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IKEOHA FOUNDATION

FINAL REPORT: A survey of innovative road transport solutions in Nigeria in response to the COVID-19 pandemic

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Abstract

This study surveyed innovative road transport solutions in Nigeria in response to the COVID-19 pandemic. The study employed a mixed-method involving both qualitative and quantitative research. Principal component analysis and multiple criteria analysis were used to analyse the data from questionnaires. The results show a high degree of compliance to safety and health protocols by road transport operators and road users, suggesting that this may have contributed to the effective management of the pandemic in Nigeria.

Keywords	Road transport, COVID-19, Low-Income Countries, Response, Nigeria, Ghana, Gambia, transport planning, innovation, solutions
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Cover Photo Credit: Sunny-O

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ACRONYMS

AUMTCo	Abuja Urban Mass Transit Company Ltd
AKTC	Akwa Ibom Transport Company Ltd
APTCN	Association of Private Transport Companies in Nigeria
CCS	Enugu State Coal City Shuttle
COVID-19	Novel Coronavirus Disease 2019
EVD	Ebola Virus Disease
FCDO	Foreign, Commonwealth & Development Office
FMoT	Federal Ministry of Transport, Nigeria
FRSC	Federal Road Safety Commission, Nigeria
HVT	High Volume Transport Applied Research Programme
IMC	IMC Worldwide Ltd
LBSL	Lagos Bus Services Limited
LIC	Low-income country
MDAs	Ministries, Departments and Agencies
MCA	Multiple Criteria Analysis
NARTO	National Association of Road Transport Owners
NCDC	Nigeria Centre for Disease Control
NURTW	National Union of Road Transport Workers
PCA	Principal Component Analysis
SDGs	Sustainable Development Goals

EXECUTIVE SUMMARY

This study examined how road transport operators in Nigeria have coped with (or responded to) the Novel Coronavirus Disease 2019 (COVID-19) challenges as well as how lessons learned can be used for future programmes. It surveyed the innovative road transport solutions in Nigeria in response to the COVID-19 pandemic, with the aim of understanding how road transport operators in Nigeria coped with (or responded to) COVID-19 challenges and how lessons learned will be useful in the future. The study employed a mixed-method involving both qualitative and quantitative research. The qualitative method examined diverse opinions and views of stakeholders in the road transport industry in Nigeria. In addition, it examined technologies, processes and procedures that have been employed in responding to COVID-19.

Primary data from the qualitative method derives from observations and semi-structured face-to-face oral interviews administered on a sample of 17 representatives of the different categories of road transport operators. On the other hand, the quantitative method used in this study sought to obtain empirical data through a questionnaire administered to a sample of 20 stakeholders in the road transport sector. The sample was selected from a frame of seven different categories of road transport operators in Nigeria. This was to ensure a manageable sample size within the specified period of study. The stakeholders were chosen to geographically cover the nation's seven heavily travelled road transport corridors in the South-eastern, South-western and Northern parts of the country. The study used the Principal Component Analysis (PCA) and Multiple Criteria Analysis (MCA) methods to analyse the data from the questionnaire.

The results show that road transport operators perceive responses to the COVID-19 pandemic in Nigeria as 90.7% effective. A breakdown shows that observing a lockdown directive was the most effective (20%) road transport operators' response to the COVID-19 pandemic in Nigeria. It was followed in descending order by COVID-19 safety protocols (12.6%), environmental sanitation (9.8%), promotion of hygiene (8%), information technology (7.8%), face mask wearing (7.3%) and physical distancing (6.6%). Other responses include public enlightenment (6.2%), palliative support (5.1%), inclusiveness (4.1%) and mass media (3.4%).

The response to the COVID-19 pandemic in Nigeria's road transport sector presents some development opportunities. These opportunities, in descending order, include developing a new business model, (20.4%), modernisation of the road transport system (18.6%), application of information technology (15%), revitalisation of road transport infrastructure (13.5%) and development of a sustainable work model (12.1%). The lessons from pandemic infection control and public health should be the basis for stricter enforcement of safety protocols in the formal and informal public road transport sector.

