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The Role of Leadership in Adoption of Waste-to-Energy (WtE) in Nigeria

Jahan Moghadam

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The Role of Leadership in Adoption of Waste-to-Energy (WtE) in Nigeria

by

Jahan Moghadam

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

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ACCEPTANCE

This dissertation was prepared under the direction of the *JAHAN MOGHADAM* Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ABSTRACT

The Role of Leadership in Adoption of Waste-to-Energy (WtE) in Nigeria

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The use of Renewable Energy (RE) has considerably increased in the last several years. Innovative forms of sustainable alternative energy production, such as solar and wind, have now become recognized energy sources. Following suit, this paper has reviewed Waste-to-Energy (WtE), an innovative and evolving form of RE, and its possible adoption in Nigeria to address both the energy crisis and the pollution problem. The theoretical framework of this paper utilizes the genesis of Fishbein and Ajzen's (1975) theory of reasoned action (TRA), expanding on renewable energy studies using TRA such as Bang, Ellinger, Hadimarcou, and Traichal (2000) Mishra, Akman, & Mishra (2014), and the leadership-led change framework (Andrews, McConnell, & Wescott, 2010) in order to explain leaders' behavior to adopt WtE in Nigeria. Four factors act as antecedents to the formation of attitudes and subjective norms about WtE, which then impact intentions to adopt WtE. Intentions then become a predictor of behavior for adopting WtE in Nigeria as a solution for energy and pollution issues. Combining these two theoretical frameworks allows us to study leader's behavioral intentions and the behavior to adopt WtE in Nigeria. Leadership-led change was examined as a moderator in the relationship between intention and behavior to adopt WtE in Nigeria. Results showed that leadership-led construct did not have a statistically significant moderating effect. This led to a post-hoc analysis

of leadership-led as a mediator, which showed leadership-led had a partial statistically significant mediating effect between leaders' attitudes and intention to adopt WtE.

INDEX WORDS: reasoned action, TRA, Waste-to-Energy, WtE, renewable energy, sustainable energy, pollution, attitudes, subjective norms, behavioral intention, leadership, leadership-led change, developing countries, Nigeria

I CHAPTER 1: INTRODUCTION

A key factor contributing to the wellbeing and prosperity of a country is secure and stable access to energy. Availability of energy has a tremendous effect on a country's growth in several key areas including economy, education, commerce, healthcare, poverty, and transportation (Ghali & El-Sakka, 2004; Jumbe, 2004; Maji, 2015; Mozumder & Marath, 2000; Shiu & Lam, 2004). Having stable sources of energy is particularly important to developing countries, but the infrastructure to produce this energy is typically not as technologically advanced or well developed there as in industrialized nations. At the same time, such developing nations are usually rich in not only the energy sources employed in conventional methods of energy production but also renewable resources such as solar energy, wind, and waste. The purpose of the study was to examine the factors affecting adoption of one type of sustainable renewable energy creation, Waste-to-Energy (WtE), in the developing country of Nigeria.

The United States Department of Energy (n.d.) defines renewable energy (RE) as energy produced from resources that are being continuously replenished, including solar energy, wind, water, geothermal heat, and bioenergy. Conventional energy, in contrast, has traditionally been generated from non-renewable resources such as coal, natural gas, and oil. WtE is based on waste, a form of renewable energy. Unlike other RE sources, however, waste is not a product of nature but rather of human activity. Every human produces approximately 4.3 pounds of waste per day (Duke University, 2016), and as waste is produced continuously, it could provide an abundant and constant stream of feedstock for energy creation. WtE fundamentally converts various forms of waste into such useful energy forms as hydrogen (bio-hydrogen), biogas, bio-alcohol, etc., through latest WtE technologies such as grate-fired combustion, gasification, pyrolysis, and plasma gasification.

This study has examined what influences the intention to adopt WtE and the behavior to adopt WtE by leaders in developing countries in Africa using Nigeria as an illustrative example of developing countries. The following section will look at renewable energy's definition within the literature. A rationale for the importance of this particular research is then provided, and the benefits that developing countries can derive from its adoption are discussed.

I.1 Renewable Energy

RE technology has become a more appealing alternative energy source for leaders concerned about the environment (Osterhus, 1997). Incineration, an older form of WtE, is persistently used as a cost-effective approach to waste disposal, but modern WtE is also an effective means of reaching targets for RE production and a source of future sustainable energy, according to the International Solid Waste Association (ISWA, 2009). Benefits of WtE include reduced cost compared to landfilling, higher rates of energy recovery, and reduced environmental impacts attributable to recycling (Achillas et al., 2011). Event management organizations that organize mega sporting events around the world such as Olympics and World Cups have taken up a zero waste initiative, and waste management itself has become a key policy priority of these global events (Mantz & Mantz, 2016). Initiatives to curb waste have been adopted by individual firms even at a micro-level to address their respective wastes (Orge & McHenry, 2013). However, even with increasing interest in RE and waste management, energy companies have met with limited success in making RE a "normative" energy source in the economy, and it is still not substitutable with conventional energy sources (Gleason, de Alba, & Fish, 1996).

As Figure 1 shows, bio-power technologies (e.g., WtE) only accounted for 1.8% of global production of electricity in 2013, compared to a total of 22.8% created by RE sources (REN21,

2015). As Figure 2 shows, global RE consumption represents only 19.1% of total energy use, with bio-power specifically accounting for only 1.3% **(REN21, 2015). These figures show the lack of utilization of the innovative WtE technology globally (in critical areas like West Africa, for example). It also illustrates that WtE is not widely implemented as an RE technology.** The world has abundant RE sources that could offer global environmental benefits, and WtE is the only practical clean alternative for providing sustainable energy while simultaneously reducing mismanaged waste (Achillas et al., 2011). A possible explanation in the lack of use of RE and WtE has been noted in literature (Kessides & Wade, 2011; Alexander, 2016). Kessides and Wade (2011) argues that the energy output from RE as compared to conventional energy (e.g., nuclear energy) shows some constraints in its ability to achieve high rates of power production. Further, there is some hesitancy to implement WtE methods among individuals who are apprehensive about having a WtE plant in their backyard based on the general assessment that renewable energy technologies are not safe (Alexander, 2016). In addition, the perception that there is not enough feed stream (waste) for WtE to produce ample amounts of power (Alexander, 2016) is quite common and leads to the assumption that WtE is not sustainable in the long run.

Figure 1: Estimated RE Share of Global Final Energy Production in 2013 (REN21, 2015)

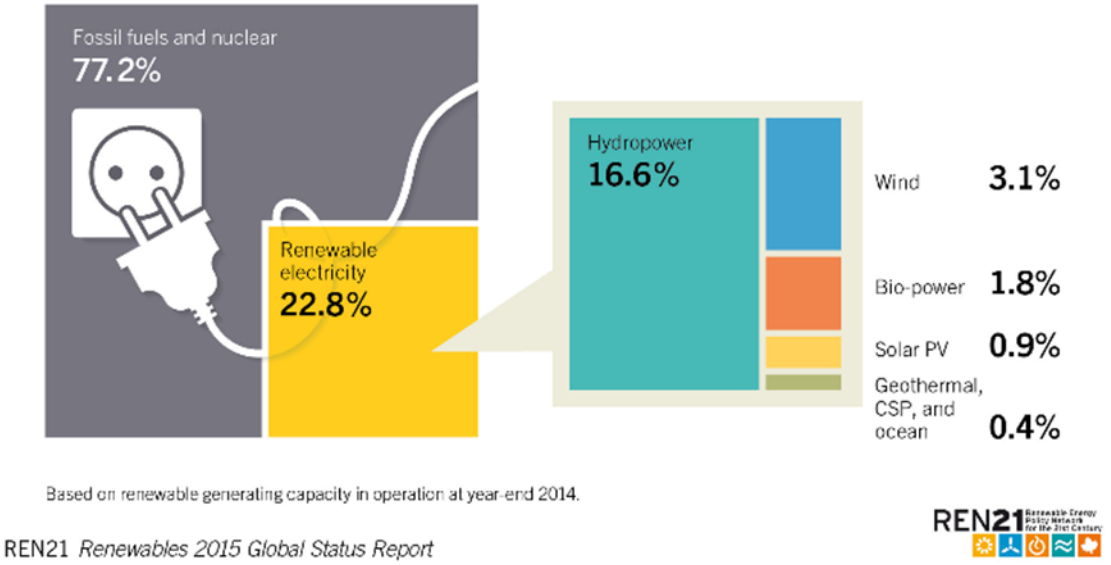
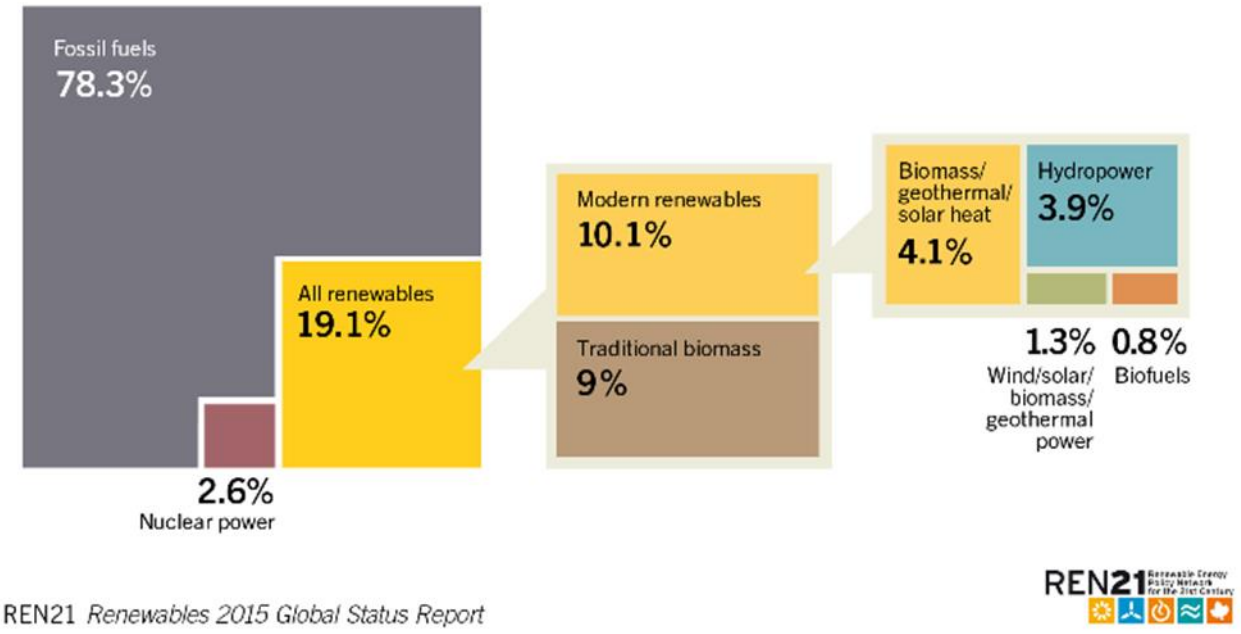


Figure 2: Estimated RE Share of Global Final Energy Consumption in 2013 (REN21, 2015)



I.2 Infrastructure in Developing Countries

A key component in a country's development and prosperity is stable and secure access to energy. Without energy infrastructure, modern economic and technological development cannot be realized, as witnessed in many parts of the developing world (Calderón & Servén, 2004). Infrastructure in its totality governs the basic physical structures and facilities needed for the operation of a country, enterprise, or society. Within a nation's complete overarching infrastructure lies its energy infrastructure, which plays a vital role in the development of the country through increased economic growth and improved standards of living.

Access to energy has a tremendous effect on a country's growth in several key areas, including finance, education, commerce, healthcare, transportation, and many other areas (Maji, 2015). Furthermore, as shown by Ghali and El-Sakka (2004), access to energy is necessary for economic and social development, and its lack can be viewed as a deterrent to economic growth. The adoption of modern energy use has more far-reaching benefits for economic development and poverty alleviation than the ones that can be quantified (Cabraal, Barnes, & Agarwal, 2005). With regard to economic indicators, Mozumder and Marathe (2007) found unidirectional causality running from gross national product (GNP) to energy consumption in Bangladesh. Shiu and Lam (2004) also identified a unidirectional causal relationship between energy consumption and GNP in China, while Jumbe (2004) found bidirectional causality between energy consumption and GNP in Malawi.

The most direct role energy plays in an economy is as an input to production. In essence, a country without energy exists in a non-mechanized world. In a comparison of developed, emerging, and developing markets, energy is one factor that distinguishes their infrastructures. Domestic energy production and distribution have several positive advantages, including economic growth (Pollmann, Podruzsik, & Feher, 2014).

Apart from the obvious direct effects of energy infrastructure, Agénor and Moreno-Dodson (2006) and Agénor (2009) provide examples of several indirect channels through which energy infrastructure can also affect an economy. By indirectly providing citizens with education and health services, energy infrastructure affects productivity. For instance, access to electricity reduces the cost of boiling water as well as improving hygiene and health, as hospitals are highly dependent on electricity. Electricity also increases opportunities to use electronic equipment (e.g., computers) as well as study time, thereby improving learning. The effects on health and education are also interdependent, as better health increases school attendance and learning ability, and better education increases public awareness and the capacity to address health needs. Thus, the availability of energy can affect the overall wellbeing of a society, and not only in terms of increased commerce or an improved standard of living.

Employment in formal and in informal sector activities is positively correlated with access to such modern energy options as electricity, as is worker productivity in value-adding processes (Karekezi, McDade, Boardman, & Kimani, 2012; Dinkelman, 2010). However, since a conventional energy supply is driven by land and natural resource use, the conversion of these natural resources can negatively affect the environment both locally and globally (Pachauri, Rao, Nagai & Riahi, 2013). The global focus is thus moving towards more environmentally friendly energy sources.

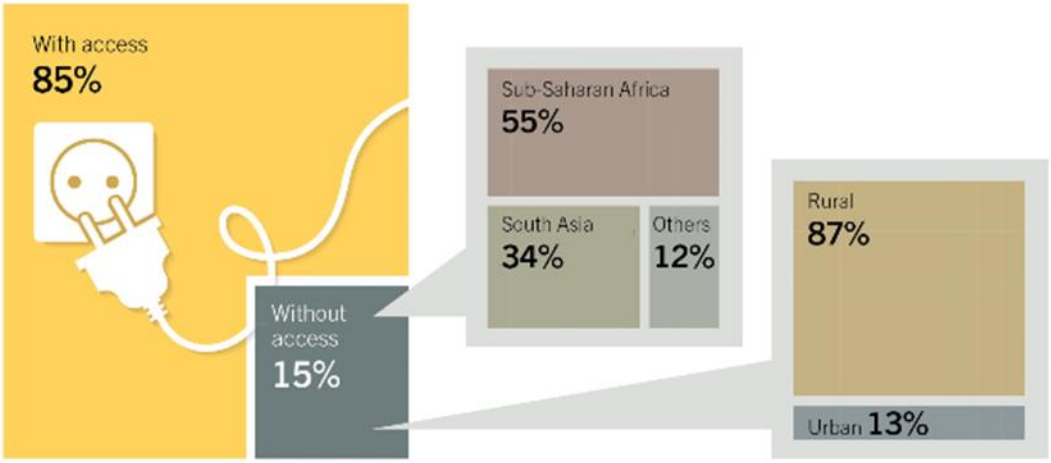
Developing countries typically lag far behind industrialized nations in terms of energy infrastructure, with African nations being a case in point. For example, only two in five Africans have access to a reliable supply of electricity throughout the day (Park, 2016). This shortcoming is attributable, at least in part, to African nations' failure to make full use of the continent's abundant natural resources. Isaksson (2009) estimated that less than five percent of the

continent's hydropower potential had been tapped. Consequently, residents of Africa experience both higher electricity prices and higher operating costs than other regions as Africa's power producers rely on relatively more expensive energy generation sources (Foster, 2008). Clearly, this inefficient and inadequate energy production is not due to lack of resources but rather due to poor policy-making and lack of capital. As noted by Akuru and Okoro (2014), market distortions such as the price distortion, poor regulatory environment and inadequate infrastructure were the few characteristics that explained the problems with the energy market of Nigeria. Pendse (1979) also noted that an energy crisis could also ensue in developing countries due to scarcity of capital; energy industries are highly capital intensive, and developing countries are often unable to provide sufficient capital for its development. In the absence of the necessary capital, a government may respond to these energy crises with calculated policy packages to mitigate the crises' adverse impact on the unorganized and poorer section of energy consumers instead of focusing on a policy towards energy creation. These energy crises are persistent in other developing countries as well who boast possession of abundant natural resources (The Economist, 2010). Moreover, even with high endowment of natural resources, these developing countries are unable to generate sufficient energy due to poor policy-making (Pendse, 1979).

Figure 3 shows world access to electricity, which globally is 85% with and 15% without access (REN21, 2015). Out of the 15% of the global population without electrical access, 55% is located in Sub-Saharan Africa (SSA), with 87% in rural areas and 13% in urban (REN21, 2015). The power generation capacity of SSA is quite low—as mentioned by Isaksson (2009), this capacity is only equal to that of one European country: Spain. Isaksson (2009) further elaborated on this and mentioned that South Africa is the biggest electricity producer in the continent; if South Africa were to be excluded from SSA, the region's capacity would be reduced to one-third

of what it is producing right now (The Economist, 2014). In objective terms, the SSA region consisting of 22 countries is only able to produce electricity equivalent to a single developed country. In contrast, in 1970, SSA had almost three times as much electricity-generating capacity per million persons as South Asia, with similar per capita incomes. Three decades later, South Asia had left SSA far behind, with nearly twice the electricity-generating capacity (Isaksson, 2009). This lack of energy infrastructure is prevalent in most parts of Africa.

Figure 3: World Electricity Access and Lack of Access (REN21, 2015)



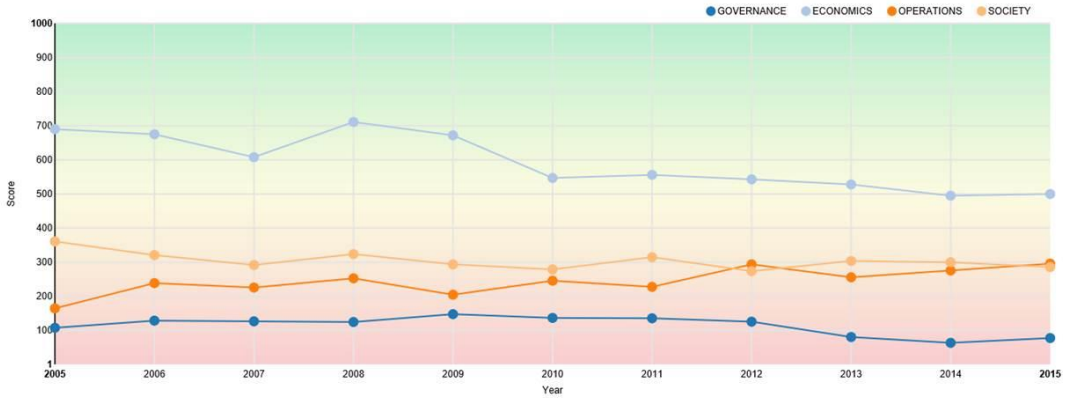
I.3 Need for Energy Infrastructure and Waste Management in Nigeria

Like the majority of African nations, Nigeria, the focus of this study, suffers from a crippling energy shortage. According to a report by the United States Department of Energy (2015), "the electrification rate in Nigeria is estimated at 41%—leaving approximately 100 million people in Nigeria without access to electricity" (p. 2). The cost of creating energy infrastructure can be very high, especially in rural areas, due to the lack of complementary capital goods and infrastructures. As has been shown in literature, cost, location, and scale-up

factors primarily determine the total cost of a project (Remer, Lin, Yu, & Hsin, 2008), and poor conditions in such areas could therefore potentially add billions of dollars to infrastructure costs. Moreover, costs associated with extending and generating energy infrastructure also depend on still more factors, including the governance of the country and the current transportation conditions.

Nigeria suffers from all these issues. Firstly, its lack of transport infrastructure considerably increases the cost of any project involving movement of heavy capital goods. Secondly, Nigeria suffers from poor governance, ranking 130th (out of 199) globally in the Robinson Country Intelligence Index's (RCII) governance dimension; inadequate government control (e.g., high levels of corruption) adds to project costs as each bureaucrat demands a cut from a project's budget. Moreover, the hard decisions frequently required by leaders in cost-efficient projects to address infrastructure needs sustainably are impossible. In terms of economics, Nigeria ranked 2nd in Africa and 57th globally in 2015 but dropped in 2016 to 6th in Africa and 80th globally (RCII), despite being one of the most advanced countries in Africa and boasting a large population and abundant natural resources (see Figure 4).

Figure 4: Overall Ranking of Nigeria according to RCII 2016

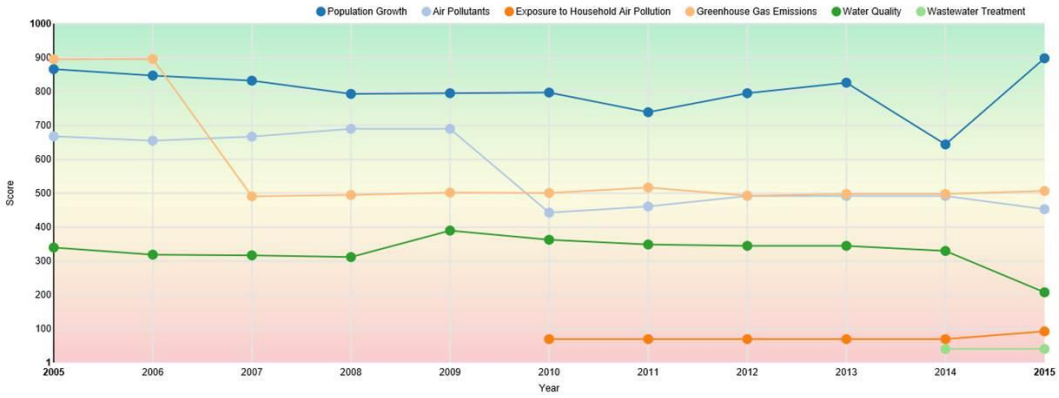


Global Rankings according to Robinson Country Intelligence Index (RCII)

- Nigeria ranks overall 119 on the RCII.
- Governance, 130th
- Economics 80th, dropped from 2nd in 6th in Africa
- Operations 114th
- Society, 121st

Another critical and prominent problem that hinders development in West African countries, particularly Nigeria, is high pollution levels. Referring to the RCII again, Nigeria ranks 120th among all countries with respect to air pollution, and ranks 111th regarding exposure to household air pollution, as shown in Figure 5 along with other pollution indicators.

Figure 5: RCII Ranking for Nigeria Concerning Pollution



Global Rankings according to Robinson Country Intelligence Index (RCII)

- Population Growth, 117th (7th in total population)
- Air Pollutants, 120th
- Exposure to Household Air Pollution, 111th
- Greenhouse Gas Emissions, 57th
- Water Quality, 129th
- Wastewater Treatment, 106th

In Lagos, for example, massive amounts of toxic waste cause devastating health issues, and water polluted with plastics has caused the fishery economy to shrink. Concurrently, the continuous expansion of Lagos's population has increased pollution, especially greenhouse gas emissions, posing environmental challenges resulting in loss of life and destruction of property (Olowoporoku, Longhurst, & Barnes, 2012). The problem of pollution and energy infrastructure go hand in hand; e.g., neither goal is more important than the other, but rather, the goals of improved energy infrastructure and reduced pollution are integrated and mutually reinforcing (Ban, 2016).

An optimal way to address the energy crisis while simultaneously reducing pollution is to produce energy in the most environmentally efficient way possible, allowing a developing country to produce sufficient energy while preserving the environment. In Nigeria, many issues, including environmental ones, stem from the lack of reliable power; for example, when standard

electricity is unavailable, residents employ other methods of energy generation, including running diesel-powered generators that cause severe pollution.

Over time, concern about this environmental hazard and other related issues have mounted because of their health implications, not only in that country but globally (Howarth & Norgaard, 1995). The silver lining in this situation is that the people of Nigeria have shown concern for this looming crisis. According to the World Bank (2015) report, the Lagos community has shown concern for the pollution problem, and action in the form of increased public transport usage to supplant private vehicles has been noted. Indeed, with very few developing countries showing any concern for climate change, Lagos, with its willingness to develop while protecting the environment, does actually provide a glimpse of the future. This scenario makes Nigeria a perfect country for the focus of this study, since it is economically strong but chronically experiences both chronic power shortages and major pollution crises that must be addressed. WtE could provide a solution to Nigeria' needs and simultaneously address both issues.

I.4 Research Rationale and Summary

This study sought to explain why WtE is not gaining widespread adoption as a means of producing clean sustainable energy in Nigeria, a representative developing nation. This study employed the theory of reasoned action (TRA) developed by Fishbein and Ajzen (1975), a widely used model of behavioral intentions and behavior (Madden, Ellen, & Ajzen, 1992) to examine leadership's behavioral intention and behavior with respect to adoption of the innovative technology WtE. **More specifically, the study examines the factors contributing to the intention and behavior to adopt WtE. Expanding on the research of** Moghadam, Smith, and

Jaddoud (2016) on acceptance of WtE in the U.S., this study used a similar theoretical approach to estimate the intention to adopt WtE in a developing country.

Intention to adopt is necessary for widespread implementation of any innovative technology, but appropriate policy by the country's leaders is also necessary. Fishbein and Ajzen (2011) view intention as an objective that addresses the essentially dichotomous nature of behavior, and define it as an individual's subjective probability dimension connecting a particular individual to some specific behavior. Prior to acting, individuals consider the consequences of alternative behaviors and then select the behavior associated with most desirable outcome as a course of action (Ajzen & Fishbein, 1975; Bang, Ellinger, Hadimarcou, & Traichal, 2000). Consequently, individual behavior reflects the intention to perform it. Thus, TRA provides a basic framework on the thought and behavioral process of reaching a reasoned action.

TRA has been used in studies involving decisions concerning the environment. Bang et al. (2000) employed TRA to understand the individual's attitude and behavioral intention for renewable energy. More specifically, they examined the relationship between consumer concern for the environment, consumer knowledge, and beliefs about renewable energy on the one hand, and consumer willingness to pay more for renewable energy on the other hand. Chang (1998) has also used both TRA and the theory of planned behavior (TPB) to predict behavior in a different subject area. Use of TRA to explain behavior for various subjects is a valid strategy when explaining behavior.

A study that uses the partial TRA framework in the acceptance of RE is Bang et al. (2000). This research has used the complete version of TRA model (Fishbein & Ajzen, 1975), developing on Bang et al. (2000) to include subjective norms. Intuitively, when considering all

the benefits of renewable energy, it should be more widely adopted. Renewable energy sources such as WtE are able to directly address persistent energy issues including the high demand for power, inconsistent delivery of electricity and gas that lead to scheduled cutouts (load shedding), increasing pollution, and environmental concerns. However, adoption of WtE has been far less than optimal.

This research introduced the role of leaders in understanding this disparity and the intentions and behavior of leaders with respect to adoption of WtE. To explain the role leaders' behavioral attitudes have on the intention and behavior to adopt WtE as a viable solution for the energy crisis in Nigeria, this study incorporated the leadership-led change theory of Andrews, McConnell, and Wescott (2010) and the theoretical framework of TRA into its research design.

In the context of our research, TRA helped us understand behavior of Nigerian leaders based on their pre-existing attitudes. As part of this study, participants were asked whether they intended to perform a certain behavior—adoption of WtE, an action requiring both a thinking process and reasoning. Fundamentally, an individual's decision to engage in a particular behavior reflects attitudes he or she has developed, given that individual's concerns and prior knowledge. TRA can explain how an individual's attitudes lead to changes in his or her intended and actual behavior. Like other individuals, Nigerian leaders may tend to behave with respect to the outcomes they expect, and consequently, TRA may help to explain their behavior (Chang, 1998; Madden, Ellen & Ajzen, 1992). In summary, this research argued that change can result from effective leadership; thus, it is important for leaders in developing countries to make a reasoned action that will subsequently lead to the desired behavior of adopting WtE.

The following sections has addressed the literature around RE and WtE and established how lack of energy is a strong problem in African countries using Nigeria as the focus. The

further sections have developed on theoretical models, hypotheses and the research strategy used to evaluate these defined hypotheses. The final sections look at the obtained results used and discuss the possibilities of further research on this topic.

II CHAPTER 2: LITERATURE REVIEW

The past decade has seen increased concern about the sustainability of energy resources across the globe to continue to meet worldwide demand (Carlson, Grove, & Kangun, 1993; Kilbourne, McDonagh, & Prothero, 1997; Zinkhan & Carlson, 1995). Worldwide power generation is responsible for more pollution than any other single activity (Dunn, 1997). Effects of utilizing fossil fuels, including global warming and climate change, world energy conflicts, and energy source shortages, have increasingly threatened world stability. Negative effects are observed at all levels of the society, e.g., locally, regionally, and globally (Kothari, Tyagi, & Pathak, 2010). The world is seeking ways to increase sustainable energy production without also increasing pollution. Developed countries such as the United States are considering more environmentally friendly sources of energy production, such as renewable energy, to meet their demands and address environmental concerns (Osterhus, 1997). In terms of scalability and net-production, the appeal of renewable energy has been low due to its inability to produce as much energy as nuclear power generation (Kessides & Wade, 2011). In addition, public concern regarding recycling and renewable energies has been found to be not exceedingly high, and, as a consequence, the public is not willing to pay the added premium for undertaking sophisticated waste management methods (Achillas et al., 2011). Therefore, despite the various technologies available for waste valorization, a large number of issues remain unaddressed (Stehlík, 2009).

