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Transitions in unlikely places: Exploring the conditions for renewable energy adoption in Nigeria

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A B S T R A C T

This paper examines conditions and pathways that explain variation in the adoption of renewable energy (RE) in Nigeria's 36 states based on a fuzzy set qualitative comparative analysis. Using three analytical lenses proposed by the multi-level socio-technical theory (niches, regimes, and landscapes), we examine RE adoption in these states. While all three lenses explain variation to some extent, a combination of regime and landscape characteristics, enables states to overcome dependence on oil while triggering the adoption of RE. States with high income and a regime featuring institutions and coalitions supporting transitions establish themselves as pioneers. States with medium/low income and a regime characterised by a weak pro-RE political coalition support emerge as laggards. Hence we conclude that the role of the regime and particularly political actors therein, is central in energy transition processes among Nigerian states. This has implications for future transition attempts in Nigeria and developing (rentier) countries, generally.

1. Introduction

Several attempts have been made at global and regional levels, in recent years, to promote renewable energy transitions in Africa. While some of these efforts have targeted renewable energy financing, others have been designed to promote policy cohesion and data reporting at national levels. Examples include the Economic Community for West African States (ECOWAS) Centre for Renewable Energy and Energy Efficiency (ECREEE), the Africa-EU Energy Partnership (AEEP) and the Africa-EU Renewable Energy Cooperation Program (RECP). These initiatives have provided countries in Africa with renewable energy finance and data on latest market developments and trends,—all of which are directed at increasing policy cohesion at regional and national levels. Accordingly, renewable energy investments in Africa have increased tenfold, from US$500 million in 2004 to US$9 billion in 2013 (REN21, 2014).

Nigeria has not been left out in the pursuit of renewable energy although it is an oil exporting nation with 70% of its income linked to extraction and exploration of fossil fuels (crude oil) (Bala-Gbogbo, 2015). Currently, Nigeria produces an estimated 1.4 million barrels per day (bpd) with a crude reserve of 37.1 billion barrels (Holodny, 2016). Despite its vast fossil fuel resources, Nigeria is still unable to meet its energy demands due to its low refining capacity with crude refining being pegged as low as 20% run rate. Hence, 80% of domestically consumed petroleum products in Nigeria are imported (IEA, 2014).

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In addition, more than 60% of Nigeria's population lacks access to electricity (Ley et al., 2014). However, emerging trends suggest an ongoing transition within the energy sector in Nigeria. Prominent examples include, for instance, solar and biogas adoption by communities in Lagos, Delta and Sokoto. Two factors make this change particularly interesting: (a) Nigeria's dominant energy system which is heavily reliant on fossil fuels has been limitedly functional over the years, triggering demand for alternative sources of energy; and (b) the shift towards the adoption of renewable energy is not mainly driven by the federal government but by state governments, private corporations and community initiatives. However, there is remarkable variation in the adoption of renewable energy among the thirty-six states in Nigeria. While some are championing renewable energy through collaborative investments, research and the development of regulatory mechanisms, others are still heavily dependent on fossil fuels for economic growth and development.

To understand these dynamics of transition, this paper pursues the following research questions: why are some states within the same country (Nigeria) pioneers and others laggards in the adoption and development of renewable energy? Which factors explain this variation? And how can a sustainable energy transition process be more widely adopted in Nigeria?

In evaluating the transition to renewable energy in Nigeria we examine the scale of renewable energy adoption in each of its thirty-six states on the basis of a variable commonly used in the literature on energy transitions: the installed capacity of renewable energy technologies. In turn, our analysis of the variation in the installed capacity of renewable technologies among the Nigerian states is based on the three analytical lenses derived from the multi-level-socio-technical perspective (MLP).

The MLP explains transitions based on the interaction between "niches", "regimes" and pressure from "landscapes". Building on this, we hypothesise that renewable energy adoption is a product of niche experimentation, regime characteristics and landscape influences. While research in this field to date has focused on the complementary nature of these three levels among industrialized countries (Mazur et al., 2015) or on their independent influence on transitions, (Lawhon and Murphy, 2012; Lopolito et al., 2011; Raven, 2007; Smith and Raven, 2012), in this paper we try to understand which level is more prominent in explaining the current state of renewable energy adoption in a developing and rentier country like Nigeria.

Accordingly, this paper contributes to the knowledge and understanding of transitions in an understudied part of the world where conditions for transitions may differ substantially in relation to those present in the global North where the majority of transition research has been conducted to date (McCauley and Stephens, 2012; Wangel et al., 2013). It, thus, contributes to the currently scarce but growing literature of energy transitions in the global South (Baker et al., 2014; Lawhon, 2012; Rolffs et al., 2015; Wieczorek et al., 2015), rentier countries (Atalay et al., 2016), and communities within a country (Seyfang et al., 2014; Yildiz et al., 2015). More specifically, an analysis of energy transitions in Nigerian states offers multiple insights on: (i) the role of local political actors and coalitions in the transition processes; (ii) the strategies employed by different actors in coordinating a push towards energy transitions; and (iii) a contribution to the on-going debates within the MLP on the role of politics and regime characteristics in transitions. Understanding this latter point is particularly important as previous studies (Normann, 2015; Elzen et al., 2011) argue that for transitions to be successful there must be a cogent alignment of technological substitution and political keenness.

This study is mainly qualitative and offers original empirical data on the latest technological and scientific advancements in Nigeria and the factors which explain these advancements and their variation. Data was collected on the basis of an extended literature review, policy documents such as the Renewable Energy Master Plan, the Feed-in Tariff draft and the revised draft of Nigeria's Energy Policy.

For information on oil revenues, we juxtaposed figures from governmental sources (the Ministry of Finance, the National Bureau of Statistics (NBS), BudgIt and websites of numerous state governments), media news stories, and energy reports. Key informant interviews were conducted with a total of ten experts from energy ministries and agencies, renewable energy research centres in Nigeria and financial institutions during the first quarter of 2014. Although this appears as a top down approach, interviews were limited to a select group of experts due to the fact that most projects identified were largely state sponsored or projects created through collaboration with state actors and inter-governmental organisations splinted across cities and rural areas of the relevant states.

In addition, it was not possible to conduct large surveys because some states became high risk states due to insurgencies during the research period. Likewise, availability of data on consumer use of renewables was limited. While we acknowledge these limitations, our analysis still provides valuable insights on current renewable energy projects and actors involved as we were able to interact with both policy makers and consumers at formal and informal levels to understand their stance on the diffusion of renewable energy at the state and local levels. The paper is structured as follows: Section 2 briefly discusses the multi-level socio-technical theory and presents our hypotheses. Section 3 presents the methodological approach to this study. Section 4 provides and discusses the empirical results. We conclude in Section 5 with insights for science and policy on the application of the MLP in Nigeria, and identify future research prospects.