The PCA results show a breakdown of opportunities that may influence transition to low carbon and cleaner transport systems in Nigeria. These include: adopting green transportation (17.3%), investment in green energy infrastructure (10.7%), and increased adoption of other climate change mitigation measures (13.8%). In addition, the results indicate that road transport operators in Nigeria emphasised inclusiveness in their operations during this pandemic, especially in the areas of accessibility to transport facilities (13.5%) and the provision of special facilities for vulnerable groups (11.4%). The lessons from their responses can make emergency and essential services providers more responsive to the issues of inclusion and similar challenges posed by this pandemic.

The outcome of this study informs road transport policy and feeds into global repositories for information relating to the coping mechanisms of countries and cities now and in the future. Utilising these findings can contribute, in the immediate post-Coronavirus period, to stimulate robust socio-economic recovery, especially in low-income countries in Africa.

1. Introduction

The Novel Coronavirus Disease 2019 (COVID-19) pandemic is the most crucial global health calamity of the century and the greatest challenge that humankind faced since the Second World War. It has fundamentally disrupted individual's lives, families, organisations, transportation, supply chains, markets and global trade. There are no answers yet to the challenges posed by the pandemic, but innovative solutions have sprung up around the world to address the challenges. These range from allocation of more road infrastructure to bike users in some cities like Bogota,[1] to the Cool App in Malta that allows drivers to pool multiple deliveries from stores and small businesses into the same vehicle to increase efficiency.[2] There are lessons to learn from such examples; nevertheless, what works in some places may not be relevant elsewhere. In Nigeria, where road transport accounts for over 90% of freight and passenger movements, road transport operators face the additional challenge of poor infrastructure. However, irrespective of this and other daunting challenges, Nigeria has responded to the pandemic appreciably well relying almost entirely on road transport to render essential services.

This study therefore sought to describe how road transport operators have responded to the pandemic, the innovative solutions they employed in responding to the pandemic, and to deduce lessons that could be applied in the post-Coronavirus period to stimulate a robust socio-economic recovery. The outcome of this study will inform road transport policy in the future and feed into a global repository for information relating to the coping mechanisms of countries and cities now and in the future. This study is imperative as no study has yet aggregated the unique experiences and innovative technologies employed by different categories of operators involved in road transport in Nigeria in containing the Coronavirus pandemic. Consequently, this study provides an experience-sharing opportunity for stakeholders, which will result in a more efficient and effective service provision in the nation's road transport sector.

1.1 Project aims and objectives

The aim of this research is to examine how road transport operators in Nigeria have coped with (or responded to) COVID-19 challenges and how lessons learned can be used for future programmes. Research objectives are:

- To identify and categorise new technologies, processes and procedures used by road transport operators to respond to the pandemic in Nigeria;
- To evaluate what opportunities are available in the transport sector because of national response, and how these opportunities can better be utilised;
- To collate lessons learned about infection control and public health safety measures for both formal and informal transport systems;
- To collate perspectives of transport operators on opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria;
- To understand how road transport operators are grappling with issues of inclusion especially regarding persons with disabilities, the aged, women and children.

1.2 Transport challenge being addressed during/ post-COVID-19

This study addresses the following transport challenges:

- How to keep drivers, workers and transport users safe from COVID-19;
- How to keep road transport operators in business; and
- How to utilise lessons learned to stimulate greater economic growth in the post COVID-19 period.

These challenges require immediate attention given that the global transport industry, which has been greatly affected by the COVID-19 pandemic, has witnessed huge losses in revenue due to tremendous decline in patronage. informal transport operators are worst hit as many of them have experienced 100% loss in revenue due to city lockdowns. In addition, transport workers on the frontline are prone to infection with the virus as they struggle to provide essential services. This study has therefore aggregated the unique

experiences and innovative technologies and approaches employed by different categories of operators involved in road transport in Nigeria in containing the Coronavirus pandemic. It intends to assist transport stakeholders and the public in Nigeria and other low-income countries (LICs) in Africa to respond adequately to COVID-19 and be better prepared against similar emergencies in the future.

1.3 Alignment with the HVT research themes, priorities and programme objectives

This study aligns with the High Volume Transport (HVT) Programme's priority of supporting research that produces innovation and technology that can help manage immediate response to COVID-19 pandemic and guide recovery. By highlighting approaches being used by road transport operators in Nigeria to respond to the COVID-19 pandemic, this study can stimulate wider operational and policy changes in Nigeria and other LICs in Africa. Thus, it contributes to HVT's research themes on road and rail transport, low carbon transport, and gender and inclusive transport, supporting LICs in Africa and South Asia to achieve universal access, efficiency, and safe and green transport.

