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Josephine Ilesanmi

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IMPORTANCE OF ECO-ENTREPRENEURSHIP AS A TOOL FOR CLIMATE ACTION AND LOW-CARBON TRANSITION IN DEVELOPING COUNTRIES: A CASE STUDY OF NIGERIA

Josephine Ilesanmi*

ABSTRACT

Climate change poses socio-economic, legal and environmental vulnerabilities such as land degradation, biodiversity loss, loss of property and livelihood, increase poverty rate and a threat to public health. These impacts are said to only intensify with projected increase in population and global economic growth. Hence, global consensus advocate for decarbonisation and low carbon transition in all economic sectors as an effective mitigation strategy for climate change. In an attempt to lower carbon emissions, leading cooperation's and organizations have focused on mitigation projects that regulate activities of cooperate actors and big CO_2 emitters such as the oil and gas conglomerates. However, the United Nation Sustainability Development Goals (SDGs) promotes a transformative bottom-up approach to address climate change via localism and citizen participation to educate and train eco-entrepreneurs or ecopreneurs who participate and engage in strategic entrepreneurship projects designed to actively decarbonize economies. These ecopreneurs generate home-grown sustainability-focused small and medium scale eco-enterprises (SMEEs), also called energy citizens, ecological citizens, energy communities and co-operatives that can develop sustainable business model innovations, nature-based services and solutions, sustainable business management strategies, technologies and green jobs needed to drive the low carbon transition in key CO_2-emitting economic sectors such as the energy, agriculture, transportation, waste management, food, tourism, building and architecture and fashion industries. This article examines the characteristics, nature and benefits of eco-entrepreneurship as a tool for advancing climate action and low carbon energy transition. Using Nigeria as a case study, a profile of the barriers slowing the growth of eco-entrepreneurship is identified within the PESTEL framework. Furthermore, drawing examples from the U.K. governance landscape and portfolio, recommendations on a transformative yet contextual strategy captured in the five transformative features (diversity, connectivity, polycentricity, redundancy and directionality) are made

to interrogate and overcome entrepreneurial ecosystem barriers towards successfully supporting the rapid growth of eco-entrepreneurship.

Keywords: Transformative governance, Eco-Entrepreneurship, Small to medium scale eco-enterprises (SMEEs), Energy Citizenship, Sustainability, Green energy, Energy transition, Decarbonisation, Entrepreneurial ecosystem.

1. INTRODUCTION

Climate change is a global emergency with environmental and social impacts such as: land loss and degradation; loss of livelihood, increase poverty in marginalized and vulnerable communities[1]. Global statistics show that one third of the worlds forest is lost due to both climate change impacts and anthropogenic activities while 1.6 billion of the world's population depend on resources and services from these ecosystems[2]. Climate change requires urgent intervention and mitigation strategies and the main culprit for this 'Wicked Problem' is greenhouse gas (GHG) emissions, specifically carbon dioxide (CO_2)[3]. Therefore, global consensus advocate for decarbonisation and low carbon transition strategies in all economic sectors (energy, agriculture, industries and waste)[4] as an effective mitigation strategy for climate change. Hence, the urgent need for supportive institutional governance structures to promote home-grown sustainability-focused small and medium scale eco-enterprises (SMEEs) that generate sustainable business model innovations (SBMIs) in eco-innovations, green technologies, green institutions, renewable

* PhD Candidate, Durban University of Technology, South Africa and Research Fellow, Institute for Oil, Gas, Energy, Environment and Sustainable Development (OGEES Institute), Afe Babalola University, Ado Ekiti, Nigeria. Email: 22384684@dut4life.ac.za; josephineilesanmi@gmail.com .

1 Hannah Ritchie, 'The world has lost one-third of its forest, but an end of deforestation is possible' (OurWorldInData, 9 February 2021) < https://ourworldindata.org/world-lost-one-third-forests> Accessed 13 April 13 2024; Kumar Sambhav Shrivastava, 'About 1.6 billion people of the world depend on forests for living' (DownToEarth, 6 June 2014) < https://www.downtoearth.org.in/news/about-16-billion-people-of-the-world-depend-on-forests-for-living-44647> Accessed 13 April 2024.

2 Ibid.

3 Hannah Ritchie, Pablo Rosado and Max Roser, 'Breakdown of carbon dioxide, methane and nitrous oxide emissions by sector' (ourworlddata, January 2024) <https://ourworldindata.org/emissions-by-sector> Accessed April 13 2024

4 Breno Bringel and Maristella Svampa, 'The Decarbonization Consensus' (Global dialogue, 15 November 2023) <https://globaldialogue.isa-sociology.org/articles/the-decarbonisation-consensus> accessed 13 April 2024

energy (RE) and nature-based enterprises, services and solutions that capture social and environmental value.[5]

International efforts such as the UN 2030 SDGs provide a framework for the global business community to identify and capture these problem solving business strategies by engaging disruptive and transformative entrepreneurial skills[6]. For example, achieving the SDG 7, 8, 11, 12, 13, goals requires sustainable production and consumption of energy via green innovation to harness clean energy, generate green jobs, and promote green communities and services that decarbonize economies. Also, target 14, 16, 19 of the Kunming-Montreal Global Biodiversity Framework (GBF) specifically calls on countries to engage in citizen empowerment and localism to educate indigenous communities to recognize and capture sustainable value from all sectors by generating nature-based business models.[7] These business models aim to promote sustainable competitiveness and reduce climate change vulnerabilities especially in marginalized communities.[8] Hence, there is an urgent need for the generation and rapid growth of SMEEs, supportive organizational governance structures and governance portfolio which are effective at capturing and creating sustainable towards decarbonizing the economy. Entrepreneurship plays a crucial role in transitioning economies towards sustainability and clean energy because through global entrepreneurship, 90% of employment originate and 90% businesses are generated which makes enterprises the backbone of global economy[9]. It serves as an incubator that provides the skeletal framework for generating the

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5 Rosaria Ferlito and Rosario Faraci, 'Business model innovation for sustainability: a new framework' [2022] Innovation & Management Review Vol. 19 (3):222-236

6 Ching-Hsun Chang, Meng-Yi Shih, Hsin-Ju Peng 'Enhancing entrepreneurial opportunity recognition: Relationships among green innovative capability, green relational capability, and co-innovation behavior' [2022] Vol. 31 (4): 1358-1368.

7 Qingyang Li, Yingxue Ge and Jeffrey A. Sayer, 'Challenges to implementing the Kunming-Montreal Global Biodiversity Framework' (2023) Land 12, 2166

8 'Kunming-Montreal Global Biodiversity Framework' (Home | Convention on Biological Diversity) https://www.cbd.int/gbf/introduction/ (Section B: Purpose, no 4) and Biodiversity finance Report, International Finance cooperation (page iii).

9 Anon., 'Small and medium enterprises (SMEs) finance' (The world bank, 16 October 2019) <https://www.worldbank.org/en/topic/smefinance#:~:text= SMEs %20account%20for%20the%20majority,(GDP)%20in%20emerging%20economies> (Accessed 3 November 2023).

above SBMIs that rapidly decarbonize economies towards meeting the UN SDG goals by 2030 and beyond.[10]

While several studies have examined the importance of eco-entrepreneurship as a tool for decarbonizing all economic sectors in countries like United Kingdom, an in-depth examination of how transformative governance can comprehensively amplify the role and contribution of eco-entrepreneurship towards achieving climate action and low carbon transition plans in most developing countries is lacking. Hence, this article fills a gap in this regard. This article examines the characteristics, nature and benefits of eco-entrepreneurship. After which the concept of transformative governance is unpacked highlighting the U.K. has a suitable country to adopt best practices. Using Nigeria as a case study, a profile of the barriers slowing the growth of eco-entrepreneurship is identified within the PESTEL framework; lastly, using examples capture in the U.K. governance landscape and portfolio, recommendations on a transformative yet contextual strategy captured in the five transformative features (diversity, connectivity, polycentricity, redundancy and directionality) are made to interrogate and overcome entrepreneurial ecosystem barriers towards successfully supporting the rapid growth of eco-entrepreneurship.

This article is divided into five sections, this introduction being the first. Section 2 examines the nature, scope and benefits of eco-entrepreneurship and its potential contribution to climate action and low carbon energy transition. Section 3 unpack the policy, economic, social, technological, environmental and legal (PESTEL) framework as an investigative tool used for analyzing the entrepreneurial ecosystems. Using the PESTEL framework, it investigates the key barriers to eco-entrepreneurship in Nigeria.