2. Theoretical context

The multi-level socio-technical perspective (MLP) explains the dynamics between technology, institutions, norms, markets and society. The framework has been significant in analysing changes and stability in socio-technical systems, i.e. linkages between technological artefacts, social and cultural elements and how these transform to long-term development (Geels, 2002). The literature on MLP divides energy transitions across three different levels. The micro level is the "niches", i.e. (test beds) technology. The meso level involves "regimes", i.e. actors and institutions. The macro level is the "landscapes" i.e. exogenous factors such as climate change, food security and sea level rise (Markard et al., 2012). The interaction between these three levels triggers transition. In the next section, we briefly discuss these three levels of transition, operationalise them in the Nigerian context and present our hypotheses.

2.1. Niches

Niches are micro levels of transition serving as protective spaces for the development of alternative technologies. They serve as visions and experimentations of what a socio-technical transition is and should be.

Niches emerge or are developed to compete and/or complement existing energy technologies. The presence of actors interested in these new technological developments creates the space and network for transition (Augenstein, 2015). However to change existing routines, niche experimentation must transcend from its protected spaces to interact and importantly overcome existing production modus operandi and institutional conduct within the dominant energy infrastructure. This becomes more evident especially when there are tensions within the existing regime or pressures from exogenous factors (Bolton and Foxon, 2015; Gosens et al., 2015).

Importantly, scholars argue that even in cases of tensions within the regime, niches are only able to gain more traction in the transition process, while effectively influencing a broader diffusion of technologies when they are guided and steered by expectations (heuristics and visions), social networks (constellation of actors with shared visions, forms and function), and learning (a reciprocal feedback loop on failed and on-going projects) (Smith and Raven, 2012). In addition, the success of niches in engineering a takeover of the regime depends on whether developed technologies are designed to "fit and conform" with existing regime rules and structures or "stretch and transform" the entire system (Raven et al., 2015). Put succinctly, niche experiments are necessary conditions for transition but are insufficient for a proper diffusion of technologies unless they are developed to conform or are "shielded" to a point of maturity in order to take over the existing regime. Turning to MLP, niches are operationalized as pilot renewable energy technologies designed, developed and implemented by renewable energy institutes and firms at the state level. In this paper we examine niches on the basis of renewable energy institutes and firms based on theoretical and empirical evidence suggesting that these tend to develop technologies to interact with end-users thereby creating a process of social learning at each phase of design. This interaction influences the way the technology becomes adapted and socially embedded (Domnech and Saurí, 2010; Ulsrud et al., 2011). Second, we decided not to examine the installation and distribution chain of technologies due to lack of verifiable data and little consideration of these issues by the interviewees. Thus we hypothesise that:

H1. Renewable energy adoption is a product of niche experimentation and design through the establishment of research institutions and the presence of technological firms (manufacturers and installers of energy products) that promote technological development and learning.

2.2. Regime

Regimes are existing institutional structures, actors and interests which coordinate and maintain stability within a system (Smink et al., 2015). Regimes in socio-technical transitions are centred on user patterns, market formation, technological trajectories as well as social relations that shape societal technological demands (Kern, 2012; McCauley and Stephens, 2012). Regime analysis within the MLP has often focused on interactions between actors and their systematic co-option of technologies or the creation of inertia via selective resistance to pressures from niches (Nææss and Vogel, 2012).

Critical to regime interactions is the presence of structural relations and dependence among actors in determining the selection and co-option of technologies (Meadowcroft, 2011; Rosenbloom and Meadowcroft, 2014). This dependence is created by power relations among actors (Avelino and Rotmans, 2011; Geels, 2014), fostered by a coalition of "historic blocs," and relational networks within the regime. In this regard, dependence is fostered both by a mutual exercise of power (horizontal), and the exercise of power by one actor over another (vertical) (Avelino and Wittmayer, 2015).

In this study we evaluate the role of structural dependence among actors within the regime and how this has shaped the adoption of renewable energy technologies among the thirty-six states in Nigeria.[1] In the Nigerian context, structural dependence is created and maintained on the basis of fossil fuel rents. This, in turn, determines the ability of the regime to favour transition or not. Despite structural dependence within the regime, actors can change regime structures and introduce their technological preferences by increasing their own competencies (Grin et al., 2011; Rosenbloom and Meadowcroft, 2014). Drawing on previous and ongoing research on energy transitions (Geels, 2014; Hess, 2014) actors proposing change within the energy regime often use structural and institutional mechanisms in triggering transitions while reducing the regime's dependence on fossil fuel. Such mechanisms include: (i) the creation of renewable energy-based agencies, (ii) the enactment of renewable energy policies, and (iii) the promotion of renewable energy investments by members of the

[1] While it would have been interesting to focus on cities in the regime and niche discussion, our paper is limited to states because there is no separate city governance system in Nigeria. In addition, the local government system in place is constrained in the deployment of Renewable Energy Technologies as their income/budget is still funded by state governments.

regime. For example these mechanisms were adopted by actors in promoting Dutch energy transitions (mobility, gas and built environment) (Kern and Smith, 2008), and have been applied in cases of patent applications for renewable energy technologies in twenty-five countries in the global North (Johnstone et al., 2010).

Based on the above, we hypothesise that:

H2. The adoption of renewable energy technologies is a product of actors aiming to trigger transitions while overcoming structural fossil fuel dependence within the regime. We expect that states with well-developed political and civil society actors are better able to initiate transitions and overcome dependence in contrast to states that lack these characteristics. These states also are more likely to develop energy agencies, policies and investments which can sustain transitions over time.

2.3. Landscapes

Landscapes are macro-level factors in transition processes (Geels, 2011). The landscape element of the multi-level socio-technical theory has often been characterised as a global dimension of transitions which transcends national boundaries. Such global factors include but are not limited to the emergence of social movements with regards to the use of common pool resources, climate change, oil shocks, embargoes or increase in oil prices (e.g. the 1979 oil price embargo and the 2008 increase in crude-oil price). Landscapes at the local level can take the form of decline in oil production and increase in population or income, for instance.

Evidence suggests that landscape characteristics, such as ecological (e.g. climate change) and social (e.g. population size and income) considerations have created new pressures and challenges which affect the management of infrastructures critical to urban growth and development (Hodson and Marvin, 2010). As such there is a need to understand how these factors may affect existing infrastructures and influence the transition trajectory taken. For instance in Nigeria, a growth in population and a significant rise in income, translates to a higher demand for energy access. Accordingly, as more people have the purchasing power to increase their energy demand, more pressure is placed on the limitedly functional existing energy infrastructure, which may positively, affect renewable energy transitions.

