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Exploring the challenge for Sustainable Development in the energy sector: Sociomaterial view of two British and Nigerian cases

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ABSTRACT

Global pressure on the green environment has been a major obstacle in attaining future Sustainable Development (SD). In this study, the researchers explore the recent challenges of SD in the power sectors in the United Kingdom (UK) (as a Northern European country) and in Nigeria (as a Southern African country). These two contexts have witnessed an unstable epileptic power supply, despite the trillions of dollars invested in the sector. To avoid solving the sustainability problem and causing other economic, social or environmental problems, a thread of scholarly work has attempted to develop a systemic approach to SD. Aiming to offer an appreciative systemic lens of SD (Thatchenkery et al., 2010), we adopted the sociomateriality concept to shed light on the closeness between the social/organisational context and the resource-based/material context of SD. Sociomateriality emphasises the ongoing interaction between technology and the economic, social and environmental pillars of sustainability. This systemic view of SD avoids the defects of other dominant views such as complexity theory (Sabau, 2010), neoclassical economics/free market approaches (Heikkurinen and Bonnedahl, 2013) and ecological economics (Lele, 1991).

WASD

WORLD ASSOCIATION OF SUSTAINABLE DEVELOPMENT

Research aim: The aim of this research is to examine the extent to which sociomateriality and appreciative design help explore the challenges of SD and offer feasible solutions for policy makers, practitioners and interested scholars.

Approach/methodology: The interpretative approach has been adopted using a mix of qualitative interviewing and survey methods. Such tools helped compare and contrast British versus Nigerian power/energy as case studies.

Findings: Organisational resistance, political, economic, environmental and technological were found significant in both the British and Nigerian contexts. The interaction and interdependency between these factors offer a new sociomaterialistic view of the appreciative systemic lens of SD (Thatchenkery et al., 2010).

Limitations: Our findings cannot be generalised using a case study design that represents only two countries.

Social implications: Helping managers improve the effectiveness of SD projects using the interplay quadratic bottom line and stakeholders' involvement.

Keywords: sociomateriality; appreciative theory; Sustainable Development; SD; North-South divide; survey methods and energy industry.

INTRODUCTION: SUSTAINABLE DEVELOPMENT (SD): THE CHALLENGE

British energy companies are committed to the sustainability agenda, aiming to make a positive contribution to society, the economy and environment. The annual league table in the United Kingdom (UK) lists a range of initiatives that are underway to reduce the sector's environmental impact in the country. The researchers are of the opinion that technological advancement can also initiate more avenues and innovations that could help to sustain the environment instead of the degradation that has been encountered over the years, with more commitments from developed countries and companies that impact more on the environment. In this study, various related literatures, archives, white papers and publications will be explored and analysed.

According to Warburton (2013), in the UK's SD Commission, SD is a continuous process denoted as a journey and not a destination enjoining everyone to keep moving in the right direction. As an approach it tends to maximise positive outcomes by recognising the relationship between these three approaches to SD (economy, society and environment), by ensuring long term success across diverse sectors in delivering beneficial solutions in different ways.

Further to the submissions of the SD Commission publication on the UK (SDC UK, 2006) government becoming a greener energy economy in 2010, they analysed the progress made so far. Despite the slow pace for change, improvements in the energy sector, water consumption, waste, recycling and road transport was favourable, with a continuous drive and projection into the future with a record of about saving £13.7 m from reduced road travel in 2008–2009 alone, and savings of 18 million cubic metres of water, the equivalent of 7200 Olympic size swimming pools, adding up to £13 m worth of water bills in 2008–2009.

In addition, landfill cost savings from a reduction in waste by 126,000 tonnes in 2009–2008; this is the equivalent of the total waste produced by over 250,000 individuals in the UK. Also, the report estimated that, if the new government succeeded in meeting its commitment to cut carbon emissions from government offices by 10% over 12 months, this could result in major benefits to society (estimated at £13 m), in addition to any reduction in energy bills (SDC UK, 2010). The energy sector is believed to be vital to the development and growth of the economy of any country; therefore there has to be an effective, stable and sustainable energy production and supply.

Okolobah and Ismail (2013) described Nigeria as a tropical country within the gulf of Guinea, the most populous black country in Africa. The country is endowed with numerous natural resources in energy such as petroleum, her oil reserves are considered to be the ninth largest in the world, there are unexplored natural gas and reserves considered to be the fifth largest in the world, tin, iron ore, lead, zinc, bitumen, coal, limestone, niobium and many others.

They also pointed out that Nigeria, with a population of over 150 million, has an installed capacity of 8000 MW of electricity producing 4242.7 MW. This enables Nigeria to provide an adequate energy supply for its citizens, although the country has been plagued with an epileptic and erratic power supply over the past two decades resulting in slow economic growth and sustainability. The huge energy instability and setback has been traced to a protracted period of instability in governance for decades, and lack of commitment by both the military leaders and the politicians at one time or the other, undermining the rich energy resources with which the country has been endowed (Amadi, 2015).