1.4 Alignment with FCDO priorities

This study aligns with FCDO's priority of ensuring that transport plays its critical role in supporting LICs to reach their Sustainable Development Goals (SDGs) seeking innovative ways to make transport accessible, efficient, safe and green. The study can also influence policies that contribute to FCDO's focus on climate change mitigation and adaptation especially in developing economies where there is still opportunity to avoid the high emission trajectories seen in high- and middle-income countries. This is because transportation, as a significant contributor to global warming, holds great potential for greenhouse gas (GHG) reduction when appropriate measures are in place. And through policy changes that may arise from findings in this report, FCDO will be fulfilling its priority of strengthening resilience and response to the crisis, promoting global prosperity, tackling extreme poverty and helping the world's most vulnerable.

2. Methodology

2.1 Summary of approach

In this study, road transport operators include drivers, workers and administrators of transport companies (both formal and informal, private and public), as well as staff and administrators of regulatory authorities such as ministries, departments and agencies (MDAs).

This research design was aimed at producing results that represented the true extent of the innovative responses of road transport operators to the Coronavirus pandemic in Nigeria. The study population consisted of all public and private road transport organisations in Nigeria. The study sampled 20 questionnaire respondents and 17 personal interview respondents of these organisations to enable the completion of the study within the specified period. The sample size is adequate to capture all major stakeholders in Nigeria's road transport sub-sector, having been derived from seven categories of road transport operators in Nigeria adopted for this study.

These operators, both those that provide passenger and freight services in Nigeria have been categorised as follows:

- **Regulators**: government organs responsible for policy formulation, operational co-ordination, and standards enforcement. These include Ministries of Transport, departments and agencies.
- **Public operators**: high volume, government-owned (mostly state government) mass transit services, such as the Lagos Bus Services Limited (LBSL) and Enugu State Coal City Shuttle (CCS).
- **Quasi-public operators**: private persons or companies contracted to use government-backed vehicles for road transport, examples are vehicles under the Federal Government Urban Mass Transit Scheme, various state government-backed township cabs.
- **Organised private operators:** a collective of private operators functioning under a union or group, such as National Union of Road Transport Workers (NURTW), National Association of Road Transport Owners (NARTO), and Nigeria Labour Congress Mass Transit Services (Labour Mass) services. Examples are Chisco Transport Services Limited, ABC Transport Limited, and God is Good Motors Ltd. Many members of this category belong to the Association of Private Transport Companies in Nigeria (APTCN).
- **Organised independent private operators**: private or public companies offering road transport services.
- **Organised virtual operators:** ICT-based companies offering ride-hailing services, such as Uber, Pamdrive and Rideon.
- **Courier and logistics operators:** private or public companies offering freight or courier services.

Primary data, which was collected through telephone and face–to–face interviews, and questionnaire surveys, focused on the following:

- New technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria;
- The opportunities available in the transport sector because of the national response, and how these opportunities can be better utilised;
- Perspectives of transport operators on the opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria; and
- How road transport operators are grappling with issues of inclusion especially for persons with disabilities, the aged, women and children.

A Stratified random sampling technique was used to select 20 respondents from the sample frame of the existing seven categories of road transport operators in the country. This technique was employed to give every unit of the population an equal opportunity of being selected for the sample. This eliminated the potential error of bias in the selection of respondents that could have impacted on data quality. The road transport operators were stratified based on the categories of road transport sector explained above.

This sampling procedure also geographically covered the nation's seven heavily travelled road transport corridors. A breakdown shows that four of the organisations are based in Enugu (South-eastern Nigeria), within the Port Harcourt-Aba-Abuja-Kaduna-Kano and Port Harcourt-Aba-Enugu corridors; seven organisations are based in Lagos (South-western Nigeria), within the Lagos-Ibadan-Kaduna-Kano and Lagos-Shagamu-Benin-Onitsha-Ogoja corridors; and six organisations in Abuja (Northern Nigeria), within the Abuja-Kano-Maiduguri-Ngala corridor.

Building on the outcome of an earlier desk research, two researchers paid pre-survey visits to the operational locations of nine of the study sample elements between 26th and 30th October 2020 to note new technologies, processes and procedures in use, and to set up interviews with their appropriate authorities. These visits highlighted some gaps in the research design.