We examine the influence of two landscape characteristics: (i) the level of income or internally generated revenue in each Nigerian state, and (ii) the population of each state which determines the demand for energy use (locally and across states). By examining these two indicators, we hope to understand how they affect transitions and in what direction. We do not include demographic comparative advantage of natural resources as a variable for transitions (e.g. strong wind and biomass rich areas) as these do not play a significant role in the transition story at the local level. Importantly each state in Nigeria has its comparative advantage with regard to renewable energy resources and as such cannot provide clear evidence on why some states adopt renewable energy and others don't.

Further, we do not examine the influence of climate change e.g. floods, droughts and desertification as this does not differ in the states examined (World Bank, 2009). Lastly, one would expect that landscape factors such as natural resources would also influence technological choices and the rate of diffusion i.e. the presence of wind and biomass rich areas. However, we found that this does not play a significant role in transitions at the local level. Importantly each state across Nigeria has its comparative advantage with regards to renewable energy resources and as such this variable cannot significantly explain variation. Based on the above we hypothesise that:

H3. Renewable energy adoption is more likely to occur in states with high population and income in relation to states that lack these characteristics (landscape hypothesis) (Fig 1).

3. Methodology

This study adopts qualitative comparative analysis (QCA) (Ragin, 2008a) in order to explain variation. This qualitative method has been adopted as a substitute to orthodox statistical techniques like regression due to the small number of observations (Ns 36). QCA is a theory driven approach to empirical observations. Under QCA, dependent variables are referred to as "outcomes", while independent variables are considered as "conditions" (Schneider and Wagemann, 2010). In this study, fuzzy set QCA (fs/QCA) is applied in order analyse causal complexities generating the same outcomes (adoption of renewable energy technologies in Nigeria). Also, we make use of the notions of "necessity" and "sufficiency" to identify causation. A cause is termed as necessary if it must be present for certain outcomes to emerge. Sufficient causations on the other hand can by themselves produce certain outcomes (Cress and Snow, 2000; Ragin, 2008b).

To this end we apply this methodology to analyse three different types of cases in Nigeria; *pioneer* states in renewable energy development, *semi-laggard* states and *laggards*. A state is considered a pioneer when it has a threshold of installed capacity of 1000kw or more. It is considered a semi-laggard when it has a threshold of installed capacity between 1000 kW and 100 kW. Finally, a state is a laggard when it has a threshold of 99 kW–5 kW of installed capacity.

We use share of installed capacity as a threshold rather than energy per capita due to the lack of verifiable data on: (i) total annual electrical use of the state in kw hours, (ii) additional electricity/primary energy required per state, and (iii) hours when electricity is not available and the total number of kWh of renewable energy generated to compensate for this electricity loss.

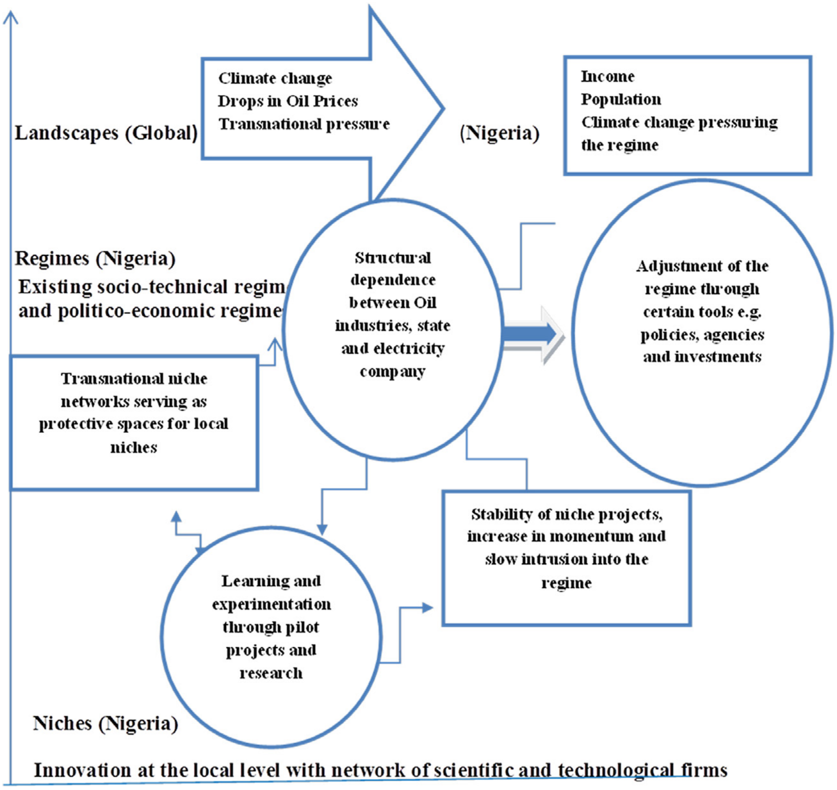

Fig. 1. Transition trajectories within a multi-level socio-technical system adapted from (Geels, 2002) (tailored to fit Nigeria).

We consider four main types of technologies in this paper (solar, wind, biogas and biofuel). We exclude the use of small hydro renewables in Nigeria for two reasons: (i) most of the identified projects were constructed in the colonial era in Nigeria specifically seventy five years ago[2]; and (ii) the identified small hydro projects are reported to be producing below their installed capacity and are in need of rehabilitation (Haliru, 2006). Originally all thirty-six states were considered and coded by examining the availability of renewable energy in each state. However, only fourteen states exhibited some level of renewable energy adoption. As the fuzzy methodology does not consider "zero" outcomes, twenty-two states were excluded from the analysis.

However, we provide some information on these states in order to understand the reasons for no adoption. Importantly, the remaining fourteen states are representative of the broader Nigerian states as they all belong to different geographical regions in Nigeria.

The independent variables (conditions) are operationalised as follows. Niches are operationalised based on the level of experimentation (research institutes) and the presence of renewable energy technology firms (manufacturers and installers). Regime conditions are operationalised based on four criteria: (a) states with structural dependence on oil income, (b) states with policy on renewables, (c) states with supporting agencies on renewable energy development, and (d) states with renewable energy investments. Landscape conditions are operationalised based on population, and internally generated revenue.