Nigeria is still far beyond the UK, but not endowed with such vast natural resources. It still manages and conserves what it has to maintain SD. Over the last decade, Nigeria was committed to pursuing energy sustainability, economy and environmental agendas. Furthermore, they stressed that Nigeria produces an average of about 30 watts/per person, while South Africa, a neighbouring country with a lower population of about 42.7 million, was able to produce 1045.67 watts/per person. They also discovered that most of the energy facilities in

Nigeria have not been maintained in the last twenty or more years, and that the Power Holding Company of Nigeria (PHCN) plants are aging despite the trillions of dollars that have been purportedly ploughed into the sector reform (Okolobah and Ismail, 2013).

In addition, Oyedepo (2012) also supported that there has been an energy crisis in Nigeria over the past two decades, and that failure has contributed to the high level economic and social imbalance, high poverty rate, paralysing various industrial and commercial activities where companies and average households are subjected to the use of generating plants. This frequent use of generating plants in millions of homes and industry because of the energy poor supply, invariably led to higher levels of air pollution. He further discovered that the Council of Renewable Energies of Nigeria estimated that the frequent power outages had resulted in huge losses of over US$984.38 m every year, with health hazards due to the high level of carbon emissions uncontrolled. Also, Oyedepo (2012) emphasised that Nigeria is considered as the African giant and the most prolific oil producing nation in the continent of Africa. Ironically, the *Nigerian Guardian* recently reported the negative impact caused by the drastic fall in oil prices after removing the Iranian sanctions. Such changes in the international market have harmed Nigeria's national budget for the year 2016, and consequently the entire economy. The country's over-reliance on oil production makes it extremely vulnerable to those global changes (The Guardian, 19 January 2016).

Udoh (2015) thinks that being an oil-dependent economy has led to an overuse of wood fuel by more than 70% of Nigerians living in rural areas. Consequently, high rates of deforestation, erosions and floods are expected (Oyedepo, 2012). In response, The UNOSD has developed eight SD goals for Nigeria in 2016 (see Figure 1).

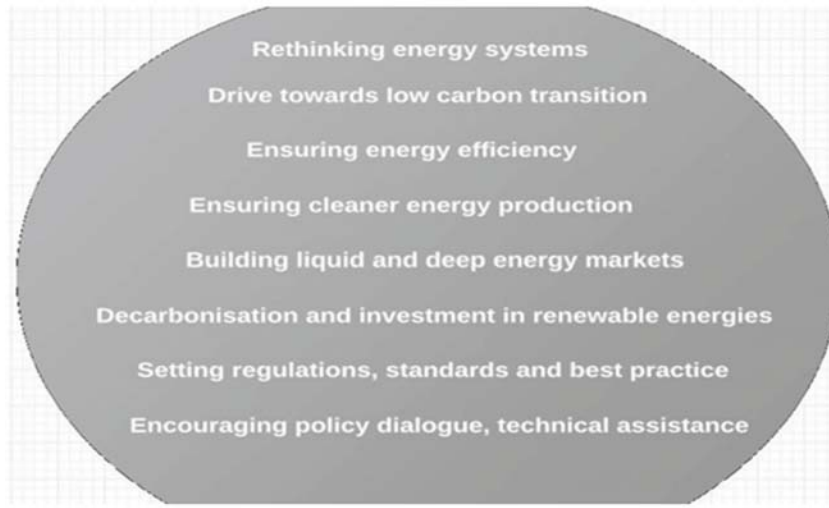

Figure 1 UN Millennium SD goals for Nigeria

Source: Summarized from UNOSD, 2005.

The issue of the North-South divide is a socioeconomic gap between the developing and developed contexts. Lieven (2001) uncovered the biotechnology boundaries between the north and south to raise the third pillar of environmental sustainability. Fulfilling the four pillars of SD through innovative strategies and technology is a step toward so called global capitalism (Castells et al., 2000). In Therien's (1999) view, today's inequalities, deprivation, xploration, exploitation of the developing nations and their natural endowments without considering the environmental impact, could today also compromise and undermine their ability to truly attain a credible SD, especially in its energy sector, which is being discussed in this study.

He further observed that there is a shift in the perceived divide and gap, giving way to a more reasonable matured partnership with a paradigm shift of the United Nation (UN) to the discourse and recent practices of its agencies, such as the UN Economic and Social Council (ECOSOC), United Nations Development Programme (UNDP), International Labour Organisation, UNESCO and the European Union looking into the concerns of these developing nations to curtail the perceived north and south divide on SD.

The UN climate change conference that took place in Paris, called the richest 20 countries to raise $100 billion a year by 2020 to help the poor nations transform their economies. This could be a step towards SD with pledges to curb emissions, and the transformation of our global economy from one fuelled by dirty energy to one fuelled by sustainable economic and environmental development (The Guardian, 14 December 2015). Such a movement might help moving from an accumulated ecological impact to an overlap between the four pillars of SD (Hopwood et al., 2005). In doing so, the next section discusses different theoretical attempts that have been developed by scholars to offer such a sustainable overlap.

