased for rural respondents who were engaged in office work, results were inconsistent for respondents who reported use of refined fuel for cooking, and for those whose husbands engaged in office work. The reasons for the inconsistent results are not clear, but may be linked to lack of, or inconsistent disposable income available to make choice on natural resource utilization (Adebulugbe & Akinbami, 1992).

Results of this study showed that agents of modernity were positively related to natural resource utilization. Respondents in both rural and urban areas who had electricity, listened to radio and watched TV used finished materials for their house, and used refined fuel for cooking. These

results corroborate others that suggest that electricity, radio, and TV are vital change agents in society (Silvast & Virtanen, 2014), and can enable transition from non-renewable to renewable natural resource use on the long-run (Showers, 2011; Mohsin, 2014). Policies and programs geared to reduce natural resource depletion and promote greener, healthy households among Nigerians will be effective if implemented alongside providing access to electricity, radio, and TV. In addition, radio, and TV will serve as vital platforms for effective and impactful policies and programs.

Conclusions

The aim of this study is to provide information that will engender realization of the country's goal of shifting reliance from natural/rudimentary materials/fuels to renewable alternatives in line with world agreed benchmarks (UNDP, 2005, 2011). This study corroborates evidence in the literature that suggest substantial unmet target of renewable energy (Baiyegunhi & Hassan, 2014; Anozie et al., 2007) which implies gap between natural (biomass) fuel and renewable fuels use. The study provides evidence on the rural-urban differences in the use of finished natural resource vs. natural/rudimentary resource highlighting key socioeconomic and agents of modernity as explanatory factors. Policies and programs at the national, regional, and state levels should consider these factors in efforts geared to achieving set targets for the sustainable development goals, with a view to enabling greener households, and quality life for the population of Nigeria.

Table 1: Frequency distribution of respondents' basic characteristics, exposure to modernity, and natural resource utilization in Nigeria

Variables N = 38,948	%	Variables N = 38,948	%	Variables	%
BASIC CHARACTERISTICS		**Husband age groups**		**House Floor, Wall, & Roof**	
Age		15-24	2.7	**Main Materials Combined**	
15-19	20.3	25-34	23.8	Mostly natural-rudimentary	43.4
20-24	17.2	35-49	47.1	Finished Materials	56.6
25-29	18.1	50-59	17.0		
30-34	13.8	60+	9.3		
35-39	12.1				
40+	18.5				
Region		**Husband Educational Level**		**Type of Cooking Fuel**	
North Central	16.0	No education-don't know	37.3	Natural Fuel	77.8
North East	17.0	Primary	19.3	Refined Fuel	22.2
North West	24.8	Secondary	28.6		
South East	11.5	Higher	14.7		
South-South	15.6				
South West	15.1				
Residence		**Husband Type of Work**			
Rural	60.1	Not working	26.6		
Urban	39.9	None office work	44.9		
		Office /related work	28.5		
Educational Level		**AGENTS OF MODERNITY**			
No Education	35.3	**Household has Electricity**			
Primary	18.2	No			
Secondary	37.0	Yes	47.2		
Higher	9.5		52.8		
Marital Status		**Frequency listened to radio**			
Never in union/others	30.0	Not at all	35.3		
Married-living together	70.0	Less than once a week	25.9		
		At least once a week	38.8		
Number of household member		**Frequency watch TV**			
1 to 4	32.9	Not at all	44.2		
5 to 8	44.9	Less than once a week	19.9		
9+	22.1	At least once a week	35.8		
Number of other wives		**NATURAL RESOURCE USE**			
None	66.5	**House Floor Main Materials**			
1	25.8	Natural-rudimentary	36.3		
2+	7.8	Finished Materials	63.7		
Type of work		**House Wall Main Materials**			
Not working	37.0	**composition**			
None office work	20.5	Natural-rudimentary	42.5		
Office/related work	42.5	Finished materials	57.5		
Wealth Index		**House Roof Main Materials**			
Poorest	17.0	Natural-rudimentary	21.4		
Poorer	19.3	Finished materials	78.6		
Middle	20.5				
Richer	21.7				
Richest	21.5				