2. NATURE, SCOPE AND BENEFITS OF ECO-ENTREPRENEURSHIP

Eco-entrepreneurship is the fusion of both ecological (green) and entrepreneurship concepts[11]. It describes an entrepreneurial action that

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[10] Juliana Kurek et al, 'Sustainable Business Models Innovation and Design Thinking: A Bibliometric Analysis and Systematic Review of Literature' Sustainability, [2023] 15(2) 1-22.

[11] Oludele Mayowa Solaja, 'Ecopreneurship and green product initiative (GPI): An agenda for Nigeria's sustainable development in the 21st century' [2017] Studia I Materiaty (23): 103-118 (105).

identifies and captures strategic opportunities that solve common social and environmental problems while generating economic benefits. Individuals and community members who engage in eco-entrepreneurship and design SBMIs are known as eco-entrepreneurs or ecopreneurs[12]. To optimise the potential of sustainable business practises, there are 3 key elements of an ecopreneur that must be developed[13]: Eco-opportunity recognition- this relates to ability of ecopreneurs to recognize gaps which can potentially address social and environmental problems while promoting economic empowerment; Eco-innovation- describes innovative business models, technologies and solutions needed to effectively capture eco-opportunities, generate new markets and create sustainable value; Eco-governance-this involves engineering a favourable EE for rapid growth of eco-entrepreneurship through governance portfolio, green policy instruments, strategic institutional re-structuring, standards, broaden financial channels. These instruments and tools transition market demand and promote sustainable competiveness.

Eco-entrepreneurship is an effective incubator to generate eco-jobs and innovations which can significantly decline unemployment within the youth and contribute significantly towards climate action and low carbon mitigation strategies[14]. Secondly, developing countries such as MENA region and Africa face over-population with lingering poor waste management issues[1516]. Hence there is a large pool of eco-opportunities in plastic recycling and waste management, converting waste to economic benefits through eco-entrepreneurship. Thirdly, countries like Nigeria and Iran rely on agriculture for a significant portion of socio-economic benefits (investment, income, food) and this threatened by climate change effects.[17] Therefore, eco-

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12 Ibid (106).

13 Ibid (106).

14 Benjamin Anabaraonye et al, 'Green entreperneruship education for sustainable development in Nigeria'. [2021] IJCET 3(1):16-19.

15 Qahtan Thabit, Abdallah Nassour and Michael Nelles 'Facts and Figures on Aspects of Waste Management in Middle East and North Africa Region' [2023] Waste 1(1), 52-80.

16 Linda Godfrey et al, 'Solid Waste Management in Africa: Governance Failure or Development Opportunity?' in Norbert Edomah (eds), Regional development in Africa (IntechOpen 2019).

17 Benjamin Anabaraonye, Joachim Chukwuma Okafor, Chukwuma Morris Eriobu, 'Green entrepreneurial opportunities in climate change adaptation and mitigation for sustainable development in Nigeria' [2019] J. Environ Pollut Manage 2: 102; Vahid Karimi, Ezatollah Karami, Marzieh Keshavarz, 'Climate change and agricul

entrepreneurs are needed to capture eco-opportunities and innovations in Agro-renewable technologies, sustainable farming, and eco-governance through green farming polices, institutions, project and initiatives. Fourthly, countries like Nigeria are blessed with renewable energy (RE) opportunities such as solar and wind with major untapped opportunities.[18] Hence, harnessing these RE require locally produced eco-innovations such as solar – thermal, photovoltaic technologies (photovoltaic streetlights, solar stills, solar dryer, solar water heater, and solar cooker) and strategic eco-governance that fast track incorporation of local RE innovations.[19] Lastly, there is a huge sustainability awareness gap in most developing countries and workshops on community and stakeholder education and skill building is urgently required to find solutions for environmental degradation, pollution, climate change impacts, poverty, unemployment, biodiversity loss.[20]

3. ADVANCING ECO-ENTREPRENEURSHIP: THE NEED FOR A PESTEL FRAMEWORK

The policy, economic, social, technological, environmental and legal (PESTEL) framework is a scholar-certified investigative tool used to capture a holistic view of the entrepreneurial environment (EE).[21] The extracted information from the EE, using PESTEL framework, helps to identify barriers to entrepreneurial activities, design context-specific business innovations and strategies, and identify optimal market entry points that will

ture: Impacts and adaptive responses in Iran'[2018] Journal of Integrative Agriculture 17(1):1-15.

18 Benjamin Anabaraonye, Joachim Chukwuma Okafor, Chukwuma Morris Eriobu, 'Green entrepreneurial opportunities in climate change adaptation and mitigation for sustainable development in Nigeria' [2019]]J. Environ Pollut Manage 2: 102.

19 Ibid.

20 Deborah Justice Kofi, Vidal Diogo Guedes and Dinis Maria Alzira Pimenta 'Raising awareness on solid waste management through formal education for sustainability: A developing countries evidence review' [2021] Recycling 2021, 6, 6.

21 Eric Mutai, 'Increasing the competitiveness and profitability of a small and medium-sized enterprise' [2023] Hameen Ammattikorkeakoulu University of applied sciences; Ubaid Ullah Khan et al, 'Macro-environmental factors and their impact on startups from the perspective of developing countries' [2023] International Journal of Sustainable Engineering, 16(1): 166–183.

successfully interrogate the EE barriers and rapidly grow eco-enterprises from emergence to maturity stage.[22]

3.1 Transformative governance

Firstly, governance describes collective approaches adopted by society towards decision making, determining actions to achieve set goals[23]. Institutional government agencies provide the policy and legal framework required to govern the successful transition towards a sustainable economy. These polices, laws, legislations and regulations set market stature which can engineer a supportive entrepreneurial environment or create market entry, establishment and operationalization barriers. Hence strategic governance is required to design and effectively implement supportive polices that promote decarbonizing the economies and growing eco-ventures. Institutional fragmentation and lack of stakeholder participation in the policy design process has favored top-to-bottom governance with few dominant actors and centralized systems that are fossil fuel dependent[24] . Hence, there is a need to shift from a centralized institutional structure and policy landscape to a decentralized governance structure that promote a bottom-top governance structure and advocates citizen autonomy.

Transformative governance addresses governance based on the current realities and magnitude of global treats which are too complex to be handled unilaterality by state governance alone[25]. It proposes a holistic, multilateral and multilayer approach of environmental and social governance (ESG) encouraging resilience, flexibility and adaptability of systems and governance structure[26]. The theoretical framework of transformative governance and

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22 Binashi Kumarasiri and Piumi Dissanayake, 'Barriers to implementing waste-to-energy projects in Sri Lanka: a PESTEL analysis' [2021] Built Environment Project and Asset Management, Vol. 11 No. 4, pp. 544-558; Ivana Marinovic Matovic 'PESTEL analysis of external environmental as a success factor of startup business' [2020]

23 Brian C. Chaffin et al 'Transformative environmental governance' [2016] Annu Rev Environ Resour 1(41): 399-423.

24 Totti Konnola et al 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

25 Anon, 'We need transformative governance' (Dogoodpoeple.com, 2023) <https:// www.dogoodpeople.com/csr-trends/esg-criteria/governance/we-need-transformative-governance/ > Accessed 13 April 2024

26 Brian C. Chaffin et al 'Transformative environmental goverance' [2016] Annu Rev Environ Resour 1(41): 399-423

features are well captured in Konnola and include: Diversity, Connectivity, Redundancy, Polycentricity and Directionality:[27]

a) **Diversity-** This addresses the variability of options and conditions and manifests as a broad range of energy actors in the EE: competitors, producers, suppliers and intermediaries resulting in a wider range of skill building, innovations, competencies coupled with institutional diversity to govern multi-players[28].
b) **Connectivity-** Following the generation of diverse actors, products and service; connecting them through networks, agents, collaborative strategies with policy makers, actors, stakeholders, ecopreneurs and institutions are imperative to prevent fragmentation. According to Finsher (2016)[29], university collaborations promote eco-innovation, patent commercialization, cluster initiatives with eco-ventures, knowledge transfer, and start-up couching through research and education.
c) **Polycentricity-** This third feature of transformative governance represents control stations of governance that are specific to certain roles yet can influence other actors in the EE making governance more flexible and sensitive to the growing needs required to promote SBMIs and SMEE growth. For example, several nodes of local governance stations that provide an interface between institutional reforms, business practices and techno-innovation.
d) **Redundancy-**represents the overlap of functions to reinforce implementation of polices for example, extracting multiple data to generate innovation and guide decision making.
e) The final feature for transformative governance is **Directionality-**this describes non-government and governing bodies focused on identifying key problems in the society and developing actions that ensure solutions are implemented and achieved. While previous features promote adaptability of the EE, directionality crowns it all by consolidating all efforts towards a singular direction: promoting climate action and low carbon transition strategies. This feature prevents anticipatory myopia

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[27] Totti Konnola et al 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106.