THEORITICAL FOUNDATIONS OF SD

Solving some problems might create other problems (Checkland, 1981). Advocates of systems thinking in the SD research community affirm the difficulty of addressing SD challenges following a single side approach, rather that integrated and inclusive remedies to be developed at the local, national, regional and global levels. The world community needs to rise to the overwhelming challenge as the perceived disparities between the north and south do not really portray the nature of the complexity of the world; this is because everyone needs to come together to achieve sustainability and true international partnerships. Therefore, a systemic framework for SD is needed as a guide for all the regions, localities and countries alike to structure the framework and tailor it to their social, economic, environmental and biotechnological requirements.

In 2006, a Scottish Government Publication categorised SD into strong versus weak sustainability; the strong extreme represents the non-ecospheric nature of capital resources that could be depleted, but that they expire must be absolutely protected as they say there is no substitute for the planet. The weak SD is an approach that suggests that human-made capital could be substituted for the natural capital and a willingness to approach (The Scottish Government Publication [TSGP], 2006). In 2012, the UN set out four principles of SD, including poverty alleviation, social inclusion, cutting carbon emissions and pursuing renewable energies and good governance (UNSDSN, 2012). These approaches have been followed by different regulatory approaches that develop international codes of conduct, and other free market approaches that exchange CO_2 emission quotas for tax exemptions.

Apart from these various attempts, SD was theorised using complexity theory (Sabau, 2010), neoclassical economics/free market approaches (Heikkurinen and Bonnedahl, 2013) and ecological economics (Lele, 1991). Contributing to this body of knowledge Thatchenkery et al. (2010) stated a special call for studies that conceptualise SD using the so called Appreciative Inquiry Theory (AIT).

Appreciative design

AIT is a systemic approach that enhances human reorientation from a resource-based view of SD to value-driven SD. AIT emphasises sustainable design and reinforces the ecosystems that create sustainable value across the board. Value-driven SD offers a reconciliation between the shareholders (economic) value and wider stakeholders (social and environmental) values (Mohamad et al., 2015). The rise of socially responsible investments reached US$2.71 trillion out of US$25.1 trillion of American investments by 2007 (Dow Jones Sustainability Indexes, 2015).

SD is no longer a project, but a sustainable enterprise that maintains the triple bottom line (Elkington, 1997). It is a systemic process through which top management create an inclusive value for employees, community and customers. This requires a life cycle approach to innovate new resources, processes and to improve the organisational overall effectiveness (Laszlo, 2008). It requires a new design to deliver the social needs behind a technical system in different fields (e.g. power/energy, finance, entertainment, etc.) (Foster and Forster, 2004; Thatchenkery et al., 2010). This participatory approach of SD creates social intelligence and reduces the resistance to new techniques or policies (Cooperrider et al., 1995). Also, it motivates the entrepreneurial thinking of stakeholders involved in sustainability programmes (Warzynski and Krupenikava, 2010).

Despite the aforementioned stone edges of SD as an inquiry system, the use of technological artefacts as a quadratic bottom line were completely ignored. The interaction between these artefacts (e.g. bio-

technology) and the other three pillars requires a new conceptualisation. In the next section we contribute to SD as an appreciative inquiry system.

Sociomateriality theory

During the last five years, the term 'Sociomateriality' has emerged as a complementary and sometimes as a synonym to the socio-technical conceptualisation. This concept was vague until Orlikowski (2007) investigated this phenomenon to understand the entanglement of the social and the material artefacts (e.g. technology, managerial technologies, devices, cognitive schemes and symbols) in everyday life.

Orlikowski and Scott (2008) examined the presence of technology in organisational life through a desk analysis of 100 articles published in the top management journals between 1997 and 2006. Following Kling's (1999) web/discrete entity model, the authors classified the presence of technology into '*discrete entities*' and '*mutually dependent ensembles*' as key streams of technology in working life (see Table 1). The former treats technology as a catalyst of the organisational process, but prejudices how all organisational practices and relationships inherit technological/material intervention. In this sense, technology is considered as a distinct organisational phenomenon rather than an integral part of all organisational processes, activities and events. It also sees 'humans/actors' and 'technology/objects' as primarily self-contained entities that interact (Orlikowski and Scott, 2008). The latter stream focuses more on the agencies of both humans and technology and how

Table 1 Two Streams of Research on Technology and Organisations

	Research Stream I	*Research Stream II*
Ontological Priority Primary Mechanisms Logical Structure Key Concepts	Discrete Entities Impact; Moderation Variance Technological Imperative Contingency	Mutually Dependent Ensembles Interaction; Affordance Process Social Constructivism Structuration
View of Social and Technical Worlds	Humans/organisations and technology are assumed to be discrete independent entities with inherent characteristics	Humans/organisations and technology are assumed to be interdependent systems that shape each other through ongoing interaction
Examples	Blau et al. (1976), Huber (1990), Aiman-Smith and Green (2002)	Barley (1986), Prasad (1993), Boudreau and Robey (2005)

Source: Adopted from Orlikowski and Scott (2008, p.438)

Our study will use these two classes; 'discrete entities' versus 'mutually dependent' to explore and investigate the status of SD in the British versus Nigerian power sectors.

they fuse with each other to achieve daily routines, processes and objectives. "*Humans and technologies have no inherent properties, but acquire forms, attributes and capabilities through their interpretation*" (Orlikowski and Scott, 2008, p.456). This study concluded that technology, work and organisational life should be conceptualised as mutually independent, and that a multiple view of technology development in the work environment is essential.