Table 2: Binary logistic regression on household characteristics, agents of modernization, and natural resource utilization in rural areas of Nigeria					
Variable	Model 1 (house floor materials)	Model 2 (house wall materials)	Model 3 (house roof materials)	Model 4 (composite measure of house materials)	Model 5 (cooking fuel materials)
BASIC CHARACTERISTICS					
Age					
15-19 (ref.)	1.00	1.00	1.00	1.00	1.00
20-24	0.90	0.93	0.92	0.93	1.12
25-29	0.90	0.80*	0.84*	0.80*	1.27
30-34	0.79**	0.74**	0.76**	0.73**	1.19
35-39	0.79**	0.76**	0.72***	0.77*	0.99
40+	0.84	0.88	0.71***	0.91	0.89
Region					
North Central (ref.)	1.00	1.00	1.00	1.00	1.00
North East	0.54***	0.23***	0.42***	0.22***	0.10***
North West	0.43***	0.24***	0.74***	0.25***	0.33***
South East	1.18***	1.55***	1.53**	1.68***	1.49*
South-South	1.09	0.84*	1.38***	0.87*	6.16***
South West	0.83*	0.66	0.84	0.74***	3.92***
Educational Level					
No Education (ref.)	1.00	1.00	1.00	1.00	1.00
Primary	1.26***	1.37***	1.40***	1.40***	1.94***
Secondary	1.80***	1.81***	2.58***	1.82***	3.19***
Higher	3.83***	3.55***	6.80***	3.68***	5.08***
Number of household member					
1 to 4 (ref.)	1.00	1.00	1.00	1.00	1.00
5 to 8	0.91*	0.96	0.99	1.00	0.56***
9+	0.92	0.92	1.20**	0.98	0.28***
Number of other wives					
None (ref.)	1.00	1.00	1.00	1.00	1.00
One	1.22***	1.19***	1.25***	1.18**	1.05
Two or more	1.71***	1.45***	1.39***	1.52***	0.75
Type of work					
Not working (ref.)	1.00	1.00	1.00	1.00	1.00
None office work	0.82***	1.02	1.92	0.96	0.59***
Office/related work	1.14**	1.08	1.11*	1.08	1.21
Husband age groups					
15-24 (ref)	1.00	1.00	1.00	1.00	1.00
25-34	1.40**	1.20	1.49***	1.22	1.07
35-49	1.42**	1.26	1.67***	1.26	1.04
50-59	1.38*	1.55**	1.75***	1.50**	0.84
60+	1.51**	1.62**	2.09***	1.57**	0.73
Husband Educational Level					
No education-don't know (ref.)	1.00	1.00	1.00	1.00	1.00
Primary	1.44***	1.60***	1.40***	1.61***	1.67*
Secondary	1.73***	1.92***	1.95***	1.94***	2.52***
Higher	2.53***	2.49***	3.54***	2.58***	3.47***
Husband Type of Work					
Not working (ref.)	1.00	1.00	1.00	1.00	1.00
None office work	0.94	0.60**	0.88	0.59**	1.04
Office/related work	1.04	0.84	1.22	0.87	1.63

Table 2: Binary logistic regression on household characteristics, agents of modernization, and natural resource utilization in rural areas of Nigeria (continued)					
Variable	Model 1 (house floor materials)	Model 2 (house wall materials)	Model 3 (house roof materials)	Model 4 (composite measure of house materials)	Model 5 (cooking fuel materials)
AGENTS OF MEDERNITY					
Household has Electricity					
None (ref.)	1.00	1.00	1.00	1.00	1.00
Yes	2.41***	3.62***	4.65***	3.97***	2.28***
Frequency Listen to Radio					
Not at all (ref.)	1.00	1.00	1.00	1.00	1.00
Less than once a week	1.50***	0.99	1.03	1.05	0.77*
At least once a week	1.31***	1.01	1.18***	1.06	0.82
Frequency Watched TV					
Not at all (ref.)	1.00	1.00	1.00	1.00	1.00
Less than once a week	1.40***	1.75***	2.00***	1.82***	3.26***
At least once a week	1.72***	1.91***	2.42***	1.96***	3.86***
Model Chi- square	**4864.508**	**6994.532**	**5417.944**	**7275.184**	**3739.461**
Nagelkerke	**0.324**	**0.455**	**0.362**	**0.473**	**0.522**
-2log likelihood square	**19220.231**	**15481.622**	**17820.637**	**14860.767**	**4308.357**
Note: Total N = 23,403, ref. = reference category, * = 0.05, ** = 0.01, and * = 0.001 levels of significance.**					