II.1 Definition of Renewable Energy and Waste-to-Energy

Renewable resource technology is defined as the electricity produced using a source other than a conventional power source, which should not utilize more than 25% of fossil fuel (Kozloff, 1994a). Renewable energy emits very little pollution, making it a favorable technology for energy production to consumers concerned with the environment (Osterhus, 1997). Kozloff

(1994b) has defined six types of renewable energy sources— photovoltaic cells, thermal electric technology, wind, biomass, geothermal, and hydropower. The energy taken from any of these sources in practice produces minimal pollution, thus preserving the environment while fulfilling the need for energy.

WtE is categorized as a renewable energy source by the U.S. Environmental Protection Agency, which states that "Waste-to-energy is a clean, reliable and renewable source of energy" (U.S. EPA, 2016). WtE is the process of generating energy in the form of electricity or heat (steam) from the thermal breakdown of waste through any thermal conversion technology or combination of conversion technologies. All the WtE technologies mentioned above follow a similar procedure of creating energy in the form of electricity, heat, fuels from a waste source (World Energy Council, 2013). These thermal conversion technologies include combustion, gasification and pyrolysis. Conventional WtE refers to grate-fired or fluidized bed combustion of waste. Direct combustion or incineration is the most conventional WtE approach, directly generating heat that creates steam, which is then used to generate power. Besides incineration, more advanced thermochemical approaches, such as pyrolysis, gasification and plasma-based technologies, have been developed since the 1970s (Kolb & Seifert, 2002). This study addressed the concept of WtE as a whole instead of limiting itself to a single WtE method, with the exception of incineration, which is not as environmentally friendly as other WtE processes.

II.2 Acceptance of Renewable Energy and WtE

Adoption of renewable energy is no longer a rare phenomenon, as demonstrated by its adoption in numerous developed countries. Incineration, a common WtE technology, has been widely adopted in the European Union, and its use is continuously growing (Grosso & Rigamonti, 2010). As of 2012, 400 WtE plants were operating in the EU-15 (Fodor & Klemeš,

2012), and these 400 WtE plants had been treating 7-10% of the total EU waste; 40% of waste still went to the landfill, however. Yassin, Lettieri, Simons, and Germana (2005) found that the energy generated from incineration in Europe in 2000 was equivalent to the electricity demand of Switzerland, and this number has been constantly rising since. With respect to RE production in the EU-28; approximately 25% of the total energy production mix stemmed from RE. This share of RE was equivalent of 196 million tons of oil equivalent (TOE). Overall, the RE within the EU-28 has also increased by approximately 75% in the year 2004 to 2014 (Eurostat, 2016).

An important aspect to be considered while taking up RE initiatives is the efficiency of wastes. Universal waste can be defined in a number of different ways. The United States Environmental Protection Agency (USEPA) defines universal waste as a set of hazardous materials generated in a wide variety of settings by a vast community, which is present in significant volumes in nonhazardous waste systems (USEPA, 2005). Energy efficiency is an important system indicator used for comparison with conventional, well-established technologies. A lack of data, however, both experimental and theoretical, often hampers a comparative study (Bosmans, Vanderreydt, Geysen, & Helsen, 2012). Grosso and Rigamonti (2009) researched the efficiency of WtE production and found that efficiency depends mostly on the composition of the waste being used. Waste can consist of organic substances, minerals, plastics, and water (European IPPC Bureau, 2006). The composition of waste is thus an important issue when working on WtE. Higher efficiency is more cost-effective. Efficient WtE plants can use their own generated electricity within the process, thereby reducing operational costs (Stehlík, 2009). Some waste materials are disposed of without being converting into any form of energy.

A common misconception is that environmental protection and sustainable initiatives must come at the expense of economic development (El-Haggar, 2007). This is a strong concern for emerging markets that require increased energy and have limited energy resources. Demand for imported oil by countries that lack energy resources, such as India, is growing each year and is expected to increase by 11% in 2016 (Raval, 2016). Consequently, these conventional energy resources such as oil and natural gas are being consumed globally at an alarming rate. At the same time, rapidly increasing population numbers contributes to a growing energy demand and pollution. The increasing population and resulting increase in demand for energy infrastructure has led these countries to focus only on solving the energy creation problem and neglecting the environmental aspect. The priority of developing countries should be to produce much-needed infrastructure for energy production to assist their energy shortfalls so as to aid in decreasing developing countries' immense poverty while simultaneously keeping the environment as clean as possible.

Increasing population levels, booming economies, rapid urbanization, and a rise in community living standards have greatly accelerated the municipal solid waste generation rate in developing countries (Minghua et al., 2009). Poor waste management further amplifies issues associated with solid waste generation and adds to the problem of pollution. Developing countries possess a mix of industrial and country-specific hazardous waste sources. The major sources of hazardous solid wastes in Tanzania, for example, are industrial activities, agriculture, medical facilities, commercial centers, and households and individuals (Kahn, Kaseva, & Mbuligwe, 2009). These wastes are not just hazardous for the general environment but, as found in literature, are a source for indirect diseases and nuisances. For the public, the main risks to public health are indirect and arise from the breeding of disease vectors, primarily flies and rats

(Royal Commission on Environment Pollution, 1984). The burning of these materials as done informally in these developing countries leads to toxic fumes, resulting in respiratory diseases (Bruce, Perez-Padilla, & Albalak, 2000). According to the World Energy Outlook (International Energy Agency, 2016), more than 2.7 billion people—38% of the world's population—are estimated to rely on the traditional use of solid biomass for cooking, typically using inefficient stoves or open fires in poorly ventilated spaces. Health risks are associated with cooking over an open fire, which causes smoke that can raise the risk of heart and lung disease, and clinics that lack adequate power supplies can potentially be harmful to patients (Bruce et al., 2000). The negative health impact attributable to these traditional orthodox cooking methods has been documented by the World Health Organization (WHO), which estimated that approximately two million deaths per year could be avoided by use of improved cook-stoves (WHO, 2009). The Global Energy Assessment (GEA) also estimated that about 2.2 million deaths in 2005 were caused by solid fuel use in households (Rao et al., 2011). The time savings from immediate access to liquid and gaseous cooking fuels for half the world's population dependent on traditional cooking methods has been valued at US$44 billion (WHO, 2006).

The source of these problems in the developing countries—especially those on the African continent—is still crippling power shortages. An estimated 1.2 billion people—16% of the world's population—live without access to electricity (International Energy Agency, 2016). Using the IEA data, the Alliance for Rural Electrification (ARE, 2011) found that the overall number of people without access to electricity in Africa reached 589 million in 2008, with an additional nine million people with no access to electricity every year since 2002. Nevertheless, the electrification rate increased from 35.5% in 2002 to 40% in 2008. In particular, the urban electrification rate reached 66.8% in 2008 while the rural electrification rate was stuck at 22.7%

in 2008, showing a very small increase from the 2002 figure of 19%. Considering around 59.6% of people are estimated to live in sparsely populated rural areas (The World Bank, 2011), access to energy and especially electricity remains a major issue for most of the continent.

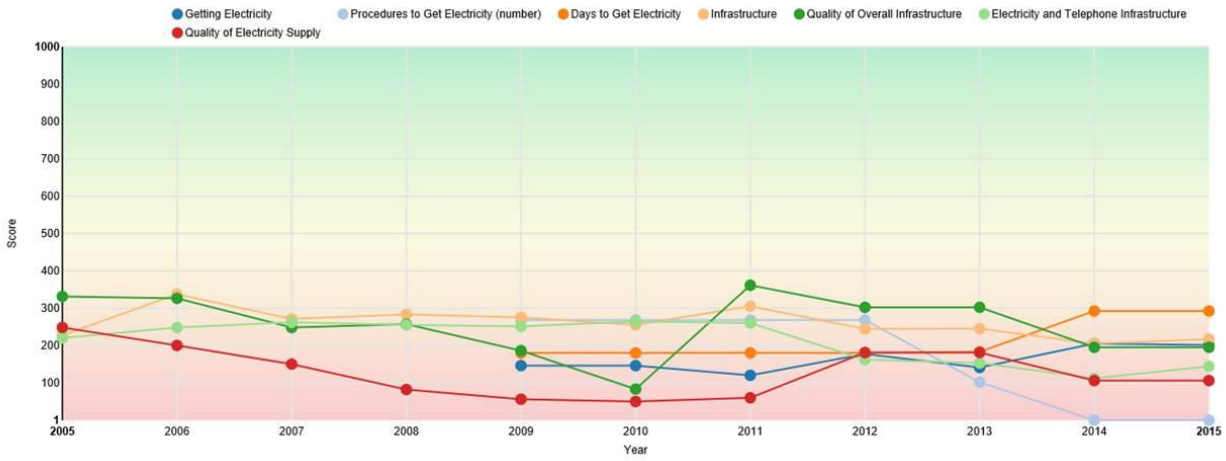
Similarly, in Nigeria, sustainable energy creation is needed to meet critical electrical demands, which only powerful leadership and efficient policies can accomplish. People naturally look to their leaders to provide their countries' power needs. Recently, in Nigeria, one of the main platforms of the newly elected President, Muhammadu Buhari, was to create sustainable power to meet his country's demand. In his nine-point agenda, he strongly emphasized economic growth and the development of energy infrastructure (Nigerian Watch, n.d.). In his speech at the United Nations (UN, 2015), President Buhari also emphasized adoption of climate change policies. According to *The Guardian Nigeria* (2016), President Buhari is demonstrating concern for change, showing both concern and knowledge of renewable energy.

At night, when viewed from above, one would expect Africa's most populated country and largest economy to be covered in lights; however, it is completely dark. According to the Ministry of the Environment of Nigeria, Nigerians spend about $5 billion yearly on fuel for loud and polluting diesel generators, thereby contributing to major pollution, and still the majority of the population does not have light (Federal Ministry of Environment, n.d.). To generate power each day, the people of Nigeria spend at least five times the amount they would if they had access to renewable energy such as wind or solar. Due to the relatively higher cost of gasoline, renewable sources of energy would provide a cheaper solution (Federal Ministry of Nigeria, n.d.), and renewable energy technology is becoming more cost-effective each day. Use of renewables would also create more jobs and stimulate the local economy, since stores and

markets could remain open after nightfall. Thus, use of renewable energy technologies would have a positive impact on commerce and thus improve the Nigerian economy.

In terms of economics, although Nigeria ranks 6th among the African countries; however, this superior economic growth does not translate into a better standard of living for its people. The infrastructure of Nigeria, as noted by the RCII, is ranked 127th in the world, and Nigerian electrical and telephone infrastructure is ranked 130th in the world. Quality of electricity supply is ranked 132nd, and the process of acquiring electricity, including other relevant power infrastructures factors, is ranked as 133rd, as shown in Figure 6. In short, its overall economic superiority among African countries has not enabled Nigeria to provide its people basic energy infrastructure, which as shown improves life in all respects.

Figure 6: RCII Rankings of Nigerian Infrastructure 2015



Global Rankings according to Robinson Country Intelligence Index (RCII)

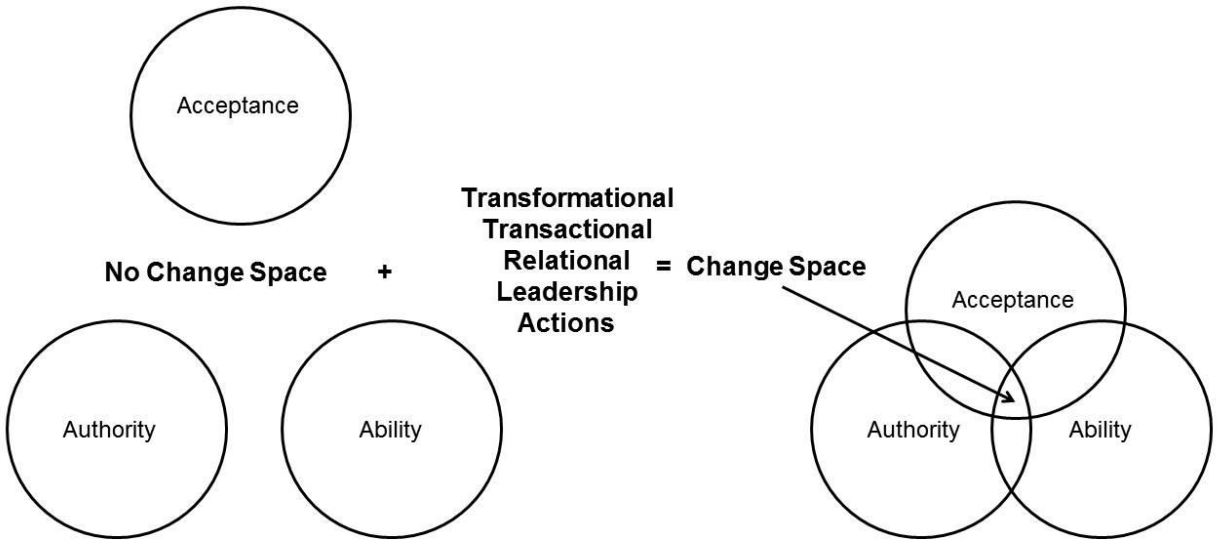
- Infrastructure, 127th
- Quality of Overall Infrastructure, 125th
- Electricity & Telephone Infra., 130th
- Quality of Electricity Supply, 132nd
- Getting Electricity, 133rd
- Procedures to Get Electricity, 133rd
- Days to Get Electricity 129th

The issues of energy creation and pollution (or solid waste management) are interrelated. Information and education can shift behavior and help gain public support for waste management initiatives such as WtE, and a wide range of activities are available to further such educational efforts. Moreover, waste characterization studies and waste audits are critical to the process of designing and implementing a waste management plan, as well as gaining insight as to where diversion efforts should be focused (Armijo de Vega, Ojeda Benítez, & Ramírez Barreto, 2008; Smyth, Fredeen, & Booth, 2010).

II.3 Role of Leadership-Led Change

WtE programs have not been adequately adopted in developing countries, but, with the aid of informed decision-making by the leaders of these countries, the adoption of WtE could well be possible. Using the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) and leadership-led change (Andrews et al., 2010), this study attempted to evaluate how WtE could be adopted in Nigeria and explored the underlying factors that affect leaders in taking reasoned actions in favor of its adoption. As shown in Figure 7, when looking at the theory of leadership-led change space, three types of theoretical approaches were particularly useful: transformational, transactional, and relational models.

Figure 7: Leadership Creates Change Space by Stimulating 3 As (Andrews et al., 2010)



Reference: Andrews et al. (2010)

Transformational leadership entails leaders that persuade people in their groups and cultures to aspire to better outcomes (Burns, 1978). Such leaders convey a vision and belief and inspire conviction for the good of the group or of its people. Transactional leadership, similar to transformational leadership, focuses on public value creation where learning results from a gradual authorizing process. This, in turn, allows leaders to explore and pursue change that benefits the group (Andrews et al., 2010). Relational leadership looks at social structures in which several groups engage together to complete things, as a key to understanding leadership in change (Andrews et al., 2010). Structures include networks and organizations that leadership creates to facilitate solutions for implementing change (Andrews el al., 2010).

II.4 Conclusion

A previous study conducted by Bang et al. (2000) examined the relationship of three factors (concern with the environment, knowledge about renewable energy, and beliefs about salient consequences) and consumer attitudes relevant to using renewable energy, which

influences the adoption of renewable energy as a source of energy production in developing countries. This study built off these variables, specifically knowledge and concern, and examined subjective norms in observing Nigerian leadership's intention and resulting behavior to adopt WtE. Drawing from Fishbein and Ajzen (1975) and expanding on the Bang et al. (2000) study, this research addressed the following question: To what extent does leadership influence the adoption of Waste-to-Energy (WtE) as a plausible energy (and environmental) solution in Nigeria?

III CHAPTER 3: THEORETICAL FRAMEWORK

Researchers have used the theory of reasoned action (TRA) of Fishbein and Ajzen (1975) as a framework to investigate human behavior in the disciplines of social psychology (Conner, Kirk, Cade, & Barrett, 2001), where it has found support in the prediction of various social behaviors (Van den Putte, 1991). For example, Teo and van Schaik (2012) compared four models (TRA, Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM) and an integrated model) to determine the accuracy of prediction of each model with respect to teachers' intentions to use technology. Similarly, the study by Shih and Fang (2006) replicated and expanded the TRA framework to probe attitudinal and subjective norm factors that would influence the adoption intention of Internet Banking. Lam, Cho, and Qu (2007) explored the relationship between IT beliefs, attitude, subjective norms, self-efficacy, and behavioral intention towards the perception of adoption of information technology by hotel employees in China.

III.1 Theory of Reasoned Actions

TRA suggests that people contemplate the consequences of new behaviors before implementing them, and individuals choose to employ the behaviors that they relate to desirable outcomes (Bang et al., 2000). Fishbein and Ajzen (1975) argue that behavioral intent (BI) is derived from two factors: (1) attitude toward the behavior and (2) subjective norms. Thus, "[a]ttitude is defined as a latent disposition or tendency to respond with some degree of favorableness or unfavorableness to a psychological object" (p. 76). The attitude can be any discriminable part of a person's realm, including behavior (Fishbein & Ajzen, 2011). Fishbein and Ajzen (2011) define subjective norms "as an individual's perception that most people who are important to her think she should (or should not) perform a particular behavior" (p. 131).

This study examined attitudes formed from factors contributing to individuals' behavior regarding WtE with the help of the theoretical models from Fishbein and Ajzen (1975) and Andrews et al. (2010). Bang et al. (2000) employed TRA in the field of renewable energy to study attitudes that contribute to the individual's intended behavior towards RE. The study by Bang et al. (2000) adopted the partial form of TRA and measured only the attitude towards behavior. The other component of attitude formation in the TRA consists of subjective norms, which are defined as the social pressure an individual feels to perform or not perform the behavior at hand (Fishbein & Ajzen, 1975). The study by Bang et al. (2000) argued that the data they had collected were not designed to test subjective norms; they further argued that such normative opinions are hard to quantify, and left these opinions to be studied by future researchers in this area. Identifying this gap, this study focused primarily on attitude towards the intended behavior, thus extending the Fishbein and Ajzen (1975) framework to a different setting. Moreover, the study incorporated subjective norms not addressed in the previous literature.

According to TRA, attitude stems from two factors: a group of beliefs that an individual has about a behavior (b_i) and evaluations (e_i) of the beliefs (Fishbein & Ajzen, 1975). Bang et al. (2000) specifically examined beliefs in the context of WtE adoption. They argued that beliefs reflect knowledge of WtE—not necessarily accurate knowledge, but at least knowledge that the individual perceives to be accurate (Bang et al., 2000). Specifically, TRA suggests that the attitude concerning the behavior (A_{act}) is the sum of the results of the beliefs that this behavior leads to significant consequences and the evaluation of these significant consequences (Bang et al., 2000). Following the theory of TRA in the context of WtE, the mathematical equation to explain the above-mentioned principles is provided below.

$$B{\sim}I = (A_B)w + other\ variable(s)$$

$$where\ B\ =\ the\ behavior\ in\ question,$$

$$I = the\ person's\ intention\ to\ perform\ behaviour\ B$$

$$A_B = the\ attitude\ (evaluation)\ towards\ performing\ B$$

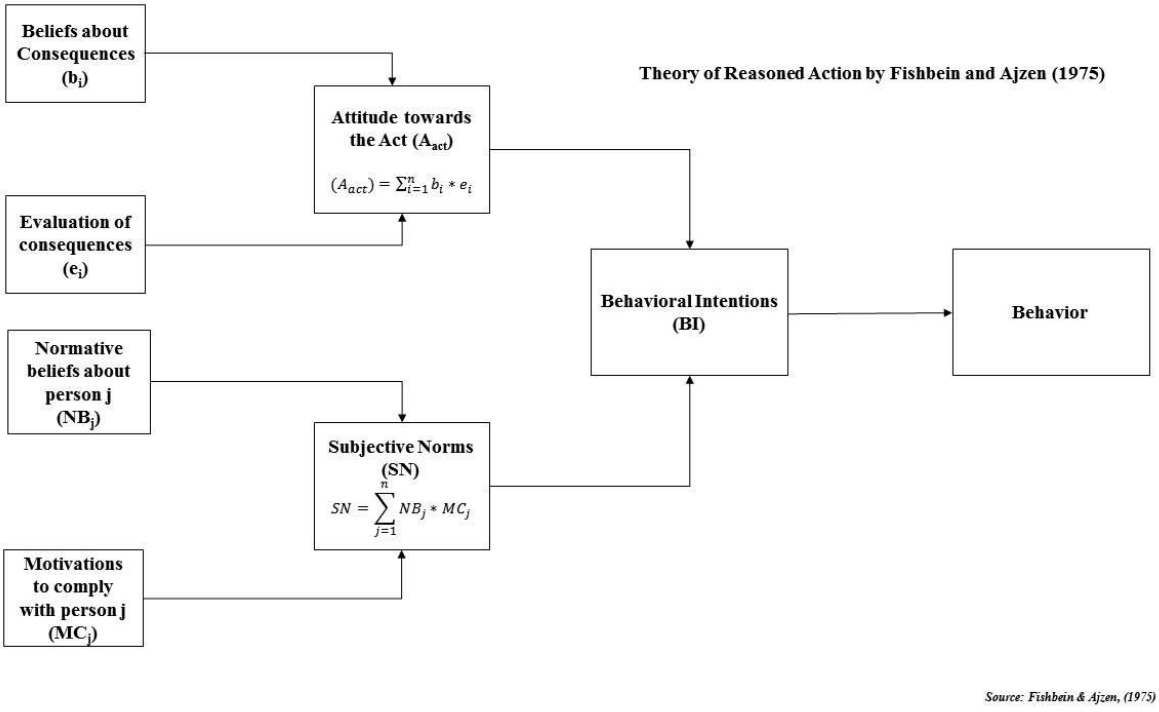
$$w = a\ regression\ weight$$

$$BehaviortoImplementWtE(B){\sim}BehavioralIntentiontoImplementWtE(I)$$

$$= \alpha_0 + wAttitudes_i + \beta_1 SubjectiveNorms_i + \varepsilon_i$$

WtE generation requires the use of waste provided by the consumer, government, or private sector, such as municipal waste or waste materials such as tires or plastics, in order to generate energy, indicating that consumer attitudes and norms are vital for widespread adoption of WtE (Moghadam et al., 2016). One goal of this study was to understand Nigerian leaders' attitudes regarding the desire to implement WtE as an energy source. Key variables measured in this research were knowledge of WtE, concern about energy creation, concern about pollution, and leaders' acceptance, authority, and ability to implement WtE. According to Bang et al. (2000), variables related to knowledge and concerns contribute to the belief component of the Fishbein and Ajzen model (see Figure 8).

Figure 8: Diagram of The Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975)



The literature suggests that renewable energy can solve energy issues without contributing to pollution (cf. Osterhus, 1997), but its implementation is not present in developing countries such as Nigeria. In Nigeria's case, concerns and knowledge that should support the adoption of RE source (WtE) does not appear to be implemented. Noting this gap between the benefits of WtE and its actual adoption in developing countries, this research introduced the role of leaders in understanding this disparity and their intentions to adopt WtE. This paper has also hypothesized that the leaders in Nigeria can initiate change to address the persistent energy and environmental crisis through adoption of WtE.

The following section develops three hypotheses to address the primary aim of this study of analyzing the adoption of WtE in Nigeria using the conceptual framework based on the behavioral intention model referred to as the TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen,

1975). This paper uses TRA to examine leaders' attitudes and subjective norms toward adopting WtE. Positive attitudes and subjective norms should show a higher intention to adopt WtE, and leadership-led change should moderate the behavior to adopt WtE in Nigeria as a solution for its energy demand and pollution reduction.

Attitude is the first construct that has an impact on intention that can lead to a behavior. Attitudes are comprised of beliefs and evaluations as mentioned in TRA, and, as explained by Ajzen & Fishbein (1980), "in order to understand why a person holds a certain attitude toward an object it is necessary to assess his salient beliefs about that object" (p. 63). The beliefs mentioned by Ajzen and Fishbein (1980) are formed by the individual's past experiences and the prior knowledge they have regarding a certain action. Using empirical evidence, Armitage, Conner, Loach, and Willetts, (1999) found that, when most respondents considered an outcome to be favorable, they showed a positive correlation between belief and attitude. A leader's belief can be formed from knowledge and concerns they have regarding events; therefore, a leader's knowledge and concern on WtE can form his/her beliefs. If the leaders have a high level of concern for pollution, we expect them to have positive attitudes towards WtE. Similarly, if people have an experience or prior knowledge about energy creation and sustainable energy, this would create positive beliefs in them, leading to positive attitudes about WtE. Bang et al. (2000) found that people who were more knowledgeable about the environment and renewable energy had a more positive attitude on renewable energy. Moreover, a recent study indicated that consumers' willingness to pay more for environmentally friendly sources of energy increased as they became more aware of the relative advantages of renewable energy in comparison to conventional sources of energy like coal (Kozloff, 1994).

Within the TRA framework of Ajzen and Fishbein (2011), attitudes follow directly from beliefs. Ajzen and Fishbein (2011) argue that individuals create these beliefs by associating the object with various characteristics and aspects. The literature indicates that perceptions and preferences about energy and the environment are influenced by objective information and sometimes by a lack of it (Farhar, 1994). Consequently, leaders who have more positive beliefs about adopting WtE developed through their prior beliefs and evaluations will have a more positive attitude towards WtE.

The second component that determines attitude is the individual's evaluation towards the action. People who have knowledge about RE (including WtE) will evaluate it as an option to be adopted. People evaluate environmental impacts, which can lead them to a reinforced interest in renewable energy (Joskow, 1996). Individuals evaluate environmental issues, such as climate change, because they are concerned with their children's and their own health today and in the future (Howarth & Norgaard, 1995). Consumers who are more concerned about the environment have a higher evaluation of renewable energy as shown by Bang et al. (2000). These consumers have a higher evaluation of RE since they are willing to pay a premium for renewable energy that consumers who are not as concerned about the environment are not (Bang et al., 2000). People who are more concerned and are knowledgeable about the problems associated with the deteriorating environment as well as the advantages of using renewable energy may have a more positive evaluation towards renewable energy (Bang et al., 2000) and thus more positive attitudes towards adopting WtE.

This study analyzed attitudes as formed by beliefs and evaluations towards the intention to adopt WtE. Research in this regard mainly relies on TRA, which maintains that attitudes affect behavior indirectly through intentions (Ajzen & Fishbein, 1980). People's intention to

perform a behavior will strengthen to the extent that they hold positive attitudes toward the behavior (Ajzen & Fishbein, 2011). As stated above, positive attitudes can arise from both beliefs and evaluations. Degree of intention formation can differ depending on motivations and opportunities (Bagozzi & Yi, 1989). Bagozzi and Yi (1989) further state that at times attitudes can be so strong that they bypass evaluations or the consequences of an act to promote a specific intention. This forms the basis of the first hypothesis of this research:

H1: Leaders with stronger attitudes about WtE will have a stronger intention to adopt WtE.

According to Fishbein and Ajzen (2011), the intention of an individual depends on two constructs, one of which is the perceived social pressure to implement a behavior (subjective norms). Fishbein and Ajzen (2011) further explain that the subjective norms are composed of normative beliefs and motivation to comply. People behave in a certain way based on the normative beliefs due to social pressure (Fishbein & Ajzen, 2011). It is important to measure how much an individual is affected by normative beliefs. Previous literature also shows that motivation to comply can also add some insight to the subjective norms (Budd, North, & Spencer, 1984; Montaño, Thompson, Taylor, & Mahloch, 1997).

Gusti, Isyandi, Bahri, and Afandi (2015) found that the subjective norms were associated with and contributed positively towards the behavioral intention to implement social welfare management in Indonesia. The relationship of subjective norms and behavioral intentions has been confirmed by several other studies (Kumar, 2012; Chan & Lau, 2001; Mahmud & Osman, 2010). Fishbein and Ajzen (2011) suggest that a person's intention of a behavior can be impacted by one's perception of the social pressure. This forms the basis of the second hypothesis of this research, which is given below.

H2: Leaders with stronger subjective norms about WtE will have stronger intention to adopt WtE.

Intention is not a complete predictor of behavior, but it is a determination to act in a certain way. Intention in an attitude–behavior relationship, as explained by Bagozzi, Yi, and Baumgartner (1990), can also be influenced by the level of effort required to exercise the behavior; thus, not all intention leads to a behavior. However, having a strong positive intention is a good indicator of an individual to perform the given behavior (Fishbein & Ajzen, 2011). Previous studies examined the behavioral intentions and its predictability of behavior with high accuracy (Giles & Cairns, 1995; Conner & McMillan, 1999; Hrubes, Ajzen, & Daigle, 2001).