RESEARCH METHODOLOGY

Our study explored the challenges of SD in the power sector and revealed the North-South contextual divide. We also investigated the key influencing factors that affect the success/failure of SD strategies in both the UK and Nigeria.

Using an interpretative approach and qualitative data collection methods (namely, semi-structured interviews and survey) we gathered evidence of the social/governance, economic, environmental and technical factors that shape SD in the UK and Nigeria. Future strategies to effectively manage these factors have also been discussed (Myers, 2013). As shown in Table 2, we conducted two phases of fieldwork.

Table 2 Research methods and justification

Country	*Phase I*	*Phase II*
	Qualitative Interviewing	*Qualitative Survey*
Nigeria	*Participants:* Supply Chain Managers who manage SD projects. *Sample:* Six supply chain managers as listed in their organisational list of the six Nigerian power suppliers. Afam Power Plc; Sapele Power Plc; Ughelli Power Plc; Geregu Power Plc; Shiroro Hydro Power Plc; Kainji Hydro Power and distribution.	*Participants:* Employees and lower-level managers involved in SD initiatives. *Sample:* Two companies; Shiroro Hydro Power Plc; Kainji Hydro Power and distribution have existing SD projects. Survey was allocated to two quotas of 30 participants who work in each company.
UK	*Participants:* Supply Chain Managers who manage SD projects. *Sample:* 18 power companies as follows: Ecotricity; Good Energy; Ebico; OVO Energy; Utility Warehouse; Flow Energy; The Cooperative Energy; Marks and Spencer Energy; Sainsbury's Energy; First Energy; Extra Utility; EON; SSE; Spark Energy; British Gas; EDF Energy; Scottish Power and NPower.	*Participants:* Survey was allocated to two quotas of 30 participants work in each company. *Sample:* Five companies; OVO Energy; British Gas; EDF Energy; Scottish Power and NPower.

Phase I aimed to identify if the power companies (in both the UK and Nigeria) follow institutional strategies for SD. In doing this, semi-structured interviews helped to evaluate the current status, explore the key factors that affect SD projects and focus on the most successful companies in the field. This phase included 24 interviews with supply chain managers, of which 6 work in the UK.

Phase II aimed to explore the key challenges and potential solutions set by companies in both the UK and Nigeria. This phase offered a deep insight into current SD projects in two Nigerian companies and five British power suppliers. The survey was allocated to 30 participants in each company with an 85% response rate.

FINDINGS AND ANALYSIS

In this section we shed light on the British versus the Nigerian power markets. We then demonstrated our findings in relation to the socio-materiality nature of SD in the energy sector in both the UK and Nigeria. Key challenges uncovered were organisational/strategic, personal /political, economic, environmental and technological.

Of the British providers, 92% emphasised that SD is a major tool for socio-economic development, while 89% of Nigerian providers confirmed that the national concern of SD was slow over the last decade. Currently, Nigeria is experiencing a protracted period of power inefficiencies and failures; they are unable to generate and supply power to the entire nation.

Of the British experts, 90% saw SD as a process that balances between the present and future generations. The government developed variant strategies for lowering carbon emissions and called for more dependency on fossil fuel and renewables to keep such balance. The investment in affordable renewable energies requires a partnership between the government, international communities and local non-governmental organisations. The ongoing efforts for SD are part of the European Union requirements, the UN climate change campaign, and strict regulations. Such efforts motivate good practice and standards even in the energy sectors in the UK. Of the British experts, 10% reported that SD strategies are lowered because of high resistance to greening and environmental activists. They also reflected on the conflict that SD projects raised regarding routine operations and logistical procedures. In the UK, the use of molecular biology and chemical engineering helped produce affordable carbon-neutral fuels identical to diesel and jet fuel (NPower supply chain manager, December 2015).

In Nigeria, 75% reported a variety of challenges such as poor government policies, lack of standards and poor procedures leading to poor

service delivery in the sector, and in the country in general. However, with the new government now in place, the country expects more hope for recovery with the reforms that have engrossed the sector over the years. In addition, the sector and the country in general has been endowed with many resources, including renewable resources, but the question will be affordability and sustainability for now and the future. The other 25% of respondents remained neutral.

In the UK, 98% of the respondents pointed to challenges such as low energy security, low quality supplies, and affordability of biotechnology. However, they confirmed that the government is developing public–private partnership to overcome such challenges. Private partners improve corporate affordability and this, in turn, increases employee satisfaction (including an effective reward system, involvements and engagements, drive for research and development, and other robust incentives).