[28] Totti Konnola. Ville Brummer and Ahti Salo 'Diversity in foresight: insights from the fostering of innovation ideas' [2007] Technol. Forecast. Soc. Change 74, 608–626.

[29] Klaus Fichter et al, 'Shifting the Support of Entrepreneurship in Eco-Innovation' [2016] Work Package 9 – Final report of the Eco-Innovera project SHIFT. Berlin, Helsinki, Linköping: SHIFT.

during implementation stage and facilitates policy diffusion from national to local levels[30]. Directionality is manifested in mission-oriented innovation polices leading to strategic innovation programs and socio-technical networks and collaborations with various actors and stakeholders[31].

3.2 Transformative governance approach to Eco-entrepreneurship in the United Kingdom

In developed nations such as United Kingdom and other European countries, the potential of eco-entrepreneurship as an effective tool to promote climate action and low carbon transition strategies is actively harnessed through transformative polices and strategic institutions that provide support via green financing, incentives and subsidies, promote green research and development, innovation, ease legitimization and establishment of eco-ventures, etc. This transformative approach provides a supportive entrepreneurial environment for multi-SBMIs, multi-layer partnerships and collaborations, bottom-top governance structures, transparency and ease of data sharing, all tailored to meet national objectives to harness the potential of SMEEs to rapidly contribute towards climate action and low carbon transition plans. The United Kingdom's energy system shares similar characteristics and challenges with developing countries such as Nigeria such as: outdated and decaying infrastructure, energy centralization, dominant control of few national actors, and heavy reliance on fossil fuel.[32] However, over the years, the U.K. has made tremendous progress in developing innovative and transformative policies, initiatives, financial incentives, business models and strategies and is consistently and significantly decarbonizing national grid and energy systems making the U.K. a suitable country for drawing transformative governance strategies and lessons.

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30 Totti Konnola et al 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

31 Stephen Park 'Legal Strategy Disrupted: Managing Climate Change and Regulatory Transformation' [2022] American Business Law Journal, Vol. 58 (4): 1-37

32 Pegah Mirzania et al 'The impact of policy changes: The opportunities of Community Renewable Energy projects in the UK and the barriers they face' [2019] Energy Policy Vol. 129: 1282-1296; Emmanuel Taiwo Fasina
Bankole Adebanji and Abe Adewale 'Integrating localised energy systems into the Nigerian power network' Global Journal of Engineering and Technology Advances 15(01): 001–007

Moving the discussion forward, practical strategies were identified and extracted from the U.K. policy portfolio, white and grey papers and used to make contextual recommendations for the subsequent case study (Nigeria). A look at the U.K institutional and policy landscape shows the success of SMEEs in the U.K is attributed significantly to policies and government objectives that have engineered a supportive EE conducive to SMEEs and the generation of innovative management strategies.[33] Looking at the history of energy policy in the UK[34], it is laced with strategic approaches to interrogate institutional defragmentation towards specialization and crafting of well-informed policy design in the area of renewable energy. This has led to the United Kingdom pioneering community-led renewable energy projects, and is continually developing, optimizing and redesigning policies to strengthen the effectiveness of SMEEs contribution to the energy transition[35]. In the recommendation section, U. Ks transformative strategies will be analyzed. Discussing each of the polices and strategies pose as redundant, for clarity sake, specific policy and institutional strategies that reflect the five transformational features will be highlighted and unpacked. Therefore, this article draws from Konnola's transformative governance framework which can be contextualized based on unique socio-political barriers of a region, as a key strategy to address entrepreneurial ecosystem barriers and promote the rapid growth of SMEEs towards effective decarbonisation of economies and sustainability.[36]

4. AN EVALUATION OF NIGERIA'S GOVERNANCE STRUCTURE FOR ECO-ENTREPRENEURSHIP

Using the Nigerian EE as a case study, it was found that eco-entrepreneurship is yet to be fully tapped as a sustainable strategy to: transform Nigeria's resourced-based economy to a circular or green economy; harness the bounteous untapped renewables, nature-based

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[33] (C. Nolden, J. Barnes and J. Nicholls, 'Community energy business model evolution: A review of solar photovoltaic developments in England' [2020] Renewable and Sustainable Energy Reviews 122:1-12

[34] Suzanna Hinson and Paul Bolton 'Energy policy: an overview' (2020) Number 8980 House of commons Library < https://commonslibrary.parliament.uk/research-briefings/cbp-8980/>

[35] Seyed Masoud Sajjadian, 'A critique on the UK's net zero strategy' [2023] Sustainable energy technologies and assessments 56:103003

[36] Totti Konnola et al 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

solutions and other sustainable opportunities; actively contribute to achieving Nigeria's climate action and low carbon mitigation pledges. Nigeria is the biggest emitter of greenhouse gas (GHG) in Africa; runs the largest economy in Africa with a population above 200 million people.[37] Therefore, Nigeria has a crucial role in achieving the UN climate action and low carbon transition targets for the continent of Africa. A look at Nigeria's total GHG emissions for 2015 showed: 712,638 $GgCO_2$-eq with sectorial emissions from: land use, forestry and agriculture at 66.9% of total emissions (476,949 Gg CO_2-eq); energy at 28.2%, waste at 3.0% and production and consumption at 1.9%.[38]

Fortunately, Nigeria has strong potentials for significantly contributing towards climate action and low carbon transition plans. For example, Nigeria is endowed with RE resources like solar, wind, hydro and biomass.[39] Solar energy is estimated to generate 27 times more energy than fossil fuel i.e., Solar-electricity generating potential is 115,000 capacity greater than fossil fuel-generating electricity.[40] Photovoltaic technology, wind energy, hydropower and biomass is estimated to potentially generate 492,471 MW, 36,683 MW, 12,220 MW, 7,291 MW respectively[41]. If harnessed effectively, Nigeria's RE alone is able to meet energy demands for all West African countries.[42] A report by International Renewable energy Agency (IRENA) showed that 60% of Nigeria's energy demand can be met by 2050 eliminating 65 % of oil consumption and 40% of natural gas demand.[43] Furthermore, Nigeria has a strong potential for carbon sinking due to rich geographical

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37 Ogbonna Chukwuemeka et al 'Understanding Nigeria's transition pathway to carbon neutrality using the Multilevel Perspective' [2023]. Carb Neutrality **2**, 24

38 Ibid

39 Yusuf. N. Chanchangi et al, 'Nigeria's energy review: Focusing on solar energy potential and penetration' [2022] Environment, Development and Sustainability 25:5755–5796

40 Ogbonna Chukwuemeka et al 'Understanding Nigeria's transition pathway to carbon neutrality using the Multilevel Perspective' [2023]. Carb Neutrality **2**, 24

41 Habiba Ahut Daggash and Niall Mac Dowell 'Delivering low-carbon electricity systems in Sub-Saharan Africa: insights from Nigeria' [2021] Energy Environ Sci 14:4018–4037

42 Ogbonna Chukwuemeka et al 'Understanding Nigeria's transition pathway to carbon neutrality using the Multilevel Perspective' [2023]. Carb Neutrality **2**, 24

43 Anon 'High promise, high potential: the future of Nigerian renewables' (power.nridigital.com) <https://power.nridigital.com/future_power_technology_apr23/nigeria_renewable_power> accessed 16 April 2024

variations at the southern region composed of rain forests and mangrove swamps.[44]

Nigeria's current efforts to engineer a supportive entrepreneurial environment to increase capacity to capture green opportunities is expressed in pledges such as: National Climate Change Act 2021, National Determined Contribution, National Renewable Energy Action Plan 2015-2030, National Biodiversity strategic and action plan (2016-2020) which outlines carbon reduction plans in agreement with United Nations Framework Convention on Climate Change (UNFCCC) requirements with Nigeria committing to: 47% reduction in emission with international support in areas of capacity development, technology and financial support and 20% reduction from business as usual by 2030.[45] Furthermore, a 7-year ambitious plan targeting all economic sector aimed at gradually improving energy efficiency by 2.5%/year is estimated to reduce total energy consumption by 40% which translates to reduction in a large portion of emissions by 2030.[46]