Armitage and Conner (2001), who examined the intention-behavior correlation in 48 different studies and found significant positive correlation between behavioral intentions and behavior, also support this notion. Previous researchers have utilized behavioral theories to explain behavior towards performing an action, for example, observed behaviors in specific Information Technology (IT) use (Agarwal & Prasad, 1997). TRA studies have shown that intentions are significantly correlated with behavior (Mishra, Akman, & Mishra, 2014). Positive intentions can lead to the adaptive behavior; for example, the intention to purchase an item has been found to be a good predictor of the behavior purchasing the item (Ramayah, Lee, & Mohamad, 2010).

This hypothesis predicts a leader's behavior on adopting WtE based on the leader's intentions of adopting WtE. It is important to know this intention-behavior relationship since the purpose of this study was to understand what can lead to adopting WtE. This forms the basis of the third hypothesis:

H3: Leaders who have stronger intentions to adopt WtE will positively predict leaders' behaviors to adopt WtE.

III.2 Leadership-Led Change

The leadership-led change study by Andrews et al. (2010) provided a framework for the role of leadership and its impact on creating change. Leadership provides a set of actions that create a "change space" that organizes people, thoughts, and resources to accomplish a change purpose (Andrews et al., 2010). Figure 9 and Figure 10, from the Andrews et al. (2010) study; show the interaction between leadership and change space. In essence, leadership identifies the issue at hand and possible solutions to it and then acts to begin implementing change. Leadership-led change theory further maintains that both active engagement and a contextual space in which change happens are needed to broaden comprehension of and facilitate such change (Andrews et al., 2010; Moghadam et al., 2016). The change space framework suggests that social capacity to change depends on having space to identify change, moving emphasis towards change demands, and embracing new forms that support development (Andrews et al., 2010).

Leadership actions focus on enhancing the acceptance of change, as well as the authority and ability to explore and pursue change in given contexts, such as clean energy sustainability (Andrews et al., 2010). These leadership actions—acceptance, authority, and ability—offer key contextual influences within the change space, as shown in Figure 10 (Andrews et al., 2010).

Figure 9: Dynamic Interaction Between Leadership and Change Space (Andrews et al., 2010, p. 17)

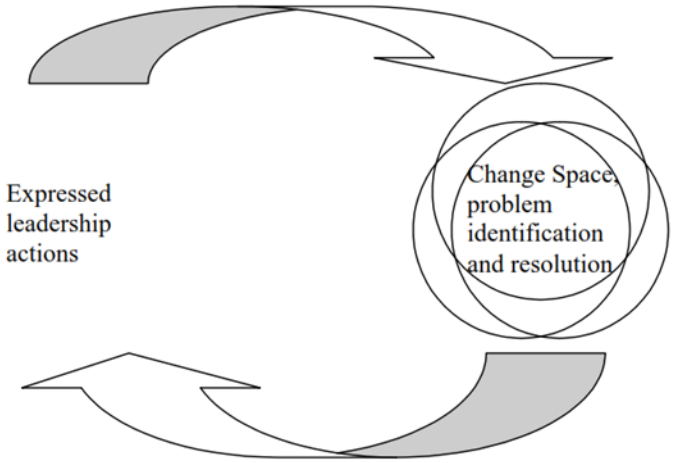
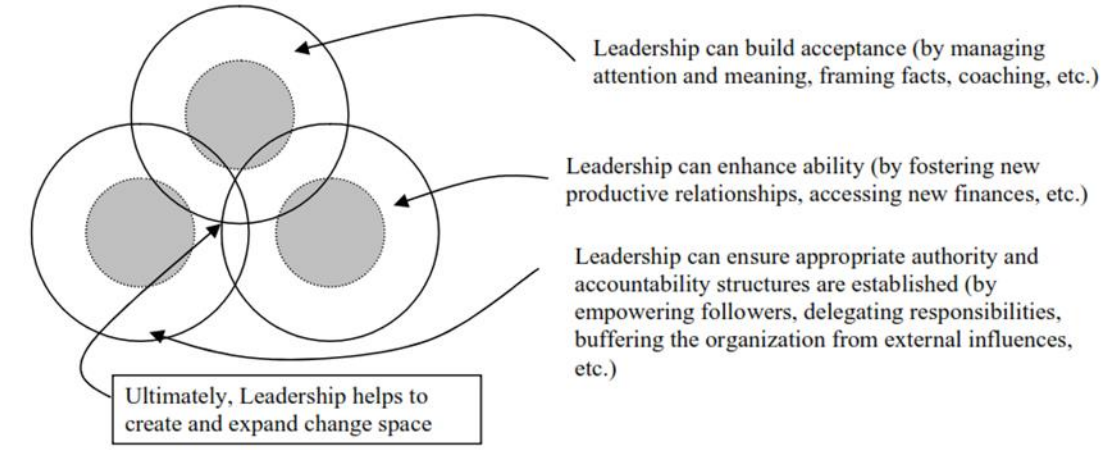


Figure 10: What Leadership Does in the Change Process = Creates Change Space (Andrews et al., 2010, p. 14)



Source: Based on Andrews (2008b).

The current research analyzed leadership's intention and behavior in adopting WtE by examining attitude factors of leaders on WtE and giving acceptance, authority, and ability to Nigerian leaders to adapt much-needed change to resolve some of the Nigerian issues discussed

previously. Leadership builds "acceptance" by managing and educating internal and external support for fellow leaders and citizens. Then leadership explores the resources, creates positive relationships, and assesses funding, all of which enhance the "ability" for change. Leadership gives "authority" for change by empowering groups and delegating responsibilities for that change.

Expanding on these theories and other research, a variety of roles exist in the change process. One such is the "idea champion," who leads the commitment to the change idea (Kanter, 1983). Figure 11 shows a general leadership network featuring a "connector" at the center; this role has emerged as a dynamic leadership function in theories, varying from collaborative leadership (Kanter, 1994) to connective leadership (Lipman-Blumen, 2000) and leadership in networks (Andrews, 2008; Balkundi & Kilduff, 2006; Andrews et al., 2010).

Figure 11: A Simple Function-Driven Leadership Network (Andrews et al., 2010, p. 13)

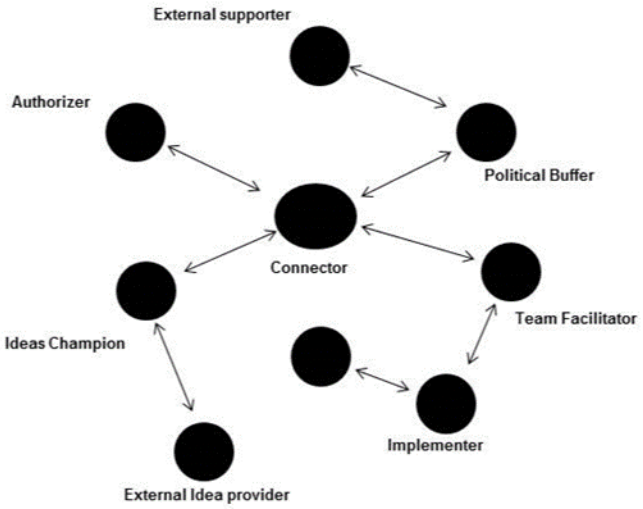
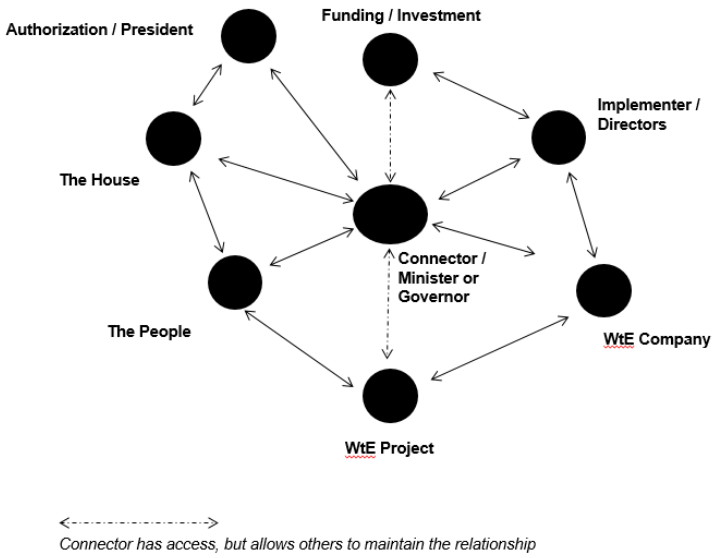


Figure 12 shows an example, adapted from the Andrews (2008) study, of how the role of connector can be fulfilled by a minister or governor as its idea of *champion*, and how they

connect other leaders, people, and groups to implement needed change and influence the intention to implement WtE.

Figure 12: Example of Nigeria-Driven Leadership Network for WtE



Andrews et al. (2010) state:

> Leadership contributes to change when it builds change space—where leaders foster acceptance for change, grant authority to change (with accountability), and introduce or free the abilities necessary to achieve change. Change space is especially enhanced where leadership facilitates open access to societies and learning organizations in which members are empowered—in groups—to pursue change through problem solving. (p.16)

This framework illustrates how leadership can act to initiate change with respect to the current energy and environmental concerns in Nigeria, using renewable resources (WtE) as a solution. This study built off the Moghadam et al. (2016) research on acceptance of WtE in the U.S. (a developed country) and examine leadership acceptance of WtE in developing countries such as Nigeria. When defining leadership intention to adopt WtE in Nigeria, as well as the

capacity for changing the perception of those in Nigeria, there must be sufficient capability for social change, given contextual pressures for new innovations in renewable energy to occur (Andrews et al., 2010; Moghadam et al., 2016). In this study, we expect that, although Nigeria has not shown much progress in the adoption of RE and specifically WtE technology, there is an adequate degree of what Andrews et al. (2010) call "change space" available for leaders to gradually implement innovative WtE technology in order to create sustainable energy infrastructure growth and to reduce issues related to an unfriendly environment.

Leaders' attitudes and subjective norms influence their intention to adopt WtE. Change space framework incorporates three factors, which are fundamentally influencing organizational and social capacities to adjust to contextual demands: acceptance, authority (and accountability), and ability (Andrews, 2008). Andrews et al. (2010) explain acceptance as a mentality or "buy-in" that there is a need for change. Change space also requires authority (and accountability) that influences the development of change and its need. Change space also requires ability, which is in the form of a leader's ability to provide resources to make this change happen.

Change is affected with the belief of the leaders in themselves concerning the three As of change, which moderate the intention and the resulting behavior to adopt WtE. This change space can also be influenced by organizational and societal beliefs (Andrews et al., 2010). Leadership-led change will thus moderate the relationship between attitudes and intention to adopt WtE. "Moderator variable is a qualitative (e.g., sex, race, class) or quantitative (e.g., level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable" (Baron & Kenny, 1986, p. 1174). This study is focusing on leadership, since it seems the adoption of WtE in Nigeria has been stalled at the leadership level. One of the main research aims of this study was to see if the

leadership-led change (three As model) by Andrews et al. (2010) influences the strength of the relationship between leaders' attitudes (TRA) and their intention to adopt WtE. Leaders who have stronger attitudes on energy creation and environmental issues, such as pollution, will have a higher intention to adopt WtE. In addition, WtE programs can become more appealing for leaders who are concerned about the environment (Osterhus, 1997). This provides the basis for the fourth hypothesis:

H4: Leadership-led change moderates the relationship between leaders' attitudes on WtE and their intention to adopt WtE.

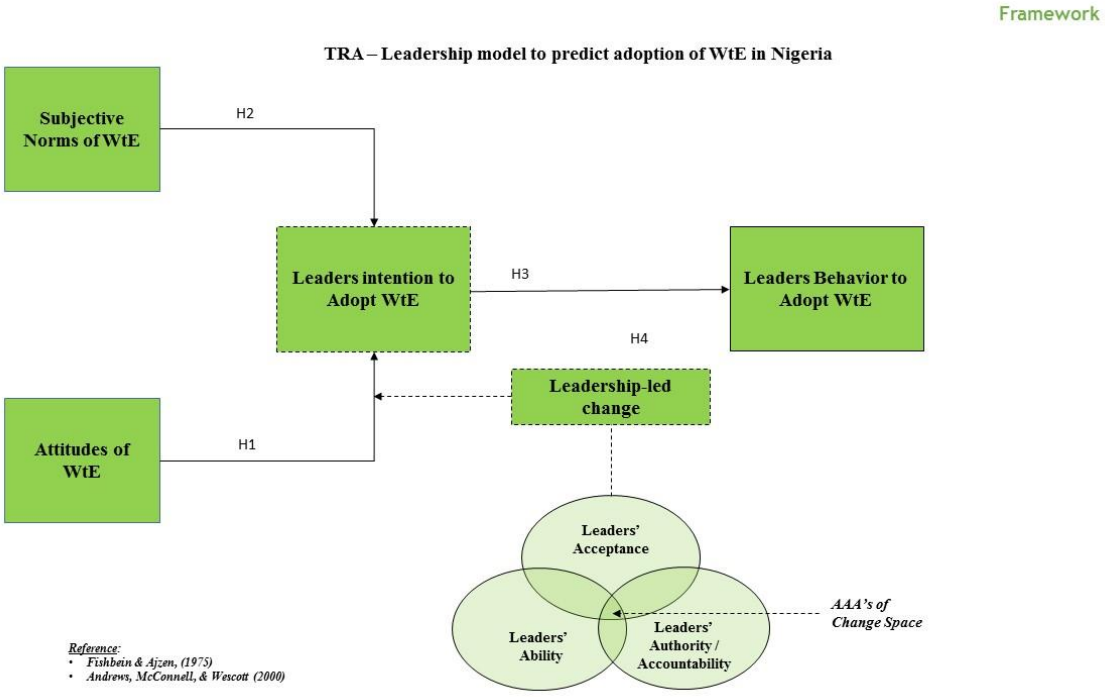
III.3 Integrated Framework

This study utilized the Fishbein and Ajzen (1975) theoretical model as used in Bang et al. (2000) and Mishra et al. (2014) (see Appendix A) using the variables related to knowledge and concern that contribute to belief/attitude towards RE. The TRA model traditionally involves four constructs: attitudes, subjective norms, intention, and behavior (Mishra et al., 2014). In addition to these four constructs, this study also included the flow of hypothesized TRA relationships leading to leaders' intention to adopt WtE moderated through leadership-led change (three As) on to the behavior of adopting WtE. The relationship between adoption of WtE and the ex-ante beliefs and attitudes is strongly dependent on his/her ability to undertake a behavior—thus, leadership-led constructs act as a moderator between the key dependent and independent variables. This is also one of the important aspects of this study: that it incorporated two theoretical frameworks into one, such that the research was able to measure the leaders' intention and behavior to adopt WtE with respect to TRA while simultaneously using the leadership-led change theory designed by Andrews et al. (2010). Thus, TRA permitted measurement of the behavioral intention and the resulting behavior of implementing this change. Specifically, this

study investigated the role of leadership in the ability to bring change in the form of adoption of WtE.

The three As of leadership, as explained above, moderate the intention to adopt WtE, as is illustrated below in Figure 13.

Figure 13: TRA Leadership-Led Change Model to Predict Adoption of WtE in Nigeria



This study centered on the process from leaders' attitudes and behavioral formation leading towards creating change by actual intent to adopt WtE. This study focused on Nigerian leaders' attitudes towards WtE and leaders' intention and behavior to implement WtE as an energy source. Figure 13 shows how the theoretical framework of this study integrated TRA (Fishbein and Ajzen, 1975) and leadership-led change (Andrews et al., 2010)—two theoretical models previously defined. The mathematical equation explained in the above section can be extended by incorporating the leader-ship led change variable and the previous equation takes the following form:

$$BehaviortoImplementWtE(B) \sim BehavioralIntentiontoImplementWtE(I)$$
$$= \alpha_0 + w_0 Attitudes_i + \beta_1 SubjectiveNorms_i$$
$$+ \beta_2 LeadershipLedModerator_i + \varepsilon_i$$

It is important to note here that this study only concerned the leaders who are able to create a change space such that it could actually bring change in the society, where change refers specifically to adoption of WtE. The figure explains the attitudes of the leaders towards WtE through beliefs and evaluations, and these attitudes determined through ex-ante belief, evaluations, and subjective norms eventually leads to the behavioral intentions and the actual behavior of adopting WtE.

III.4 Hypotheses Summary

The research explored how adoption of WtE by the leaders of developing countries can be made possible. As stated above, the use of TRA and leadership-led change theory provided a theoretical framework for the research, specifically, analyzing how leadership can implement reasoned actions leading to a change for sustainability and innovative energy practices. Similar to the study by Mishra et al. (2014) on TRA and the adaptation of Green Information Technology, one goal of this research was to examine Nigerian leaders' behavioral intention to adopt WtE by applying the TRA behavioral framework. Apart from the TRA model, the role of the leadership-led change was also examined, analyzing the three As that could successfully lead change and meet Nigeria's energy and reduction-of-pollution needs. While pollution and sociopolitical pressures may be the initial motive for pursuing sustainability actions, effective managerial action has the potential to directly improve adoption of sustainability practices and thus indirectly lead to positive sustainability outcomes (Wang, Van Wart, & Lebredo, 2014; Moghadam et al., 2016).

Four general hypotheses discussed above were developed to analyze the relationship between behavioral intent, which predicts behavior to adopt WtE, moderated by leadership-led change. Previous literature suggests that enhanced knowledge about RE leads to positive attitudes and acceptance of the benefits of utilizing RE (Bang et al., 2000), and that the accessibility of vast resources for energy purposes influences economic growth as well as the prominence of such resources in society and the environment (Pollmann et al., 2014).

IV CHAPTER 4: METHODOLOGY

This chapter describes the methodology implemented to examine the hypotheses given in the previous chapter.

IV.1 Data Collection

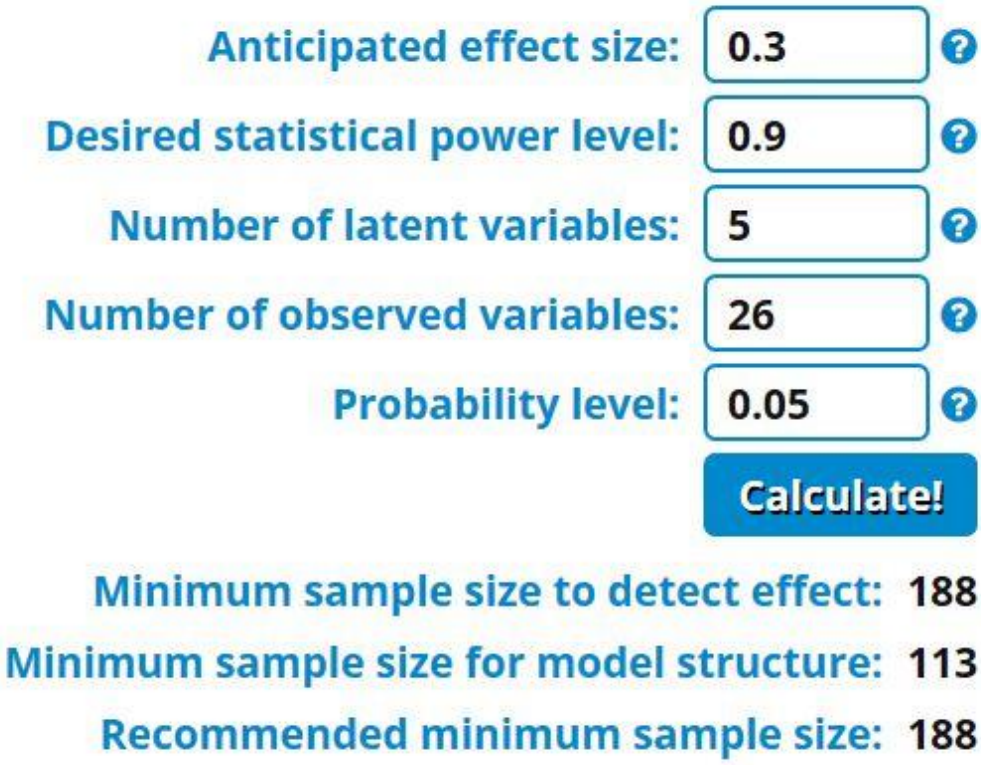
Study participants were a pool of Nigerians in leadership roles/positions. For the purpose of this study, leadership has been defined—similar to Andrews et al. (2010)—as individuals who hold senior positions in government or the private sector with over eight years or more of experience and who are in an executive role. Andrews et al. (2010) define leaders both in terms of an individual entity and as a group. In terms of individual identity, Andrews et al. (2010) define leaders as rational-legal individuals who had been given the power to issue commands and exercise authority by virtue of legal rules and often because of their superior knowledge. Andrews et al. (2010) developed on the group aspect of leadership, arguing that "leadership is more about groups than individuals; given that successful change event is done by multiple people exercising their leadership" (p. 3). These leaders are identified because of their functional contribution rather than their personal traits.

Following and expanding on Andrews et al. (2010), this study employed a similar sample of participants as leaders for survey research. On the government side, this included directors, deputy directors, general managers, assistant general managers, project managers, procurement managers, director generals, assistant director generals, house members, senators, ministers, chief advisors, and more. On the private side, it included business owners, chief executive officers (CEOs), chief operating officers (COOs), chief financial officers (CFOs), managing directors (MDs), presidents, vice presidents, and directors. We also included any leaders within the community such as senior tribal leaders and religious heads. The definition of leaders for

this study did not include general civil workers, secretaries, governors, deputy governors, or the vice president or president.

This study reached out to over 1,000 leaders provided by a U.S.-based training company, which has had over 1,000 past clients who have held a role in a management/leadership position. The target was to collect 200 responses for the study (see Figure 14). The target sample size was determined by using an a-priori sampling methodology with power of 0.9 and effect size of 0.3 (see Figure 14), which necessitated a sample size of 188 for the study. Our targeted respondents were leaders who should have a bachelor's level education at a minimum and a doctorate/higher education at maximum, which the survey captured.

Figure 14: A-Priori Sample Size Calculator for Structural Equation Model (Soper, n.d.)



IV.2 Measures

Table 1: Questionnaire Breakdown with Respect to Constructs

Construct	Questions	Answers	Data Measure	Construct Type
Attitude of WtE	Q19, Q20, Q21, Q22, Q23, Q24, Q25, Q26, Q27, & Q28	Likert	Interval	Formative
Subjective Norms	Q29, Q30, Q21, & Q32	Likert	Interval	Formative
Intention to Adopt WtE	Q33, Q34, Q35, Q36, Q37, & Q38	Likert	Interval	Formative
Leadership-Led Change	Q39, Q40, Q41, Q42, Q43, & Q44	Likert	Interval	Formative
Behavior	Q45a, Q45b, Q45c,Q45d, & Q45e	Likert	Interval	Formative

As shown in Table 1, a five-point Likert scale survey, as used in Mishra et al. (2014), with possible selections ranging from "strongly disagree" to "strongly agree," were administered. As argued in Mishra et al. (2014), the Likert scale is a highly effective and widely-used tool for scaling survey-type responses. The survey design collected study data, which includes three filters and eight demographic questions with a five-point response scale assessing participant's agreement with the items as stated above, and two open questions to collect additional participant comments that could provide useful information (see survey in Appendix O and P). The survey was built off the standard questionnaire used by Fishbein and Ajzen (2011) with the addition of the Andrews et al. (2010) leadership-led change (three As) framework. Two questions were created for each A of the three As framework (Acceptance, Ability and Authority), totaling six questions for the leadership-led moderating construct. The survey

gathered data on the following leader-related constructs relative to WtE: attitude (comprised of beliefs and evaluations), subject norms (comprised of normative beliefs and motivation to comply), intention, and the leadership-led three As of change-space (acceptance, authority/accountability, and ability) to adopt WtE.

IV.3 Procedure

This study was designed to focus on a sample of leaders in Nigeria. The survey platform Qualtrics was used to design, host, and collect the survey data. Participants were invited to partake in the study via email, and their participation was anonymous. An email with a link to the online Qualtrics survey was sent to possible participants for data collection, which could be accessed by participants with computers, smartphones, tablets, or any other web-access-capability devices. Pilot testing was conducted to ensure the Qualtrics tool was working properly. Time required for completing the survey based on pilot testing was at least three minutes. With the minimum of three minutes from the test sample, participants who completed the survey in less than three minutes were excluded from further analysis. In addition, participants who did not provide a complete data set of responses were excluded from further analysis.

Emails were sent out to possible participants using the WorldWide Solutions (WWS) database that contains over 1,000 contacts, including email addresses, of which 750 were feasible leader candidates. Participants first reviewed a consent form detailing the purpose of the study and the confidentiality assurances. In total, 253 surveys were collected. The first task in cleaning the data was to drop 14 surveys that were completed before January 7th, 2017, and thus were part of the pilot test. In the live survey, 239 were collected in total, a 32% response rate. The data collection period started on January 7th, 2017, and lasted over a five-week period, the

estimated time during which target quotas would be achieved. The survey was extended for an additional three weeks to capture additional responses for backup samples if needed to provide for a sufficient sample size.

IV.4 Respondents

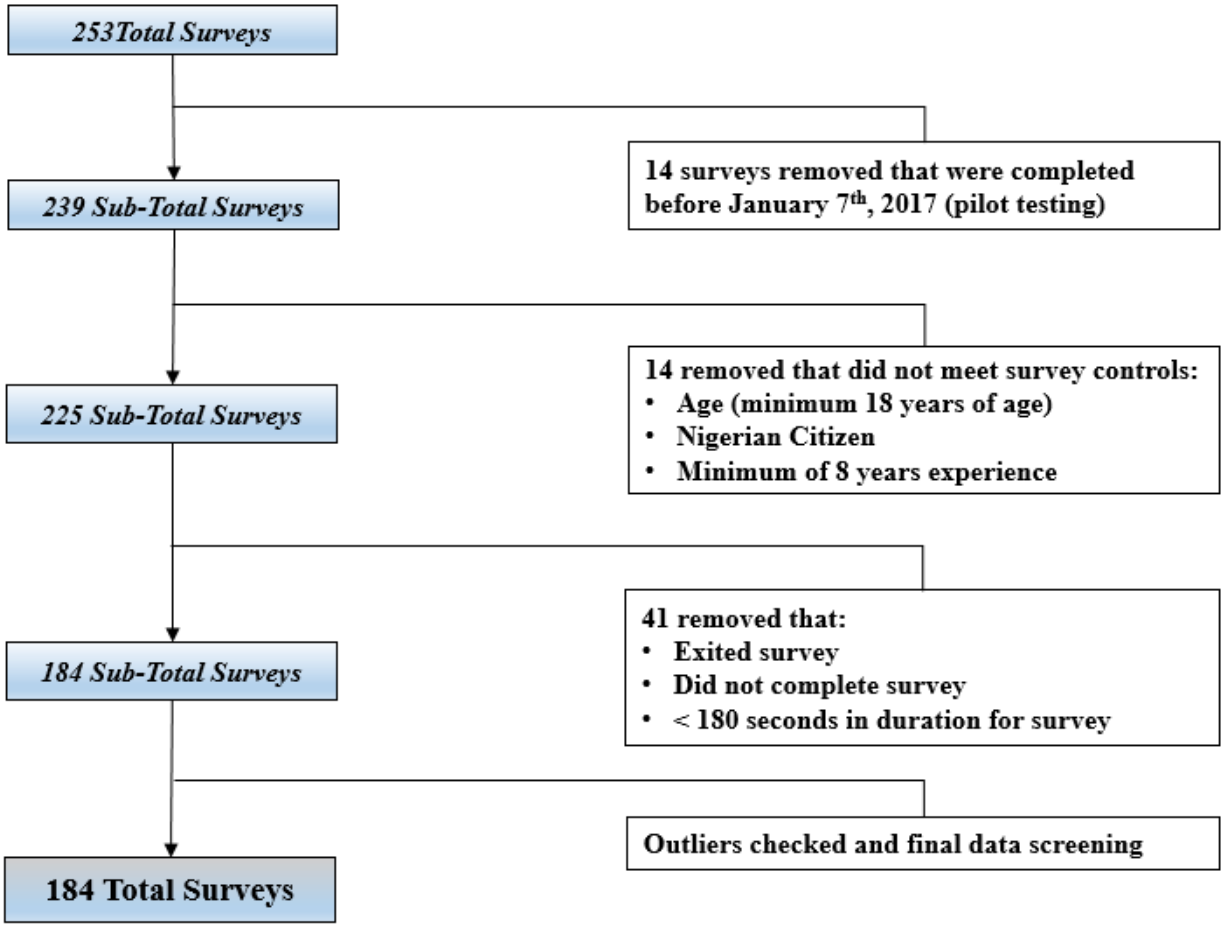
The sample pool for this consisted of Nigerian participants who met the leadership criteria defined in section 4.1. Expanding on Andrews et al. (2010), the study viewed leaders as individuals holding senior positions in government, the private sector, local community, or the military and having at least eight years or more experience. To achieve a power level of 0.9 and probability of 0.05, the minimum recommended a-priori sample size for SEM should be 188 participants. Initially, this study reached out to over 750 possible leader candidates whose names were provided by the U.S. based training company WorldWide Solutions. Out of these 750 leader candidates, 239 participated. The next section discusses the data cleaning procedure to reach the final dataset used in this study.