We assume that niches (N), regimes (R) and landscapes (L) are conditions that account for outcome = adoption of technology. The fuzzy set method allows us to identify causalities between the "outcomes" and "conditions". Causal configurations are usually formulated in Boolean algorithm as 2^k (k = number of causal conditions). As in this case k = (N), (R) and (L) which signifies that eight configurations are possible. We assign scores to cases through calibration. Using six value sets, "outcome" is present when score is = 1 fully in; 0.8 = mostly but not fully in; 0.6 = more or less in; 0.4 = more or less out; 0.2 = mostly but not fully out; 0 = fully out. In this analysis, states with 1000 kW and above are calibrated as states with outcome = (1), states with 999 kW to 100 kW are calibrated as 0.8, states with 99 kW to 65 kW are calibrated as 0.6, states with 64 to 5 kW are calibrated as 0.4, states with 4 kW to 1 kW are calibrated as 0.2, states with less than 1 kW are calibrated as 0. The crossover point in this fsQCA analysis is 0.5.

[2] NESCO, a colonial company built the six major small hydro projects in Nigeria e.g. Lere I, II, Bagel I, II, Kurra, Tiga, Oyan, Bakalor over seventy five years ago.

Table 1
Qualitative allocation of set membership.

Conditions	1 = fully in	0.8 = mostly but not fully in	0.6 = more or less in	0.4 = more or less out	0.2 = mostly but not fully out	0 = fully out
Research institutes	Presence of research institutes on renewable energy	State has universities with faculties collaborating with government on renewables	State has institutes working in areas related to renewables	Research institute on RE currently being developed	State has memorandum of understanding on research collaboration with regards to renewables	No research institute
RE Technology firms	Presence of renewable energy technology firms	State has collaborations with foreign based RE technology firms	State has technology firms working in areas related to renewables	Technology firms on RE currently being developed	State has memorandum of understanding on the establishment of RE technology firms	No renewable energy based technology firm
Agencies	Presence of Ministry of Energy with agencies on renewables as well as collaborative support from international actors	Collaboration with international and local actors on renewables	Collaboration with local actors on renewables	Memorandum of understanding with local and foreign actors but with no concrete outcome	Commitments towards creating a Ministry of Energy or agencies on renewables	No Ministry of Energy, no focus on renewables, and zero investments
Policy	State has policies on renewable energy, passed into law	State has draft policies ready to be passed into law	State has adopted energy conservation policies	State has made consultations on renewable policies	State has made presentations on the likelihood of a policy	State has no policies on renewables
Investment	State has over ₦300 million investment in renewables	State has between ₦250–300 million investment in renewables	State has between ₦200–250 million investment in renewables	State has between ₦100–200 million investment in renewables	State has between ₦50–100 million investment in renewables	State has between ₦25–50 million naira investment on renewables
Oil Dependence	State is heavily dependent on oil income	State has high dependence on oil income	State has a fair dependence on oil income	State has an average dependence on oil income	State has minimal dependence on oil income	State has zero dependence on oil income
Income	State income is above ₦50 billion	State income is ₦30-20 billion	State income is ₦20–15 billion	State income is ₦15–10 billion	State income is ₦9–5 billion	State income is below ₦1 billion naira
Population	Population is above 15 million	Population is above 11 million	Population is above 8 million	Population is above 5 million	Population is above 3million	Population is below 1 million

Source: Table compiled by authors.

This is critical for the analysis because it splits the overall set into dual sub-sets: in the first half of the sub-set, the condition is likely to be present or observed (>0.5), while in the other half, the condition is likely to be absent or unobserved (<0.5) (Sehring et al., 2013). The exact operationalisation of these variables is presented in Table 1.

4. Transition pathways in Nigeria

Table 2 illustrates the variation of renewable energy adoption in the Nigerian states on the basis of the type of technology and installed capacity in kW per state. The table shows that Lagos, Sokoto and Delta are pioneers; Enugu, Oyo and Bauchi are semi-laggard States while Nasarawa, Niger, Edo, Ogun, Jigawa, Bayelsa, Katsina and Benue are laggard states.

4.1. Explaining variation

In order to explain the observed variation, we examine the three hypotheses by looking for evidence suggesting their presence in each of the states and how their interaction led to pathways which fostered transition or not. To recap, this includes evidence of research institutes, technological firms, renewable energy policies, investments, agencies, structural dependence, income and population. Table 3 shows the calibrated conditions and outcome for each of the states. The table reveals a remarkable variation among the states in the number of conditions present or absent and the degree of outcome achieved. Four or more conditions were present for the three pioneer states. Three or fewer conditions were present for the three semi-laggard states. Two or fewer conditions were present for the eight laggard states.

Based on (Schneider and Wagemann, 2010) who emphasise the importance of checking the robustness of the analysed conditions, this study further analyses the results via changes in frequency and consistency thresholds, the number of cases analysed, the conditions adopted, and the calibration process. Via this process, we refined our analysis to exclude renewable energy technology firms and population. All fourteen states had no renewable energy technology firms and there was no

Table 2
Ranking of pioneer, semi-laggard and laggard states in Nigeria.

	States	Biogas kw	Solar kw	Wind kw	Biofuel kw	Total installed	References
Pioneers	Delta	0	8000	0	0	8000	DSG, 2013
	Sokoto	35	2045	5	0	2085	UDUSOK, 2014
	Lagos	17.9	1814	0	0	1831.9	LSEB, 2013
Semi-Laggards	Bauchi	0	600	0	0	600	BSG, 2013
	Oyo	500	0	0	0	500	GNEEDER, 2014
	Enugu	10	64	26	0	100	Sambo, 2010,
In case Laggards	Niger	63	0	0	0	63	NSG, 2014
	Edo	0	36	0	0	36	EDSG, 2014
	Nassarawa	0	30	0	0	30	ECN, 2012
	Benue	0	10	0	0	10	ECN, 2012
	Jigawa	0	10	0	0	10	ECN, 2012
	Bayelsa	0	10	0	0	10	ECN, 2012
	Katsina	0	10	0	0	10	ECN, 2012
	Ogun	0	5	0	0	5	OGSG,2011
Out of case laggards	Abia	0	0	0	0	0	ABSG, 2014
	Adamawa	0	0	0	0	0	ASG,2014
	Akwa Ibom	0	0	0	0	0	AKSG,2014
	Anambra	0	0	0	0	0	ANSG, 2014
	Borno	0	0	0	0	0	BSG, 2014
	Cross River	0	0	0	0	0	CRSG, 2014
	Ebonyi	0	0	0	0	0	EBSG, 2014
	Ekiti	0	0	0	0	0	EDSG, 2014
	Gombe	0	0	0	0	0	ESG, 2014
	Imo	0	0	0	0	0	GSG, 2014
	Kaduna	0	0	0	0	0	ISG, 2014
	Kano	0	0	0	0	0	KASG, 2013
	Kebbi	0	0	0	0	0	KSG, 2014
	Kogi	0	0	0	0	0	KGSG, 2014
	Kwara	0	0	0	0	0	KWSG, 2014
	Ondo	0	0	0	0	0	NSG, 2014
	Osun	0	0	0	0	0	OGSG, 2014
	Plateau	0	0	0	0	0	PSG, 2013
	Rivers	0	0	0	0	0	RSG, 2014
	Taraba	0	0	0	0	0	TSG, 2014
	Yobe	0	0	0	0	0	YSG, 2014
	Zamfara	0	0	0	0	0	ZSG, 2014

Source: Table compiled by authors.