However, due to the time sensitivity of climate action and low carbon transition, rapid translation of these pledges and policy instruments into effective business strategies that identify, capture and harness green opportunities face political, economic, regulatory, environmental, social and institutional barriers in Nigeria and most developing countries[47]. There is an urgent need for a disruptive and transformative approach to interrogate and overcome these barriers. To tailor a contextual-transformative governance strategy for Nigeria, the barriers to eco-entrepreneurship are unpacked and analyzed, then drawing lessens from the U.K governance strategies, a

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[44] Belinda Archibong and Philip Osafo-Kwaako, 'Delivering Nigeria's green transition' in Amar Bhattacharya, Homi Kharas and John W. McArthur (eds), Key to climate action (Brookings Institution 2023 (p.3))

[45] Department of Climate change, Nigeria's first nationally determined contribution – 2021 update. (White paper FMEnv.) Executive summer, Para 5

[46] Department of Climate change, Nigeria's first nationally determined contribution – 2021 update. (White paper FMEnv.) Chapter 5 Mitigation priorities, Table 1: Mitigation measures in the energy sector (conditional) Page 22 (FMEnv.) https:// climatechange.gov.ng/wpcontent/uploads/2021/08/NDC_File-Amended_11222. pdf

[47] Oludele Mayowa Solaja. Ecopreneurship and green product initiative (GPI): An agenda for Nigeria's sustainable development in the 21st century [2017] Studia I Materiaty (23): 103-118 (106); Haruna M.S, Ezeanayanaso C.S. & Olagoke M.F 'Solutions to the challenges facing full adoption of renewable energy transition in Africa: Nigeria as a case study' [2023] IOSRJEN Vol. 13, Issue 1, January 2023, ||Series -I|| PP 01-08

transformative and disruptive approach to interrogate identified barriers is presented, highlighting new conceptual tools of multi-level governance, illuminate novel actors and emphasizing participation from a bottom-to-top perspective.[48]

4.1 Barriers to Eco-Entrepreneurship in the Nigerian Context

In Nigeria, SMEEs are largely unsupported with multiple barriers and only few promoters at an estimated scientific ratio of 4:1.[49] A look at Nigeria's EE using the PESTEL framework follows:

4.1.1 Political factors

High insecurity is a major barrier for business establishment and operation in Nigeria.[50] For example, Nigeria has an unstable political climate with social unrest caused by Indigenous People of Biafra (IPOB) in southeast, Boko Haram in the Northeast, Niger-Delta militant activity in South of Nigeria[51] and random kidnapping are major issues[52]. The social unrest engineers an insecure environment hence low confidence in establishing businesses and lack of investor will[53]. Nigeria has a high business operating cost incurred by establishing safety mechanisms against theft and vandalism[54]. Unfavourable, insufficient or generalized government polices due to lack of harmonized policy landscape and institutional fragmentation is a major barrier to

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48 Sarah Burch et al 'Governing and accelerating transformative entrepreneurship: exploring the potential for small business innovation on urban sustainability transitions' [2016] Current Opinion in environmental sustainability vol 22: 26-32.

49 Ogbonna Chukwuemeka et al 'Understanding Nigeria's transition pathway to carbon neutrality using the Multilevel Perspective' [2023]. Carb Neutrality **2**, 24

50 Akinlabi B.H., Asikhia Olaleka U., Muraina Olaide M 'The Effect of External Business Environment on Performance of SMEs in Nigeria' [2021] IJAEM Volume 3, Issue 1 Jan-Feb 2021, pp: 762-774

51 Ibid

52 Olayinka Shehu, 'The cost of getting kidnapped in Nigeria' (icirnigeria , 10 August, 2023) <https://www.icirnigeria.org/the-cost-of-getting-kidnapped-in-nigeria/> accessed 13 April 2024

53 Akinlabi B.H., Asikhia Olaleka U., Muraina Olaide M, 'The Effect of External Business Environment on Performance of Smes in Nigeria' [2021] IJAEM Volume 3, Issue 1 Jan-Feb 2021, pp: 762-774

54 Angela Obose Oriazowanlan1 and Dominic Ose Erah, 'Effect of Insecurity on Micro, Small and Medium Enterprises (MSMEs) Development in Benin-City, Edo State' (2019) Science Arena Publications International journal of Business Manage ment Vol.4 (3): 75-86

ecopreneurs and eco-ventures[5556]. For example, lack of clear polices that govern green initiatives and eco-entrepreneurship in Nigeria is reflected in the low funding schemes and incentives to support these green initiatives[57]. There are narrow financial channels that provide reliable, safe and affordable loans which has led ecopreneurs to source funding from credit lenders with short term loans and high interest rate[58]. Furthermore, a general lack of political will towards green product initiatives and eco-entrepreneurship in Nigeria[59] translates into multiple barriers in the EE. For example, lack of polices to limit importation and outsourcing of technologies has led to high cost of production and services for which marginalized or rural community members are unable to afford. This limits the growth of home-grown green technologies and reduces ability of community members to capture value from eco-opportunities[60]. Lack of clear insurance plans and policy sandbox which promotes investment predictability while polices on technology standards and green initiative implementation guidelines are in the infancy stage[61]. Hence, reduced the ability to pool resources from greening goliaths.[62]

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55 Oludele Mayowa Solaja, 'Ecopreneurship and green product initiative (GPI): An agenda for Nigeria's sustainable development in the 21st century' [2017] Studia I Materiaty (23): 103-118 (106)

56 Damilola Olawuyi and Alex Oche 'A WEF Nexus and sustainable investments in West Africa: The Case of Nigeria' in Lira Luz Benites Lazaro et al (eds) Water - energy-food nexus and climate change in cities [2022] p.243-258

57 Takim S.A. et al, 'Applications and Performance Evaluation of Renewable Energy Technology Development in Nigeria using PESTEL Evaluation' [2017] Journal of Energy Technologies and Policy. Vol.7, No.4,

58 Akinlabi B.H., Asikhia Olaleka U., Muraina Olaide M, 'The Effect of External Business Environment on Performance of Smes in Nigeria' [2021] IJAEM Volume 3, Issue 1 Jan-Feb 2021, pp: 762-774

59 Oludele Mayowa Solaja, 'Ecopreneurship and green product initiative (GPI): An agenda for Nigeria's sustainable development in the 21st century' [2017] Studia I Materiaty (23): 103-118 (106);

60 Takim S.A. et al, 'Applications and Performance Evaluation of Renewable Energy Technology Development in Nigeria using PESTEL Evaluation' [2017] Journal of Energy Technologies and Policy. Vol.7, No.4,

61 Haruna M.S, Ezeanayanaso C.S. & Olagoke M.F, 'Solutions to the challenges facing full adoption of renewable energy transition in Africa: Nigeria as a case study' [2023] IOSRJEN Vol. 13, Issue 1,||Series -I|| PP 01-08

62 Oludele Mayowa Solaja, 'Ecopreneurship and green product initiative (GPI): An agenda for Nigeria's sustainable development in the 21st century' [2017] Studia I Materiaty (23): 103-118 (106);

4.1.2 Economic factors

Firstly, majority of government subsidies were directed to centralized fossil fuel services up until May 2023[63], hence the reason for lack of funding and incentives for green initiatives and the infancy stage of development of eco-ventures and services. Secondly, Nigeria has a volatile exchange rate with inflation at all-time high of 28.20%[64][65], this makes for costly sourcing and importation of machinery and technologies required to capture eco-opportunities and the development of eco-innovations.