IV.4.1 *Data clean procedures.*

Filters were placed in Qualtrics to ensure the sample met the minimum controlled requirements, as shown in Figure 15, which were: 1) age (must be eighteen years of age to participate), 2) Nigerian citizenship, and 3) a minimum of eight years' experience. Participants who did not meet these three requirements were exited from the survey and received a thank-you message for participating up to this point. A total of 14 were excluded for not meeting one of the control requirements, leaving a new subtotal at 225. Further participants who exited, who did not start or complete the survey after the three control questions, or who completed the survey in less than 180 seconds, were excluded as well. These dropped observations totaled 41

respondents, yielded a new data sample set of 184. Data were further analyzed for outliers and any other issues that were not apparent in the data results.

Figure 15: Data Cleaning Procedure



IV.4.2 *Preliminary Analysis*

Descriptive statistics were calculated to explore sample characteristics, such as mean age, number of male and female participants, geographic location, education level, average number of years in leadership role, and areas of leadership experience (e.g., government or private).

Reverse coded questions in the survey were analyzed to determine that sample participants were consistent in their responses and had not rushed to complete the survey. Since

all participants in the clean data sample were consistent in their survey responses, revised questions data were removed from the data set used for analysis (see Appendix O, survey questions 23, 24, 38, and 44).

IV.4.3 *Correlations with intent to adopt WtE*

Correlations were calculated for all variables, and their levels of significance indicated their strength as predictors of leader intentions to adopt WtE and their behavior to adopt WtE.

IV.5 Structural Equation Modeling (SEM)

Structural equation modeling (SEM) was employed in this study because of its ability to explore relationships between multiple latent (e.g., unobservable) and observable variables. SEM, a powerful statistical tool, has the ability to combine factor analysis and regression testing into one process (McKinnie, 2016). SEM encompasses two commonly used approaches in estimating relationships between variables: one covariance-based (CB-SEM) and one based on partial least squares (PLS-SEM) (Hair, Hult, Ringle, & Sarstedt, 2016). In general, CB-SEM is utilized to confirm or reject theory, whereas PLS-SEM is used to develop theories (Hair et al., 2016). In research, when testing and confirming theory, CB-SEM is the more suitable method; on the other hand, if the research goal is theory development and prediction, then PLS-SEM is more appropriate, as argued by Hair, Ringle, and Sarstedt (2011): "Overall, when measurement or model properties restrict the use of CB-SEM or when the emphasis is more on exploration than confirmation, PLS-SEM is an attractive alternative to CB-SEM and often more appropriate" (Hair et al., 2011, p. 140).

Due to the nature of this study, PLS-SEM was judged most suitable. Moreover, one of the most frequently cited reasons for using PLS-SEM in *MIS Quarterly* is its ability to handle small sample sizes, formatively measured latent variables, and non-normal data (Ringle,

Sarstedt, & Straub, 2012). PLS-SEM, which has the capacity to work with complex models having many structural variable relations, estimates path coefficients that maximize the R^2 values of constructs, (Hair et al., 2016). PLS-SEM handles both reflective and formative measurement models with ease, including single-item constructs with no identification complications (Hair et al., 2016). Thus, PLS-SEM is more likely to find a particular relationship significant when it is, in fact, significant in the population and with great statistical power (Hair et al., 2016).

Similarly, as stated by Ringle et al. (2012), this investigation preferred PLS-SEM specifically due to the small sample size involved and the formative measures employed in the study. Further, PLS-SEM was chosen since this research emphasized development or extension of current theory and not confirmation of theory (Hair et al., 2016). Specifically, this study extended the TRA model to identify the optimal predictor constructs through explanation of variance. Models are fit and the one that accounts for the most variance observed in the data that was accounted for. This mathematical relationship is assumed to be the one that best captures the relationship between the independent variables and the dependent variable. Also, adding to the suitability of PLS-SEM for use in this study was its capacity to easily incorporate formative measurement models, e.g., those composed of formative constructs in the research. For these reasons, PLS-SEM has rapidly gained in popularity amongst academics (Ringle et al., 2012).

V CHAPTER 5: DATA ANALYSIS AND RESULTS

This chapter presents the analyses conducted to explore the hypothesized relationships between attitude, intention, and behavior regarding adoption of WtE by Nigerian leadership and discusses the results of these analyses. The first section, 5.1, discuss characteristics of the survey respondents and present their descriptive statistics. Evaluations of the measurement model and the structural models are given in section 5.2; and results are presented section 5.3 of the moderator model. Section 5.4 provides a post-hoc analysis; section 5.5 the mediator model; section 5.6 mediator model analysis and results, and section 5.8 presents qualitative feedback results.

V.1 Descriptive Statistics

Descriptive statistical analyses were calculated and related histograms were generated using IBM SPSS version 24, and the statistics are reported in Table 2 and the histograms are given in Appendices L and M. Of the 239 people who initially participated in the Leadership Waste-to-Energy online survey, 184 comprised the final sample size after data cleaning as described above.

Table 2 provides the descriptive statistics of the sample, summery as follows: the sample was 67.0 percent male, and average age was 46.84 years. With respect to location, the majority, 48.9 percent, were geographically located in north Nigeria, with 84.2 percent living in cities with a population of one million or more. Of the other areas of Nigeria, 22.3 percent lived in the south of Nigeria, 16.8 percent in the west, and 12 percent in the east. For education level, 82.1 percent reported having a graduate degree or higher. Of economic sectors, government was the most commonly reported area of employment (60 percent), with the private sector the next most common at 36 percent. Percentiles of time (in years) in which a respondent had functioned in a

leadership position were fairly evenly distributed for ranges 6 to 10, 11 to 15, 16 to 20, and greater than 20; these percentiles ranged from 19.6 percent to 22.8 percent. The smallest percentile (12.5) had been in leadership five years or less.

With respect to renewable energy in general and WtE in particular, 92.4 percent reported at least some knowledge of RE and 89.1 percent reported at least some familiarity with WtE. For renewable energy, the sample mean was almost equivalent to "very knowledgeable" (M = 3.61, SD = 0.87), with 40.2 percent reporting themselves to be "very knowledgeable" and 15.2 percent "extremely knowledgeable." For WtE, 47.8 percent were "very familiar" and 11.4 percent "extremely familiar."

Table 2: Descriptive Statistics

Characteristics	Sample	Sample
Gender		
• Male	123	67
• Female	61	33
Total	184	100
Age		
• Mean (*SD*)	46.84	
• Median	(8.78)	
Geographic location		
• East	22	12.0
• West	31	16.8
• North	90	48.9
• South	41	22.3
Total	184	100
Location Population		
• A Major Metropolitan area (population over 2,000,000 people)	79	42.9
• City (between 1,000,000 to 2,000,000)	76	41.3
• A Small City (between 5,000,000 to 999,999)	21	11.4
• A Town area (between 100,000 and 499,999)	8	4.3
	184	100

Education level		
• Up to High School Degree	1	.5
• High School Degree	3	1.6
• Some College	3	1.6
• Undergraduate Degree	26	14.1
• Graduate degree or higher	151	82.1
Total	184	100
Leaders Experience in each sector (can be multiple)	111	60.3
• Experience as a leader in government sector	67	36.4
• Experience as a leader in private sector	38	20.7
• Experience as a leader in community sector (e.g. Pastor, Chief, Tribal, etc.	8	4.3
• Experience as a leader in military sector		

Characteristics	Sample *N*	Sample %
Years in a leadership role/position		
• 1 to 5 years	23	12.5
• 6 to 10 years	42	22.8
• 11 to 15 years	42	22.8
• 16 to 20 years	41	22.3
• Greater than 20 years	36	19.6
Total	184	100
How knowledgeable are you about Renewable Energy? (e.g. Solar, Wind, & WtE)		
• Not at all knowledgeable	3	1.6
• Not knowledgeable	11	6.0
• Somewhat knowledgeable	68	37.0
• Very knowledgeable	74	40.2
• Extremely knowledgeable	28	15.2
Total	184	100
How familiar are you with Waste-to-Energy (WtE)?		
• Not at all familiar	4	2.2
• Not familiar	16	8.7
• Somewhat familiar	55	29.9
• Very familiar	88	47.8
• Extremely familiar	21	11.4
Total	184	100

V.2 Evaluation of Measurement and Structural Model

Since PLS-SEM was selected as the analysis method for the study, a measurement model had to be deployed prior to analysis so that meaning could be derived from the results of the overall analysis (Bagozzi, 1981). Measurement modeling establishes relationships between indicators (e.g., observed variables) and constructs (e.g., latent, or unobserved, variables) and must be performed prior to structural modeling. Both the measurement model and the structural model were applied using SmartPLS v. 3.2.6 (Ringle, Wende, & Becker, 2015), a leading software tool for PLS-SEM that has assisted investigators in over 1,000 studies in the past two years (Ringle et al., 2015). The principal aim of PLS-SEM is maximization of the explained variance in a set of data through definition of endogenous constructs (Hulland, 1999). Moreover, Hulland (1999) states, "The degree to which any particular PLS model accomplishes this objective can be determined by examining the R^2 values for the dependent (endogenous) constructs" (p. 202).

V.2.1 *Reflective and Formative Constructs.*

A measurement model is composed of reflective and formative constructs (Hair et al., 2016). When using PLS-SEM, researchers frequently describe reflective constructs as Mode A and formative constructs as Mode B (Hair et al., 2011). Reflective constructs are interchangeable and highly correlated items, so that any single reflective construct item can be left out without changing the meaning of the construct. Expressed graphically, reflective mode is designated by arrows (indicating relationships) pointing from the construct to its observed indicators (Diamantopoulos, Riefler, & Roth, 2008; Hair et al., 2016,). In contrast, formative indicators are not interchangeable and may not be highly correlated, with arrows (relationships), pointing from the observed indicators to the corresponding latent construct(s) (Hair et al., 2016).

Related coefficients for formative indicators are called outer weights in PLS-SEM and are discussed in section 5.2.3.

In this model for this study, the five constructs are attitudes, subjective norms, intention, leadership-led, and behavior, and all were assumed to be formative since the corresponding indicators were not interchangeable, and removing an indicator would change the construct meaning and direction of causality (Jarvis, Mackenzie, & Podsakoff, 2003). Formative constructs can be correlated but are not required to be so (Jarvis, Mackenzie, & Podsakoff, 2003).

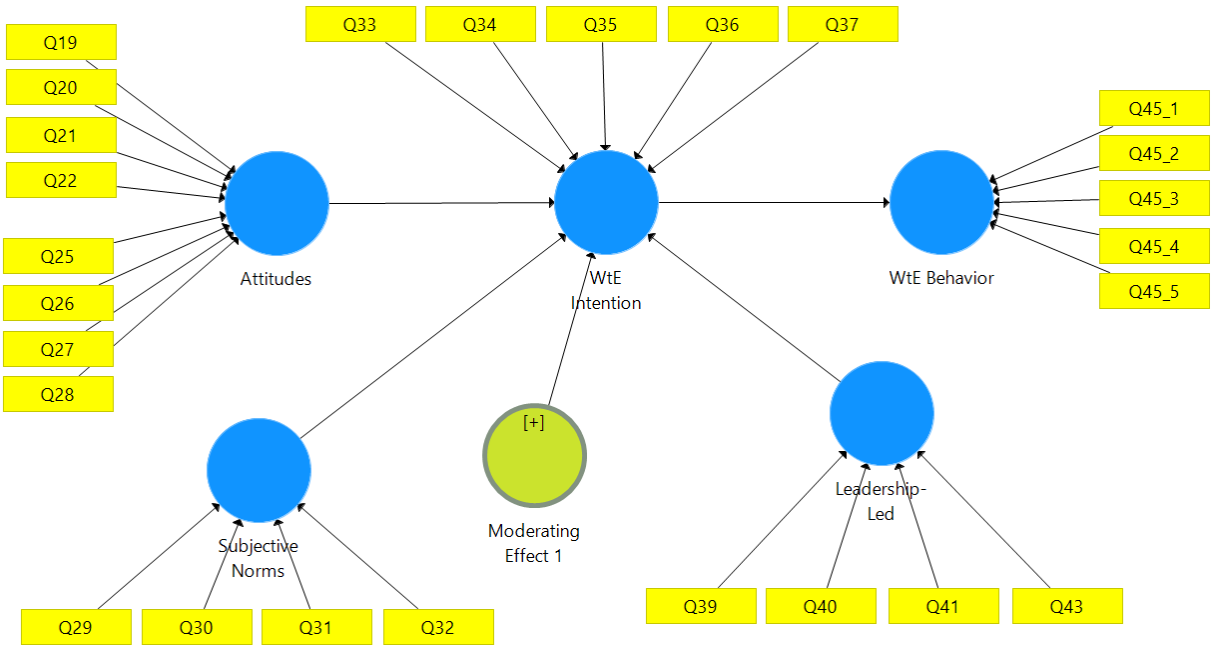
The attitude construct is comprised of beliefs and evaluations and is based on Fishbein and Ajzen's (2011) TRA model. Since attitudes include beliefs and evaluations, the attitude construct is formative, since the associated indicators are not interchangeable. Like attitudes, subjective norms are composed of normative beliefs and motivation to comply, thus making subjective norms a formative construct as well. In the subsequent analyses, all model constructs were assumed to be formative.

V.2.2 *Moderation effects in the PSL-SEM model.*

Leadership-led change is hypothesized to act as a moderator of the relationship between attitudes toward WtE and intention to adopt WtE, where a moderator variable influences the strength and direction of the relationship between the independent variable and a dependent variable (Baron & Kenny, 1986). Thus, a moderator affects the nature of the relationship between two other variables, without necessarily being correlated with either of them (Howell, Dorfman, & Kerr, 1986). Further, Hair et al. (2016) state that a moderator affects the strength of a relationship between two latent constructs. The purpose of this research was to see if the leadership-led change constructs by Andrews et al. (2010) has a moderating effect on attitudes

(TRA) of leaders and leaders' intention to adopt WtE. Figure 16 illustrates the PLS Moderator Measurement Model.

Figure 16: PLS-SEM Moderation Model



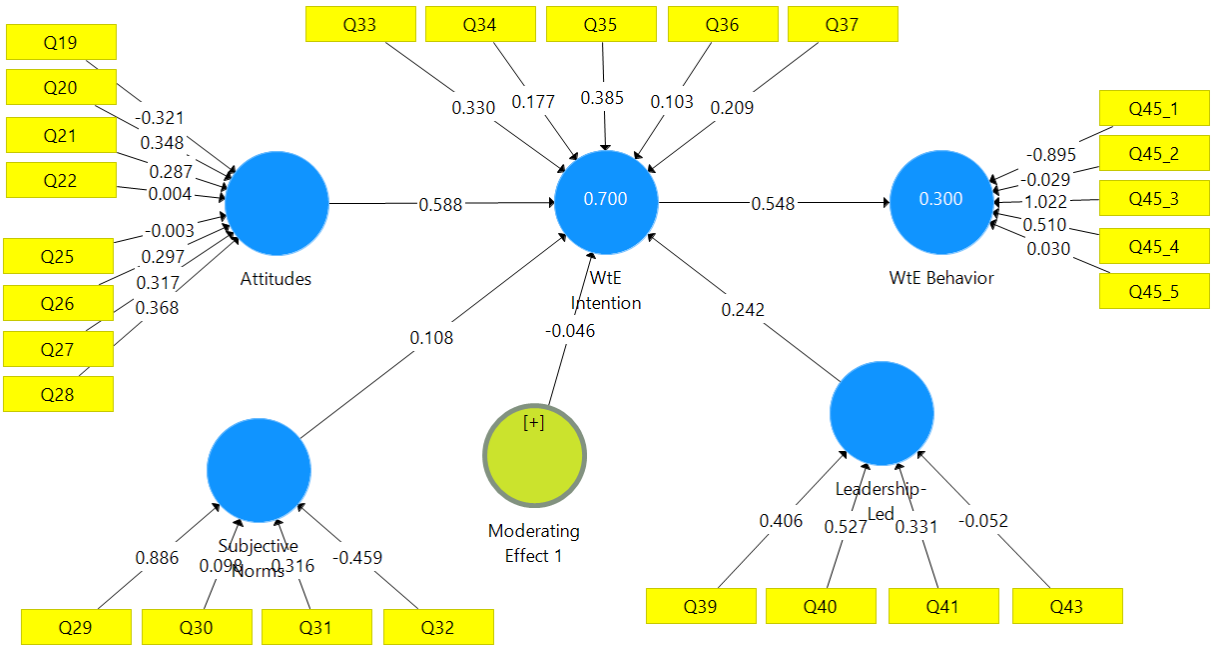
Moderator-effect results can provide insight into whether leadership-led gives strength and direction to leaders' intention to adopt Waste-to-Energy as a solution to Nigeria's energy and pollution issues. PLS-SEM provides the ability to test for a moderating effect in the model, where the dependent variable is intention, the independent variable is attitude, and the moderator variable is leadership-led. Moderator-effect results are reviewed in section 5.5.

V.2.3 *Measurement Model*

The measurement model, also referred to as outer model, was measured for collinearity, relative contribution, and significance in PLS-SEM. The PLS algorithm encompasses a series of regressions in terms of weight vectors. As shown by Dijkstra (2010), the weight vectors formed at convergence are able to satisfy fixed point equations. In evaluating the moderator formative

model, a PLS algorithm was employed to calculate the parameters as follows: path weighting of maximum 300 iterations and convergence set with a stop criterion value of 10^7. Figure 17 shows the PLS-SEM Moderator Measure Model after the PLS algorithm has been applied.

Figure 17: PLS-SEM Moderation Model Estimated Parameters



Evaluation of the measurement model is based on assessing model multicollinearity, relative contribution of variables, and significance of formative indicators (McKinnie, 2016). The first step in evaluation of the formative measurement model is assessing the variance inflation factor (VIF), which evaluates the severity of collinearity among the formative indicators (Hair et al., 2016). In PLS-SEM, indicators with estimated VIF values larger than 5 imply possible collinearity problems, and consideration should be given to removing them (Hair et al., 2011). In this formative measurement model, construct indicator VIFs of attitudes, subjective norms, leadership-led, intention, and behavior was < 3.3, signifying that collinearity between indicators did not reach critical levels (Diamantopoulos & Siguaw, 2006; Nunnally, 1978). See Table 3 for collinearity results.

Table 3: Measurement Model Outer VIF Values

	VIF
Attitudes * Leadership-Led	1
Q19	2.779
Q20	2.635
Q21	2.347
Q22	2.66
Q25	1.794
Q26	2.172
Q27	2.103
Q28	2.348
Q29	1.845
Q30	2.083
Q31	2.391
Q32	2.163
Q33	2.408
Q34	2.17
Q35	1.844
Q36	2.545
Q37	2.692
Q39	1.459
Q40	1.506
Q41	1.6
Q43	1.327
Q45_1	2.542
Q45_2	2.866
Q45_3	2.657
Q45_4	2.188
Q45_5	2.275

An evaluation of the formative measurement model at the item level can be performed by looking at outer weights of the formative measurement model. Indicators to constructs in the formative measurement models are evaluated by assessing the outer weights and should be analyzed for their significance when collinearity is not at critical level (Hair et al., 2016). See results of outer weights in Table 4 and Table 5. The PLS algorithm was calculated, and Table 4

shows the actual items with their weights. Table 5, after bootstrapping, shows constructs to items and shows if they are significant or not.

Table 4: Measurement Model Outer Weights

	Attitudes	Leadership-Led	Moderating Effect 1	Subjective Norms	WtE Behavior	WtE Intention
Attitudes * Leadership-Led			1			
Q19	-0.321					
Q20	0.348					
Q21	0.287					
Q22	0.004					
Q25	-0.003					
Q26	0.297					
Q27	0.317					
Q28	0.368					
Q29				0.886		
Q30				0.098		
Q31				0.316		
Q32				-0.459		
Q33						0.33
Q34						0.177
Q35						0.385
Q36						0.103
Q37						0.209
Q39		0.406				
Q40		0.527				
Q41		0.331				
Q43		-0.052				
Q45_1					-0.895	
Q45_2					-0.029	
Q45_3					1.022	
Q45_4					0.51	
Q45_5					0.03	

Table 5- Measurement Model Outer Weights

	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (*SD*)	*t* -Statistics (|O/STDEV|)	*p* -Values	Signifiance level
Attitudes * Leadership-Led <- Moderating Effect 1	1	1	0	0	p<.001	***
Q19 <- Attitudes	0.132	0.13	0.018	7.222	p<.001	***
Q20 <- Attitudes	0.167	0.168	0.026	6.434	p<.001	***
Q21 <- Attitudes	0.157	0.152	0.016	9.909	p<.001	***
Q22 <- Attitudes	0.178	0.177	0.016	11.218	p<.001	***
Q25 <- Attitudes	0.139	0.141	0.026	5.358	p<.001	***
Q26 <- Attitudes	0.201	0.203	0.028	7.188	p<.001	***
Q27 <- Attitudes	0.21	0.211	0.027	7.768	p<.001	***
Q28 <- Attitudes	0.189	0.187	0.02	9.415	p<.001	***
Q29 <- Subjective Norms	0.535	0.543	0.102	5.266	p<.001	***
Q30 <- Subjective Norms	0.395	0.396	0.07	5.658	p<.001	***
Q31 <- Subjective Norms	0.217	0.192	0.086	2.509	0.012	**
Q32 <- Subjective Norms	0.053	0.028	0.109	0.48	0.631	NS
Q33 <- WtE Intention	0.271	0.267	0.021	13.159	p<.001	***
Q34 <- WtE Intention	0.238	0.236	0.019	12.668	p<.001	***
Q35 <- WtE Intention	0.246	0.242	0.028	8.837	p<.001	***
Q36 <- WtE Intention	0.225	0.228	0.031	7.231	p<.001	***
Q37 <- WtE Intention	0.236	0.235	0.016	14.791	p<.001	***
Q39 <- Leadership-Led	0.388	0.388	0.048	8.077	p<.001	***
Q40 <- Leadership-Led	0.422	0.421	0.044	9.564	p<.001	***
Q41 <- Leadership-Led	0.348	0.348	0.039	8.954	p<.001	***
Q43 <- Leadership-Led	0.156	0.148	0.048	3.267	0.001	***
Q45_1 <- WtE Behavior	0.049	0.037	0.087	0.562	0.574	NS
Q45_2 <- WtE Behavior	0.215	0.217	0.043	4.979	p<.001	***
Q45_3 <- WtE Behavior	0.384	0.399	0.062	6.167	p<.001	***
Q45_4 <- WtE Behavior	0.342	0.353	0.068	5.057	p<.001	***
Q45_5 <- WtE Behavior	0.179	0.176	0.063	2.845	0.005	***

Note: Based on t-values, 1-tail
NS = not signifant
****p<.01; **p<.05, *p<.10*

Next in evaluation of the measurement model was an analysis of the construct indicators' statistical significance and relevance. In PLS-SEM, bootstrapping is a nonparametric method that permits testing the statistical significance of various PLS-SEM results such as path coefficients and R^2 values (Davison & Hinkley, 1997; Efron & Tibshirani, 1993). In this method, a large number of subsamples are drawn randomly from the original sample data, and the subsamples are then used to estimate the PLS path model. This process is then reiterated until a large number of random subsamples are created (Hair et al., 2016). Bootstrap subsamples allow estimation of the model, and so make estimating standard errors of the results possible.

Having standard error estimates allows computation of *t*-values, *p*-values, and confidence intervals so as to assess statistical significance of results. In this study, 500 subsamples were constructed, no sign changes, and confidence intervals set to bias-corrected and accelerated (BCa) bootstrap for a two-tailed test at a 5% significance level. Table 6 reports the results for the formative indicators at the 5% significance level.

Table 6: Measurement Model, t-Statistics and p-Values

	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (*SD*)	*t*- Statistics (|O/STDEV|)	*p* - Values
Attitudes * Leadership-Led <- Moderating Effect 1	1	1	0		
Q19 -> Attitudes	-0.321	-0.274	0.172	1.866	0.063
Q20 -> Attitudes	0.348	0.299	0.18	1.938	0.053
Q21 -> Attitudes	0.287	0.245	0.12	2.398	0.017
Q22 -> Attitudes	0.004	0.082	0.151	0.024	0.981
Q25 -> Attitudes	-0.003	0.011	0.139	0.024	0.981
Q26 -> Attitudes	0.297	0.246	0.142	2.086	0.038
Q27 -> Attitudes	0.317	0.294	0.104	3.046	0.002
Q28 -> Attitudes	0.368	0.364	0.136	2.698	0.007
Q29 -> Subjective Norms	0.886	0.816	0.273	3.251	0.001
Q30 -> Subjective Norms	0.098	0.117	0.353	0.279	0.781
Q31 -> Subjective Norms	0.316	0.295	0.247	1.28	0.201
Q32 -> Subjective Norms	-0.459	-0.421	0.227	2.023	0.044
Q33 -> WtE Intention	0.33	0.277	0.191	1.726	0.085
Q34 -> WtE Intention	0.177	0.186	0.151	1.175	0.24
Q35 -> WtE Intention	0.385	0.377	0.144	2.669	0.008
Q36 -> WtE Intention	0.103	0.151	0.184	0.557	0.578
Q37 -> WtE Intention	0.209	0.175	0.119	1.757	0.08
Q39 -> Leadership-Led	0.406	0.364	0.148	2.747	0.006
Q40 -> Leadership-Led	0.527	0.519	0.106	4.99	p<0.001
Q41 -> Leadership-Led	0.331	0.352	0.106	3.134	0.002
Q43 -> Leadership-Led	-0.052	-0.043	0.117	0.445	0.657
Q45_1 -> WtE Behavior	-0.895	-0.822	0.295	3.036	0.003
Q45_2 -> WtE Behavior	-0.029	-0.013	0.196	0.147	0.883
Q45_3 -> WtE Behavior	1.022	1.008	0.211	4.854	p<0.001
Q45_4 -> WtE Behavior	0.51	0.493	0.187	2.733	0.007
Q45_5 -> WtE Behavior	0.03	-0.023	0.224	0.134	0.893

V.2.4 *Structural Model.*

After evaluation of the measure model as described above in section 5.4.3, an analysis was executed on the structural model, typically referred to as the inner model, to assess collinearity among constructs, measure significance and relevance of model relationships, and estimate R^2 and overall predictive ability. It is important to note that, in contrast to CB-SEM,

PLS-SEM fits the structural model to the sample data to obtain the best parameter estimates by maximizing the explained variance of the endogenous latent variables. PLS-SEM enables analysis of the measure or structural model of all hypothesized latent variable correlations, whether exogenous or endogenous (McKinnie, 2016).

A confirmatory tetrad analysis (CTA), described by Gudergan, Ringle, Wende, and Will (2008), is a statistical analysis that allows of the measurement model to see if measures should be reflective or formative (Hair et al., 2016). Gudergan et al. (2008) describe the CTA procedure, which requires at least four manifest variables per construct, in detail. The CTA was conducted with subsamples of 5000, and a two-tailed test was performed at a 5% significance level to evaluate the formative constructs; as in Appendix C reports these results. At least one of the items has to be significant to be considered formative, as can be seen in Appendix C, (e.g. 85: Q19, Q22, Q26, Q27 p= 0.038; 121: Q20, Q21, Q25, Q27 p=0.009), showing that the constructs were significant at the 5% level therefore supporting the formative modeling of items.

Latent variables correlations are presented in Table 7. Correlations of 0.5 or higher indicate a high level of correlation; 0.1 or less, low correlation; and values between 0.1 and 0.5 medium correlation (Cohen, 1988). Latent variable correlations of 0.5 and higher (e.g., large positive) were obtained:

- Attitudes and intention have a large positive correlation at 0.804.
- Attitudes and leadership-led have a large positive correlation of 0.684
- Attitudes and behavior have large positive correlation of 0.535
- Leadership-led and intention have a large positive correlation at 0.695.
- Behavior and Intention have a strong positive correlation of 0.548.

Attitude has the most relationships amongst the constructs.

Table 7: Latent Variable Correlations

	Attitudes	Leadership-Led	Moderating Effect 1	Subjective Norms	WtE Behavior	WtE Intention
Attitudes	1					
Leadership-Led	0.684	1				
Moderating Effect 1	-0.21	-0.051	1			
Subjective Norms	0.344	0.438	-0.129	1		
WtE Intention	0.804	0.695	-0.215	0.425	0.548	1
WtE Behavior	0.535	0.456	-0.264	0.401	1	

The next step in evaluating the structural model was assessing the variance inflation factor (VIF). This test done for checking if the formative constructs are different from each other. Similar measures are applied as in the formative measurement model, and constructs having VIFs greater than 5.0 should be removed.

Table 8 displays all constructs for which VIF < 5.0, indicating no significant evidence of multicollinearity.

Table 8: Structural Model Inner VIF Values

	WtE Behavior	WtE Intention
Attitudes		1.998
Leadership-Led		2.112
Moderating Effect 1		1.076
Subjective Norms		1.258
WtE Behavior		
WtE Intention	1	

Next in the structural model is establishing the relationships (paths) between the latent constructs as indicated by the coefficients shown in Table 9 (and also can be seen in Figure 17, which highlights tables 9–12). Structural model path coefficients are analyzed for significance, with standardized values of path coefficients ranging from -1 and +1. Estimates near zero display a relatively weaker relationship (Hair et al., 2016). As seen in Table 9, attitude has the

highest effect on intention (0.588), followed by leadership (0.242), with subjective norms (.108) coming in third.