Table 3
Calibration of conditions for renewable energy adoption in 14 Nigerian states.

Cases	Conditions								Outcome
	Niches		Regime			Landscapes			
State	Research Institute	RE Technologyfirm	Policy	Agencies	Investment	Dependence	Population	Income	Uptake
Delta	0.4	0.2	0.8	1	1	0	0.2	1	1
Sokoto	1	0.2	0.8	1	1	0.4	0.2	0.4	1
Lagos	1	0.2	0.8	1	1	0	1	1	1
Bauchi	0	0	0.4	0.8	0.8	1	0.2	0.2	0.8
Oyo	0.6	0	0	0.6	0.4	1	0.4	0.2	0.8
Enugu	1	0	0.4	0.4	0.4	1	0.4	0.6	0.8
Niger	0	0	0	0.4	0.4	1	0.2	0.2	0.4
Edo	1	0	0	0.4	0.2	1	0.2	0.6	0.4
Nassarawa	0	0	0	0.4	0.4	1	0.2	0.2	0.4
Benue	0.6	0	0	0	0	1	0.2	0.2	0.4
Jigawa	0	0	0	0	0	1	0.2	0.2	0.4
Bayelsa	0	0	0	0	0	1	0.2	0.4	0.4
Katsina	0	0	0	0	0	1	0.4	0.2	0.4
Ogun	0	0	0	0	0.4	1	0.2	0.2	0.4

verifiable data on the activities of installers. Lastly all fourteen states had a population below 8 million with the exception of Lagos (see Appendix A); hence this revealed no form of causality.

Also to ensure robust data on the regime hypothesis, regime indicators were refined and condensed into two. Renewable energy policy, and agencies and investments were grouped together as one causal condition while dependence was the second regime condition. Table 4 displays the more refined causal conditions and combinations. Further, the consistency

Table 4
Fuzzy set membership and associated configurations.

cases	Conditions for membership				Membership configuration (including complex, parsimonious and intermediate solution)							
	Research (E)	Regime characteristics (R)	Structural dependence (D)	Income (I)	R*D*~I	R*~D*I	E*R*~I	E*R*~D	R	I*R	D*R	R*E
Delta	0.4	1	0	1	0	1	0	0	1	1	0	0
Sokoto	1	1	0.4	0.4	0	0	0.6	0.8	1	0	0	1
Lagos	1	1	0	1	0	1	0	1	1	1	0	1
Bauchi	0	0.8	1	0.2	0.8	0	0	0	0.8	0	0.8	0
Oyo	0.6	0.6	1	0.2	0.6	0	0.6	0	0.6	0	0.6	0.6
Enugu	1	0.6	1	0.4	0.6	0	0.6	0	0.6	0	0.6	0.6
Niger	0	0.4	1	0.2	0	0	0	0	0	0	0	0
Edo	1	0.4	1	0.4	0	0	0	0	0	0	0	0
Nassarawa	0	0.4	1	0.2	0	0	0	0	0	0	0	0
Benue	0.6	0	1	0.2	0	0	0	0	0	0	0	0
Jigawa	0	0	1	0.2	0	0	0	0	0	0	0	0
Bayelsa	0	0	1	0.4	0	0	0	0	0	0	0	0
Katsina	0	0	1	0.2	0	0	0	0	0	0	0	0
Ogun	0	0	1	0.2	0	0	0	0	0	0	0	0

Authors' compilation (and = *, or = +, absence of = ~, sufficient for = →).

Table 5
Summary of pathways to outcomes for in case states in Nigeria.

Outcome Pathways	Cases
Pioneers E*R*I*~D	Lagos, Delta and Sokoto
Semi-Laggards E*R*D	Enugu, Oyo and Bauchi
In-case Laggards R*D	Niger, Nasarawa, Edo, Benue, Jigawa, Ogun, Katsina and Bayelsa

threshold was increased from 0.8 to 0.9. This was done in order to test the robustness of the conditions as 0.9 and above is recommended as the threshold signifying the necessity of a condition (Ragin, 2008a; Schneider and Wagemann, 2010).

Based on Tables 4 and 5, the remaining part of this section discusses the three combinations of factors that led some states to emerge as pioneers, others as semi-laggards, and yet others as full laggards.

4.1.1. Pathway explaining pioneer states

Lagos, Sokoto and Delta are pioneers. Based on our analysis the causal pathway that gives a robust explanation on the adoption of renewable energy among these states is: (i) the presence of niche experimentation (research institutes), (ii) high income, and (iii) three regime characteristics (agencies, policy and investments). These were necessary conditions for renewable energy adoption in all three states (E*R*I*~D). Importantly, these conditions were also sufficient in overcoming the structural dependence on the oil sector and its revenue, present in all three states (albeit to different degrees). More specifically, during 1999–2007, state administrations in Nigeria including in Lagos, Sokoto and Delta state(s) were highly reliant on fossil energy for electricity generation. The reliance on oil and gas for electricity led to structural dependence between the state governments and the oil and gas industry. The dependence between these two actors existed mainly because of two factors: (i) major state income in Nigeria came from oil rents, (ii) the existing energy system had been institutionalised to rely majorly on fossil fuel to generate power for energy transmission among the Nigerian states.

The decision to shift towards renewable energy can be traced to 2007, marked by a change in administration (see more details under the 'regime' subsection). However, this did not yield immediate transition as the structures which promoted fossil fuels were still in place. Lack of initial change can be traced to the interests of core energy regime members such as the Power Holding Company of Nigeria and the association of oil and gas suppliers. This group of actors called only for the modification of the existing energy infrastructure in Lagos, Delta and Sokoto rather than a complete change of the system, bypassing demands to put renewable energy on the agenda. For example in Delta, multinational corporations systematically put renewable energy off the agenda by replacing it with offers of gas powered turbines.

Examples include the development of gas thermal plant for the electrification of the bonny community by the Nigerian National Petroleum Corporation (NNPC) and the Joint venture members (Total, Shell, Mobile Oil Nigeria, and Chevron). Thus, "clean gas" was first developed as an alternative to renewables. Below we explain how the combination of niche experimentation, sources of income generation other than rents from fossil fuels and the establishment of policies and institutions in favour of renewables enabled Lagos, Delta and Sokoto to become pioneers.