4.1.3 Social Factors

Nigeria youth unemployment is at 53.40%[66] which could be a major reason for corruption including vandalism and theft. For example, stealing of standalone photovoltaic structures for illegal selling or destruction of these structures to demand policy reforms is not unfamiliar in the Nigerian context and a barrier to eco-entrepreneurial growth and innovations[67][68]. Also, low community acceptance due to lack of awareness and interest in eco-entrepreneurship is another barrier in Nigeria[69]. The low sustainability

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63 Leon Usigbe, 'Nigeria ends oil subsidy to invest savings in infrastructure development' (Africa Renewal 17 August 2023) <https://www.un.org/africarenewal/magazine/august-2023/nigeria-ends-oil-subsidy-invest-savings-infrastructure-development#:~:text=Without%20the%20subsidy%2C%20Nigeria%20could,the%20wake%20of%20drying%20resources> accessed 16 April 2024

64 Akinlabi B.H., Asikhia Olaleka U., Muraina Olaide M, 'The Effect of External Business Environment on Performance of Smes in Nigeria'[2021] IJAEM Volume 3, Issue 1 Jan-Feb 2021, pp: 762-774

65 Chijioke Ohuocha, 'Nigeria's inflation rises to more than 27-year high in December' (Reuters, 15 January 2024) <https://www.reuters.com/world/africa/nigerias-inflation-rises-more-than-27-year-high-december-2024-01-15/>accessed April 16 2024

66 Anon 'FG inaugurates committee to tackle increasing youth unemployment in Nigeria' (https://nationalplanning.gov.ng/) <https://nationalplanning.gov.ng/fg-inaugurates-committee-to-tackle-increasing-youth-unemployment-in-nigeria/#:~:text=%E2%80%9CIt%20is%20also%20estimated%20by,Bureau%20of%20Statistics%20in%202022.%E2%80%9D> para 10. Accessed 16 April 2024

67 Haruna M.S, Ezeanayanaso C.S. & Olagoke M.F, 'Solutions to the challenges facing full adoption of renewable energy transition in Africa: Nigeria as a case study' [2023] IOSRJEN Vol. 13, Issue 1,||Series -I|| PP 01-08

68 Akinlabi B.H., Asikhia Olaleka U., Muraina Olaide M 'The Effect of External Business Environment on Performance of SMEs in Nigeria'[2021] IJAEM Volume 3, Issue 1 Jan-Feb 2021, pp: 762-774

69 Takim S.A. et al 'Applications and Performance Evaluation of Renewable Energy Technology Development in Nigeria using PESTEL Evaluation' [2017] Journal of Energy Technologies and Policy. Vol.7, No.4,

awareness can be linked to inadequate coaching and skill building platforms in urban and rural area to build capacity in eco-entrepreneurship[70]. Furthermore, the over-dependence on non-renewable ventures has slowed the uptake of eco-entrepreneurship[71]. Hence, the low community confidence for engaging in eco-entrepreneurship can be due to unclear polices, unfavorable governing structures, lack of financial support channels, lack of government projects and incentives, unclear market entry and low market demand, unskilled human capital, high start-up cost, insufficient technology required to capture eco-opportunities.[72]

4.1.4 Technological factors

Nigeria's public energy infrastructure is at a poor state with energy generated meeting only 50% of demand; the operational efficiency of the power sector is one of the least efficient in Africa[73]. Nigeria has a poor transportation system and maintenance culture for roads[74] creating business logistic challenges. Ecopreneurs commonly face low capacity to capture eco-opportunities and eco-innovations due to issues with infrastructural facilities and green technologies[75]. Also lack of favourable polices reduce locally developed green technologies, low management and standard of quality

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70 Haruna M.S, Ezeanayanaso C.S. & Olagoke M.F, 'Solutions to the challenges facing full adoption of renewable energy transition in Africa: Nigeria as a case study' [2023] IOSRJEN Vol. 13, Issue 1,||Series -I|| PP 01-08

71 Haruna M.S, Ezeanayanaso C.S. & Olagoke M.F, 'Solutions to the challenges facing full adoption of renewable energy transition in Africa: Nigeria as a case study' [2023] IOSRJEN Vol. 13, Issue 1,||Series -I|| PP 01-08

72 Takim S.A. et al, 'Applications and Performance Evaluation of Renewable Energy Technology Development in Nigeria using PESTEL Evaluation' [2017] Journal of Energy Technologies and Policy. Vol.7, No.4,

73 Akinlabi B.H., Asikhia Olaleka U., Muraina Olaide M, 'The Effect of External Business Environment on Performance of Smes in Nigeria'[2021] IJAEM Volume 3, Issue 1 Jan-Feb 2021, pp: 762-774

74 Patience Chinyelu Onokala and Chidinma Joy Olajide, 'Problems and challenges facing the Nigerian transportation system which affects their contribution to the economic development of the country in the 21st century' [2020] Transportation Research Procedia Vol 48: 2945-2962

75 Oludele Mayowa Solaja, 'Ecopreneurship and green product initiative (GPI): An agenda for Nigeria's sustainable development in the 21st century' [2017] Studia I Materiaty (23): 103-118 (106);

control of technologies while most prosumers will prefer technologies that are usable, maintainable and efficient within the Nigeria context[76].

4.1.5 Environmental factors

Firstly, Nigeria's over population is a major environmental pressure[77] . Over population is directly linked to environmental degradation, water and food scarcity, low employment opportunities and destruction of ecosystems due to excessive urbanization which reinforces climate change effects[78]. Secondly, pollution, illegal waste disposal and oil spills lead to eutrophication which pollutes water bodies and marine ecosystems due to lack of enforced environmental laws, standards and regulations. This reduces the eco-opportunities in the area of nature-based enterprises. Furthermore, deforestation in Nigeria due to mining, logging, industrialization, expansion of farm land and urbanisation reduces eco-opportunities[79]. Thirdly, climate change impacts in Nigeria such as rise in ocean levels causing flooding in western lowlands region and drought and desertification in the north region has reduced farming and pasturing abilities and increased water scarcity while in the middle region of Nigeria, there is high mortality due to scarcity of land resource.[80]

4.16 Legal factors

Through the National Environmental Standards and Regulations Enforcement Agency (NESRA), Nigeria has made efforts to design national environmental policies that govern and regulate terrestrial ecosystems, marine

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[76] Takim S.A. et al, 'Applications and Performance Evaluation of Renewable Energy Technology Development in Nigeria using PESTEL Evaluation' [2017] Journal of Energy Technologies and Policy. Vol.7, No.4,

[77] Rita Anekwe, Ardi Gunardi and Nwanna Patience Chizoba, 'Ecopernuership Implementation and environmental sustainability in Nigeria' [2020] International Jounral of academic information systems research Vol 4(5): 1-6

[78] Doris Baus 'Over population and the impact on the environment 'The City University of New York. [2017] < https://academicworks.cuny.edu/cgi/view content.cgi?article=2929&context=gc_etds>

[79] Anekwe Rita Ifeoma, Ardi Gunardi and Nwanna Patience Chizoba 'Ecopreneur ship Implementation and environmental sustainability in Nigeria' [2020] IJAISR Vol 4 (5): 1-6

[80] Olagunju T E et al, 'Climate change impacts on environment: Human displacement and social conflicts in Nigeria' 4th International Conference on science and sustainable development (ICSSD 2020), IOP conf. Series: Earth and environmental science 655(2021) 012072.

ecosystems, and related science and technologies'[81]. However, enforcing these environmental laws through licenses, impact assessment and permit systems have been inadequate[82]. For example, lack of comprehensive environmental impact assessment prior to project approval has damaged cultural heritage sites which are potential indigenous eco-opportunities that promote socio-cultural beliefs while simultaneously preserving the environment and generating economic benefits.[83]

5. TRANSFORMATIVE GOVERNANCE: PROMOTING ECO-ENTREPRENEURSHIP IN THE NIGERIAN CONTEXT

In developing countries like Nigeria, entrepreneurship is a vital tool for rapid growth of sustainable business model innovations for climate action and low carbon transition strategies.[84] However, translating international pledges and green policy instruments into effective business strategies that identify and capture eco-opportunities and co-value creation face major barriers in Nigeria[85]. A transformative approach to address complexities and challenges towards engineering transformative innovation in the policy landscape; adaptive and participatory governance and complex resilient business models that are aligned and adaptable to Nigeria's complexities and uncertainties[86]. This will lead to proliferation of eco-entrepreneurship initiatives that provide long term environmental, social and economic benefits. Furthermore, Nigeria's contextual complexities, captured in the PESTEL analysis must be

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81 Oluwabunmi O. Adejumo, 'Growth Limits: A Conceptual Analysis for Sustainable Development in Nigeria' SAGE Open 1-12 [2020]. SAGE Open Vol. 10 (2): 1-12

82 Stephen Adi Odey, 'Environmental law enforcement in Nigeria: A re-evaluation' [2023] Vol 11: 1

83 Colin Breen et al, 'Integrating cultural and natural heritage approaches to Marine Protected Areas in the MENA region'[(2021] 132, 104676 Marine Policy

84 Cle-Anne Gabriel & Jodyanne Kirkwood, 'Business models for model businesses: Lessons from renewable energy entrepreneurs in developing countries' [2016] Energy Policy, 95, 336-349.

85 Gideon Ofosu-Peasah et al, 'Beyond rhetoric and ambition: assessing the feasibility of climate pledges by West African Countries' In: Okereke C, Babatunde A, Whyte D (eds.) (Centre for Journalism Innovation and Development 2022)

86 Totti Konnola et al, 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

considered to avoid over generalization and biases in recommendations[87]. This section of the article surrogates the identified U.K transformative governance strategies to interrogate the EE barriers in Nigeria by proposing contextualized practical recommendations that reflect transformative features: diversity, connectivity, polycentricity, redundancy and directionality.