First, it was found that although it had been proposed that key informant interviews would be held with the managers of transport companies only, many workers such as drivers and other administrative staff were in fact more knowledgeable about the subject matter. Therefore, the research was quickly adapted to respond to this. Thus, in addition to key informant interviews with managers of transport companies already scheduled for interviews, a questionnaire survey was administered to other staff from similar transport companies. This adaptation of the procedure enabled the generation of more diverse views and enriched the overall contributions.

Second, five proposed respondents were incapable of granting interviews either because of bureaucracy or the effects of the EndSars protests taking place in Nigeria for most of the month of October 2020. Two of these organisations were replaced with similar operators randomly selected according to the road transport categories adopted for the study. Incidentally, one regulatory authority (out of two proposed) and two public transport operators (out of five proposed) were not interviewed. This may have caused a shortfall in the data that could have been generated from these organisations regarding the national response to the pandemic however, as proxy, all other respondents were interviewed on their awareness of national response prevalent at the time, with some of them providing valuable information. In addition, the study interviewed the Federal Ministry of Transport, the highest policy organ on transport in Nigeria. Administering the questionnaire has further compensated for the shortfall in personal interviews recorded and made the data collected more robust.

In all, 17 operators from the following categories were interviewed:

- One regulator,
- Three public operators,
- One quasi-public operator,
- Two organised group private operators,
- Five organised independent private operators,
- Two organised virtual operators (ride hailing services), and
- Three courier and logistics operators.

2.2 Methodology

The study employed the mixed method involving both qualitative and quantitative research. A qualitative research method is usually employed when there is a need to describe the *whys* and *hows* of a situation.[3] It is a method that seeks to understand the behaviour patterns, motivations, opinions and perceptions of a population. It utilises data gathered by the researcher through interviews, focus group discussions, transect walks, questionnaires, and personal observations. On the other hand, quantitative research entails collecting and analysing numerical data to test causal relationships, find patterns, and predict outcomes of events. Data for quantitative research can be gathered through experiments, controlled observations, polls, interviews and questionnaires. Combining these two methods, a technique known as triangulation, ensures credible results that give a better description of human behaviour, a phenomenon or situation.

This technique has been used in this study to generate opinions and views of stakeholders in the road transport industry in Nigeria on the five main objectives of this study. Primary data from the qualitative

method were generated through observation and semi-structured face-to-face and telephone interviews from a sample of 17 respondents out of a projected 20 representatives from the various categories of road transport operators.

The study could not interview three of the proposed respondents due to the EndSars protests taking place during the study period. To overcome this challenge, this study administered an additional 20 questionnaires to other respondents. This was to ensure that empirical data from the questionnaire covered the gap created by the shortfall in the number of interviewees. Secondary data was derived from publications such as reports by government and non-governmental agencies as well as through social media channels, reports, thought pieces, websites and blogs.

The descriptive statistics derived from the survey defined two levels of analysis based on Multiple Criteria Analysis (MCA). The first analysis determined the matrix of preferred levels of perception and the second used the calculated Mean to measure levels of perception. The scoring of the levels of perception proceeds with a convenient scale based on the range of calculated Mean. The Principal Component Analysis (PCA) was applied to analysis of the empirical data from the questionnaire on objectives 1, 2, 4 and 5.

PCA is a statistical technique that converts a set of linearly uncorrelated variables into components or factors using orthogonal transformation. The perception of road transport operators on the effectiveness of their responses to COVID-19 pandemic was measured by the PCA based on 5-point Likert scale, namely, very high (5), high (4), moderate (3), low (2) and very low (1). This was to establish the effectiveness of their responses in containing the pandemic.

The formula of PCA is given as:

$F = \sum_{j}^{n} = 1$ W1 X1 + W2 X2 + …… Wn Xn …… (1)

Where:

W1 –W2 = factor weight

X1 – X2 =Original variable

2.3 Innovation

In this study, 'innovative road transport solutions', means those new measures, administrative processes and procedures, technologies, approaches, actions or policies that have been used by road transport operators to safeguard workers and users of road transport services in Nigeria from contracting COVID-19, prevent the spread of the virus and prepare the general population for life after the pandemic.