Table 9: Structural Model Path Coefficient (Direct)

	WtE Behavior	WtE Intention
Attitudes		0.588
Leadership-Led		0.242
Moderating Effect 1		-0.046
Subjective Norms		0.108
WtE Behavior		
WtE Intention	0.548	

Indirect effect and total effects, shown in Table 10 and Table 11, respectively, provide the model's path analyses. As seen in Table 10, the indirect effect of attitude on behavior by way of intention is significant at $p < 0.001$ and of leadership-led on behavior by way of intention is significant at the .05 level. The moderator variable and subjective norms had no impact at the 0.05 level.

Table 10: Structural Model Indirect Effect

	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (*SD*)	*t*-Statistics (|O/STDEV|)	*p*- Values
Attitudes -> WtE Behavior	0.322	0.356	0.066	4.876	p <0.001
Attitudes -> WtE Intention					
Leadership-Led -> WtE Behavior	0.132	0.145	0.043	3.059	0.002
Leadership-Led -> WtE Intention					
Moderating Effect 1 -> WtE Behavior	-0.025	-0.029	0.024	1.027	0.305
Moderating Effect 1 -> WtE Intention					
Subjective Norms -> WtE Behavior	0.059	0.049	0.034	1.729	0.084
Subjective Norms -> WtE Intention					
WtE Intention -> WtE Behavior					

Table 11 shows the results for the structural model's total effects.

Table 11: Structural Model Total Effects

	WtE Behavior	WtE Intention
Attitudes	0.322	0.588
Leadership-Led	0.132	0.242
Moderating Effect 1	-0.025	-0.046
Subjective Norms	0.059	0.108
WtE Behavior		
WtE Intention	0.548	

Table 12 provides the statistics related to the bootstrap procedure, which found that WtE attitudes and leadership-led constructs are direct predictors of WtE intention with statistically significant *p*-values less than 0.05. The subjective norm construct also has a positive relationship with WtE intention, with an estimated coefficient near high significance (*p*-value = 0.059). WtE intention was found to be a strong positive indicator of WtE behavior with a *p*-value less than 0.001.

Table 12: Structural Model p-Values and t-Statistics

	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (*SD*)	*t*- Statistics (|O/STDEV|)	*p*- Values	
Attitudes -> WtE Intention	0.588	0.61	0.075	7.811	*p* <0.001	***
Leadership-Led -> WtE Intention	0.242	0.251	0.076	3.167	0.002	***
Moderating Effect 1 -> WtE Intention	-0.046	-0.049	0.044	1.046	0.296	NS
Subjective Norms -> WtE Intention	0.108	0.083	0.057	1.892	0.059	*
WtE Intention -> WtE Behavior	0.548	0.583	0.075	7.308	*p* <0.001	***

Note: Based on t-values, 1-tail
NS = Not Signiant
****p<.01; **p<.05, *p<.10*

The PLS-SEM approach was created primarily for prediction purposes (Hair et al., 2016). In the structural model, R^2 values signify the amount of explained variance of the endogenous constructs and range from zero to one with greater levels predicting accuracy (Hair et al., 2016). In marketing research, $R^2 > 0.75$ indicates that a model accounts for a substantial amount of the variability observed in the data whereas $R^2 < 0.25$ indicates that it explains a relatively small amount of the variability observable in the data and so is a weak model. R^2 values around 0.5

indicate that the model accounts for a moderate amount of the variability observed (Hair et al., 2016).

The R^2 values for the endogenous latent variables are reported in Table 13. The constructs attitude and subject norms explain 70% of the variability observed in data for the intention construct. The independent variables explain just 30% of variability observed for behavior.

Table 13: Structural Model R^2 (Moderator)

	R^2	R^2 Adjusted
WtE Behavior	0.3	0.296
WtE Intention	0.7	0.694

V.2.5 *Blindfolding.*

Stone-Geisser's Q^2 value was employed to measure the model's predictive relevance (Hair et al., 2016). Q^2 values, which are estimated by the blindfolding procedure, were conducted for the PLS-SEM in this study. These signify how well the path model is able to predict the originally observed values (Hair et al., 2016). Q^2 can be calculated by two methods: cross-validated redundancy and cross-validated communality (Hair et al., 2016). The cross-validated redundancy approach fits this study's overall PLS-SEM model, since it builds on path model estimates of both the measurement and structural model predictions (Hair et al., 2016).

Endogenous constructs have predictive significance for other endogenous constructs, and its level of significance is measured by Q^2 values greater than 0 (Hair et al., 2016). More specifically, Q^2 values around 0.02, 0.15, and 0.35 suggest small, medium, and large (respectively) predictive relevance for a specified endogenous construct (Hair et al., 2016). In this study, blindfolding was performed to measure the models predictive relevance for the PLS-

SEM, and the Q^2 values for intention indicated large predictive power ($Q^2 = 0.394$). Behavior, the only other construct having a non-zero Q^2, had one indicating small predictive power (0.05), as shown in Table 14.

Table 14: Construct Cross-Validated Redundancy (Blindfolding)

	Q^2 (=1-SSE/SSO)
WtE Intention	0.394
WtE Behavior	0.049

V.3 Moderation Model Summery

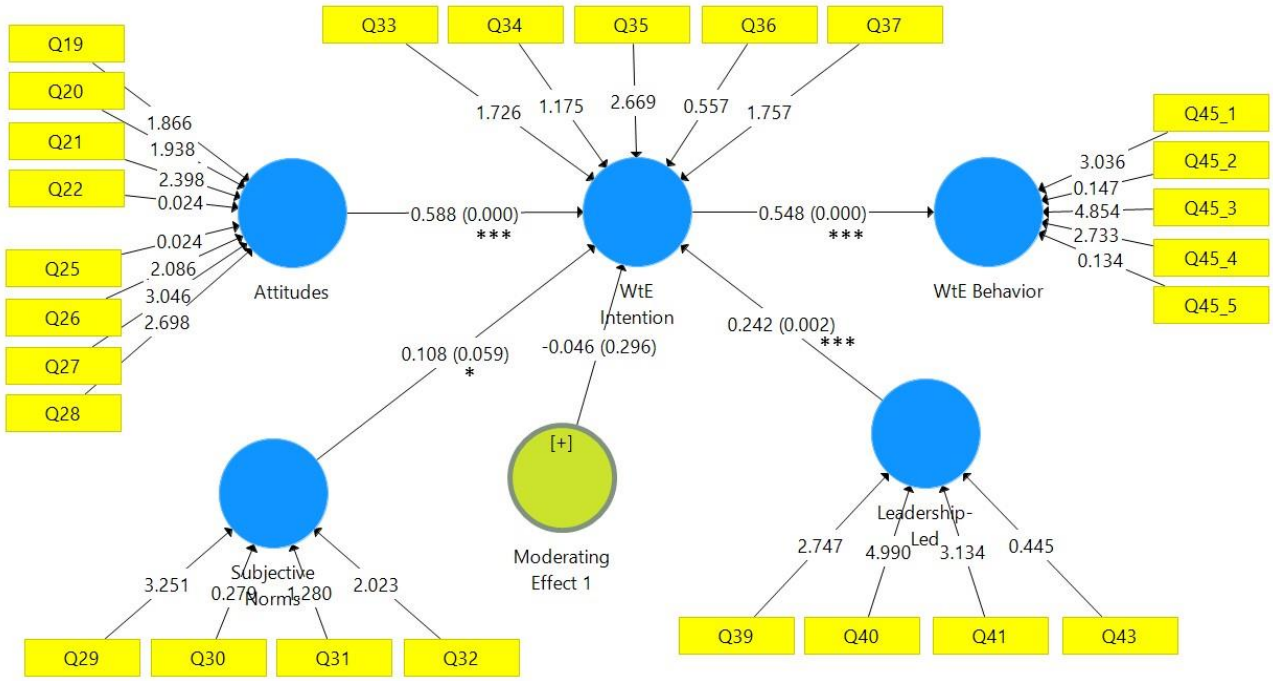
The overall model was statistically significant, with results supporting two of the four hypotheses, as shown in Table 15. Figure 18 shows the PLS-SEM moderator model and its estimated beta and *p*-values (see Appendix E for estimated PLS-SEM moderator model and its estimated beta and *t*-statistics). Based on the path coefficients, the primary driver for WtE adaption among study respondents was the path leader attitude to intention to adopt WtE

According to the results, leaders with strong positive attitudes about WtE will have strong positive intentions to adopt WtE (H1). At p-value < 0.001, total effects of .588 validated the beta (0.588) for attitude to intention. Leaders having strong positive intentions to adopt WtE are very likely to adopt WtE (H3). Total effects confirmed the beta (0.588) and p-value < 0.001 for leader intention to adopt to behavior to adopt WtE. According to the results, attitude, subjective norms, and leadership-led change explain 70% ($R^2 = 0.70$) of the variability observed in the data with respect to intention to adopt WtE. WtE intention explains 30% ($R^2 = 0.30$) of the variance observed with respect to behavior to adopt WtE.

The results did not support the hypothesis that strong leader subjective norms were a positive driver of intention to adopt WtE among participants (H2). Additionally, results did not

support the hypothesis that leadership-led change had a moderating effect on the relationship between leader attitude and intention to adopt WtE (H4).

Figure 18: PLS-SEM Moderator Model with Beta and p-Values



****p*<.01; ***p*<.05, **p*<.10

Table 15: Levels of Support of Study Hypotheses

H#	Hyphothesis	
H1	Leaders with stronger attitudes about WtE will have a stronger intention to adopt WtE.	Supported ***
H2	Leaders with stronger subjective norms about WtE will have stronger intention to adopt WtE.	*
H3	Leaders who have stronger intentions to adopt WtE will have a positively predict leaders' behaviors to adopt WtE.	Supported ***
H4	Leadership-led change moderates the relationship between leaders' attitudes on WtE and their intention to adopt WtE.	NS

Note:

NS = not significant

***p<.01; **p<.05, *p<.10

That the results did not show the moderator model as having statistical significance led us to perform a post hoc investigation of mediation, as discussed in section 5.6 below.

V.4 Post-Hoc (Mediation Analysis)

As stated above, the moderator relationship of leadership-led change and intention to implement WtE was found to have no statistical significance. We interpret the construct leadership-led change to, in general, encompass the mechanics of adopting WtE—the leader having the authority and ability to achieve its implementation and the stature to successfully advocate for its acceptance among subordinates. It would appear that, along with positive attitudes toward WtE, leaders' views of themselves as having the capability to translate these positive attitudes into the real world would strengthen their intention to adopt. Thus, the finding that leadership-led change lacked statistical significance as a moderator of intention to adopt was somewhat a surprising result.

A possible explanation may rest in the criteria employed to select these participants. In effect, they were chosen because they possessed the capabilities encompassed by the construct leadership-led change. Thus, implicit in their evaluation of intention to implement was a view of themselves as possessing the capabilities inherent in leadership-led change. The construct did not show as statistically significant, therefore, because it was implicitly included in attitude. This was somewhat of a surprise since leadership-led change was initially hypothesized to have a moderating effect between attitudes and subjective norms and intention to adopt WtE

In order to further explore this issue and the relationships between the constructs attitude, intentions, behaviors, and leadership-led change, a post-hoc analysis was performed in which leadership-led change acted as a mediator between attitudes and intention to adopt WtE. Recognizing that leadership plays an important role in adoption of WtE in Nigeria, this research

investigated further channels through which leadership can affect attitudes toward WtE and intention to adopt WtE. Previous literature on leadership as a mediator construct to a behavior construct supports this research for further analysis to be performed (Yousef, 2000). Wang, Law, Hackett, Wang, and Chen (2005) examined how leadership mediated between performance and behavior. In line with these two previous studies, this study also explored leadership-led change as a mediator effect on attitudes and intentions to adopt WtE.

The model was thus restructured with leadership-led change acting as a mediator between attitudes and intention to adopt WtE, and the sections below discuss the results of this mediating model, including an evaluation of the measurement and structural models; the Sobel test performed to measure the mediating effect; the Preacher and Hays bootstrapped test of mediation, as recommended by PLS-SEM (Hair et al, 2016); and results. Testing for reliability and validity of the formative measurement and structural models (Thongrattana, 2010) will also be performed as described in section 5.7, without, as described in section 5.4 with respect to testing legitimacy of measures, restating reasoning for each validity test."

V.5 The Mediator Model

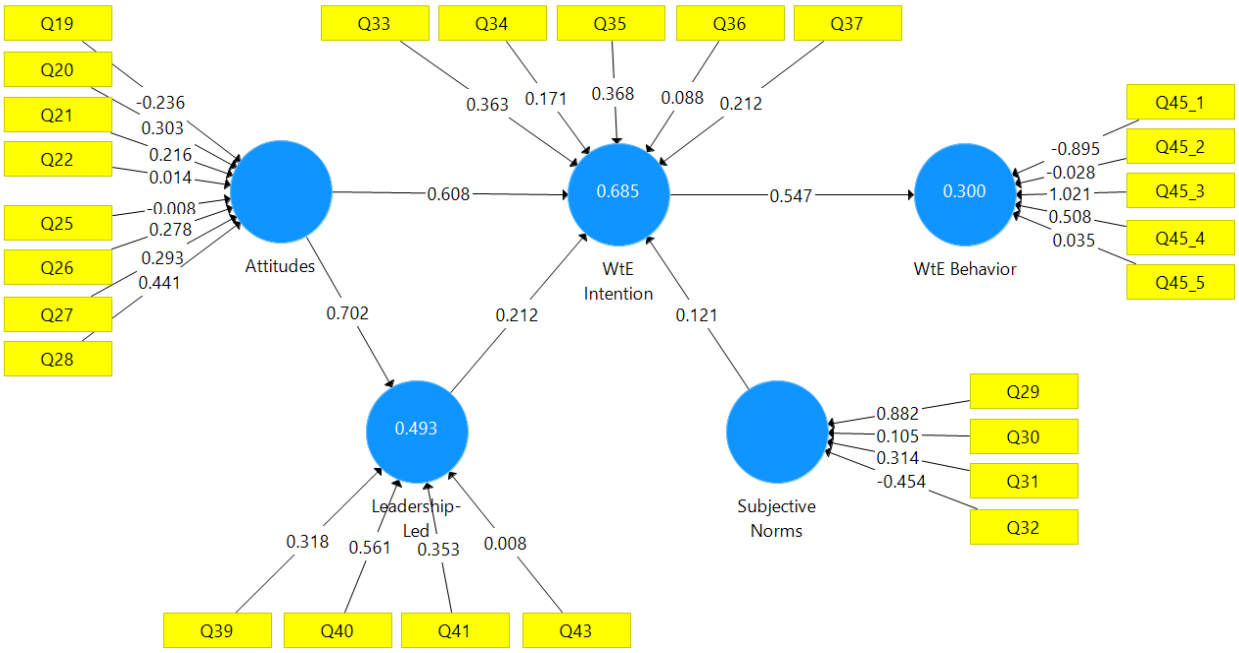
V.5.1 *Measurement Model*

As a mediator, leadership-led change was assumed to account for the relation between a predictor and a criterion or between two constructs (Baron & Kenny, 1986), in this case, between attitude with respect to WtE and intention to adopt WtE. As stated previously, the failure of leadership-led change to achieve statistical significance as a moderator of intention led us to hypothesize that what this construct represents, e.g., the capability of the leader respondents to achieve successful implementation of WtE, was present implicitly in their attitude toward WtE. The post-hoc investigation was thus an attempt clarify this relationship by explicitly

differentiating between leadership-led change and attitude as determinants of intention to implement.

Leadership-led change was thus incorporated into the model as shown in Figure 19 below, and PLS-SEM was again employed to test for strength of the relationships in this modified model. As can be seen in Figure. 19, the PLS-SEM mediator model now displays two distinct indicator and construct paths from attitude to intention, one direct and one encompassing leadership-led change.

Figure 19: PLS-SEM Mediation Model (Calculated)



A Confirmatory Tetrad Analysis (CTA), described by Gudergan et al. (2008), was conducted with subsamples of 5000, and a two-tailed test was performed at the 5% significance level to test the results of the formative constructs (see Appendices C and D). For this procedure, at least four manifest variables per construct are needed.

As explained above, the PLS algorithm is a series of regressions designed to generate weight vectors that satisfy fixed point equations (Dijkstra, 2010). In evaluating the moderator formative model, a PLS algorithm was employed to calculate the parameters as follows: path weighting of a maximum of 300 iterations with convergence set at a stop criterion value of 10^{7}. **Error! Reference source not found.**19 shows the PLS-SEM moderator model after the PLS a lgorithm was applied.

V.5.2 *Results of Mediation*

The following section looks at the results of the study when leadership-led change construct is treated as a mediator through which attitudes impacts intention to adopt WtE.

V.5.2.1 Correlations of the Structural Model (Mediator).

As discussed above in section 5.2.4, Table 16 reports the correlations of the latent variables, with 0.5 or greater indicating strong correlation, 0.1 or less low correlation, and 0.3 to 0.5 medium correlation (Cohen, 1988). Attitude had the highest number of relationships amongst the constructs. The constructs with strong positive correlations were the following:

- Attitude and intention had a strong positive correlation at 0.8.
- Attitude and leadership-led change had a positive correlation of 0.702.
- Attitude and behavior had a strong positive correlation of 0.543.
- Leadership-led change and intention had a strong positive correlation at 0.692.
- Behavior and intention had a strong positive correlation of 0.547.

Table 16: Latent Variable Correlations (Mediator)

	Attitudes	Leadership-Led	Subjective Norms	WtE Behavior	WtE Intention
Attitudes	1				
Leadership-Led	0.702	1			
Subjective Norms	0.353	0.437	1		
WtE Intention	0.80	0.692	0.428	0.547	1
WtE Behavior	0.543	0.461	0.4	1	

V.5.2.2 Path coefficients (direct effect), indirect effects, and total effects.

Table 17 below displays the two-way coefficients generated during the structural model fit of PLS-SEM. These are associated with the model's latent variables and measure the relationship between the two constructs. As described above, structural model path coefficients are analyzed for the significance and relevance. Standardized values of path coefficients range from -1 and +1, with estimates that are close to zero displaying a weak relationship between the two latent variables (Hair et al., 2016).

Table 17: Mediation Structure Model Path Coefficient (Direct Effect)

	Leadership-Led	WtE Behavior	WtE Intention
Attitudes	0.702		0.608
Leadership-Led			0.212
Subjective Norms			0.121
WtE Behavior			
WtE Intention		0.547	

Results associated with indirect effects, e.g., relationships among constructs with at least one intervening construct, are shown in Table 18. See Appendix B for the significance table for these indirect effects.

Table 18: Mediation Structural Model Indirect Effect

	Attitudes	Leadership-Led	Subjective Norms	WtE Behavior	WtE Intention
Attitudes	0	0	0	0.414	0.149
Leadership-Led	0	0	0	0.116	0
Subjective Norms	0	0	0	0.066	0
WtE Behavior	0	0	0	0	0
WtE Intention	0	0	0	0	0

Table 19 displays the table showing the total effects, e.g., the sum of the direct effects and indirect effects via the mediating construct leadership-led change. Note that attitude has a pronounced effect on WtE intention (0.757). Leadership-led to attitudes has a high effect (0.702). The attitudes value explains WtE intention at the higher level amongst the constructs, and similarly for WtE behavior.

Table 19: Mediator Structural Model Total Effects

	Leadership-Led	WtE Behavior	WtE Intention
Attitudes	0.702	0.414	0.757
Leadership-Led		0.116	0.212
Subjective Norms		0.066	0.121
WtE Behavior			
WtE Intention		0.547	

Table 20 show this formative mediator structural model, construct indicators for attitude, subjective norms, leadership-led change, intention, and behavior have VIFs < 3.3, signifying that collinearity between indicators did not reach critical levels (Diamantopoulos & Siguaw, 2006; Nunnally, 1978).

Table 20: Structural Model Inner VIF Values

	Leadership-Led	WtE Behavior	WtE Intention
Attitudes	1		1.983
Leadership-Led			2.147
Subjective Norms			1.242
WtE Behavior			
WtE Intention		1	

Table 21 reports the results of the structural model bootstrap analysis. The attitude construct was found to be a direct predictor of WtE intention with a statistically significant *p*-value <.0.001. The leadership-led change mediator construct had a positive mediating effect with *p*-value < 0.001. Although the subjective norms construct also had a positive relationship

with WtE intention, its estimated coefficient was near significance (*p*-value = 0.059). WtE intentions was found to be a strong positive indicator for WtE Behavior with a *p*-values less than 0.001

As stated in section 5.5, in the structural model, R^2 values signifies the amount of explained variance of the endogenous constructs. The constructs attitudes, subject norms, and leadership-led explains 69% of variance of intention. The construct intention explains 30% of variance in behavior, which both R^2 report in Table 22.

Table 21: Mediation Structural Model p-Value and t-Statistics

	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (*SD*)	*t*- Statistics (|O/STDEV|)	*p*- Values	
Attitudes -> Leadership-Led	0.702	0.715	0.045	15.574	*p* <0.001	***
Attitudes -> WtE Intention	0.608	0.634	0.083	7.357	*p* <0.001	***
Leadership-Led -> WtE Intention	0.212	0.203	0.08	2.642	0.008	***
Subjective Norms -> WtE Intention	0.121	0.115	0.06	2.01	0.058	*
WtE Intention -> WtE Behavior	0.547	0.586	0.079	6.954	*p* <0.001	***

Note: Based on t-values, 1-tail
NS = Not Signiant
****p<.01; **p<.05, *p<.10*

Table 22: Mediation Structural Model R^2

	R^2	R^2 Adjusted
Leadership-Led	0.493	0.49
WtE Behavior	0.30	0.296
WtE Intention	0.685	0.68

V.5.3 *Blindfolding for Mediator*

Stone-Geisser's Q^2 value was employed to measure the model's predictive relevance (Hair et al., 2016). Q^2 values, which are estimated by the blindfolding procedure, were conducted for the PLS-SEM in this study. These signify how well the path model is able to predict the originally observed values (Hair et al., 2016). Q^2 can be calculated by two methods, cross-validated redundancy and cross-validated communality (Hair et al., 2016). The cross-

validated redundancy approach fits this study's overall PLS-SEM model, since it builds on path model estimates of both the measurement and structural model predictions (Hair et al., 2016).

Endogenous constructs have predictive significance for other endogenous constructs, and its level of significance is measured by Q^2 values greater than 0 (Hair et al., 2016). More specifically, Q^2 values around 0.02, 0.15, and 0.35 suggest small, medium, and large (respectively) predictive relevance for a specified endogenous construct (Hair et al., 2016).

In this study, blindfolding was calculated in PLS-SEM, and Q^2 values resulted from large intention (Q^2 = 0.395), medium leadership-led at Q^2 = 0.224, and small Behavior at 0.05, the results of which are shown for the blindfolding test in PLS in Table 23. A note, the mediator model shows slightly better Q^2 values than the moderator model.

Table 23: Construct Cross-Validated Redundancy (Blindfolding)

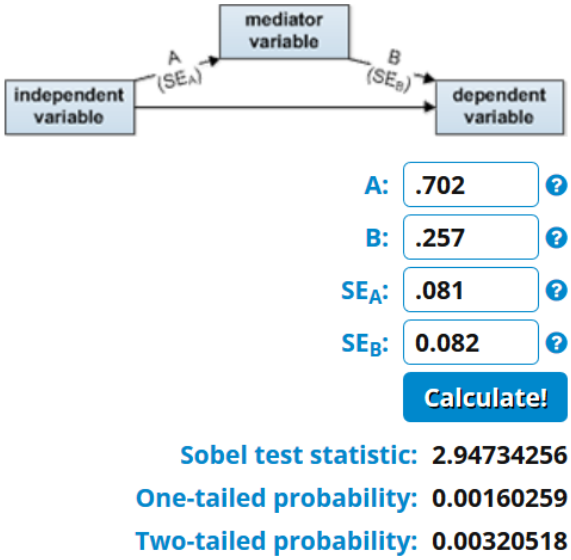
	Q^2 (=1-SSE/SSO)
Leadership-Led	0.224
WtE Intention	0.395
WtE Behavior	0.05

V.5.4 *Sobel Test and Bootstrapping (Preacher and Hays) for Mediation*

V.5.4.1 Sobel Test.

A common testing approach for mediating effects is the Sobel (1982) test. It examines the relationship between the dependent and independent variable, and measures the relationship between the two variables including the mediation construct (Helm, Eggert, & Garnefeld, 2010). The Sobel test is used to assess the significance of a mediation effect. The Sobel test results reports mediation is statically significant at the p-value < 0.0016, as displayed in Figure 20.

Figure 20: Sobel Test



Ref: http://www.danielsoper.com/statcalc/calculator.aspx?id=31

V.5.4.2 Bootstrapping the Mediating Effect.

The Sobel test, when applied to small sample sizes, requires unstandardized path coefficients as input for the test statistic and lacks statically power. Investigators should follow Preacher and Hays (2008) when testing mediating effects, and bootstrap the sampling distribution of the indirect effect (Hair et al., 2016). Since this study had 184 responses, we employed Preacher and Hays to reconfirm. No assumptions about the shape of the variables' distributions are made in bootstrapping process, thus making it suitable for use in PLS-SEM, allowing sample distribution for the statistics to be applied to small sample sizes with more confidence (Hair et al., 2016). Preacher and Hays (2008) recommend bootstrapping over Sobel testing due to the fact that bootstrapping has higher power while sustaining reasonable control over Type 1 error rate, and that Preacher and Hays only recommend the Sobel test when there are large samples in the research. Table 24 shows that the mediator effects results using the bootstrapping Preacher and Hays (2008) were statistically significant at the 5% level for attitudes

of WtE to intention to adopt WtE with mediating effect by leadership-led change. This supports that leadership-led has a mediating effect on attitudes and WtE Intention.

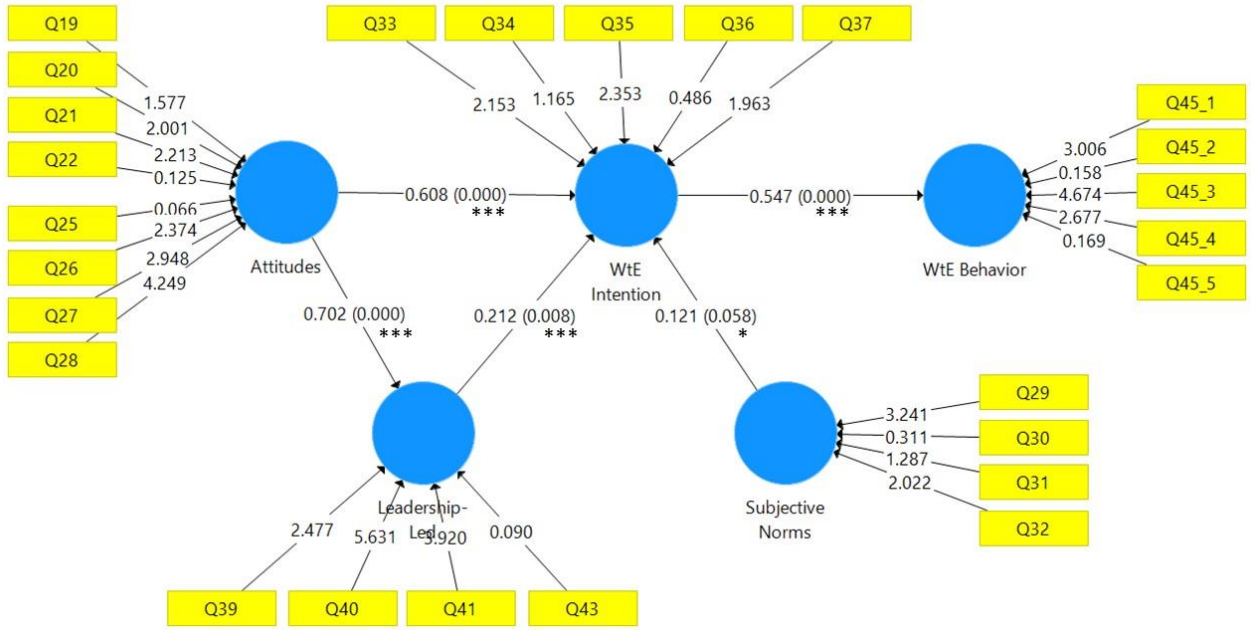
Table 24: Bootstrapping Preacher and Hays

	Original Sample (*O*)	Sample Mean (*M*)	Bias	2.50%	97.50%
Attitudes -> Leadership-Led	0	0	0	0	0
Attitudes -> WtE Behavior	0.414	0.461	0.046	0.272	0.507
Attitudes -> WtE Intention	0.149	0.147	-0.002	0.053	0.277
Leadership-Led -> WtE Behavior	0.116	0.12	0.004	0.035	0.209
Leadership-Led -> WtE Intention	0	0	0	0	0
Subjective Norms -> WtE Behavior	0.066	0.068	0.002	-0.006	0.148
Subjective Norms -> WtE Intention	0	0	0	0	0
WtE Intention -> WtE Behavior	0	0	0	0	0

V.6 Mediator Model Summary Analysis and Results

The overall model was statically significant, with results supporting three of the four hypotheses, including the mediator effect proving statically significant. Figure 21 shows the PLS-SEM moderator model and its estimated Beta and *p*-values (see Appendix F for estimated PLS-SEM mediator model and its estimated Beta and *t*-statistics). Based on the path coefficients, the primary driver for WtE adaption is a leader's attitudes to intention to adopt WtE.