5.1 Diversity by multi-specialized green institutional structures and innovative green policy instruments and initiatives

In the U.K., various institutional restructuring, innovative policy reforms and declarations have allowed for new eco-ventures, sustainable business model innovations, services and technologies in the U.K. entrepreneurial ecosystem. For example, the 2023 split of BEIS into three specialized departments enables proper governance of the multi-actors in the EE. Also, multiple strategies have been designed with the Net Zero objective in view including: the 2020 Ten Point Plan for a Green Industrial Revolution, Energy White Paper; the 2021 Net Zero Strategy; the 2022 British Energy Security Strategy; and the 2023 Transmission Acceleration Action Plan, Net Zero Growth Plan and Energy Security Plan [88]. These initiatives manifested as incremental diversification of product, services and techno-innovations in solar energy generation, smart home technologies such as: smart meters, PV panels, renewable technology installations, maintenance, recycling and green jobs to implement government projects, proposals and initiatives facilitated by availability of a broad range of financial channels, subsidies, grants and incentives.

Nigeria requires broader legislations to govern green finance, grant renewable energy projects[89]. Although Nigeria shows consistent commitment to adopt institutional and policy reforms to meet global goals using the UN SDG framework[90] with collaborative efforts with UN, the Special Advisor to the President on SDGs (OSSAP-SDGs) and other governing departments to

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87 Saeed Nosratabadi et al, 'Sustainable Business Models: A Review' [2019] Sustainabi lity, 11(6), 1-30.

88 Department of Energy and Net Zero Draft: Strategy and policy statement for energy policy in Great Britain (White paper 2024) paras 5<https://www.gov.uk/government/publications/strategy-and-policy-statement-for-energy-policy-in-great-britain/draft-strategy-and-policy-statement-for-energy-policy-in-great-britain-accessible-webpage> accessed 14 April 2024

89 Musbahu Hassan, 'Sustainability Governance and Achievement of Sustainable Development Goals in Nigeria' [2020] JIRD Vol4 (1): 65-80

90 Anon, 'How the UN is supporting the sustainable Development Goals in Nigeria' <https://nigeria.un.org/en/sdgs> accessed 16 April 2024

ensure national budgets and strategies align with SDG goals[91]. For example, the policy simulation tool known as Integrated Sustainable Development Goals (ISDGs) model which helps Nigeria design national programs and strategies within the SDG framework[92]. However, Nigeria's Voluntary National Review 2020 focuses on addressing SDG 1, 3,4,5,8, 16 and 17 with no mention of SDG 7 and 12 relating to clean energy and sustainable economy[93] . Also, Nigeria's institutional structure and polices have limited renewable energy objectives and current polices have not diffused effectively on a local scale. For example, the Department of Climate Change under the Ministry of Environment designed the National Policy on Climate Change 2021-2030 with strategies for reducing greenhouse gas emissions but lack of clear and consistent polices is one of the barriers to SMEE growth in Nigeria[94]. For example, one of the core objective of the policy was to strengthen current national institutions for effective climate change governance with no mention on how this will be implemented and measured[95]. Also, one of the Renewable Energy Master Plan objectives is to increase renewable energy investments and upscale existing renewable enterprises in wind, solar and hydro[96]; yet, inadequate funding, poor infrastructure and unfavorable institutional structuring are major barriers to the growth of SMEE[97]. Hence, recommendations to establish the Ministry for Climate Change and Net Zero (MCC-Zero) should be created with at least two specialized departments: Department of Business and Commerce (DBC), Department of Technology and Innovation (DTI), and Department for Energy Security and Sustainability (DESS). The proposed MCC-Zero will possess the required level of constitutional power to effectively design

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91 Ibid

92 Office of the Senior Special assistant to the president on SDGs, 'Achieving the SDGs in Nigeria: Pathways and policy options' [White paper 2019] Ch 1 page 3, para 1

93 Anon, 'Voluntary National review 2020' <https://sustainabledevelopment.un.org /memberstates/nigeria> accessed April 12 2024

94 Chukwuemeka Ogbonna, 'Understanding Nigeria's transition pathway to carbon neutrality using the multilevel perspective' [2023] Carbon Neutrality 2 (1): 1-21

95 Department of climate change, National climate change policy for Nigeria (White paper, 2021-2030) Ch1, Page 7, para 1 <https://climate-laws.org/document/ nati o nal-policy-on-climate-change-and-climate-change-policy-response-and-strategy_95ff> accessed 14 April 2024

96 Anon, 'Nigeria renewable energy master plan' (IEA50, 3 July 2013) < https://www .iea.org/policies/4974-nigeria-renewable-energy-master-plan> 14 April 2024

97 Musbahu Hassan, 'Sustainability Governance and Achievement of Sustainable Development Goals in Nigeria' [2020] JIRD Vol 4 (1): 65-80

tailored polices that will steward the EE and market structure through inter-departmental collaboration with (DBC, DESS and DTI) for generating large-scale eco-projects, green policies and legislations that provide tax-breaks, policy-sandbox, incentives and subsidies for security and theft-proof infrastructure which subsidizes the start-up cost for SMEEs.

5.2 Connectivity by commissioning of network associations, green National Executive Councils and platforms for local, national and international collaborations

In the U.K., the Energy Networks Association, provides a platform for stakeholder engagement and captures how national energy policies are affecting community members and businesses on a local scale through Open network programs[98]. Also, EnergyAssets captures innovative business models by collaborating with public and private sectors, connecting local network ownership with data services such as metering and renewable infrastructure for customers to better regulate their bills providing end-to-end value[99]. In November 2023, The Office of Gas and Electricity Markets (Ofgem) published a "call-for-input-Data Sharing in a Digital Future" with the objective of improving data sharing to promote personalized energy services, lower bills and reduce carbon footprint of UK citizens[100]. Also, institutional collaborations to advance innovations in sustainable, low- carbon energy towards achieving net zero target include: the U.K. DESNZ collaboration with the US. Department of Energy (DOE) towards knowledge sharing for the purpose of facilitating legalization and commercialization of clean energy solutions[101]. Furthermore, the DSIT and DBT share business data collected via the office of National Statistics through a Memorandum of Understanding for the purpose of developing and fine-tuning innovation policy and promoting business innovation in the UK[102].

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98 Anon, 'How the UK's energy networks are connecting with communities' (Energynetworks, 17 June 2022) <https://www.energynetworks.org/newsroom/how-the-uks-energy-networks-are-connecting-with-communities> accessed April 16 2024

99 Anon, (Energy Assets) <https://www.energyassets.co.uk/> accessed April 16 2024

100 Anon, (Ofgem, 30 November 2023) <https://www.ofgem.gov.uk/publications/data-sharing-digital-future

101 Department of Energy, (Energy.gov, 8 November 2023) <https://www.energy.gov/articles/joint-statement-between-doe-and-uk-department-energy-security-and-net-zero-concerning> accessed April 16 2024

102 Department for Business & Trade, UK Innovation Survey (UKIS) – Privacy Notice (White paper, 2023) para 1 <https://assets.publishing.service.gov.uk/media

In Nigeria, some collaborative efforts include knowledge sharing with the objective of effective green policy design. For example, collaborations with International Renewable Energy Agency (IRENA) helped design tailored strategies towards sustainable energy; and the creation of the Renewable Energy Road Map 2023 with Sustainable Energy for All. Also, the integration of techno-innovations such as the Integrated Energy Planning Tool uses geospatial technology to map out suitable on and off grid sites which illuminates possible eco-ventures, SBMIs and green jobs[103][104]. However, according to the African Data transparency report by Ember's, Nigeria's energy data management platforms is characterized with long lagging time, low quality and limited information; hence receiving the least rating of 1 over 5[105]. Also, recent literature highlights the lack of diversity in stakeholder participation with mostly multilateral organizations and donor groups and the need for collaborations and input from broader stakeholder groups[106].