This definition is supported by diverse literature on innovation including the works of Schumpeter,[4] Lijster,[5] Franklin,[6] Bhasin,[7] and Forbes,[8] which agree on one thing: creating new technologies or disruptive organisational arrangements are not the only aspects of innovation. Other aspects in the view of Cirera and William[9] include 'commercial applications of new technology, new material, or new methods and processes, [all of which]…primarily involves the process of adoption of existing technologies, the process of copying or imitating attributes from other products, or the adoption of new managerial and organisational practices or business models from other companies.' From this Schumpeterian[10] view they sum up innovation as '…the ability to use knowledge to develop and apply new ideas that result in changes in the production and organisational structure of the firm.'[11]

This study surveyed what road transport operators in Nigeria considered to be 'innovative solutions' in their response to the pandemic. The effectiveness of these solutions can be measured by the increasing or decreasing number of new cases since their adoption, the rate of spread attributable to road transport and the general population's preparedness for life after the pandemic.

2.4 Research activities undertaken

This study was planned to be concluded in eight weeks beginning with desk research (gathering secondary data and literature) in weeks one and two and ending in week eight with a capacity building workshop for stakeholders. The study progressed as planned; desk research was conducted, interviews with 17 respondents

held, the questionnaire administered to 20 respondents, interviews transcribed, and data generated has been analysed.

2.5 Assumptions

- Critical stakeholders in the road transport sector will be willing to learn how the study's findings can contribute to better service provision.
- Policy officials will commit to implement relevant recommendations.

3. Implementation

3.1 Activities conducted

Research activities were satisfactorily concluded. Two researchers visited the operational sites of nine of the study sample elements between 26th and 30th October 2020.

Between 27th October and 19th November 2020, 17 interviews were held in three locations as proposed: Enugu, Lagos and Abuja, achieving an 85% success rate. These cities were selected as they represent major transport hubs in Nigeria, the Federal capital Territory, and Abuja, particularly because it is home to headquarters of many transport organisations.

Table 1: Schedule of interviews held

Interviewee	Location	Category	Date	Interview type
UPS Nigeria	Enugu	Courier and logistics	27th October 2020	Face-to-face
Rideon	Enugu	Organised virtual operator	30th October 2020	Face-to-face
Pamdrive	Enugu	Organised virtual operator	2nd November 2020	Telephone
NURTW	Enugu	Group private operator	2nd November 2020	Face-to-face
Libra Motors	Lagos	Independent private operator	5th November 2020	Face-to-face
Uber	Lagos	Organised virtual operator	5th November 2020	Face to face
AKTC	Lagos	Public operator	12th November 2020	Face-to-face
The Young	Lagos	Independent private operator	14th November 2020	Face-to-face
GUO Maza	Lagos	Independent private operator	14th November 2020	Face-to-face
GUO Iyana Ipaja	Lagos	Independent private operator	14th November 2020	Face-to-face
Okeyson Logistics	Lagos	Courier and logistics	18th November 2020	Face-to-face
AUMTCo	Abuja	Public operator	6th November 2020	Face-to-face
FMoT	Abuja	Regulator	9th November 2020	Face-to-face
NARTO	Abuja	Group private operator	13th November 2020	Face-to-face
Whole Deliveries	Abuja	Courier and logistics	13th November 2020	Face-to-face
Okun Line	Abuja	Independent private operator	19th November 2020	Face-to-face
Peace Mass	Abuja	Independent private operator	19th November 2020	Face-to-face

The questionnaires administered to the 20 respondents achieved a 100% return rate.

Available data was analysed from two approaches: PCA was used on data from the questionnaire, while responses from the personal interviews were categorised into themes corresponding to study objectives.

Three validation workshops were held for road transport stakeholders in Lagos, Abuja and Enugu between 23rd January and 11th February 2021, with a total of 84 participants. The workshops were held to present preliminary findings from the study, get the stakeholder's feedback , and build their capacity to utilise the findings. The workshops were useful as the participants helped to clarify misconceptions. They also served to validate the findings of the study as being a true representation of road transport operators' responses to the pandemic in Nigeria. In addition, they discussed in detail the under-representation of women in the road transport sector and possible causes and called for policy interventions to bring sanity and order to road transporter's operations to open operational space for women in sector.

A webinar was held on 24th February 2021 to present the study findings to the public, with a view to publicising research activities, and generating feedback that could aid in fine-tuning the research analysis.