4.1.1.1. Niche experimentation. As expected by the MLP theory on niche diffusion, which indicates that learning, prototyping and experimentation foster transitions, we observed that both Lagos and Sokoto show evidence of experimentation with the presence of established research institutes on renewable energy and energy conservation. Lagos has the "Centre for Energy Conservation and Energy Efficiency," (CECEE) while Sokoto has the (SERC) "Sokoto Energy Research Centre" (ECN, 2014).

Interestingly, both centres have been involved in the fabrication of renewable energy technologies as a response to the incessant energy crisis and power outages in their respective states. Prominent ways by which experimentation in these two states were encouraged are: acquisition of grants for technological development and learning while also engaging with other non-renewable energy specialised universities in the transfer of knowledge. For instance, the CECEE's experiments on renewable energy technologies in Lagos have been targeted at supporting existing thermal power plants (Island power plant, Akute power plant and Egbin power plant) in meeting meet large industrial and municipal energy demand (Ogunbiyi, 2012).

However with regards to technological deployment, SERC has been more active than CECEE. This can be attributed to two decades of expertise and knowledge aggregation by SERC in the assembling of renewable energy technologies. SERC was the first established renewable energy institute in Nigeria—created in response to Nigeria's energy access problems. It was established in 1982 as an alternative means of resolving the energy challenges that the National Electric Power Authority was incapable of solving. In recent years, SERC has collaborated with Waziru-Umaru Federal Polytechnic in Kebbi State to establish a Centre of Excellence in Renewable Energy Research and Development. This research centre has been rather fruitful in its outputs as several locally made mini-grids have been produced for rural electrification, water pumping, water heating and street lighting (Sambo, 2009). SERC has also transferred its solar expertise to other states such as Kano, Kaduna, Nassarawa and Minna with the installation of mini-grids in rural areas in these states thus contributing to knowledge consolidation. To date the only renewable energy powered village with over 1000 inhabitants in Nigeria was a product of the pilot solar energy development from the Sokoto Energy Research Centre.

4.1.1.2. Landscape: income. Regarding income, the analysis reveals that it has significantly contributed to the reduction of structural dependence among regime actors and renewable energy adoption. One of the main reasons why these three states were able to overcome such dependence was the use of internally generated revenue in buffering these states' economy. In reducing dependence on oil rents, Lagos, Sokoto and Delta created a sustainable taxation system in their respective states, although taxes which serve as a regime tool led to an exponential increase in their internally generated revenue since 2007 (FAAC, 2013). Significant increase in income via taxes and other investments has not only placed these three states among the top twenty states with the highest income in Nigeria but has also triggered their investment in renewable energy (LSEB, 2013). In Lagos, energy taxes have been used as inducements in reducing unsustainable energy consumption thus promoting energy efficiency.

4.1.1.3. Regime. As mentioned earlier, 2007 marked a change in administration in the three pioneer states with the new state governors undertaking measures to put renewable energy back on the agenda. These included: (a) the establishment of a Ministry of Energy and sub-agencies; (b) the development of policy documents on renewable energy and energy conservation; (c) the promotion of collaborative investments with inter-governmental organisations and international technological firms. These are further discussed below.

(a) **Establishment of Ministry of Energy and sub-agencies on renewables:** Delta was the first state to place renewable energy on its agenda through the establishment of two main institutions on energy in 2007. The Ministry of Energy which had a specific sub-department focused on the development of renewables (updated to the current Delta Green Economy Commission) and a sub-agency known as the Rural Development Agency (focused on rural electrification). By 2009, governor Fashola responded to transition resistance in Lagos by revamping existing agencies around resources that could potentially generate renewable energy. An example of such agency is the Lagos Waste Management Authority (LAWMA). The LAWMA division created in the 1970's, initially moribund was revamped in 2009 to place high importance on municipal waste energy generation within the state. This was highly strategic as Lagos generates the largest amount of bio-mass waste in Nigeria. Also in 2009, Sokoto established a Ministry of Environment saddled with the deployment of renewable technologies. By 2011, Lagos created the Ministry of Energy and Mineral Resources and this ministry was tasked with the design of an energy master plan with renewable energy development at its core.
(b) **Creation of renewable energy policies:** In terms of policy development, Lagos and Sokoto are the only pioneer states with a concise energy policy on renewable energy. The policy framework on renewable energy was created to serve as a platform by which further technological and financial development can be achieved in the renewables sector. For example, in Lagos, policy was designed to ensure the generation of 400mw of energy via renewables by 2016 and promote 90% use of renewable energy by 2020 (LSMEMR, 2013). Through fiscal and regulatory mechanisms, both states aimed to promote renewable energy entrepreneurs by increasing targets on renewable energy procurement and encouraging investments from the private sector, communities and NGOs within the state.

Lagos has also expanded its requirements on energy policy and utilisation by including laws on building codes that emphasise energy efficiency, mandatory energy audits and creation of energy management maps by corporations existing within its territory. As of 2012, the Lagos state government passed legislation on energy efficiency focusing on the heating, cooking and building sectors (LASG, 2012). However, while we find that the creation of renewable energy policy matters, it appears less important in relation to the other two factors as it was present only in two of the pioneer states.

- **Promotion of renewable energy investments:** All three pioneer states collaborated with inter-governmental organisations, international technological firms and community coalitions in order to promote and attract investments in renewable energy. As of 2014, the Total Energy Group, a multinational Oil Corporation financed a 1.5 million USD solar powered service station in Lagos (Total, 2014). International firms like Schneider and Siemens have also signed memorandums of understanding with the Lagos state in developing techno-institutional capacities in the deployment of renewable energies (Boussougouth, 2012; Siemens Energy, 2012). Likewise, so far, the Sokoto government has been able to attract foreign organisations to invest in pilot renewable energy projects. Private Solar companies like KNX and ZAGO have been involved in the development of solar technologies especially for rural electrification in Sokoto. In 2005, KNX deployed solar refrigerating technologies to ninety rural villages in northern Nigeria, specifically Sokoto state (Usman, 2012). Between 2012 and 2014, the United Nations Development Programme (UNDP) in collaboration with the Bank of Industry invested US$4780 million in financing renewable energy projects in Lagos, Sokoto and Delta in order to facilitate the growth of micro, small and medium enterprises in these states (UNDP, 2014).

In addition, community coalitions like the Ifelodun Cooperative Society have been majorly active in Lagos. This group of actors possess consumer power and have been able to initiate the deployment of renewable energy technologies in their diverse localities. An example of this is the Ifelodun/Ojokoro Cooperative Multipurpose Agricultural Society's 18m3 pig dung biogas plant in Lagos which is used to generate electricity for their community.