To increase effective collaborations, stakeholder engagement requires creation of multi-level platforms to collate stakeholder input e.g. "Calls-for-Input" via online surveys, telephone calls, organized workshops, emails or local government town hall meetings. Nigeria requires strategic informal (Local Councils) and formal (National Executive Councils) networks of support centers to collate local and indigenous information and act as a service station for addressing the needs of the community members. These support centers and state networks should be empowered to approve green funding, incentives and grants to eco-projects and eco-innovations. Also, inadequate data sharing platforms can be attributed to poor infrastructure such as poor internet connections and outdated infrastructure[107]. With the proposed DTI, direct governance for multiple sources of green funding,

/642450f860a35e00120cb105/UK_innovation_survey_privacy_notice.pdf> accessed 14 April 2024

103 Anon, 'Universal integrated energy planning' (Sustainable energy for all) <https://sdg7energyplanning.org/

104 https://www.esi-africa.com/energy-efficiency/nigeria-launches-data-driven-geospatial-integrated-energy-planning-tool/> accessed April 13 2024

105 Anon, 'African electricity data transparency' (Ember, January 2022) <https://ember-climate.org/app/uploads/2022/01/African-Electricity-Data-Transparency.pdf> accessed April 14 2024

106 Norbert Edomah, Gogo Ndulue and Xavier Lemaire 'A review of stakeholders and interventions in Nigeria's electricity sector' Heliyon Vol 7 (9): e07956

107 Nigerian communications commission, 'Challenges of technology penetration in an infrastructure deficit economy (Nigeria perspective)' 2021. Executive summary, Chapter2 Page 5, 29 Paras 1, 1

R&D collaborations can be pulled on a national scale and effectivity diffused through National and Local Councils to fund green techno-innovations that facilitate the development of high technology energy data management platforms. Furthermore, creating a diverse yet interconnected cluster of monitoring centers such as Eco-Entrepreneurship Centers (EEC), green institutions and green unipreneur societies creates an interface between decision makers and stakeholders promoting access to a vast amount of information to generate multiple green solutions and strategies. For example, collaborations with financial institutions and green funding centers for green loans, start-up financial packages and crowd funding initiatives. Additionally, the establishment of Green Business Development Organizations (GBDO) can provide support services for contract design, training, certificate programs and collaborations with government bodies to generate eco-projects. Finally, engaging stakeholders via the GBDO, Eco-Entrepreneurship Centers and Local councils with decision-making bodies provides multiple platforms to advocate favorable importation laws that restrict outsourcing of green technologies, subsidies, and tax laws that encourage development of locally made green technologies.

5.3 Polycentricity by multi-location monitoring stations

To ensure place-based and whole-system governance, the U.K has established strategic monitoring stations to promote adaptability and actively incorporate policy reforms and strategies to rapidly resolve co-ordination inefficiencies and gaps due to the broadness and increased innovation of green products and services. The U. Ks departmental reviews and call- for- input have manifested the Regional Energy Strategic Planners (RESPs) in 2023 which is tasked with designing strategic plans on how the energy system should be governed on a local scale based on national objectives[108]. These strategies will be communicated to all local level energy system actors and stakeholders, boosting investor confidence to capture eco-opportunities[109]. These RESPs will be located as governing stations spread across the U.K geographical region: with 8-10 in England, 1-2 in Scotland, 10-13 across Great Britain[110].

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[108] Anon, 'The case for the regional energy strategic planners' (UKERC, 11 January 2024) https://ukerc.ac.uk/news/the-case-for-the-regional-energy-strategic-planners/ accessed 14 April 2024

[109] Fiona Campbell, 'Local energy system governance for a net zero future' (Ofgem, 6 April 2023) <https://www.ofgem.gov.uk/news-and-views/blog/local-energy-system-governance-net-zero-future> accessed April 14 2024

[110] Anon, 'Future of local energy institutions and governance' (Ofgem, 15 November 2023) < https://www.ofgem.gov.uk/sites/default/files/2023-02/Future%20of%20

Also, the UK Energy Research Centre (UKREC) designed energy system models as a supporting platform to ensure local decisions match national polices and support the exploitation of renewable technologies and resource for shared value. These control stations promote energy planning, market flexibility and real-time operations information[111].

Nigeria's dependence on fossil fuel is reflected in the instructional structuring and this prevents favorable policy reforms that support renewable energy resource development[112]. For example, the Bureau of Public Enterprise (BPE) established in 1999 is solely responsible for commercialization and privatization of enterprises that operate both renewable and non-renewable projects such as Zungeru Hydropower projects and fossil fuel exploration and refining projects in collaborations with Port Harcourt Refining Company Limited and Kaduna Refining and Petrochemical company (KRPC) [113]. This promotes an over-generalized approach to renewable energy governance. Also, about 71% of Nigeria's do not have access to energy[114], so there is a need for localized control centers such as the proposed EECs and GBDOs tasked with effectively diffusing available financial instruments to facilitate socio-technical advancements and rapidly increase local scale renewable energy generation towards achieve climate action and low carbon transition goals by 2030[115]. To achieve this, multiple control stations of EEC and GBDOs would be tasked with implementing initiatives such as: community-led strategic energy planning projects. These control stations will

local%20energy%20institutions%20and%20governance.pdf> accessed 16 April 2024

111 Modassar Chaudry et al, 'Modelling the interactions between national and local energy systems: research gaps' (2022) Page 6 para 3 < https://d2e1qxpsswcpgz.cloudfront.net/uploads/2022/07/UKERC_BN_Modelling-the-interactions-between-national-and-local-energy-systems.pdf> accessed 14 April

112 Agaptus Nwozor et al 'Transition to green energy and sustainable development in Nigeria: A prospective and evaluative analysis' [2021] IOP Conference series earth and environmental science 665 (1):012029

113 Bureau of public enterprises, 'Nigerian Mining corporation' <https://www.bpe.gov.ng/nigerian-mining-corporation/> accessed 16 April 2024

114 World Economic Forum, 'Here's how Nigeria is tackling the barriers to its green energy transition' (The European sting, 9 May 2023) < https://europeansting.com/2023/05/09/heres-how-nigeria-is-tackling-the-barriers-to-its-green-energy-transition/> accessed 16 April 2024

115 Anon, 'Here's how Nigeria is tackling the barriers to its green energy transition' (World economic forum, 8 May 2023) <https://www.weforum.org/agenda/2023/05/how-nigeria-is-tackling-barriers-to-its-green-energy-transition/> accessed 16 April 2024

report to the DBC and should be located at every other local government. The proposed stations will be an interface between national and local energy governance. These nodes of government will ensure renewable energy objectives are meet and national renewable energy policies are effectively diffused on a local scale. They will be tasked with promoting eco-entrepreneurship, creating a platform for stakeholder and eco-entrepreneur participate in green policy designs; and influence financial institution for green loan development. They will react to and mitigate set-backs of green polices, proactively enforce environmental compliance, materiality assessments and provide intervention plans as opposed to a generalized national governance strategy. Each of the nodes are centers of power with ability to uniquely regulate the EE but at the same time, they share information and are interconnected promoting flexible and adaptability[116].

5.4 Redundancy by data sharing and strategic over lapping platforms

The U.K Department of Business and Trade (DBT) coordinated the Data Protection and Digital Information No. 2 (DPDI) Bill 2023 which includes the Smart Data legislation. This Bill encourages data sharing of private sectors/ customers with third-party providers (TPP) who in turn customize services tailored to customers' needs[117]. Other established platforms exist that provide multi- data for eco-innovative projects and business model designs such as UKERC Energy Data Centre[118], Energy Systems Catapult Open data platform[119] and ElectraLink[120] providing cloud-based networks and platforms for data extraction. These data centers are equipped with advanced IT infrastructure due to broad funding and techno-innovation initiatives. For example, the 2019, £480,000 funding to promote technology upgrade for energy data systems and the research and innovations project in partnership with Ofgem and BEIS[121] . Also, innovative competitions and

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[116] Totti Konnola et al, 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

[117] Anon, ' Smart Data: The UK's new data sharing laws will spur innovation and improve consumer outcomes' (techUK, 15 March 2023) <https://www.techuk.org/resource/smart-data-the-uk-s-new-data-sharing-laws-will-spur-innovation-and-improve-consumer-outcomes.html> accessed 14 April 2024

[118] Anon, 'Independent whole systems research for a sustainable energy future' (UKERC, March 2024) <https://ukerc.ac.uk/> accessed 16 April 2024

[119] Anon, '(Catapult) <https://es.catapult.org.uk>

[120] Anon, 'Data-driven solutions for a flexible, low-carbon UK energy market' (ElectraLink) <http://www.electralink.co.uk> accessed 16 April 2024

[121] Government of UK, Innovation funding service, 'SBRI: modernising energy data access and information, phase 1' (White paper, 2019) <https://apply-for-

funding schemes have emerged from collaborations with DESNZ and DBEIS[122] which birth: Urban Tide, a SMEE that uses advanced green infrastructure technologies by integrating artificial intelligence (A.I) with energy data management to promote sustainable energy consumption[123][124]. This promotes transparency and reliability in renewable energy strategies.