3.2 Project findings

The road transport sector in Nigeria is a male-dominated sector of the economy and this accounts for the poor participation of women in the study. Consequently, only one of the 17 interviewees was female. In addition, two participants that responded to the questionnaire were female. Combined, this translates to an 8% female participation in the survey. This low rate of participation mirrors women's participation in the transportation sector in Nigeria. Informal exchanges with some respondents in this study also suggest that the unruliness that pervades most aspects of road transportation in Nigeria might be responsible for women shunning participation in road transport operations in Nigeria. There may also be other reasons such as cultural perception of transportation as duty for males. A study of gender issues in the transportation sector of Nigeria by Richard S. H. & Okon E. O. found that the respondents believed that it was culturally inappropriate for women to engage in road transport operations, and that men were better suited to operating in the road transport sector.[12] Notwithstanding the poor representation of women in this study, the study found many instances of innovative solutions and measures used by road transport operators in Nigeria to respond to COVID-19. Table 2 details a summary of the telephone and face-to-face personal interviews detailing operator's new measures, processes, technologies, and operations in response to the pandemic in Nigeria, grouped according to study objectives.

Table 2: Summary of operators' new measures

Objective	Question	Enugu	Lagos	Abuja	Remarks
1	***What have you done differently (any new technologies, processes or procedures that you have used) within this period in response to the pandemic?***	*The use of phone played vital role in cushioning the tension due to late delivery of courier services *We introduced shift-duty to facilitate spacing *We introduced the use of hand gloves for handling money *We introduced work from home where it is convenient e.g. those in computer department *Logistics companies did not lockdown *We observe government guidelines on washing hands, physical distancing, etc. *Distribution of palliatives we received as gift *Created WhatsApp group of technicians and logistics operators to keep automated teller machines, ATMs running and to provide logistics support to financial institutions during the lockdown. *Internet booking of transport services; *Provision of home delivery services (e.g. PamStores, an online store) *Introduced other services in addition to transportation *Online communication with passengers to reduce face-to-face contact	* No. of passengers carried in 5-seater vehicles (Hummer) reduced from 15 to 9 to achieve physical distancing *Washing and sanitizing of hand before entering the park and before entering the vehicle *Use of water dispenser and soap for washing the hand before entering the terminal *The use of facemask is mandatory before entering the vehicle otherwise the driver will not move *For long distance trips, that requires sleep over or where there is curfew that restricts movement, we sleep in the park mandatorily *Increase in transport fare *Medical personnel (e.g. Doctors) at the terminal in some cases *We conduct publicity campaign for the use of masks, physical distancing, etc. *Multiple checking (or rechecking) of temperature with thermometer for workers including drivers and commuters *Sanitise car (e.g. handle of your doors) after each passenger on drop leaves *Monitoring with video call by company officials to ensure	*Continued to operate from old terminals *We enforce government guidelines especially sanitisation, hand washing and wearing of facemask *We maintained physical distancing for commuters in line with government directive *Give enlightenment lecture to commuters and answer their questions *Home delivery of food services using hand gloves on demand of customers *Payment online to avoid physical contact	*One interviewee from Lagos confirmed their company has stopped physical distancing; that they now carry full load as they used to before covid-19; and that some passengers now refuse to wear facemasks. (Sometimes they wear facemasks to enter the car then remove it thereafter)

Objective	Question	Enugu	Lagos	Abuja	Remarks
		*Limit movement to affected areas *Upfront booking of passengers to enable drivers go through rigorous testing *Training on safety measures and attitudes for drivers and other operators *Shifting and rotation of staff	compliance to government and company directives *Transport company obligated to offset hospital bills in cases of emergency *Enforcement of regulations		
2	***What opportunities can you identify for road transport from the government's response to the pandemic so far?***	*No opportunities for transport operators *Preference for private rather than public transport mode *Increase in safety consciousness	*No opportunities. Only problems especially the curfew that regulates movement *Increase in passengers' compliance *Entry permit (conditions for entry) into Lagos causes delay *Police menace on the road *Change of route assignment to beat police problems	*Created difficulties for commuters *Increase in transport fare due to limited supply of transport services. *No profit for operators *COVID-19 is disadvantageous for commuters and transport operators *COVID-19 sanitised movement *No opportunities. Strangled transport business *No assistance from government so far *Government should provide palliatives and carry the people along	
4	***What do you consider as opportunities presented by COVID-19 for a shift towards low carbon and cleaner transport systems in Nigeria, and how is your organisation keying into these opportunities?***	*Demand for transport services has reduced drastically due to work from home	*Better hygiene *Transport business reduced *Goods are moving but people are not moving (i.e. there is increase in way billing) *Enhancement of car servicing activities * More collaboration with vehicle inspection office, VIO, the police and road safety officers in decision-making	*We ensure that our vehicles/ machines (motorcycle) are in good working condition. No smoking vehicles *We reduce the amount of trips we conduct from 7 to 2 trips to reduce congestion *Withdrawal of vehicles that are not in good working condition	
5	***What policies and plans do***	*No policies for disabled	*Discount in transport-fare is	*We provide inclusive services.	