On the other hand, the Nigeria counterparts declined to talk about the issues surrounding their perceived level of satisfaction; this reveals why they said that the sector had been like that in the region for some time. Of the total respondents, 85% had not seen the power availability in Nigeria as unstable and epileptic in nature. The energy infrastructures were quite old, lacked appropriate maintenance and faced absolute neglect by the various governments that had been in power in recent years. The purported significant investments that have been acclaimed had been spent by those governments to maintain and reform the sector. Also, they highlighted the issue of absolute dependency on oil by the entire nation, even when there were other numerous resources and energy renewables as well. The respondents suggested various things that could be done to ensure the sustainability of the sector. Amongst these suggestions was the issue of fully privatising the sector as their UK counterparts had done, and for the government to become more responsive and committed to the nation and SD as other rich and developed nations. The issue of safety was also raised within the region, and they looked to the government to make the country more secure for investments.

While 96% of the British providers confirmed receiving continuous development programmes to manage SD projects, only 3% in Nigeria companies received the relevant training. Of the Nigerian participants, 85% gave no response to the issue of staff development, which reflects the internal politics in these institutions that hinder future training strategies. However, this leads to a low level of employee satisfaction as discussed above. Appendix 1 reflects our results in more detail and connects them to the interview guide and survey questions.

DISCUSSION: NORTH-SOUTH DIVIDE OF SD

The case of the British power sector

According to recent publications by Ernst and Young (2014), the UK's energy sector has been a major contributor to the UK economy. In 2013, its total economic impact was £96 billion, which makes up about 6% of the UK GDP. The sector also created many job opportunities across the country, which explains how the sector adds to the prosperity and stability of the UK economy as a whole, as well as how it delivers an absolutely fundamental service for everyone. From an international perspective, the UK has one of the most open and vibrant energy markets in the world, probably due to its drive towards sustainability, standards and regulations. Recently, electricity prices have been broadly in line with prices in Europe and, in the case of gas, below most. On the domestic front, latest statistics on household switching show that, over the past year, around 3.5 million households shopped for a new supplier leading to reductions in bills. An increasingly prominent feature of electricity distribution is the move to a 'Smart Grid'. The Smart Grid Vision and Route map invariably refers to a modernised electricity grid that utilises information and communications technology in monitoring and actively controlling generation and demand in near real time, thereby providing a more reliable and cost-effective system for transporting electricity from generators to homes, businesses and industry (Ward, 2014; Ward et al., 2014).

Furthermore, the UK's transmission and distribution investment in both gas and electricity networks continued in 2013 with the introduction of price controls. About £5.3 billion was invested in 2013 for replacing or upgrading existing electricity network infrastructure, and in accommodating new generation networks, particularly the increased penetration of renewables. This had a clear focus on the following three significant projects:

- £200 million in the 2.2 GW Western Link electricity connection between Scotland and Wales.
- The Western High Voltage Direct Current (HVDC) 420 km subsea link is a £1 billion joint venture between the National Grid and Scottish Power Transmission. London Power Tunnels: £1 billion National Grid project that started in 2001 to rewire the capital's transmission network via 32 km of deep underground tunnels.
- The £600 million of upgrades to the 220 km Beauly-Denny power line in Scotland to accommodate 2.5 GW of renewable generation. The first section of the circuit was electrified in 2013, with the upgrade expected to be completed in 2014 (Ward, 2014; Ward et al., 2014).

Currently in the UK, renewable technologies use natural energy to make electricity, including other fuel sources, such as wind, wave, marine, hydro, biomass and solar. Renewables produce 7% of the UK's electricity, and EU targets mean that this is likely to increase to 30% by 2020. From 2020, renewable energy will continue to be an important part of the strategy to reduce carbon emissions. To achieve this, a range of technologies will need to be used, such as onshore and offshore wind farms, biomass power stations or hydropower systems (Ward, 2015).

The case of Nigerian power sector

As a major African country endowed with abundant resources and sources of energy, including oil and gas, hydro, coal, biomass, wind and solar energy, Nigeria is believed to be Africa's largest oil-producing country and accounts for nearly a third of the continent's crude oil reserves. Nigeria is ranked second in natural gas production after Algeria, while petroleum exports are the main hub of the country's economy with the current crude oil reserve being about 35.5 billion barrels. Nigeria also has other sources of energy such as tar sand, coal and lignite, bitumen and uranium deposits. In spite of all these bold records of its endowments, the country has been experiencing energy deficits in a number of areas. These include oil, biomass and especially electricity, mostly due to inefficient technology, poor management, poor standards and procedures, and its high demand and over-exploitation of natural resources. According to the Manufacturers Association of Nigeria, they identified that the growth of Nigeria's industry sector has been severely hampered by a lack of energy, particularly electricity, and that between 2000 and 2009, about 857 major firms either closed or suspended operations due to the poor energy supply (interview with the head of Manufacturers Association of Nigeria, 2015).