4.1.2. Pathway explaining semi-laggard states

As indicated in Table 2, we observed that Enugu, Bauchi and Oyo are semi-laggards. The major pathway identified for these states was: (i) the presence of niche experimentation (research institute on renewables) and (ii) two regime characteristics (agency and investments). While these were necessary conditions for the adoption of renewable energy technologies among these three states, however, they were not sufficient in the presence of structural oil dependence (R) and absence of high income (L).

4.1.2.1. Niche experimentation. In terms of niche experimentation in Enugu, the National Centre for Energy Research and Development (NCERD) has been mandated to carry out solar related research. While in Oyo, niche experimentation has mainly been carried out via collaboration with universities and other non-energy specific research institutes. Examples include the development of biofuel pilot projects by the International Institute for Tropical Agriculture (IITA) in Ibadan the capital of Oyo state. Nonetheless, both institutes have served as hubs for developing different renewable technologies. In Enugu, the NCERD has been able to organise stakeholder meetings on renewable energy with some research and technological outcomes. For example the NCERD designed several pilot scale solar water heaters and solar dryers for agricultural purposes. The Centre currently hosts the newly commissioned National Stove Eligibility Laboratory founded by the International Centre for Energy, Environment and Development in collaboration with the Energy Commission of Nigeria and financed by the Global Alliance for Cook stoves (ICEED, 2015). This centre is a niche space that has been legitimised through regime support gained due to the fact that the technologies explored are designed to "fit and conform" with existing regime rules and standards. In Oyo, the International Institute for Tropical Agriculture (IITA) has mainly focused on agro-energy research. Both institutional efforts have been limited, however, to the production of scientific papers in terms of advice for renewable energy policy formulation at the local and national levels.

4.1.2.2. Landscape: income. Data obtained from the National Bureau of Statistics reveals that internally generated revenue within all three semi-laggard states ranges from ten to eighteen billion naira annually—which equals fifteen percent of what states like Delta and Lagos generate annually (National Bureau of Statistics, 2016). For instance per capita income in these states in 2014 was between US$800 and US$1000 which is 100% smaller in relation to the aforementioned pioneer states (Lagos and Delta) which had an estimated US$2900 per capital income (Nigeria Business News, 2014). In contrast to what we observed in pioneer states, we could identify no taxation or other financial mechanisms that were used by these states in order to support the development of renewables.

4.1.2.3. Regime. Although all three states are non-oil producing, they exhibited high reliance on federal income from oil rents. More specifically, data obtained from the National Bureau of Statistics suggests that more than 60% of budgets within these states were financed by federal income. Furthermore internally generated revenue merely contributed an average of 12–13% in the execution of state budgets in 2015 (National Bureau of Statistics, 2016). For example, Bauchi's overall budget for 2014 was a total of ₦133.5 billion; their internally generated income was calculated as ₦9.9 billion while expected federal income was pegged at ₦77.7 billion. Based on our calculations, more than 59% of Bauchi's budget was financed by federal income while about 8% came from internally generated income.

Nevertheless, Bauchi and Oyo exhibited two of the regime conditions that were necessary for the adoption of renewable energy in the pioneer states, namely the establishment of agencies focusing on renewables and efforts to attract investments. In terms of agencies, we observe that Bauchi and Oyo both have Ministries of Power and Environment and sub-agencies on rural electrification focused on the deployment of renewable energy technologies. However, while we find that the presence of these ministries and sub-agencies matters, they appear less important in relation to renewable energy investments by state and civil society actors (excluding Enugu). Regarding investments we observe the following. In Bauchi, investments in renewable energy were not pursued until 2009. However, by the end of 2009, the state government began to invite private actors to help develop the renewable energy sectors. Particularly the Bauchi government found the deployment of renewable energy critical to its agenda of resolving energy access issues among rural communities.

In order to commercialise renewables, the Bauchi state government in collaboration with a Chinese equipment corporation created a company known as the Yankari Power Company of Nigeria (YPCN). YPCN was tasked with the deployment of power generating plants for the state with the target population being the rural communities. Bauchi state government also signed a memorandum of understanding with another German company known as “HELIOS ENERGIE” tasked with the generation of 20–30 megawatts of energy through solar power (Daily Independent, 2012). However, despite the above attempts at promoting renewables, Bauchi has no renewable energy agency, ministry or policies to localise renewable energy technology and little or no effort has been made to reduce its dependence on fossil fuels.

Regarding investments in the other two states, Enugu showed no sign of public-private-partnerships on renewable energy deployment while in Oyo the only observed investment in renewable energy came from collaboration between civil society actors and the UNDP in 2005. This collaboration involved a local NGO, known as the Global Network for Environment and Economic Development (GNEEDER), the Sustainable Ibadan Project and the Centre for Youth, Family and the Law. The initial idea of these civil actors was to develop a waste water treatment plant for a slaughter house in Ibadan, Oyo state. However while waste treatment solved the initial problem of water pollution, it created another problem which was a significant increase in the methane and carbon dioxide released into the atmosphere (Adelegan, 2007). This led to the conversion of the waste treatment to a biogas system. The project was completed based on a US$480,000 investment fund provided by the UNDP (Adelegan, 2007).

4.1.3. *Pathway explaining laggard states*

Laggards in this study are categorised into two groups: states that have been calibrated as cases and states that were unable to make it into the membership pool. States outside the membership pool are states with no visible form of renewable energy adoption. In this section, we focus on states with some level of adoption that are part of the group of 14 cases that were studied using the fuzzy logic methodology. Eight of these states are categorised under the category of full laggards (see Table 4).

4.1.3.1. Niche experimentation. We observe in some states such as Edo and Benue the presence of niche experimentation. For instance, pilot scale solar deployments have been credited to collaborations between the Center for Energy and Environment, University of Benin (Edo), and local NGOs and community organisations such as the Community Research and Development Centre (CREDC, 2012). Also niche experimentation on biofuels, specifically Jatropha has been credited to research carried out at the Federal University of Technology, in Markurdi (Benue).

4.1.3.2. Landscape: income. All states in the laggard category are mid/low income states and heavily dependent on oil rents for social and infrastructural development. More specifically, data obtained from the National Bureau of Statistics suggests that allocation of federal income accounted for more than 70% of each state’s budget while internally generated revenue ranged between ₦3 billion and 35 billion (with the exception of Rivers and Akwa-Ibom state—both oil producing states). For a detailed overview, see Appendix A.