Objective	Question	Enugu	Lagos	Abuja	Remarks
	you have in place to ensure that persons with disabilities, the aged, and women are not marginalised either as commuters or as road transport operators?	because most time we use rented apartments *However, we deliver drugs used by the disabled. We take these drugs to their doorstep *Provide employment for people with disability *We treat everybody like a premium client with preference for the elderly	given for children below 10yrs *We exempt people on wheelchair from paying transport fare *We turn sick people back *Proper handling of the physically challenged is an integral part of service mandate *No discrimination	No discrimination *Observance of government guideline on COVID-19 in the terminal	

Source: Field study, November 2020

Objective 1: To identify and categorise new technologies, processes and procedures used by road transport operators to respond to the pandemic in Nigeria

Results from the personal interviews in Table 2 above show that the new technologies, processes and procedures employed by road transport operators in Nigeria to respond to the COVID-19 pandemic can be categorised as follows:

1. Technologies based on quick adoption and utilisation of NCDC COVID-19 safety protocols

At the outset of the pandemic in Nigeria, particularly at the point of the index case on 27th February 2020, the Nigeria Centre for Disease Control (NCDC) released guidelines and protocols on health and safety measures to respond to the disease.[13] These measures included the prohibition of all interstate travel except for essential travels and services such as the transportation of agricultural produces, petroleum products, relief items, goods and commodities related to the COVID-19 response, and persons on essential duty. Where movement of goods and persons must occur, the guidelines advised the provision of hand washing facilities, physical distancing, mandatory use of face masks/ face coverings, mandatory temperature checks and the use of alcohol-based hand sanitisers. This study found that transport operators were quick to adopt and utilise these guidelines. Some road transport operators interviewed such as the Abuja Urban Mass Transit Company Limited adapted and expanded the guidelines[14] to cover all sectors of their operations targeting commuters, supervisors, drivers and other field staff. All the interviewees reported the following operations:

- Mandatory temperature checks, use of alcohol-based hand sanitiser, face masks/ coverings, and disposable gloves for handling money;
- Hand washing facilities and mandatory hand washing for operators and users;
- Physical distancing, both at terminals and on transit.

2. Information and communication technology, (ICT) based innovations

All transport operators sampled seemed to have also adopted and deployed ICT-based solutions in response to the pandemic. The operators to avoid contact with commuters, for instance, generally used online booking and ticketing. In addition, transport operators reported increased use of technologies to hold remote staff meetings. Rideon, a ride hailing service provider in Enugu, reported that it has held 100% of its meetings remotely since the start of the pandemic. A major downside however to this widespread adoption and use of information technologies, according to respondents, was the increase in the cost of gadgets, voice, video and data services, as well as the unstable and poor quality of these services.

THE CASE OF PAMDRIVE

Pamdrive, a ride hailing services provider based in Port Harcourt, has had to change its entire operational and business orientation in response to the pandemic. Before the pandemic, the company's operations were limited to using its online application to link commuters to vehicles registered with them. But with restriction of movement, especially the city-wide lockdown and curfew, the company found itself operating at almost zero capacity. Fortunately, a timely review of operations revealed a gap in logistics within the city into which the company quickly positioned itself and filled. It began to deliver items (some of which were sent from other states and as such could only get to the border), to their owners. As soon as movement restriction was relaxed, the company began the home delivery of essential items such as food and drugs, and finally planned to roll out an online store called PamStores to furnish the backend of the entire chain.