It is very sad to infer that nearly all major companies in Nigeria provide their own electricity through diesel generators in recent times, which is not a step toward a sustainable environment. This could be energy poverty that takes the form of inadequate quantity, poor quality and low access, despite the abundant endowment of energy resources. According to a recent publication, the Nigerian Association of Energy Economists has said that about 75% of Nigeria's 170 million people still live without access to a regular electricity supply; they opined that despite statistics indicating that 45% of the country's population is currently connected to the national grid, a regular supply is still restricted to approximately 25% of the population. A high level of dependency on traditional biomass sources for cooking, which are quickly becoming a scarce resource, and a lack of access to electricity and modern energy sources, profoundly limits economic development, constrains people's life chances and traps millions in extreme poverty (This Day Live, 2015).

Table 3 Sociomaterilaity of SD in power sectors in the UK and Nigeria

	Nigerian Energy Sector (Stream II)	*British Energy Sector (Stream II)*
Ontological Priority	The technical pillar is missing, while the three other pillars are not in intimacy (i.e. Discrete entities)	There is a high use of biotechnology and advanced technological infrastructure that matches the socioeconomic plan for the country and the need for green society.
Primary Mechanisms	Using traditional SD policies that improve the efficiency of carbon-fuel in order to green the environment. The proposed technology will be imported from western countries, which will result in design-actuality gap (i.e. technology as a moderator).	An interactive public-private participatory approach to develop SD policies. Affordance is maintained by the private sector, while regulations are forced by the public side.
Logical Structure	SD includes different economic, environmental and social enablers that are not consistent.	SD is considered as an iterative process where reconciliation between the four pillars of sustainability takes place.
Key Concepts	Less advanced infrastructure and potential of imperative technology to be imported in case of contingency.	SD's technology is socially constructed by participatory stakeholders involved.
View of Social and Technical Sustainability	The four pillars of SD, technology, economy, society and environment, are independent of each other's.	The four pillars of SD are interdependent and their ongoing interaction shapes the future performance.

Sociomaterilaity of SD

Looking through the Nigerian energy sector, the series of reform strategies and privatisation programmers as pursued by the national governments were more political rather than real business for national development and sustainability. The challenges of setting major infrastructures, maintaining existing ones, bidding for the licenses by companies are more politically and regionally motivated. This set aside specialties and competencies based on technological expertise, thereby recycling the same people around while maintaining the status quo and being rigid to change, development and sustainability. This could lead to a major challenge in the global drive towards renewable energies for a SD in the region, with the culture of influencing who gets what against the culture of capability and expertise.

In the case of the UK energy sector, the scenario is different with major energy companies focusing together with the government on driving towards sustainability. The energy sector in the UK is fully private sector-based, and their contribution to the national economy and development has been quite immense with glaring records on the ground.

Most of these companies, such as British Gas (i.e. owned by Centrica), E-ON, NPower, Scottish power, EDF energy and SSE, are the six big producers of energies promoting renewables. While OVO energy and some others also promote affordable renewable energies as marketers to households and businesses. There are existing statutory regulations and standards put in place by the government and its agencies to regulate the energy sector. The situation is far from this in Nigeria, and that is why the situation of SD is a major challenge. As shown above, Table 3 presents the sociomaterial difference between SD in the UK versus Nigeria. It clarifies that the UK takes stream II, while Nigeria is still at the early stages of stream I.

CONCLUSIONS AND FUTURE RESEARCH

Our research offered a literature review of SD in both Europe and Africa. The evidence provided shows that energy efficiency and renewable energy technologies are very prominent in the overall agenda for SD, whether local, national, regional or global. Also, it shows that SD is a quadratic bottom line process that should be iterative and socially constructed by public–private stakeholders. Key challenges found are poor governance, employee satisfaction, technological infrastructure, organisational resistance and affordability. However, they exist with varying degrees in Nigeria and the UK.

Our research offered a new conceptual lens of SD based on Sociomaterilaity (Orlikowski, 2007). A part of other approaches such as complexity theory (Sabau, 2010), neoclassical economics/free market approaches (Heikkurinen and Bonnedahl, 2013), and ecological economics (Lele, 1991), our research offers a systemic approach that contributes to the body of literature on AIT (Thatchenkery et al., 2010).

REFERENCES

Aiman-Smith, L. and Green, S. (2002) 'Implementing new manufacturing technology: the related effects of technology characteristics and user learning activities', *Academy of Management Journal*, Vol. 45, pp.421—430.

Amadi, N.H. (2015) 'Power outages in Port Harcourt City: problems and solutions', *Journal of Electrical and Electronics Engineering*, Vol. 10, No. 2, pp.59—66.

Barley, S.R. (1986) 'Technology as an occasion for structuring: evidence from observations of CT scanners and the social order of radiology departments', *Administrative Science Quarterly*, Vol. 31, pp.78—108.

Blau, P.M., Falbe, C.M., McKinley, W. and Tracy, P.K. (1976) 'Technology and organization in manufacturing', *Administrative Science Quarterly*, Vol. 21, pp.20—40.