In Nigeria, institutional fragmentation is a barrier for eco-entrepreneurship growth[125]. This can be addressed through institutional redesign to promote overlapping and repetition of functions enhancing reliability and transparency. The proposed MCC-Zero can collaborate with green research centers and other relevant ministries such as Ministry of Science and Technology and Ministry of Environment for knowledge sharing through 'Memorandum of understandings'; pull funds for research and development, competitions and initiatives for the generation of high infrastructure community-owned SMEEs that support industry efforts towards sustainable energy production and consumption. This gives energy autonomy to community members, reduce energy prices and engineer a favorable entrepreneurial environment for sustainable business innovations. Additionally, strategic information sharing and overlap can be promoted with collaborations with National environmental standards and regulations enforcement agency (NESRA), (Small & Medium enterprise Development Agency of Nigeria (SMEDEN) and proposed control centers (EEC and GBDOs). The objective of the overlap will reinforce compliance to environmental and social governance (ESG) standards and guidelines by eco-enterprises, promoting credibility and investor confidence. Hence, both stakeholder-led control stations and regulators work together to ensure

innovation-funding.service.gov.uk/competition/491/overview> accessed 16 April 2024

122 Government of U.K, 'Government funding for innovation in smart energy systems and technologies' (White paper, 2021) < https://www.gov.uk/guidance/ funding-for-innovative-smart-energy-systems> accessed 15 April 2024

123 Anon, 'Modernising Energy Data Applications' (Catapult) <https://es.catapult.org.uk/case-study/modernising-energy-data-applications/> accessed 14 April 2024

124 Anon, 'Helping people and places work smarter, together' (Urban Tide) <https://urbantide.com/products> accessed 15 April 2024

125 Damilola Olawuyi and Alex Oche, 'A WEF Nexus and sustainable investments in West Africa: The Case of Nigeria' in Lira Luz Benites Lazaro et al (eds) Water - energy-food nexus and climate change in cities [2022] p.243-258

quality control, standard procedures are followed and proactively address challenges of eco-entrepreneurs, enhancing adaptiveness and resilience.[126][127].

5.5 Directionality by mission-oriented innovation polices and green objective strategies

Across the U.K. policy landscape and metamorphosis of institutional structures, directionality can be clearly observed through policy reforms and objectives, strategic institutional restructuring and multi-stakeholder participation in decision making procedures aimed to engineer a supportive entrepreneurial ecosystem to facilitate SMEEs establishment and rapid growth. The split of BEIS into three specialized departments was for the propose of fine-tuning objectives which will accommodate and facilitate the scale and magnitude of U.K.s energy transition[128]. Also, the Call-for-input from stakeholders was for the purpose of providing democratized governance on the local scale aimed at supporting SMEEs by engineering market flexibility. The outcome of which manifested the 2023 Regional Energy Strategic Planners (RESPs) across the U.K., addressing fragmentation and promoting decentralized energy governance.

Also, the UK Innovation Strategy 2021, priorities clean technologies as part of technologies to strengthen through increase R&D with funds of £22 billion, ensuring government instruments are properly steward to ease market entry for SMEEs, services and products. Finally, the establishment of the Regulatory Horizon Council tasked with ensuring optimal value from innovative projects are achieved and UKs sustainable competitiveness is promoted[129] shows clarity and objectivity towards decarbonizing the U.K. economy and promoting rapid growth of SMEEs.

Institutional structures are essential to and serve as implementation instrument for renewable energy objectives in Nigeria[130]. Nigeria has made

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[126] Totti Konnola et al, 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

[127] Totti Konnola et al, 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

[128] Anon, 'BEIS split into new business, energy and science ministries' (The engineer, 7 February 2023) <https://www.theengineer.co.uk/content/news/beis-split-into-new-business-energy-and-science-ministries/>

[129] Anon, 'UK Innovation strategy published' (Matrix, 22 July 2021) <https://matrixni.org/uk-innovation-strategy-published/> accessed 14 April 2024

[130] Temilade Sesan, 'Status of Renewable Energy Policy and Implementation in Nigeria' [2008] Institute for Science and Society, Faculty of Social Sciences, Law and Education, University of Nottingham, United Kingdom.

strategic polices and plans such as National Renewable Energy and Energy Efficiency Policy (NREEP), Renewable energy Master Plan, Feed –in Tariffs (Fits), Off-grid Electrification Strategy, yet energy is centralized to industrialized and urban areas[131] and 71 % of the population lacking energy[132]. The lack of proper policy implementation strategies has prevented diffusion of policy objectives on the local and rural scale[133]. Again, emphasis on the need for the MCC-Zero provides the magnitude of constitutional support required to pull all RE incentives, green funding towards multi-control stations (EECs and GBDOs) who are tasked with stewardship and implantation of green strategies on a micro-level to generate multi-complex SBMIs, eco-ventures, services, technologies and jobs while ensuring alignment to federal government RE objectives. Additionally, RE policies are over generalized and require detailed objectives supported with timelines for achievement. For example, ambiguity in statements and lack of targets by the NREEEP on solar water heating; and the non-binding targets set by Renewable Energy Master Plan (REMP) due to lack of constitutional support[134]. Therefore, to promote directionality, renewable energy policies should be backed up with benchmarks, timelines and targets[135] to prevented anticipatory myopia. Furthermore, establishing EECs and GBDOs led by stakeholder provides a platform for collaboration with policy makers and academic institutions and research centers to innovate guidelines, standard procedures and typologies for eco-ventures, advocate favorable polices, organize social awareness campaigns, capacity development programs, generate informal financial channels (crowd funding) that will proactively support and drive eco-entrepreneurship in Nigeria[136] and promote

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131 Nuru Garba et al, 'Sustainable Energy Policy for Africa (Nigeria) and Europe: A Comparative Study'[2022] International Journal of Energy and Environmental Engineering Vol:16 (3): 3--36

132 Anon, 'Here's how Nigeria is tackling the barriers to its green energy transition' (World economic forum, 8 May 2023) <https://www.weforum.org/agenda/2023/05/how-nigeria-is-tackling-barriers-to-its-green-energy-transition/> accessed 16 April 2024

133 Musbahu Hassan, 'Sustainability Governance and Achievement of Sustainable Development Goals in Nigeria' [2020] JIRD Vol4 (1): 65-80

134 Chigbogu G. Ozoegwua and Patrick U.Akpana, 'A review and appraisal of Nigeria's solar energy policy objectives and strategies against the backdrop of the renewable energy policy of the Economic Community of West African States' (2021) Renewable and Sustainable Energy Reviews 143 110887

135 Ibid

136 Totti Konnola et al, 'Transformative governance of innovation ecosystems' [2021]. Technological forecasting and social change. Vol. 173, 121106

directionality. These various institutional restructuring and strategies culminate to transition the Nigerian community members towards sustainable practices and increase awareness and generation of eco-opportunities, eco-innovations and eco-governance.

6. CONCLUSION

Nigeria can potentially achieve set climate action and low carbon transition plans if transformative governance is effectively adopted to promote rapid the growth of eco-entrepreneurship. The contextual recommendations are aimed at interrogating barriers in the entrepreneurial ecosystem preventing rapid proliferation of eco-entrepreneurship in Nigeria. Government and policy makers need to address the high cost of production, sourcing of raw matters from abroad, poor infrastructure facilities, policy overgeneralization and fragmentation, low start-up capital and dependence on fossil fuel. Addressing these barriers through transformative governance will promote flexibility, connectivity and adaptability of the Nigerian EE. Also community members and citizens most build capacity take up leadership roles in eco-governance and capture eco-opportunities and innovate new markets through climate change and sustainability certification courses, trainings, workshop and programs. This will increase investor confidence, credibility and provide directionality required to steward the evolution of Nigerian citizens towards sustainability practices and economic empowerment.

Nigeria has vast eco-opportunities in eco-tourism, renewable energy and sustainable agriculture[137]. Hence, commitments to institutional restructuring and specialization, mission-driven policy reforms with set targets; increased participation of multi-stakeholders and community members in rural regions, research centres and control stations embody transformative governance; making Nigeria a leading example for promoting a decarbonized economy in Africa.

[137] Anon. 'Problems' (Interactive country fiches) <https://dicf.unepgrid.ch/nigeria/green-economy> accessed 13 April