Figure 21 - PLS-SEM Mediation Model with Beta and p-Value



****p<.01; **p<.05, *p<.10*

Results showed that leaders with strong attitudes about WtE will have strong intentions to adopt WtE at the statistical significance (H1). Total effects of 0.608 validated the Beta (.608) and *p*-value < 0.001 for attitudes to intention.

The mediator effect was statically significant between leaders' attitudes and WtE intention as confirmed by Sobel test and bootstrapping Preacher and Hayes test shown in section 5.8.

The results did not support hypothesis that subjective norms are a positive driver of intention to adopt WtE (H2) at the alpha threshold of 0.05.

A stronger intention to adopt WtE has a direct effect on leaders' exhibited behavior to adopt WtE and was statistically significant (H3). Total effects confirmed the Beta (0.547) and *p*-value < 0.001 for leaders' intention to adopt the behavior to adopt WtE.

Results showed that attitudes, subject norms, and leadership-led explain 69% of the variance in WtE. Intentions ($R^2 = 0.69$), and WtE intentions ($R^2 = 0.30$) explains 30% of the variance to the behavior to adopt WtE.

Additionally, results shown in Table 25 supports the post-hoc hypothesis that leadership-led change has a mediating effect on the relationship between leaders' attitudes and intention to adopt WtE (H4). Systematic representations of the model illustrating direct effects, indirect effects, and mediator model(s) are found in Appendices G through K.

Table 25 - Post Hoc Hypothesis Summary

	Post Hoc Hyphothesis	*Beta*	*t* -Statistics	*p*- Values	
Direct Effects	Leaders with stronger attitudes about WtE will have a stronger intention to adopt WtE.	0.806	20.98	$p < .001$	Supported ***
Post Hoc	Leadership-led change mediates the relationship between leaders' attitudes on WtE and their intention to adopt WtE.	0.62	7.617	$p < .001$	Supported ***

Note:
NS = not significant
***p<.01; **p<.05, *p<.10

V.7 Qualitative Feedback Results

Comments made by study participants at the end of the survey indicated two main themes, 1) Addressing Energy and Pollution crisis, and 2) Support for WtE, which are illustrated in Table 26.

Table 26 - Theme of Leader's Feedback

Theme	Feedback/Evidence
➢ Addressing Energy and Pollution crisis	• "Please bring Waste-to-Energy to being in Nigeria pollution from the use of generator as a substitute for power generation has claimed lots of families and will be a positive change in a good direction to adopt a more cleaner and sustainable energy" • "The adoption of Waste-to-Energy in Nigeria, would profoundly reduce pollution and high level of PM10 (Particulated Matter Concentration) in the atmosphere, which is causing people to fall sick in various communities in the country." • "This is an excellent idea. It will reduce the percentage of PM10 (Particulate Matter Concentration) in Nigeria, which is harmful to the environment and people." • "There is serious energy shortfall in Nigeria which has become enormous concern to the government and people of Nigeria. Therefore, the need for the use of WtE is welcome development in Nigeria to boost the energy supply that has been the bane of development in the country." • "Nigeria is in dire need of energy to satisfy the huge demand for power. There is a serious deficit compared with the size of the economy. Nigeria generates just between 4000-5000 MW… and Current demand for electric power in Nigeria is put at between 15,000-20,000 MW…. there is the urgent need for harnessing diverse sources of energy such as WtE to quickly bridge the energy supply gap." • "Waste-to-Energy is the key as this will help reduce pollution in Nigeria, which is a major problem in our country."
➢ Support for WtE	• "I will help to advocate to my other fellow community leaders with no knowledge of WtE share it my other family member who are in a position of authority" • "Will give my support to the best of my capacity." • "I support every application of the use of WTE to have a clean energy supply is to have a healthy living"

	• "With my group of colleagues we are ready to give our support with the move to start WtE in Nigeria" • "We generate enough daily waste that can support waste to energy initiative in Nigeria. So much pollution around in terms of waste while present demand for energy cannot be met"

The first theme which goes directly to the issue in Nigeria, is an appreciation of the seriousness of Nigeria's energy shortage and, second, enthusiasm for renewable energy. Specifically, one respondent leader described Nigeria as suffering from a "chronic shortage of power leading to shut down of industries and jobs," while others highlighted Nigeria's pollution problem (see Appendix P). Moreover, there appeared to be general agreement that "We generate enough daily waste that can support waste to energy initiative in Nigeria. So much pollution around in terms of waste while present demand for energy cannot be met" (see Appendix P). WtE was clearly perceived as a positive means to address both Nigeria's energy shortage and its pollution problems: "[T]here is [a] serious energy shortfall in Nigeria which has become [an] enormous concern to the government and people of Nigeria. Therefore, the need for the use of WtE is [a] welcome development in Nigeria to boost the energy supply that has been the bane of development in the country" (see Appendix P).

VI CHAPTER 6: DISCUSSION AND CONCLUSION

Nigeria, a developing country, suffers a continuous 60 percent shortfall in energy production, meaning that less than 40 percent of its people do not have access to the power grid (Kennedy-Darling, Hoyt, Murao, & Ross, 2008). This shortfall, which is due to severe energy infrastructure constraints, inhibits its development and growth. Thus, increasing reliance on renewable energy technologies such as WtE would seem to be a vital step in addressing the nation's energy resource inadequacies in a sustainable manner (Shaaban & Petinrin, 2014) and without increasing environmental pollution, thereby improving the welfare of Nigeria's citizens and also its economic outlook over the medium to long term (Shaaban & Petinrin, 2014). However, renewable energy has not been implemented within Nigeria. As the potential for implementing these technologies would rest with the country's leaders, this study was an attempt to determine why the impetus to proceed with this implementation has been lacking among Nigeria's leadership. Specifically, it investigated why Nigeria's leadership has not more strongly sought adoption of renewable energy in general and WtE in particular.

VI.1 Description of Study

In order to explore Nigerian leaders' failure to adopt WtE and expanding on previous TRA research in RE technology (Bang et al., 2000; Mishra et al., 2014; Moghadam et al., 2016), this study also employed the theory of reasoned action (TRA), the well-known human behavior model of Fishbein and Ajzen (1975), which postulated that attitude toward a behavior and subjective norms are primary drivers of behavioral intent, with attitude influenced by two factors: beliefs concerning the behavior and evaluations of the beliefs. In the context of this study's model, attitude was assumed to be dependent on five factors related to belief: concern for energy creation, concern related to pollution, knowledge of renewable energy in general,

knowledge of WtE specifically, and belief in the salience of leadership in implementing renewable energy.

Four hypotheses were formulated with respect to the strength and direction of the influence of the constituent pieces of the model, a survey instrument was designed and administered to obtain data to represent the models' variables, and statistical procedures were performed to test these hypotheses. Since the study focused on the decision-making process of Nigerian leaders with respect to WtE, Nigerian leaders—who, following Andrews et al. (2010), were defined as those who had held senior positions in government, private sector, community, or military for at least eight years—comprised the sampling population. Out of the 750 leaders initially selected, 239 participated in the study's survey, and, of these, surveys of 184 respondents were complete and so comprised the data analyzed. Once translated into mathematical models, PLS-SEM was chosen as the primary statistical technique to evaluate the relationships between the various variables included in the models.

VI.2 Discussion of Results

Based on the study hypotheses, the strength and direction of the following effects were tested: attitudes on intention to adopt WtE (H1), subjective norms on intention to adopt WtE (H2), and intention to adopt on actual behavior (e.g., adoption of WtE) (H3). Hypothesis 4 concerned the moderating effect of leadership-led change on intention to adopt and actual adoption of WtE. Fitting the model to the survey data yielded strong support ($p < .001$) for hypotheses 1 and 3, moderate support ($p < .1$) for hypothesis 2, subjective norms were again found to have only a moderate effect on intention ($p < .1$); and no support for hypothesis 4.

The rationale underlying hypothesis 4, that leadership-led change would moderate the relationship between attitudes toward WtE and intention to adopt WtE, was that the leaders'

capabilities with respect to actual implementation would bolster their intention to implement. Leadership-led change consisted of the three As—acceptance, ability, and authority. Specifically, it consists of the leader respondents having or obtaining the technological and financial capabilities needed to implement WtE; actively building acceptance for WtE by creating/fostering relationships and the ability of identifying resources (e.g., finance) to increase the likelihood of WtE adoption; and creating the authority/accountability structures needed to implement WtE throughout the value chain. That the moderating relationship of this construct, i.e., as strengthening (or weakening) the relationship between attitude and intent, was not statistically significant was surprising since leadership is the bottleneck of adopting and implementing WtE in Nigeria. This was puzzling at the time of analysis, which forced a re-evaluation of the assumptions underlying hypothesis 4. One possible explanation was that the leadership-led moderator construct may not be the right representation, however leadership-led change is acting as a mediator with the true reflection of leaders on WtE attitudes towards the intention to adopt WtE.

Thus, the model was re-run with leadership-led change assumed to be a mediating variable between attitude and intent. As a mediator, leadership-led change would be assumed to have a strong relationship with attitude and would thereby directly affect intention. Moreover, the stronger the leadership-led change activities, the greater the extent to which the effects associated with the direct attitude-to-intention path would be diminished because leadership-led change has the potential to be much more powerful, creating a multiplier effect.

After modifying the model to include leadership-led change as a mediator, two tests—Sobel's test and Preacher and Hayes bootstrapped test—were performed in order to test the statistical significance of this mediated effect. Fitting the model incorporating this construct as a

mediating variable resulted in leader attitude as being the primary driver of intention to adopt ($p \approx 0$), which was in turn the primary driver of adoption ($p \approx 0$). Attitude had a strong positive influence on leadership-led change ($p \approx 0$), which then had a moderate positive influence on intention to adopt ($p < .01$).

Thus, even though leadership-led change was found to be statistically insignificant as a moderator, it did achieve significance as a mediator, indicating that the issue was not a mal-formed construct but rather with further investigation of the construct's specific relationship with the other constructs attitude and intention. Another possible avenue through which to explore this could be a re-definition of the construct to more clearly distinguish between moderator types. More granular variable types could then be based on type of moderating effect, e.g., neutralizing or enhancing versus substituting or complementing. In effect, developing distinct moderator variable types could provide a structure for moderator research and allow creation of reproducible and comparable results (Howell et al., 1986).

Another result of the study was the lack of importance participants placed on societal norms in influencing their intentions to adopt. The information provided by survey participants did not reflect any external motivations to comply or normative beliefs, e.g., subjective norms in TRA. A possible explanation for this is that the study participants were, in fact, leaders and so were not easily influenced by social norms due to their relatively high positions in their respective hierarchies. Moreover, they boasted considerable experience in their professional roles and high educational levels. Previous research supports this assumption; in these, subjects reported minute amounts of social pressure from colleagues and friends (e.g., subjective norms), resulting in low levels of social influence (Bagozzi & Yi, 1989).

Recognizing the role of leadership in adoption of WtE as a viable solution for developing countries such as Nigeria necessitated further investigation on the role of leadership in affecting attitudes and intention in the context of WtE adoption. After statistically analyzing the moderating behavior of leadership-led change constructs, this study looked at leadership-led change in a mediating setting as well. A recognition of understanding the importance of leadership-led change in determining attitudes and intention made implausible the results reported in the previous section, e.g., that the three As of leadership-led change played no role in determining the influence of leader attitude on intention to adopt WtE. Analysis identified a partial mediating effect of leadership-led change on the relationship between attitudes and intention to adopt WtE.

This finding has importance for both academicians and practitioners in the field of RE. For companies specializing in WtE, promoting and supporting the efforts of leaders by offering WtE as a viable solution to address Nigeria's energy and pollution concerns would be worthwhile. Educating and promoting WtE to leadership, and to the public, can increase positive attitudes toward WtE that can help leadership-led change to intentions to adopt WtE that eventually leads to actual adopting WtE in Nigeria and using it to solve its issues.

VI.3 Leaders' Feedback

Given that the respondents appeared to recognize the seriousness of Nigeria's energy shortage and pollution problems as well as the promise of WtE in addressing these problems, their failure to adopt it to date is puzzling. The failure of leader-led change to achieve statistical significance reflects this disconnect between the recognition of its potential value and the past failure of leadership to push for its adoption. This construct consisted of the mechanisms associated with actual implementation: leaders' building of acceptance of the technology among

the populace, leaders' enhancing the ability of the nation to carry out its implementation, and leaders' setting up of structures of authority and accountability (e.g., an infrastructure) to implement it. As will be discussed under study contributions, the lack of significance of the leader-led change construct could point to a possible means of initiating Nigerian leaders' promotion of WtE.

VI.4 Contributions and Implications of the Study

As discussed below, this study made significant practical and academic contributions.

VI.4.1 *Researchers.*

Our model had several novel aspects that would be of interest to academicians. First, although TRA had been used previously in a similar model to analyze factors important to adoption of WtE (Moghadam et al., 2016), that research was situated in the U.S. and not in a developing nation, unlike the current study. More importantly, unlike Bang et al. (2000), this study modeled the full TR model, and incorporated a leadership model, one based on Andrews et al. (2010), in order to judge the effect of leadership-led change in the attitude-to-intention-to-behavior relationships, a suggestion for future research by Bang et al. (2000). Thus, the model employed in this study was an extension of previous models.

VI.4.2 *Practitioners.*

The findings are also of value to practitioners in the field of energy production in general and renewable energy production in particular and to Nigerian leaders. First, the study established that attitude toward WtE was a prime driver of intent to adopt, which in turn was a prime driver to adoption. Thus, those wishing to promote RE/WtE in Nigeria, and in developing countries in general, would be well served to cultivate positive attitudes among the country's

leaders, those who would be most responsible for creating the basic infrastructure to create WtE, through education and campaigns involving active approaches to promote WtE.

Moreover, the failure of societal norms to be a significant moderating influence on intent to adopt points to this as being a relatively weak means of exerting influence on leaders to adopt WtE, pointing again to direct approaches to Nigeria's leaders to change attitudes and increase awareness, possibly aimed at pointing to WtE's advantages not only to Nigeria and its people as a whole but to the leaders themselves and to their specific areas within Nigerian society. For instance, an approach emphasizing the important role of sustainable energy in increasing national security could be emphasized in approaches to military leaders, while approaches underscoring opportunities for profit could be employed for leaders within the private sector.

The lack of significance of leader-led change as a moderating variable and its statistical significance when incorporated as a mediator between attitude and intention indicated that the construct itself is not inherently flawed. Moreover, the role of mediator appears to more accurately represent reality and, to the extent that the leader participants acted in line with these espoused attributes that create the change space argued by Andrews et al. (2010), we would expect to see not just the intention but ultimately the resulting behavior at some time actually coming to fruition in Nigeria.

There appears to be a disconnect between the overall positive attitude of the study's leaders with respect to WtE and their actual advocating of its use. Leadership-led change, comprised of acceptance, ability, and authority (the three As), represents the mechanics of creating a WtE infrastructure. Leaders must be willing and able to advocate for acceptance of the technology within the society; leaders must have the ability, e.g., the knowledge of how to translate general positive attitudes into concrete infrastructures capable of producing renewable

energy through WtE; and leaders must have the authority to adopt, or at least to advocate for its adoption. This is why this study finds that leadership-led change does mediate the relationship of leaders WtE attitudes to their intention to adopt WtE.

Given that the leaders in the sample expressed positive attitudes toward WtE, leadership-led change appears to represent the disconnect in the failure to implement it. Nigeria's leaders have not implemented WtE. Thus, those wishing to promote WtE in Nigeria should concentrate on the factors that comprise leader-led change—leadership authority, ability, and acceptance within the society. Efforts should be made to ensure that Nigeria's leaders have the authority, the ability (e.g., knowledge as to how to implement the technology), and the means to motivate Nigerian society to accept the technology.

WtE's benefits to Nigeria appear obvious; however, the specific benefits to various sectors of the economy, and hence to the leaders of those sectors, would need to be listed and broadly disseminated within appropriate venues. For instance, WtE's advantages would lead to stability of and public satisfaction with government performance, thereby strengthening the position of those public servants that back its adoption. Within the private sector, the opportunities for profit through reduction of production costs would be attractive to business leaders. A stable, nonpolluting energy supply would lead to development of a healthier nation and a stronger nation, thus appealing to leaders. Programs targeting leaders within the nation's sectors should motivate these leaders to back WtE's adoption, and the results of the interviews seemed to support this.

The role occupied by leadership-led change within the TRA framework in our model was also novel. The study results indicate that change requires both abilities and resources, and context may be constrained by the amount of fiscal, human, and/or informational abilities

available, or by the degree to which latent resources are given free expression in exploring, pursuing, and implementing change (Andrews et al., 2010). This study examined how leaders' acceptance, ability, and authority influenced their attitudes towards WtE and affected their behavior with respect to adopting WtE. Leaders can be connected to other leaders, groups, and people with the knowledge to motivate change that impacts WtE adoption in Nigeria.

Those wishing to influence a country's leaders to adopt WtE should emphasize these aspects of leaders' roles in promoting WtE. Approaching those with authority to advocate for or to actually adopt WtE, they should ensure that they provide specific information on how to build the appropriate infrastructure so as to translate positive attitudes and visions into concrete infrastructure. Leaders must also be able to advocate for acceptance of the technology; again, practitioners within the renewable energy industry wishing to promote WtE should be able to provide leaders with information and materials that would aid them in educating and changing attitudes of those within these leaders' hierarchies. The following statements by a survey respondent highlight the importance of a leader in advocating for acceptance of the technology (see Appendix P): "I will pass the knowledge I got from here on to promote the awareness of WtE"; "I will help to advocate to my other fellow community leaders with no knowledge of WtE and share it my other family member who are in a position of authority."

VI.5 Study Limitations

In a study such as this, practical and theoretical limitations are inevitable. One obvious limitation was the inability to truly evaluate behavior. In practice, participant behavior would be measured by action aimed at establishing WtE in Nigeria—active advocacy, building of a WtE plant, signing a contract to initiate construction of a WtE facility, etc. Needless to say, observing

such behavior was impossible in the context of our study, and a possible avenue of future research would be a study linking present intention with future actions.

Rather than actions, our study employed measurement of behavior in a manner somewhat similar to that described in Bagozzi and Yi (1989). As proxies for behavior, we employed five indicators in the form of survey questions that expressed a willingness to perform the action described (see Appendix O):

- Sign a letter of support for WtE (B1)
- Attend meeting with colleagues/leaders to support WtE adoption in Nigeria (B2)
- Show support publicly for the adoption of WtE in Nigeria (B3)
- Support allocated resources to use WtE in Nigeria (B4)
- Like to learn more about WtE (B5)
- Other (Please share what you would do)

Item values were measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Although this constituted the study's attempt to measure behavior, we acknowledge the difficulty of truly capturing behavior of adopting WtE; an example of observing behavior in this case could be through observing the signing of a contract to construct a WtE plant. Future study would depend on seeing if the intentions of the leaders participating in this study bore fruit through future WtE-related actions.

Second, for purposes of the current study, the qualitative constructs of Andrews et al. (2010), a qualitative study, were adapted for use in a quantitative context rather than a qualitative one for this research. Prior to this research, these constructs had never been operationalized in a quantitative study, thus potentially opening this research to criticism. Future consideration of

these constructs and their measurements merits attention to the adaptation of leadership-led change's 3 As into a quantitative format.

Study participants, who met the study criteria that defined them as leaders, viewed how leadership-led change would contribute to adoption of WtE through the lenses of their own perspectives as leaders. Possible consideration should be given to extending the study to include a second group of "non-leaders" or "general public" and comparing this second sample group's perceptions of the factors that influence WtE adoption with those of the leaders. A comparison of the two sample assessments of the relationship of leadership-led change and its influence on WtE adoption would prove interesting and informative.

A final study limitation was not including interviews in the data-gathering process. Although participants were offered the opportunity to include comments on the survey instrument and many did take advantage of this opportunity, this capability did not produce the rich results that actual interviews would have, with the opportunity to ask questions and clarify responses.

VI.6 Future Research

There are numerous opportunities for future research embedded in the results of this study. The first is that subsequent studies could expand on behavior models to measure and analyze influencing factors to WtE adoption in both developing and emerging countries. This could provide important insight into assessing why adoption of WtE has been extremely slow in these aforementioned countries.

Since the study provided participants with a limited number of responses to only questions we conceived, it allowed for little qualitative insight. A future consideration would be to do a full qualitative examination with in-depth interviews, which would allow the possibility

of uncovering ideas and information of which we had not previously conceived. Such an option could, for instance, increase understanding of leaders/consumers in building marketing strategies for WtE.

As stated section in 6.4, an extension to this study that included a second, "non-leader" sample group would provide the ability to make comparisons between the two. A case study designed to examine and compare the effects of two developing countries and its use of WtE would be insightful; evaluating the differences between the country that used WtE and the one that did not could further identify advantages and establish its usefulness. Moreover, this approach would allow exploration of cultural differences that could also affect factors and success of implementation. This would allow for a more robust measurement of behavior of adoption in WtE.

An important issue for future exploration is why leadership-led change was insignificant as a moderating effect but was significant as a mediating one. As stated earlier, the construct leadership-led change appeared to capture the nuts and bolts of implementation, the furtherance of skills, acceptance, and authority within the leaders' hierarchies. While the study participants could have viewed leadership-led change as not affecting the degree of their willingness to implement (e.g., intent), they also could have viewed these as affecting their ability to do so. Further exploration of this issue by more precisely defining leadership-led change could answer this question, and in-depth interviews could shed light on this apparently contradiction.

An attempt was made to examine a moderation effect, which then led to a post-hoc investigation on a mediation effect. Future research to combine moderation and mediation in the study would pose an interesting examination; however, as Edwards and Lambert's (2007) research indicated, complexity of integrating both moderation and mediation could make this

approach difficult and perhaps problematical. A moderator construct influences the strength of a relationship between two other constructs (Baron & Kenny, 1986). In this case, the leadership-led construct acts as a moderator between attitudes, subjective norm and intentions. One possible explanation of this lack of significance of the moderating effect is due to the relationship between attitudes and intention was found to be very strong. While, the leadership-led mediating effect in this study increased the strength between attitudes to intention of adopting WtE through leadership led. A mediator variable as explained by Baron and Kenny (1986) and as seen in the results actually mediates the relationship and becomes a part of the construct. Additionally, the study participants could have viewed leadership-led change as not affecting the degree of their willingness to implement (e.g., intent), they could have viewed these as affecting their ability to do so. Further exploration of this issue by more precisely defining leadership-led change could answer this question, and in-depth interviews could shed light on this apparently contradiction.

At least two other possibilities exist for future research. This study incorporated the leadership change theory of Andrews et al. (2010). Other leadership models exist, and incorporating this theoretical framework with another could allow evaluation of the robustness of our model. Specifically, it would strengthen the position that leadership acts to moderate or mediate the attitude-to-intention relationship. In addition, the study of Andrews et al. (2010) was a qualitative study, and incorporating other leadership models into a TRA framework could permit use of other constructs that would allow increased quantitative measurement of leadership effects in implementation.

Lastly, this study suggests that the future research on leadership and RE adoption could investigate the role of education level in the determination of RE adoption. The dataset obtained

for this study had a set of leaders who were highly educated (at least graduation) and the attitudes of less educated leaders could not be evaluated. Such a future research could add further validity to the findings of this paper.

VI.7 Conclusion

The enthusiasm with which study participants met the idea of WtE confirmed our own belief as to the significant contributions this technology is capable of making in addressing challenges to meeting energy demands and reducing pollution simultaneously. One leader in our study stated, "Please continue with your research, so that Nigeria can adopt the system," and another wrote, "I Pray the Nigeria[n] authority [will] adopt WtE soon. WtE is a wonderful idea and it will move Nigeria to a higher level, and the country will be pollution free, and [its] energy problem will finally be solved" (see Appendix P). Still another wrote, perhaps most encouragingly, "WtE is a world changer and from what I've learnt so far, the future is brighter with WtE" (see Appendix P).

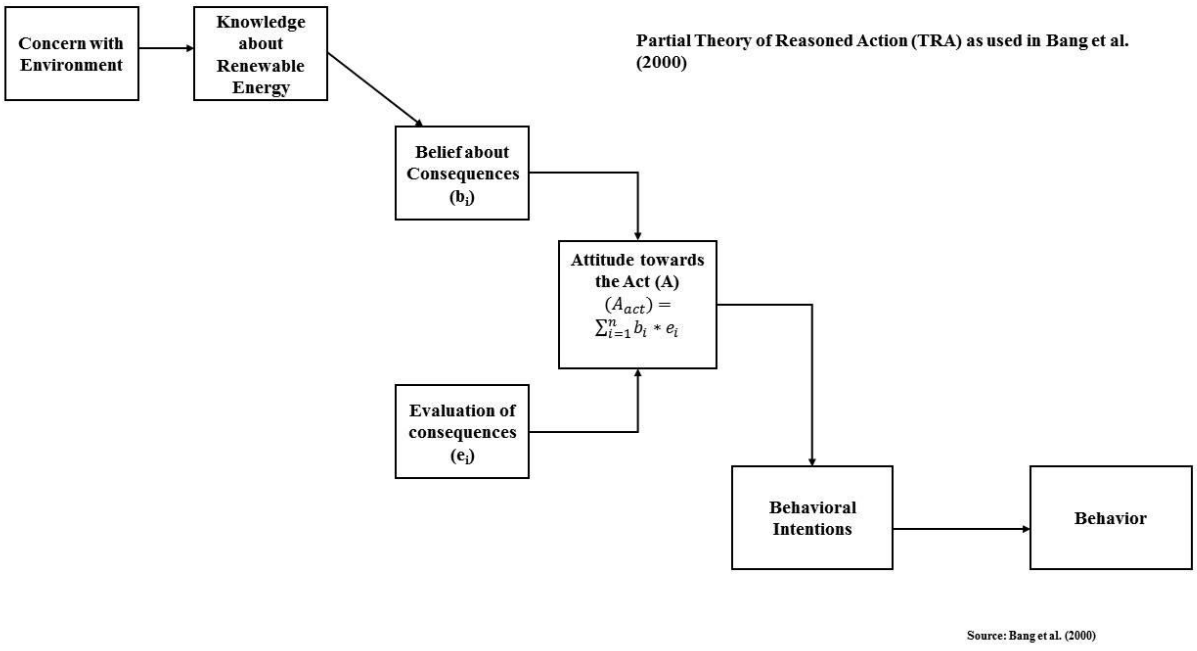
To summarize the sentiments expressed in the comments included in the survey responses, we created a word cloud, in which the size and color of the most frequently used words in a body of text indicates their prominence. Figure 22 below displays this word cloud. Word clouds are useful instruments for gaining insights and summarizing subjective data. The insights are summarized into keywords based on the frequency of the words' usage. Occupying a central spot in verdant green and the largest font displayed in the cloud is the word "Nigeria." Above and below "Nigeria" are "energy" and "WtE," also in green. "Pollution" and "waste" encompass these other words. Other words appearing in smaller text are "help," "need," "support," "knowledge," "power," and "environment." In orange, "awareness" and "change," and, again in green, the words "help" and "give" bracket "pollution" in purple. In summary, the

word cloud emphasizes the positive feelings with which the participants responded to the WtE technology.