Boudreau, M.C. and Robey, D. (2005) 'Enacting integrated information technology: a human agency perspective', *Organization Science*, Vol. 16, No. 1, pp.3—18.

Castells, M., Hutton, W. and Giddens, A. (2000) 'Global capitalism', *Economic Strategy*, May, No. 3, p.17.

Checkland, P. (1981) 'Systems thinking, systems practice'.

Cooperrider, D.L., Barrett, F. and Srivastva, S. (1995) 'Social construction and appreciative inquiry: a journey in organisational theory', *Management and Organization: Relational Alternatives to Individualism*, pp.157—200

Dow Jones Sustainability Indexes (2015) *Results Announced for 2015 Dow Jones Sustainability Indices Review*, Available at: http://www.sustainability-indices.com/images/150910-djsi-review-2015-en-vdef.pdf, Accessed on 3 January 2016.

Elkington, J. (1997) *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*, Capstone: Oxford.

Foster, K. and Forster, R. (2004) *Advances in Appreciative Inquiry*, in D.L. Cooperrider and M. Avital (Eds.). Elsevier .

Heikkurinen, P. and Bonnedahl, K.J. (2013) 'Corporate responsibility for sustainable development: a review and conceptual comparison of market-and stakeholder-oriented strategies', *Journal of Cleaner Production*, Vol. 43, pp.191—198.

Hopwood, B., Mellor, M. and O'Brien, G. (2005) 'Sustainable development: mapping different approaches', *Sustainable Development*, Vol. 13, No. 1, pp.38—52.

Huber, G.P. (1990) 'A theory of the effects of advanced information technologies on organizational design, intelligence, and decision making', *Academy of Management Review*, Vol. 15, No. 1, pp.47—71.

Kling, R. (1999) *What is Social Informatics and why does it matter? D-Lib Magazine*, Vol. 5, No. 1. Laszlo, C. (2008) *Sustainable Value: How the World's Leading Companies are Doing Well by Doing Good*, Stanford University Press.

Lele, S.M. (1991) 'Sustainable development: a critical review', *World Development*, Vol. 19, No. 6, pp.607—621.

Lieven, A. (2001) 'Sustainable development, biotechnology and the North-South divide', *BioEssaysVolume 25, Issue 2, Version of Record online*, Available at: http://onlinelibrary.wiley.com/doi/10.1002/bies.10242/pdf, Accessed on 14 January 2016.

Mohamad, M., Wood-Harper, T. and Newman, M. (2015) 'Information system development at the BoP: contextualising and theorization', *Information System Journal*.

Myers, M.D. (2013) *Qualitative Research in Business and Management*, Sage.

Okolobah, V. and Ismail, Z. (2013) 'On the issues, challenges and prospects of electrical power sector in Nigeria', *International Journal of Economy, Management and Social Sciences*, Vol. 2, No. 6, pp.410—418.

Orlikowski, W.J. (2007) 'Sociomaterial practices: exploring technology at work', *Organization Studies*, Vol. *28*, No. 9, pp.1435—1448.

Orlikowski, W.J. and Scott, S.V. (2008) '10 sociomateriality: challenging the separation of technology, work and organization', *The Academy of Management Annals*, Vol. 2, No. 1, pp.433—474.

Oyedepo, S. (2012) 'Energy and sustainable development in Nigeria: the way forward', *Energy Sustain Social*, Vol. 2, No. 1, p.15.

Prasad, P. (1993) 'Symbolic processes in the implementation of technological change: a symbolic interactionist study of work computerization', *Academy of Management Journal*, Vol. 36, pp.1400—1429.

Sabau, G. (2010) 'Know, live and let live: toward a redefinition of the knowledge-based economy-sustainable development nexus', *Ecological Economics*, Vol. 69, pp.1193—1201.

Sustainable Development Commision [SDC UK] (2006) *Meeting the Challenge: Energy Policy for the 21st Century*, UK, Available at: http://www.sd-commission.org.uk/data/files/, Accessed on 3 January 2016.

Sustainable Development Commission [SDC UK] (2010) *Becoming the Greenest Government Ever*, Available at: http://www.sd-commission.org.uk/data/files/publications/SDC_SDiG09_webFINAL.pdf, Accessed on 2 January 2016.

Thatchenkery, T.J., Cooperrider, D.L. and Avital, M. (Eds) (2010) *Positive Design and Appreciative Construction: From Sustainable Development to Sustainable Value*, Bingley, UK: Emerald.

The Guardian (14 December 2015) 'Paris climate change agreement: the world's greatest diplomatic success', Available at: http://www.theguardian.com/environment/2015/dec/13/paris-climate-deal-cop-diplomacy-developing-united-nations, Accessed on 10 January 2016.

The Guardian (19 January 2016) 'Crude oil price plunges to $27.67 per barrel', Available at: http://www.ngrguardiannews.com/2016/01/crude-oil-price-plunges-to-27-67-per-barrel/.