Table 3: Binary logistic regression on household characteristics, agents of modernization, and natural resource utilization in urban areas of Nigeria					
Variable	Model 6 (house floor materials)	Model 7 (house wall materials)	Model 8 (house roof materials)	Model 9 (composite measure of house materials)	Model 10 (cooking fuel materials)
BASIC CHARACTERISTICS					
Age					
15-19 (ref.)	1.00	1.00	1.00	1.00	1.00
20-24	1.03	1.18	0.84	1.21	1.20
25-29	1.32	1.34	1.06	1.36	1.69**
30-34	1.21	1.37	0.98	1.40	1.94***
35-39	1.56*	1.70**	1.24	1.73**	1.91***
40+	1.21	1.63*	1.25	1.62*	1.28
Region					
North Central (ref.)	1.00	1.00	1.00	1.00	1.00
North East	1.34*	0.40***	0.49*	0.40***	0.23***
North West	0.38***	0.39***	0.41***	0.39***	0.69***
South East	0.52***	0.44***	0.21***	0.43***	0.97
South-South	0.70*	0.36***	0.39***	0.35***	3.13***
South West	4.36***	2.74***	6.53**	2.75***	4.12***
Educational Level					
No Education (ref.)	1.00	1.00	1.00	1.00	1.00
Primary	1.19	1.37**	1.19	1.38**	1.89***
Secondary	2.03***	2.11***	2.24***	2.14***	3.14***
Higher	3.66***	2.57***	1.84	2.63***	5.57***
Number of household member					
1 to 4 (ref.)	1.00	1.00	1.00	1.00	1.00
5 to 8	0.79**	0.98	0.73*	0.97	0.53***
9+	0.75**	0.85	0.83	0.84	0.25***
Number of other wives					
None (ref.)	1.00	1.00	1.00	1.00	1.00
One	0.95	1.07	1.07	1.06	0.64***
Two or more	1.05	1.23	1.26	1.14	0.86
Type of work					
Not working (ref.)	1.00	1.00	1.00	1.00	1.00
None office work	0.65***	0.83	0.82	0.82	0.42***
Office/related work	1.03	1.04	1.03	1.04	0.81**
Husband age groups					
15-24 (ref)	1.00	1.00	1.00	1.00	1.00
25-34	1.14	1.29	1.62	1.27	1.29
35-49	1.37	1.54	2.17	1.55	1.35
50-59	1.32	1.69	2.03	1.71	1.40
60+	1.30	1.82	3.65**	1.84	0.93
Husband Educational Level					
No education-don't know (ref.)	1.00	1.00	1.00	1.00	1.00
Primary	1.08	1.58***	1.47*	1.57***	1.28
Secondary	1.43***	1.73***	1.98***	1.69***	1.85***
Higher	1.47**	1.71***	1.55	1.69***	1.72***
Husband Type of Work					
Not working (ref.)	1.00	1.00	1.00	1.00	1.00
None office work	0.37**	0.82	0.93	0.81	0.89
Office/related work	0.49*	1.08	1.12	1.07	1.30

Table 3: Binary logistic regression on household characteristics, agents of modernization, and natural resource utilization in urban areas of Nigeria (continued)					
Variable	Model 6 (house floor materials)	Model 7 (house wall materials)	Model 8 (house roof materials)	Model 9 (composite measure of house materials)	Model 10 (cooking fuel materials)
AGENTS OF MEDERNITY					
Household has Electricity					
None (ref.)	1.00	1.00	1.00	1.00	1.00
Yes	3.32***	5.10***	3.41***	5.03***	2.51***
Frequency Listen to Radio					
Not at all (ref.)	1.00	1.00	1.00	1.00	1.00
Less than once a week	1.17	1.05	1.21	1.07	0.99
At least once a week	1.32**	1.13	0.95	1.13	1.03
Frequency Watched TV					
Not at all (ref.)	1.00	1.00	1.00	1.00	1.00
Less than once a week	1.50***	1.73***	1.82***	1.69***	2.17***
At least once a week	1.79***	2.20***	2.81***	2.16***	2.86***
Model Chi- square	**2047.155**	**2369.307**	**731.424**	**2369.111**	**4531.854**
Nagelkerke	**0.355**	**0.389**	**0.279**	**0.39**	**0.523**
-2log likelihood square	**5500.844**	**5637.059**	**2202.057**	**5671.332**	**8030.046**
Note: Total N = 15,545, ref. = reference category, * = 0.05, ** = 0.01, and * = 0.001 levels of significance.**					

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