Figure 22 - Word Cloud Derived from Survey Comments

APPENDICES

Appendix A: Diagram of The Theory of Reasoned Action (TRA) by Bang et al. (2000)



Appendix B: Significance of Indirect Effects

	Q19	Q20	Q21	Q22	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q39	Q40	Q41	Q43	Q45_1	Q45_2	Q45_3	Q45_4	Q45_5
Q19	1	0.707	0.564	0.592	0.316	0.318	0.385	0.577	0.209	0.348	0.276	0.189	0.492	0.299	0.301	0.303	0.254	0.322	0.304	0.43	0.395	0.348	0.431	0.534	0.397	0.23
Q20	0.707	1	0.546	0.558	0.16	0.303	0.443	0.352	0.261	0.17	0.193	0.159	0.561	0.41	0.366	0.422	0.342	0.395	0.348	0.294	0.311	0.207	0.327	0.404	0.464	0.324
Q21	0.564	0.546	1	0.694	0.425	0.236	0.323	0.452	0.176	0.274	0.209	0.074	0.457	0.332	0.511	0.337	0.335	0.302	0.276	0.444	0.289	0.178	0.261	0.365	0.264	0.129
Q22	0.592	0.558	0.694	1	0.425	0.401	0.433	0.604	0.295	0.356	0.194	0.116	0.519	0.476	0.438	0.407	0.4	0.371	0.331	0.531	0.294	0.182	0.349	0.496	0.273	0.149
Q25	0.316	0.16	0.425	0.425	1	0.519	0.383	0.52	0.07	0.336	0.101	-0.002	0.265	0.337	0.468	0.362	0.336	0.312	0.273	0.407	0.21	0.221	0.258	0.312	0.113	0.1
Q26	0.318	0.303	0.236	0.401	0.519	1	0.656	0.496	0.225	0.158	-0.033	-0.056	0.441	0.498	0.529	0.521	0.566	0.419	0.501	0.334	0.138	0.084	0.212	0.346	0.233	0.082
Q27	0.385	0.443	0.323	0.433	0.383	0.656	1	0.509	0.273	0.088	0.01	-0.027	0.548	0.574	0.604	0.459	0.474	0.336	0.583	0.369	0.162	0.064	0.208	0.347	0.297	0.129
Q28	0.577	0.352	0.452	0.604	0.52	0.496	0.509	1	0.281	0.391	0.184	0.059	0.594	0.438	0.478	0.396	0.474	0.375	0.5	0.577	0.326	0.217	0.358	0.502	0.202	0.145
Q29	0.209	0.261	0.176	0.295	0.07	0.225	0.273	0.281	1	0.67	0.395	0.277	0.412	0.315	0.254	0.3	0.395	0.378	0.374	0.299	0.16	-0.033	0.043	0.231	0.261	0.059
Q30	0.348	0.17	0.274	0.356	0.336	0.158	0.088	0.391	0.67	1	0.496	0.418	0.33	0.194	0.091	0.288	0.339	0.336	0.226	0.449	0.385	0.225	0.236	0.333	0.218	0.089
Q31	0.276	0.193	0.209	0.194	0.101	-0.033	0.01	0.184	0.395	0.496	1	0.728	0.202	0.036	0.084	0.171	0.186	0.155	0.188	0.206	0.315	0.213	0.195	0.233	0.202	0.157
Q32	0.189	0.159	0.074	0.116	-0.002	-0.056	-0.027	0.059	0.277	0.418	0.728	1	0.069	-0.037	-0.066	0.081	0.12	0.105	0.095	0.135	0.226	0.102	0.143	0.125	0.042	0.031
Q33	0.492	0.561	0.457	0.519	0.265	0.441	0.548	0.594	0.412	0.33	0.202	0.069	1	0.671	0.602	0.613	0.62	0.47	0.544	0.436	0.3	0.06	0.209	0.36	0.321	0.2
Q34	0.299	0.41	0.332	0.476	0.337	0.498	0.574	0.438	0.315	0.194	0.036	-0.037	0.671	1	0.613	0.536	0.562	0.457	0.489	0.398	0.159	0.036	0.143	0.329	0.308	0.152
Q35	0.301	0.366	0.511	0.438	0.468	0.529	0.604	0.478	0.254	0.091	0.084	-0.066	0.602	0.613	1	0.451	0.521	0.423	0.489	0.406	0.162	0.016	0.182	0.334	0.282	0.155
Q36	0.303	0.422	0.337	0.407	0.362	0.521	0.459	0.396	0.3	0.288	0.171	0.081	0.613	0.536	0.451	1	0.755	0.465	0.456	0.382	0.155	0.046	0.164	0.281	0.267	0.095
Q37	0.254	0.342	0.335	0.4	0.336	0.566	0.474	0.474	0.395	0.339	0.186	0.12	0.62	0.562	0.521	0.755	1	0.475	0.498	0.426	0.127	0.048	0.212	0.319	0.269	0.147
Q39	0.322	0.395	0.302	0.371	0.312	0.419	0.336	0.375	0.378	0.336	0.155	0.105	0.47	0.457	0.423	0.465	0.475	1	0.496	0.411	0.326	0.033	0.095	0.202	0.212	0.122
Q40	0.304	0.348	0.276	0.331	0.273	0.501	0.583	0.5	0.374	0.226	0.188	0.095	0.544	0.489	0.489	0.456	0.498	0.496	1	0.465	0.19	0.076	0.207	0.358	0.29	0.073
Q41	0.43	0.294	0.444	0.531	0.407	0.334	0.369	0.577	0.299	0.449	0.206	0.135	0.436	0.398	0.406	0.382	0.426	0.411	0.465	1	0.465	0.225	0.299	0.436	0.211	0.052
Q43	0.395	0.311	0.289	0.294	0.21	0.138	0.162	0.326	0.16	0.385	0.315	0.226	0.3	0.159	0.162	0.155	0.127	0.326	0.19	0.465	1	0.277	0.212	0.316	0.111	0.105
Q45_1	0.348	0.207	0.178	0.182	0.221	0.084	0.064	0.217	-0.033	0.225	0.213	0.102	0.06	0.036	0.016	0.046	0.048	0.033	0.076	0.225	0.277	1	0.715	0.676	0.571	0.645
Q45_2	0.431	0.327	0.261	0.349	0.258	0.212	0.208	0.358	0.043	0.236	0.195	0.143	0.209	0.143	0.182	0.164	0.212	0.095	0.207	0.299	0.212	0.715	1	0.738	0.602	0.62
Q45_3	0.534	0.404	0.365	0.496	0.312	0.346	0.347	0.502	0.231	0.333	0.233	0.125	0.36	0.329	0.334	0.281	0.319	0.202	0.358	0.436	0.316	0.676	0.738	1	0.629	0.566
Q45_4	0.397	0.464	0.264	0.273	0.113	0.233	0.297	0.202	0.261	0.218	0.202	0.042	0.321	0.308	0.282	0.267	0.269	0.212	0.29	0.211	0.111	0.571	0.602	0.629	1	0.666
Q45_5	0.23	0.324	0.129	0.149	0.1	0.082	0.129	0.145	0.059	0.089	0.157	0.031	0.2	0.152	0.155	0.095	0.147	0.122	0.073	0.052	0.105	0.645	0.62	0.566	0.666	1

Appendix C: Confirmatory Tetrad Analysis (CTA) for Moderator Model

Subjective Norms	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (STDEV)	*t*- Statistics (|O/STDEV|)	*p*- Values	Bias	CI Low	CI Up	Alpha adj.	z(1-alpha)	CI Low adj.	CI Up adj.
1: Q29,Q30,Q31,Q32	0.086	0.085	0.022	3.987	*p* <.001	-0.002	0.042	0.127	0.025	2.248	0.036	0.133
2: Q29,Q30,Q32,Q31	0.094	0.092	0.021	4.462	*p* <.001	-0.002	0.051	0.133	0.025	2.248	0.045	0.139

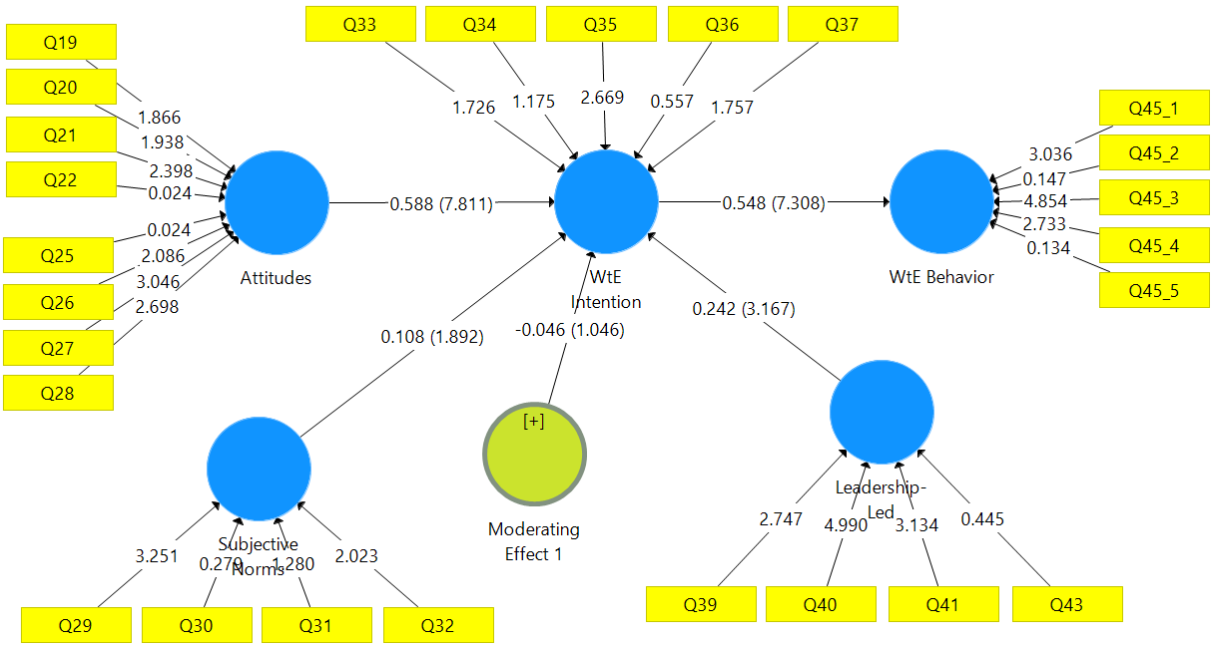
Attitudes	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (STDEV)	*t*- Statistics (|O/STDEV|)	*p*- Values	Bias	CI Low	CI Up	Alpha adj.	z(1-alpha)	CI Low adj.	CI Up adj.
85: Q19,Q22,Q26,Q27	0.031	0.031	0.015	2.072	0.038	0	0.001	0.061	0.003	3.025	-0.015	0.077
121: Q20,Q21,Q25,Q27	0.028	0.028	0.011	2.615	0.009	0	0.007	0.049	0.003	3.025	-0.005	0.061
156: Q20,Q26,Q27,Q25	-0.014	-0.014	0.007	1.939	0.052	0	-0.027	0	0.003	3.025	-0.035	0.008

Appendix D: Confirmatory Tetrad Analysis (CTA) for Mediator Model

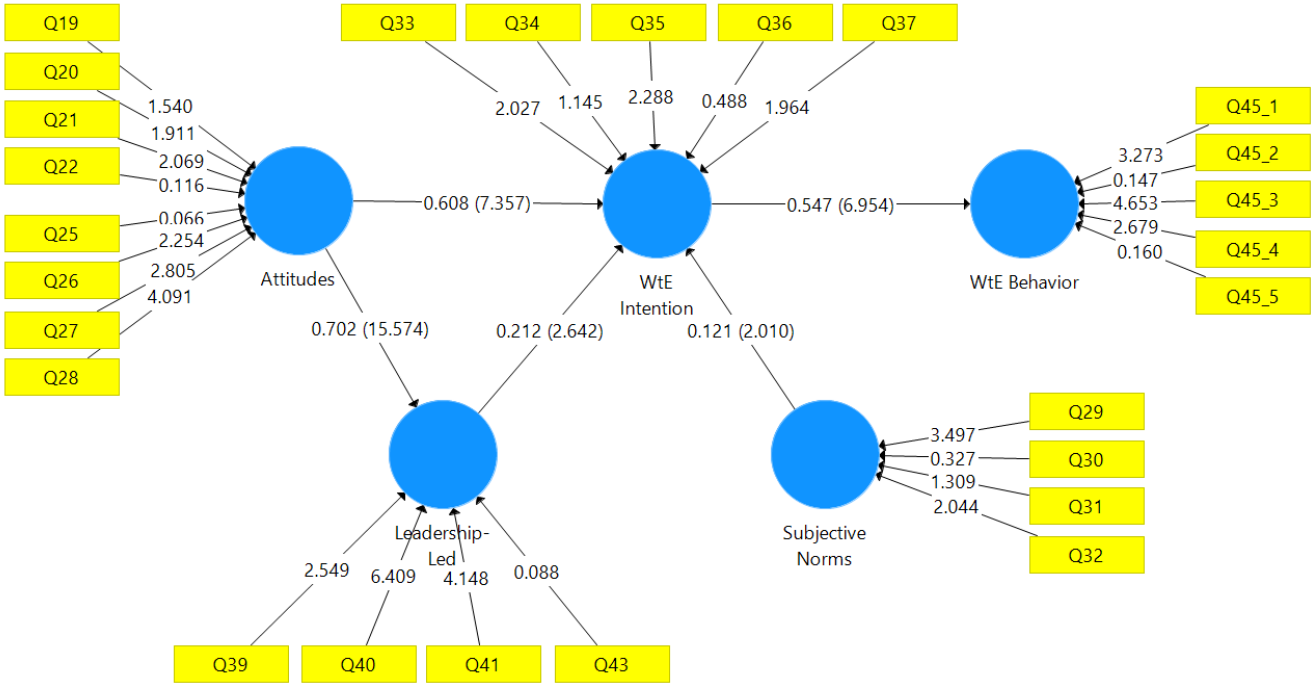
Subjective Norms	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (STDEV)	*t*- Statistics (|O/STDEV|)	*p* - Values	Bias	CI Low	CI Up	Alpha adj.	z(1-alpha)	CI Low adj.	CI Up adj.
1: Q29,Q30,Q31,Q32	0.086	0.083	0.023	3.674	*p* <.001	-0.003	0.037	0.129	0.025	2.248	0.03	0.136
2: Q29,Q30,Q32,Q31	0.094	0.09	0.023	3.996	*p* <.001	-0.003	0.044	0.136	0.025	2.248	0.038	0.143

Attitudes	Original Sample (O)	Sample Mean (*M*)	Standard Deviation (STDEV)	*t*- Statistics (|O/STDEV|)	*p* - Values	Bias	CI Low	CI Up	Alpha adj.	z(1-alpha)	CI Low adj.	CI Up adj.
85: Q19,Q22,Q26,Q27	0.031	0.03	0.015	2.137	0.033	-0.001	0.002	0.059	0.003	3.025	-0.014	0.075
121: Q20,Q21,Q25,Q27	0.028	0.028	0.011	2.662	0.008	-0.001	0.007	0.049	0.003	3.025	-0.004	0.06
156: Q20,Q26,Q27,Q25	-0.014	-0.013	0.007	1.986	0.047	0	-0.027	0	0.003	3.025	-0.034	0.007

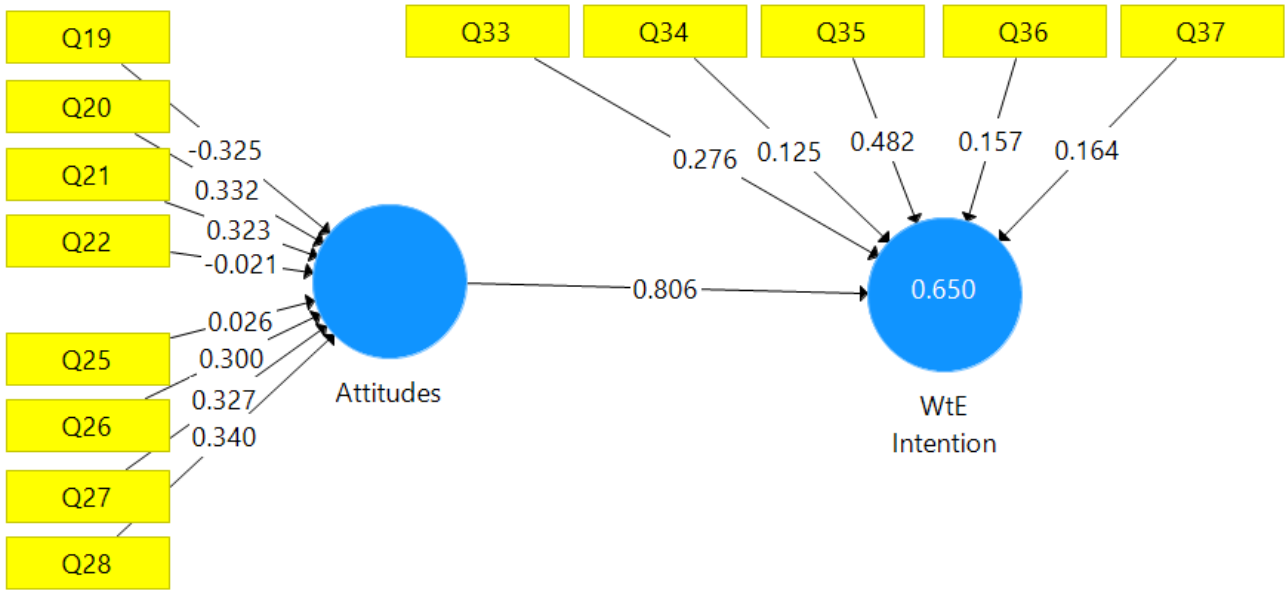
Appendix E: PLS-SEM Moderator Model with Beta and T Statistics.



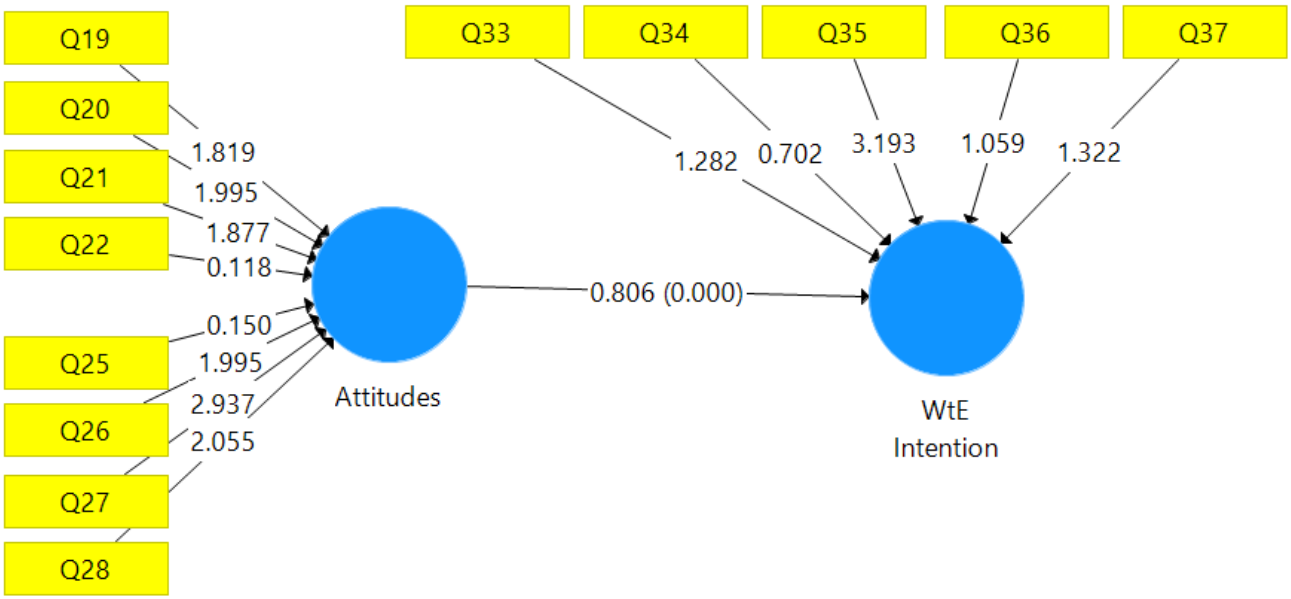
Appendix F: PLS-SEM Mediation Model with Beta and t-Statistics



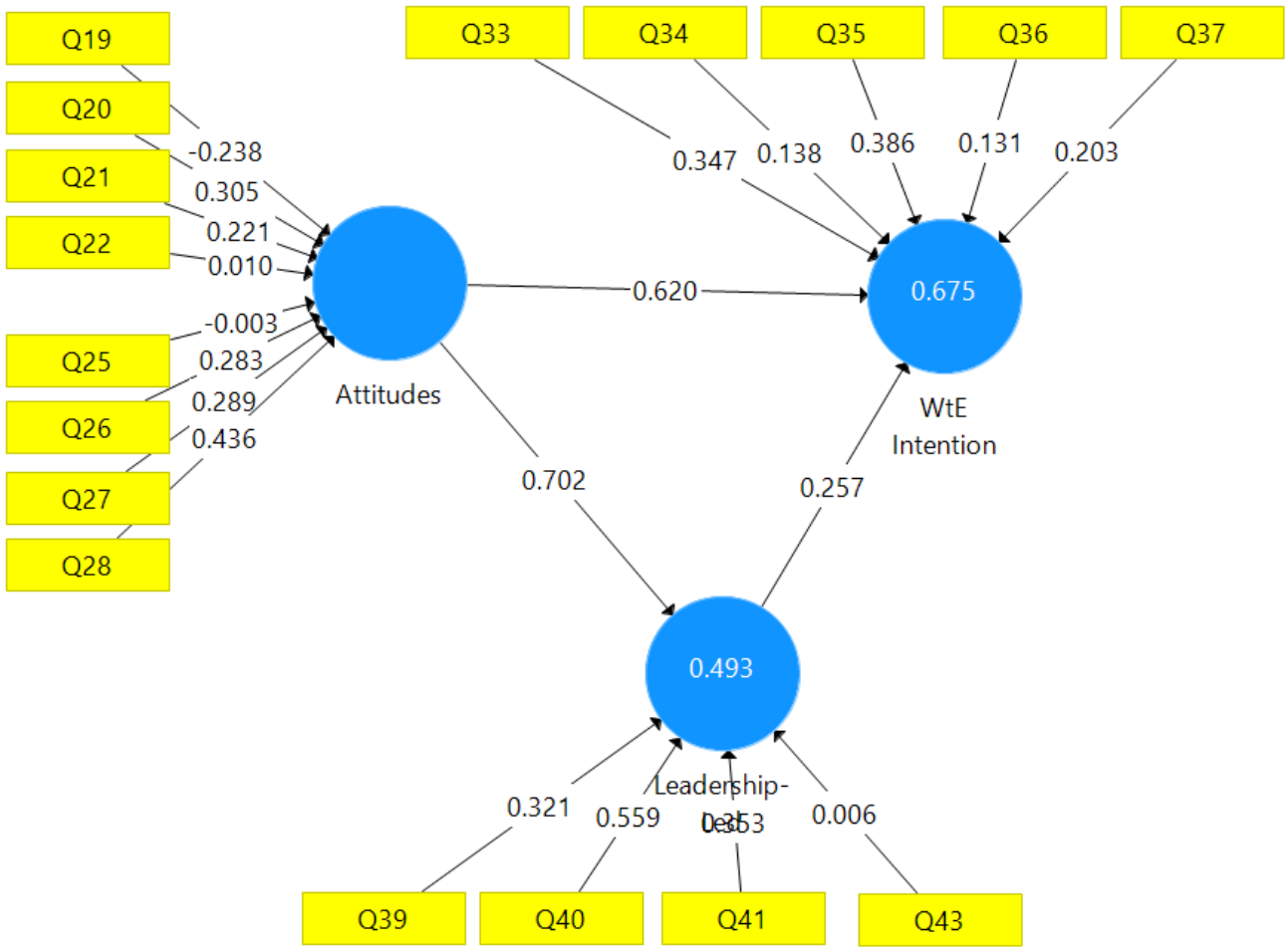
Appendix G: Direct Effects Model Attitude to Intention



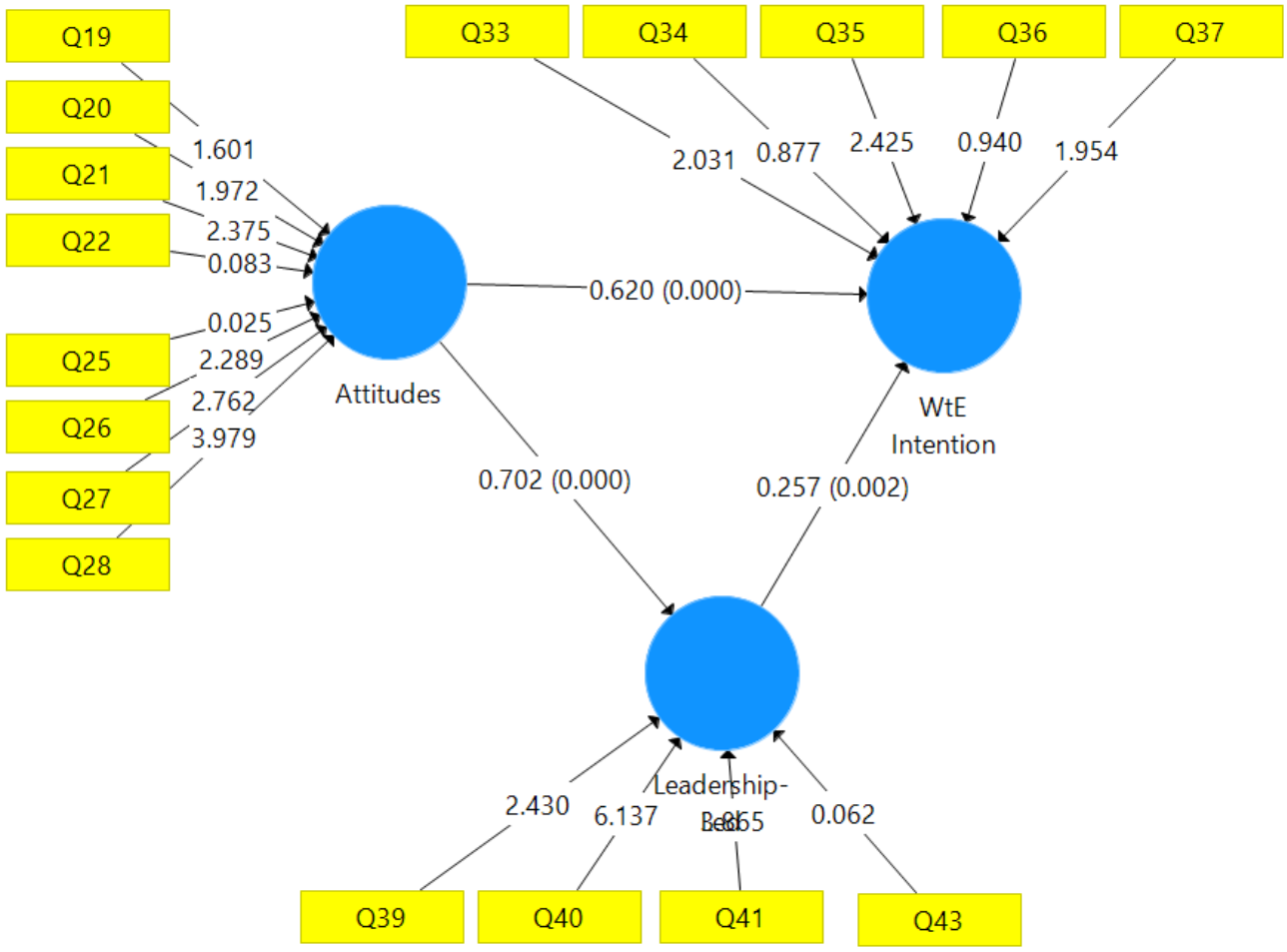
Appendix H: Directs Effects Model Attitudes to Intention Beta and p-Value