The Scottish Government Publication [TSGP] (2006) 'Sustainable development: a review of international literature', [Online] Available at: http://www.gov.scot/Publications/2006/05/23091323/4, Accessed on 8 January 2016.

Therien, J. (1999) 'Beyond the North-South divide: The two tales of world poverty', *Third World Quarterly*, Vol. 20. No. 4, pp.723–742, [Online] Available at: http://www.tandfonline.com, Accessed on 18 January 2016.

This day live.com. (8 January 2015) 'Fixing Nigeria's Electricity Problems-Government as A Change', Available at: http://www.thisdaylive.com/articles/fixing-nigerias-electricity-problems-government-as-a-change-agent/211460/, Accessed on 14 January 2016.

Udoh, B. (2015) 'Nigeria energy crisis worsens', *Only 5 of 23 power plants functional – NERC – Premium Times Nigeria. Premium Times Nigeria*. [Online], Available at: http://www.premiumtimesng.com/news/headlines/183687-nigerias-energy-crisis-worsens-only-5-of-23-power-plants-functional-nerc.html, Accessed on 14 January 2016.

United Nations Sustainable Development Solution Network (2012) *The Framework for Sustainable Development*, UN [Online], Available at: http://unsdsn.org/resources/framework-for-sustainable-development, Accessed on 18 January 2016.

Warburton, D. (2013) *Community and Sustainable Development: Participation in the Future*, Routledge.

Ward, T (2015) 'Energy UK', [Online] Available at: http://www.energy-uk.org.uk, Accessed on 14 January 2016.

Ward, T. (2014) 'Energy UK', [Online] Available at: http://www.energy-uk.org.uk, Accessed on 14 January 2016.

Ward, T., Warburton, F. and Torrens, J. (2014) 'Powering the UK', Available at: http://www.ey.com/Publication/vwLUAssets/EY-Powering-the-UK-2014/$FILE/EY-Powering-the-UK-2014.pdf.

Warzynski, C.C. and Krupenikava, A. (2010) 'Creating macro actors for sustainable development', *Positive Design and Appreciative Construction: From Sustainable Development to Sustainable Value: From Sustainable Development to Sustainable Value*, Vol. 3, pp.319—337.

BIOGRAPHICAL NOTES

Mostafa Mohamad is a Senior Lecturer, Salford Business School. Research Interests: Technology adoption in International Business, e-Business, Information System Development, Mobile Financial Services, Innovation Systems, Institutional Theory, Participatory Development, ICT4D, Entrepreneurship and Economic Development. He was a research fellow and lecturer at the University of Manchester before joining the Salford Business School.

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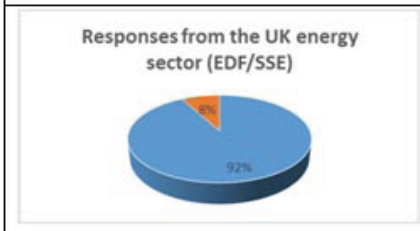
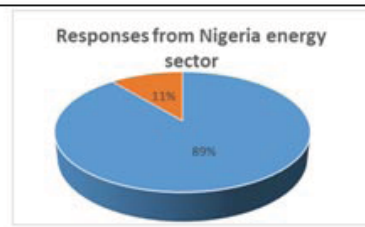
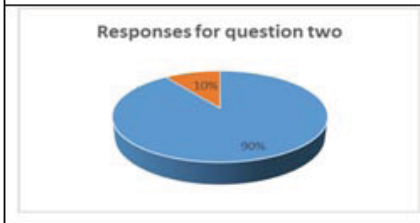
APPENDIX 1: SURVEY QUESTIONS

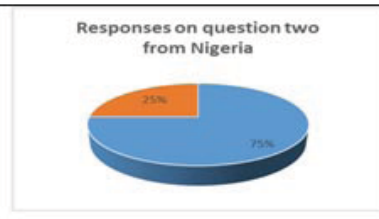
Question one: To what extent is SD important in your region?



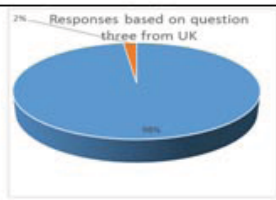


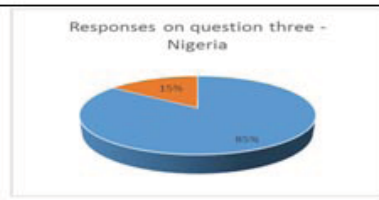
Question two: Does SD only focus on the future?





Question three: Can you suggest strategies to improve the SD in your company?





Question Five: Have you been on any recent intensive professional on the job training and development programmes for employees in your sector?

Responses	*Percentage (%) (UK)*	*Percentage (%) (Nigeria)*
Yes	96	3
No	1	12
Undecided	3	85

Question Six: How satisfied are you working within your sector in your region?

Responses	*Percentage (%) (UK)*	*Percentage (%) (Nigeria)*
Very satisfied	94	7
Unsatisfied	3	13
Undecided	3	80