4.1.3.3. Regime. The only condition present in terms of desirable regime characteristics in these states was some level of renewable energy investments. More specifically, these were investments made by international organisations such as the World Bank and the European Union. Examples include EU’s EUR3.4 billion support fund provided to boost the deployment and development of renewable energy in Nigeria (specifically among the identified laggard states) under the aegis of the Nigeria Energy Support Programme (NESP). Nevertheless, these states lack ministries, policies and agencies on renewable energy development and this explains why there has been little adoption of renewable technology within their borders.

Finally, regarding the remaining twenty-two states excluded from our analysis they have recorded no form of technology adoption. Common to all these states is that they all exhibit high level of dependence on oil rents as income for social and infrastructural development (see Table 3) and none of the conditions which would allow them to overcome it (research institutes, presence of regime mechanisms such as agencies, policies and investments). Accordingly, energy transitions within these states have been potentially difficult to achieve in the absence of these factors.

5. Conclusions

This paper aimed to document and explain variation in renewable energy transitions among Nigerian states. Out of the thirty-six states examined, three were identified as pioneers based on their share of renewable energy adoption; three were classified as semi-laggards and eight as laggards. The remaining twenty-two states were found to be out of case laggards—as no renewable energy deployment was observed. We explained variation by applying the multi-level socio-technical theory (MLP) which uses the lenses of niches, regimes and landscapes to explain transitions. Methodologically, we used the fuzzy-set qualitative comparative analysis (fsQCA)—which allowed us to identify multiple causal pathways and conditions responsible for transitions within Nigerian states.

Our analysis identified three pathways that led some states to emerge as pioneers, others as semi-laggards and, the majority, as laggards. We found that a combination of income and regime conditions, were fundamental in explaining the pathways towards pioneering states while these were completely absent in laggards. Specifically, only pioneer states exhibited an effort to diversify income sources away from dependence on oil rents. Likewise, only pioneer states had policies and agencies on renewable energy. Further, collaboration between civil society actors in the pioneer states, i.e. Lagos, Sokoto and Delta, were able to defy structural relations and oil dependence.

In contrast, niches (the presence of research institute/learning) were significant in the deployment of renewable energy technologies both among pioneer and semi-laggard states. They were particularly important among pioneer states when the existing energy infrastructure could no longer meet societal energy demands. While niches were necessary conditions for transitions (as seen in the case of the SERC and its deployments of technologies in neighbouring villages), they were unable to significantly diffuse and deploy their experiments, however.

Lastly, regarding landscape (income), though evident as a pathway for transitions among pioneer states, was on its own insufficient. Indeed, it was the role of political regime actors who designed innovative ways by which revenues could be generated to place energy transitions on the agenda that enabled transitions.

Despite the encouraging deployment of renewable energy technologies in a fossil dominant society, however, it is evident that a full transition to a low carbon energy system in Nigeria will require active participation and commitment from the political cadre. If this new wave of transitions is going to contribute to wider RE adoption by states and the federal government in Nigeria, it would require political support and attention, recognition of its financial viability and a pluralistic institutional basis providing a suitable platform and network where niches are able to coordinate technological development and learning.

Clearly, the role of the regime, and political actors in particular, in energy transition processes is central. While we have been able to contribute to the on-going debate on the role of political actors within the regime, furthermore, our results open numerous prospects for future research on renewable energy deployment in developing countries where economic and political power is concentrated among a selected few. The development of a more nuanced conceptualisation of the regime which includes rentier elites might address these emerging debates.

Appendix A

States	Total population	IGR 2015 in billion naira	Federal Allocation 2015 in billion naira	Budget 2015 in billion naira
Abia	2,833,999	13, 349,444,263.72	40,082,563,528.57	102.38
Adamawa	3,168,101	4,451,736,117.84	37,753,050,520.67	100.89
Akwa Ibom	3,920,208	14, 791, 175,253	163,962,359,835.25	462
Anambra	4,182,032	14, 791,175,253.00	40,384,859,045.39	164.5
Bauchi	4,676,465	5,393,721,996.00	44,476,175,229.12	127.88
Bayelsa	1,703,358	8,713,516,526.24	88,305,401,800.85	250.95
Benue	2,300,736	7,631,789,841.37	37,819,773,534.73	105.1
Borno	4,151,193	3,530,261,222.31	48,243,658,732.84	98.5
Cross River	2,888,966	13, 567, 122, 507.38	30,036,497,990.10	149
Delta	4,098,391	40, 805, 656,911.96	120,122,741,706.71	327.68
Ebonyi	2,173,501	n/a	30,521,338,932.29	82.01
Edo	3,218,332	19,117, 468,369.25	40,107,447,041.09	159.3
Ekiti	2,384,212	3,297,707,703.96	28,219,449,434.94	80.78
Enugu	3,257,298	18, 081, 014, 527	38,215,557,755.62	96.73
Gombe	2,353,879	4,784,605,861.47	29,508,862,661.74	89.45
Imo	3,934,899	5,472,581,634.18	39,478,849,278.83	141.2
Jigawa	4,219,244	5,081,424,105.40	44,705,996,445.11	88.75
Kaduna	6,066,562	11, 536, 729,988.59	48,637,908,665.02	203.7
Kano	9,383,682	13, 611, 853,935.85	64,062,012,377.28	210.7
Katsina	5,792,578	5,791,008,741.00	48,369,024,174.45	113.3
Kebbi	3,238,628	3,592,406,108.00	40,980,037,717.08	166.81
Kogi	3,278,487	6,776,580,756.17	40,415,861,606.59	110.2
Kwara	2,371,089	7,178,922,182.76	34,051,502,675.12	122.43
Lagos	17,552,94	268,224,782, 435.23	88,349,485,946.83	489.69
Nassarawa	1,869,377	4,281,701,806.50	34,924,800,403.00	107.8
Niger	3,950,249	5,975,149,921.86	40,133,571,728.90	80.82
Ogun	3,728,098	34, 596, 446, 519.52	34,333,291,920.52	210.35
Ondo	3,441,024	10,098,000,000.00	41,614,974,587.05	131
Osun	3,423,535	8,072,966,446.00	20,223,138,804.75	201.7
Oyo	5,591,589	15, 663,514,824.73	42,990,133,458.65	141.8
Plateau	3,178,712	6,937,349,802.70	33,753,863,416.05	215.3
Rivers	5,185,400	82, 101,298,408.43	105,175,742,696.86	338
Sokoto	3,696,999	6,224,448,122.53	43,174,134,135.70	112.5
Taraba	2,300,736	4,155,053,816.15	36,763,808,789.50	96.52
Yobe	2,321,591	2,251,330,427.39	39,044,192,135.55	80.6
Zamfara	3,259,846	2,741,632,541.03	32,060,000,283.80	92.8

Source: Data compiled from the National Bureau of Statistics, Budgit, State press releases.

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