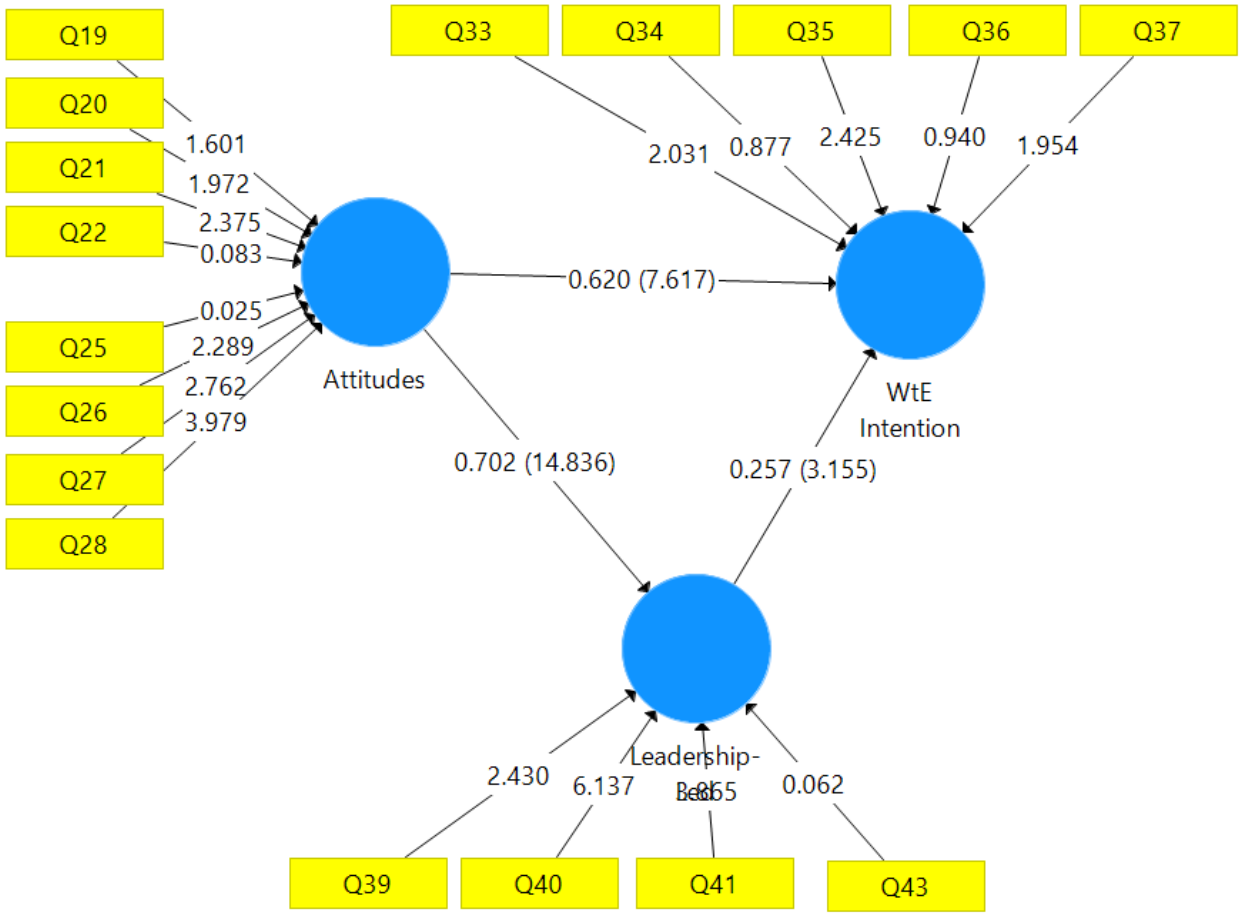
Appendix I: Mediator Model Beta and R2



Appendix J: Mediator Model Beta and p-Value



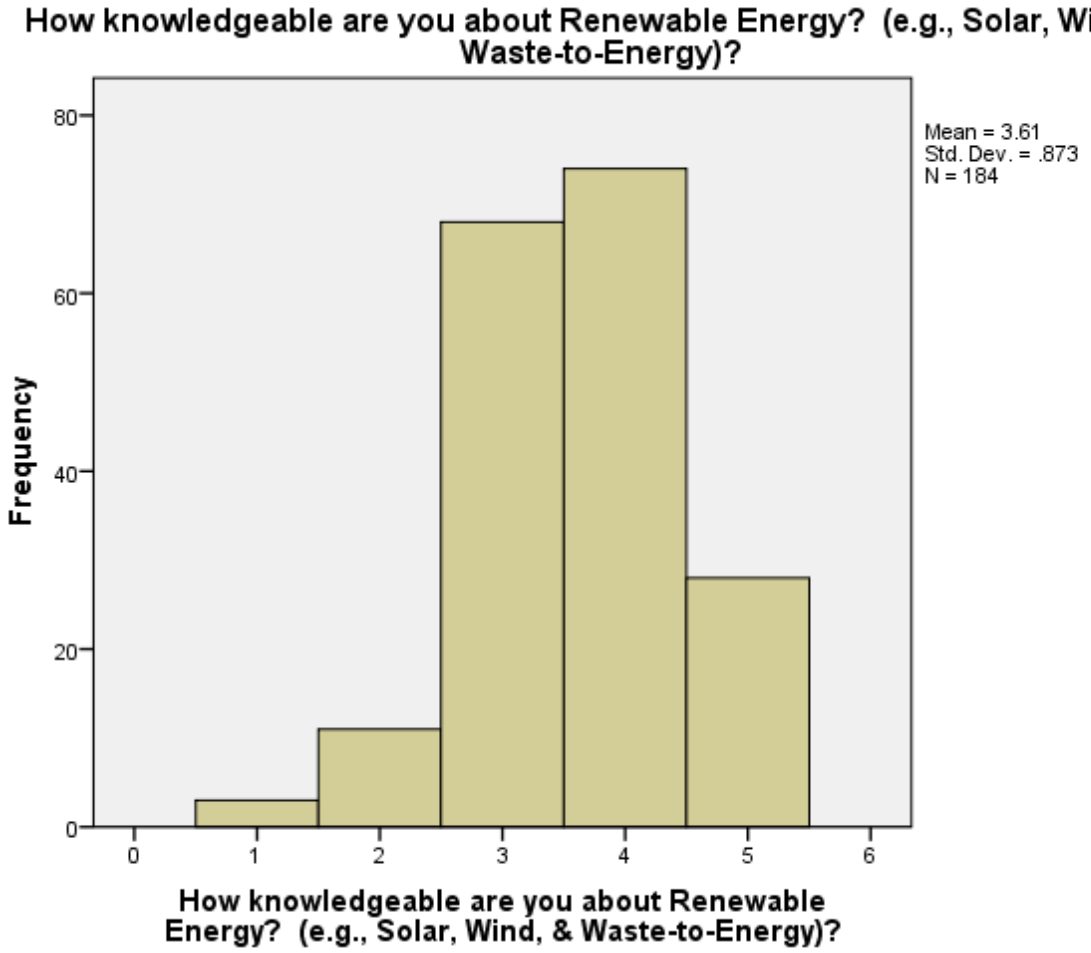
Appendix K: Mediator Model Beta & t-Statistics



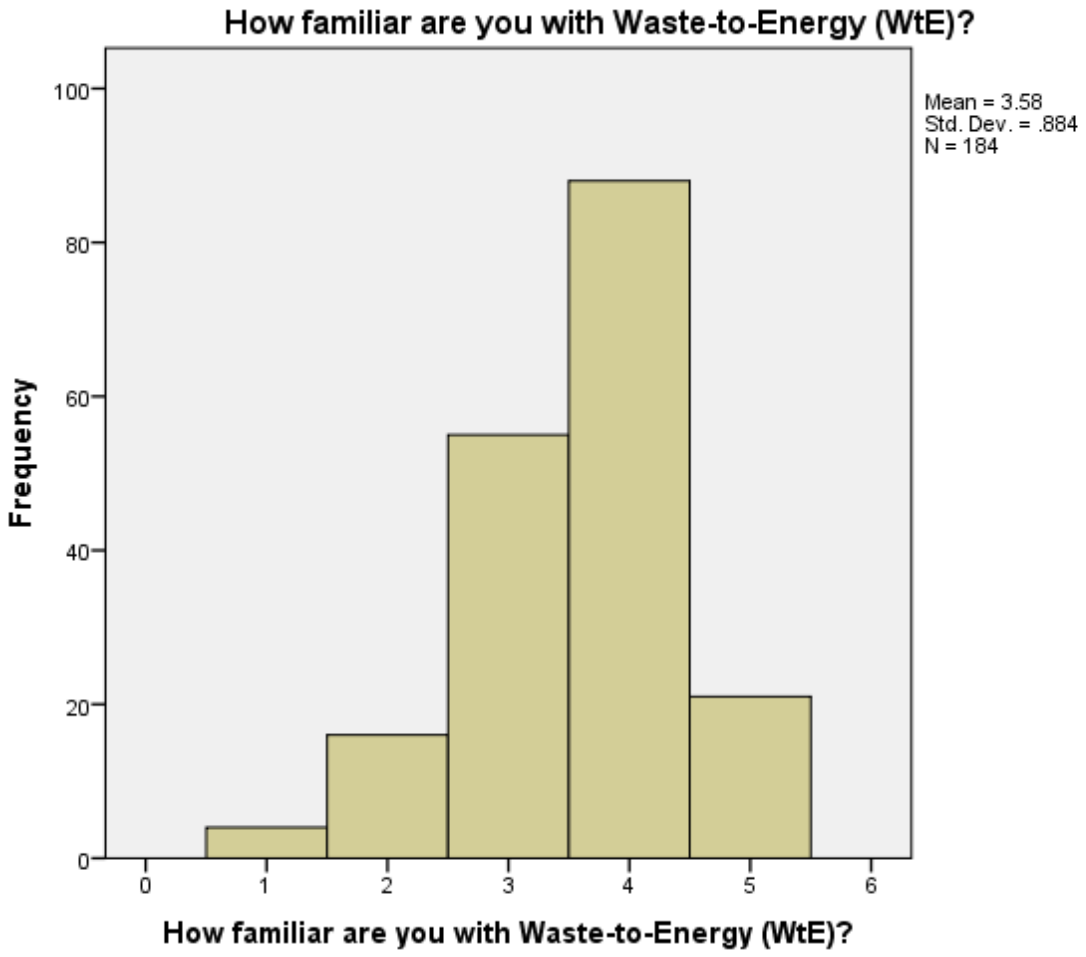
Appendix L: Histogram on Sample Knowledge of Renewable Energy

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	*t* -Statistics (|O/STDEV|)	*p* -Values
Attitudes -> Leadership-Led					
Attitudes -> WtE Behavior	0.414	0.456	0.073	5.641	p <0.001
Attitudes -> WtE Intention	0.149	0.144	0.056	2.649	0.008
Leadership-Led -> WtE Behavior	0.116	0.117	0.045	2.59	0.01
Leadership-Led -> WtE Intention					
Subjective Norms -> WtE Behavior	0.066	0.068	0.039	1.714	0.087
Subjective Norms -> WtE Intention					
WtE Intention -> WtE Behavior					

Appendix M: Histogram on Sample Knowledge of Renewable Energy



Appendix N: Histogram of Sample Familiarity with Waste-to-Energy (WtE)



Appendix O: Survey Questions Draft

1: What is your age? (Filter/Control Q's, must be 18 and older. If not Thank You Message, exit survey)

_____

2: Are you a Nigerian citizen? (Filter/Control Q's)

- **Yes**
- **No *(Thank you very much for your willingness to participate).***

3: How many years of work experience do you have? *(If less than 8 years, Thank you very much for your willingness to participate.)* (Filter/Control Q's)

- Less than 8 years.
- 8 years or more

[full survey begins here]

(Demographic)

4: What is your gender? (qDemographic)

- Male
- Female

5: Broadly, what is geographic location within Nigeria? (qDemographic)

- East
- West
- North
- South

6: Do you live in (qDemographic)

- A Major Metropolitan area (population over 2,000,000 people)
- A City (between 1,000,000 and 2,000,000)
- A Small City (between 500,001 and 999,999)
- A Town (between 100,000 and 499,999)
- A Rural area (under 100,000)

7: What is your highest education level completed? (qDemographic)

- Up to High School
- High School Diploma
- Some College
- Undergraduate Degree
- Graduate degree or higher

8: Your experience as a leader is in which area (please select all that apply) (qDemographic):

- Government
- Private
- Community (for example: Pastor, Chief, Tribal, etc.)
- Military

9: How long have you been in a leadership role/position? (qDemographic)**:**

- 1 to 5 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- Greater than 20 years

10: Please indicate the number of years of experience respectively in applicable sector:

Sector	How many years of experience do you have in each sector	How many years have you been in a leadership role
Government		
Private		
Community		
Military		

11: How knowledgeable are you with renewable energy? (qKnowledgeRE)

- Not at all knowledgeable
- Not knowledgeable
- Somewhat knowledgeable
- Very knowledgeable
- Extremely knowledgeable

12: I do not have a clear understanding of Renewable Energy. (qKnowledgeRE)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

13: How familiar are you with Waste-to-Energy (WtE)? (qKnowledgeWtE)

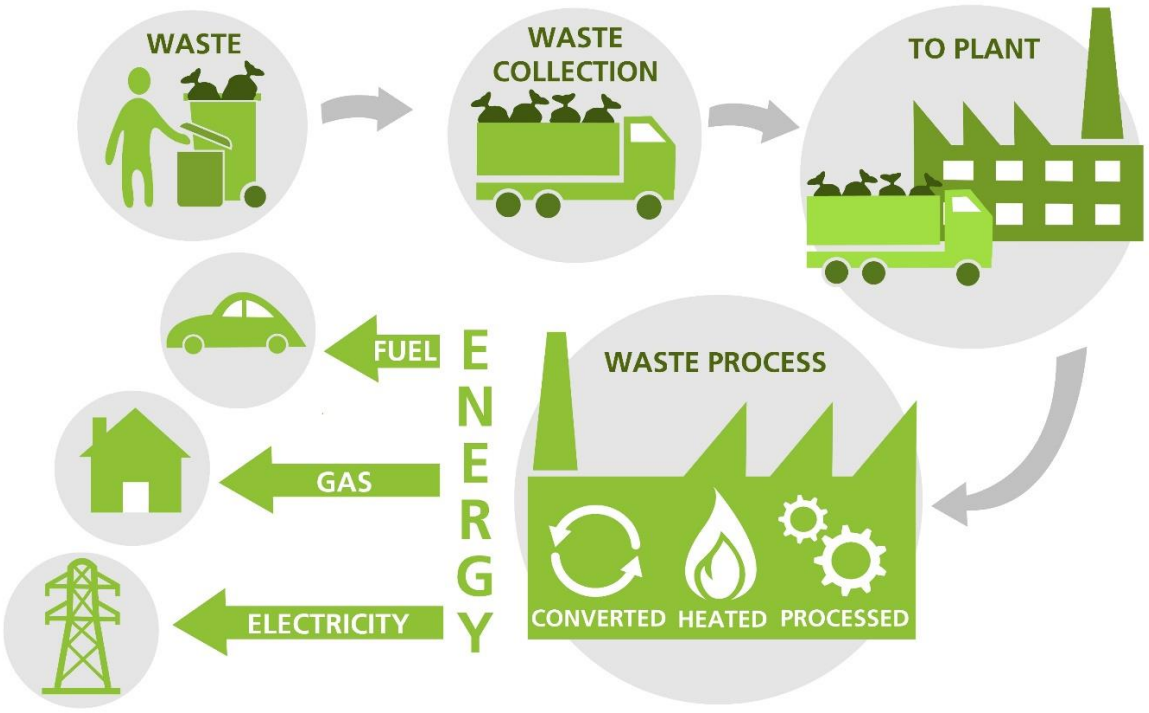
1. Not at all familiar
2. Not familiar
3. Somewhat familiar
4. Familiar
5. Very familiar

14: I do not have a clear understanding of Waste-to-Energy (WtE). (qWTE Knowledge-)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

15: Please view the following Waste-to-Energy (WtE) diagrams and information prior to completing the remainder of the survey.

WtE is a form of renewable energy that takes any type of waste and converts it into energy.



Source: Africa Engineering New, 2014

Facts about Waste-to-Energy (WtE):

- 1 ton of Municipal Solid Waste (MSW)/Trash = Approximately 1 Mega Watt (MW) of Electricity
- 1 vehicle tire = 1 gallon of diesel
- 1 human = 2-4 pounds of waste (trash) per day

Comparison among Energy Sources

Dominate Energy Sources in Use in Nigeria Today				
Power Plant Type	**Cost $/kiloWatt-hr(kWh)**	**Feedstock for Energy**	**Pros**	**Cons**
Natural Gas	**$0.07 - $0.14**	**Gas**	○ Less Harmful than Coal or Oil ○ Easy Storage & Transport ○ Instant Energy ○ Abundant	○ Toxic & Flammable ○ Damage to Environment ○ Contributes to Greenhouse Gas Emissions ○ Non-Renewable ○ Complex & Expensive Process Installation
Coal	**$0.10 - $0.15**	**Coal**	○ Well Developed Technology ○ Cheap & Reliable	○ Contributes Major Pollution ○ Non-Renewable ○ Accidents
Hydro	**$0.08**	**Water**	○ Renewable/Green/Clean Energy ○ Reliable/Stable ○ Flexible & Safe	○ Environmental Consequences ○ Expensive to Build ○ Droughts & Floods ○ Limited Reservoirs
Renewable Energy for Nigeria to Adopt: Waste-to-Energy (WtE)				
Power Plant Type	**Cost $/kiloWatt-hr(kWh)**	**Feedstock for Energy**	**Pros**	**Cons**
WtE (Biomass)	**$0.10**	**Waste / Trash**	○ Renewable/Green/Clean Energy ○ Carbon Neutral (clean air) ○ Reliable/Stable ○ Widely Available ○ Reduced Dependency on Fossil Fuels ○ Reduce Waste/Pollution ○ Reduce Landfills ○ Power Remote Areas ○ Bi-product Creation: e.g. steel, water, fertilizer, & fuels/diesel	○ Initial Costs ○ Requires Space ○ Requires Waste

- ***http://energyinformative.org and http://www.conserve-energy-future.com***

16: Did you review the Waste-to-Energy (WtE) diagram and information?

- Yes
- No (if no, an error message saying "Please review WtE Diagram")

17: After viewing the diagram and information, I have a better understanding of the Waste-to-Energy (WtE) process? (qCheck)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

19: Waste-to-Energy (WtE) would provide Nigeria with more reliable energy. (qAttitudes belief-1a)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

20: Waste-to-Energy (WtE) can provide sustainable energy creation to help meet Nigeria's energy demands. (qAttitudes, beliefs)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

21: Waste-to-Energy (WtE) would reduce pollution in Nigeria. (qAttitudes, beliefs)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

22: Waste-to-Energy (WtE) would contribute to a cleaner environment in Nigeria. (qAttitudes, belief)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

23: Meeting energy demand is not a problem in Nigeria. (qAttitudes, belief)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

24: Pollution is not a problem in Nigeria. (qAttitudes, belief)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

25: It is important for Nigeria to have an energy source that reduces pollution. (qAttitudes, evaluation)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

26: Protecting the environment is important for the well-being of Nigerians? (qAttitudes, evaluation)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

27: It is important for Nigeria to have a renewable energy source to help meet its power demand. (qAttitudes, evaluation)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

28: It is important for Nigeria to use renewable energy sources such as Waste-to-Energy (WtE)? (qAttitudes, evaluation)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

29: Most people who are important to me think it would be a good idea to adopt Waste-to-Energy (WtE). (qSubject Norms, normative)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

30: Most of my colleagues I know would want me to adopt Waste-to-Energy (WtE). (qSubject Norms, normative)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

31: When it comes to matters of adopting Waste-to-Energy (WtE), I want to do what my colleagues think I should do. (qSubject Norms, motivation)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

32: When it comes to matters of adopting Waste-to-Energy (WtE), I want to do what other leaders think I should do. (qSubject Norms, motivation)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

33: I intend to adopt Waste-to-Energy (WtE) as a renewable energy source to help meet Nigeria's power demands in Nigeria? (Intention)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

34: I support the adoption of Waste-to-Energy (WtE) process to produce energy in Nigeria. (Intention)
1. Strongly Disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly Agree

35: I support the adoption of Waste-to-Energy (WtE) to reduce pollution in Nigeria. (Intention)
1. Strongly Disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly Agree

36: I intend to promote Waste-to-Energy (WtE) as a viable energy solution in Nigeria. Intention)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

37: I will advocate for the use of Waste-to-Energy (WtE) in Nigeria. (Intention)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

38: I do not intend to promote Waste-to-Energy (WtE) as an energy solution. (Intention)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

39: As part of a leadership effort, we can build acceptance of Waste-to-Energy (WtE) as a sustainable energy source for Nigeria. (qLeadership acceptance)
1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

40: Nigerian leaders must accept change from using only current energy sources (e.g. natural gas, coal) to adopt the use of Waste-to-Energy (WtE) in Nigeria. (qLeadership acceptance)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

41: As Nigerian leaders, we have the ability to explore and pursue Waste-to-Energy (WtE) adoption

(qLeadership ability)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

42: As a part of leadership effort, we have limited ability to explore and pursue Waste-to-Energy (WtE) adoption. (qLeadership ability)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

43: As a part of leadership effort, we have the authority to explore and pursue Waste-to-Energy (WtE) adoption. (qLeadership authority)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

44: As a part of leadership effort, we have limited authority to explore and pursue Waste-to-Energy (WtE) adoption. (qLeadership authority)

1. Strongly disagree
2. Disagree
3. Neither agree or disagree
4. Agree
5. Strongly agree

45: In an effort to adopt Waste-to-Energy (WtE) as a long term solution to Nigeria's energy needs and environmental concerns, PLEASE indicate the extent to which you agree or disagree that YOU WOULD DO THE FOLLOWING: (qBehavior)

I WOULD:	***Strongly Disagree***	***Disagree***	***Not agree or disagree***	***Agree***	***Strongly Agree***
Sign a letter of support for WtE					
Attend meeting with colleagues/leaders to support WtE adoption in Nigeria					
Show support publicly for the adoption of WtE in Nigeria					
Support allocated resources to use WtE in Nigeria					
Like to learn more about WtE					
Other -- Please share what you would do:		***(This is an open text box in Qualtrics)***			

46: If you wish, please share with us any additional thoughts you may have about energy or pollution concerns in Nigeria:

Thank you for your time and assistance!

Appendix P: Survey Feedback from Participants

“I would like to learn more about WTE. I have lots of concerns for energy creation. WtE maybe a very good solution.”
“will give my support to the best of my capacity.”
“WTE has my full support and I believe waste to energy is the way forward for energy needs around the globe.”
“WtE should put more effort in creating more awareness in Nigeria.”
“promote the adoption of WtE to canvas for a change to WtE.”
“share my thought with more of my colleague.”
“an opportunity to provide any form of approval will be granted to help in creating more awareness.”
“most needed energy alternative supply and will give in to any form of support needed from me as leader.”
“I support every application of the use of WTE to have a clean energy supply is to have a healthy living”
“I've learned more from this survey”
“WTE is a world changer and from what I've learnt so far, the future is brighter with WtE”
“From the little knowledge gathered from the illustration I will study more on WtE to enable me give my very best in advocating for WtE”
“with my group of colleagues we are ready to give our support with the move to start WtE in Nigeria”
“share my knowledge of WtE with other who are not knowledgeable. Other sources of Energy generation in Nigeria is best option”

“will pass the knowledge i got from here on to promote the awareness of WtE”
“I agree with the thought of the author I agree with the thought of the author WtE in Nigeria is a bit of an challenge because the kind of waste typically generated is often biodegradable. It tends to have a lower calorific content and thus is less suitable for WtE. Or atnpeast, makes your $.10/kWh optimistic. Give advice on how to go about getting the waste?”
“From what I’ve learnt about this company i would support it all the way...”
“Please continue with your research so that Nigeria can adopt the system.”
“Please bring Waste-to-Energy to being in Nigeria pollution from the use of generator as a substitute for power generation has claimed lots of families and will be a positive change in a good direction to adopt a more cleaner and sustainable energy”
“i will help to advocate to my other fellow community leaders with no knowledge of WtE share it my other family member who are in a position of authority”
“Machines involve should be locally fabricated.”
“To use my authority to enforce the implementation of WtE in Nigeria. WtE will enhance good living of the Nigeria citizens through having an energy supply with no environmental pollution”
“Let others know about it as a viable option for the current waste management process as well as the power solution.”
“I am in full support of the adoption of WtE and will contribute my quota as a leader”
“Advocacy. Awareness from the primary level.”
“To participate in the establishment and management of the WtE Business Plan and manage the affairs of the Company when it comes to fruition. We may not promote CHANGE from the existing energy sources but advocate energy mix that would encourage WtE.”

"I would be interested to discuss further on exploring options for promoting waste to wealth ventures"
"Push harder to adopt WtE"
"Business Partnership to conduct feasibility study and evaluate practical options. Nigeria has Carbon credit advantages that are untapped. Assistance is needed in this area."
"Using medium of communication to publicized WtE "
"Pollution has affected farm produce in Nigeria"
"We generate enough daily waste that can support waste to energy initiative in Nigeria. So much pollution around in terms of waste while present demand for energy cannot be met"
"This program apart from its intended policies it will help to lift out a lot of Nigeria youth from unemployment thus improve security too. Nigeria currently is suffering from a lot of power energy problems in fact from chronic shortage of power leading to shut down of industries and jobs. WtE will help improve power employment and wealth to Nigeria and eliminate pollution since both smoke and co2 from generators will cease. as well water channels from blocked sewages by waste papers etc. will be reduced and eliminated."
"We need more robust energy policy and regulatory framework to cover renewable energy. I would be grateful if am given the privilege to both to trained and empowered to promote WtE."
"Enlightenment campaigns to be done. The political continuity"
"The adoption of Waste-to-Energy in Nigeria, would profoundly reduce pollution and high level of PM10 (Particulated Matter Concentration) in the atmosphere, which is causing people to fall sick in various communities in the country."

"I WILL LOVE TO SUPPORT THE ADOPTION AND AWARENESS OF USE OF WASTE TO WASTE ENERGY IN NIGERIA. AIR POLLUTION IS ONE OF THE CHALLENGES NIGERIA IS FACING RIGHT NOW, AND TACKLING IT WILL DO A LOT GOOD FOR OUR HEALTH."
"Use the social media as a tool for the publicity that Waste to Energy Projects in Nigeria."
"It will be a unique opportunity for Nigeria as a country and the continent of Africa in general, if WtE is promoted and encouraged with global support and funding. I therefore support every initiative that will help in this direction."
"There is serious energy shortfall in Nigeria which has become enormous concern to the government and people of Nigeria. Therefore, the need for the use of WtE is welcome development in Nigeria to boost the energy supply that has been the bane of development in the country."
"door to door campaign on the adoption of Waste-Energy (WtE) Pollution is affecting farm produce in Nigeria"
"One the challenges Nigeria may have in adopting WtE as a source of energy is insufficient infrastructure and lack of commitment on the part of individuals to do the needful like separation of solid waste and safe guarding properties that has to do WtE. It will take a long time for people to buy-in to WtE in Nigeria, because individuals have lost confidence on the Government since most Government projects have failed in the past. For WtE concept to succeed in Nigeria it must have a component of private sector participation."
"Apart from the support of leaders, I strongly believe that general public enlightenment on WtE will provide a very strong support base for promoting it at the grass-root."

"Nigeria is in dire need of energy to satisfy the huge demand for power. There is a serious deficit compared with the size of the economy. Nigeria generates just between 4000-5000 MW of electricity which compared woefully with other developing countries even in Africa such as South Africa and Egypt. Current demand for electric power in Nigeria is put at between 15,000-20,000 MW. This deficit has been the main constraint to economic activity especially in Northern Nigeria with many industries closed down an relocated to other countries or regions. Apart from the serious concerns and effects of fossil fuel on the environment and the consequent militancy in the south-south region where most of the oil and gas is found, there is the urgent need for harnessing diverse sources of energy such as WtE to quickly bridge the energy supply gap."
"This is an excellent idea. It will reduce the percentage of PM10 (Particulate Matter Concentration) in Nigeria, which is harmful to the environment and people."
"I will like to give my time by working with WtE. We can have a processing plant in all state and highly populated areas in Nigeria."
"Nigeria needs both all the power they can generate and cleaning the environment. Advertising, lobbying, and marketing of WtE is essential in promoting the technology. Attracting international donors to prepare bankable studies to attract investment is also important."
"I think pursuing stronger policies, reviews of extant legislation in support of adoption of WtE will no doubt provoke the minds and thinking of our leaders towards embracing this noble initiative in order to protect the society from age-long burden of ever increasing tons of waste adoring our landscape."

“Waste-to-Energy is the key as this will help reduce pollution in Nigeria, which is a major problem in our country.”
“The adoption of WtE power generation is excellent for Nigeria. WtE adoption will reduce the level of pollution in Nigeria, which is affecting our communities with unknown diseases. Secondly, we have enough waste in Nigeria to generate significant amount of power, which will reduce annual number of blackouts in the country. Lastly, it will reduce the level of PM10 (Particulate Matter concentration) in the atmosphere which is caused by emission.”
“Kindly explore installation of Mini-Grids in certain communities and States in Nigeria, especially Abuja, Lagos, Port-Harcourt, Benin, Delta, Kano and Kaduna States. Information is key, be the first to Act.”
“WtE will be a very welcome idea in Nigeria and I am certain that all Nigerian and the arms of government will be grad to be a part of change in Nigeria's energy and power.”
“I have always appreciated the Indian people how they have discovered the use of waste product converting it to energy and fuel. I once watched a documentary of it in Indian and have been feeling bad that Nigerians are using it to block water ways and heat this waste that cause pollution and diseases in our environment. Again this waste product can be use as fertilizer etc. please will strongly support for any company that will have an agreement with the Nig. government to utilize the immense waste product that we have. Thank you. As mentioned above it causes pollution, sicknesses and block our drainage including erosion.”
“There is the need for extensive advocacy for waste disposals and management amongst families, especially in the rural settlements in Nigeria.”

"I Pray the Nigeria authority adopt WtE soon. WtE is a wonderful idea and it will move Nigeria to a higher level, and the country will be pollution free, and energy problem will finally be solved."
"Give in any form of contribution by me when needed"
"Engagement with peer groups and other social groups on the necessity to consider WtE as a viable energy option for my country Nigeria.I am worried about the poor attitude of most Nigerians towards the environment generally. Something has to be done to sensitize Nigerians on how they need the environment and not the other way round. Attitudinal change will draw attention to the need for s in Nigeria to consider and adopt WtE as a viable and environmentally friendly energy option for Nigeria."
"share my knowledge by conference"
"Nigeria has high energy deficit, so it will be a welcome development to convert waste to energy as it also help to a cleaner environment."
"At any time I am called upon to participate in Brain-Storming sections to develop ideas on how we as Nigerians can implement the concept of Waste-to-Energy, I will be most delighted to do so. The major problems we have in Nigeria on Energy and Pollution concerns are 1) The political-will of our leaders in Government to do the needful in developing and implementing this concept. Their personal gains on the use of other sources of Energy e.g. Fossil Fuels is more important to them than Environmentally friendly sources of Energy. 2) Proper legislation need to be put in place to convert the heavily generated waste in Nigeria into Energy, to reduce the Energy demand in Nigeria. 3) Air, Water and Lad Pollution is alarming and Multinationals need to be put on check and mandated to put all the necessary structures in place to convert this waste (e.g. Gas) and stop flaring. 4) Waste Management Plants should be

built all over the country (e.g. In the Niger Delta) to re-cycle the waste and convert then to Energy production. 5) The Nigerian People should be educated on Waste re-cycling and Management."
"I would love to engage in a sensitization drive to ensure many more key in to the WtE philosophy. If I may use this space, on the question MEETING ENERGY DEMANDS IS NOTHING A PROBLEM IN NIGERIA, the first and last response options both say strongly disagree, which I think is an error. The last option ought to have read STRONGLY AGREE."
"in trying to enlighten the people about it, teaching them the important of waste to energy"
"By supporting legislation on waste to wealth, waste to energy. And by setting up a micro plant as a pilot project in the Niger Delta community to covert our domestic waste to energy."

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