3. Technologies and processes that enabled change in work procedure

Road transport operators in Nigeria have had to adapt their work procedures in response to the pandemic. All operators interviewed reported that they had introduced shifts to create the required physical distance in the work environment, especially the offices. Not all operators however were able to create a work-from-home environment because of lack of access to (and sometimes inability to use) certain information technology gadgets such as computers and smart phones, or due to their duties not being suited to be performed remotely, such as drivers and cleaners.

4. Information dissemination procedures and channels

COVID-19, being a novel virus, brought fear and uncertainty especially when it assumed pandemic proportion. This triggered the release of large volumes of information by all and sundry through all media channels however, much of the information was conspiracy theories that lacked any form of credibility. This study however, found that road transport operators in Nigeria relied solely on government-approved channels for information. All road transport locations visited had ample display of NCDC and Ministry of Health approved infographics. The operators noted that this was important to ensure that they were consistent with guidelines for commuters and other road users. The Federal Ministry of Transport for instance has collaborated with the Federal Roads Safety Corps (FRSC) and other security agencies to organise periodic public enlightenment programmes for all categories of road transporters.

5. Procedures for national response

- Issue and enforcement of directives

Regulatory authorities especially the ministries of transport were swift to issue operational guidelines for essential service workers and transporters during the lockdown. Drivers and other operators reported that they received appropriate permits for intra- and inter-city travel.

- Changes in infrastructure

Although active transport has been encouraged to ease the worsening flow of traffic due to more private cars on the road, the study did not find any changes in road infrastructure arising from response to COVID-19 in Nigeria. If anything, transporters have reported declining quality of roads since the pandemic.

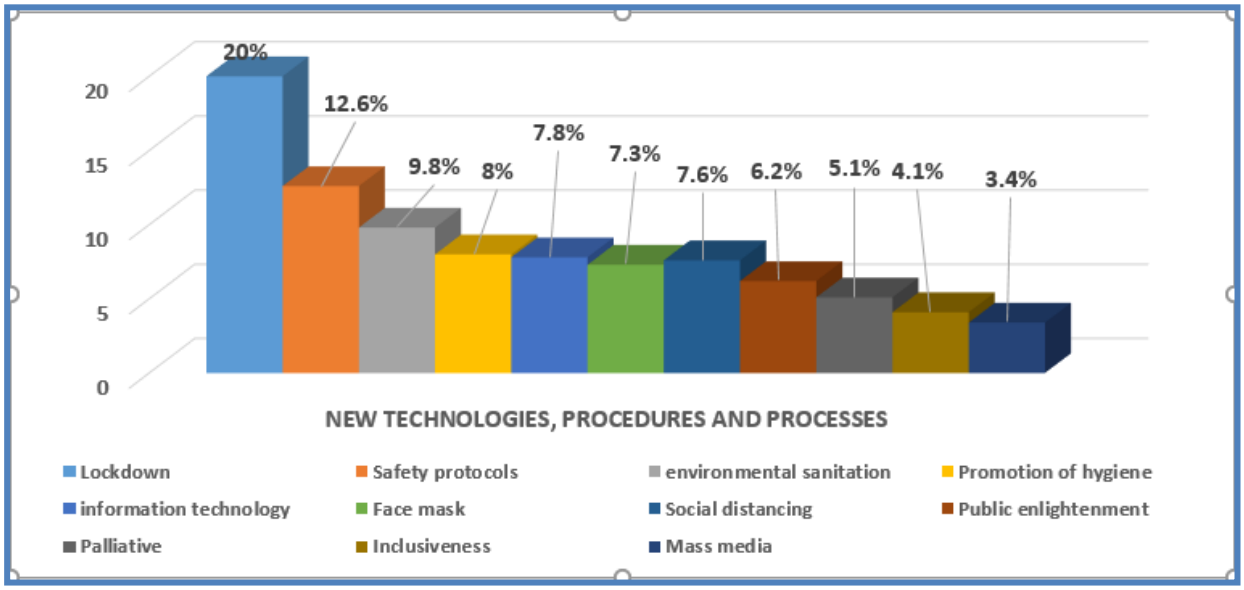
- Stimulus package

Twelve of the road transport operators interviewed were not aware of any national stimulus package meant for them. This calls to question the modalities for disbursing the Federal Government of Nigeria (FGN) Micro, Small and Medium Enterprise (MSME) Survival Fund grants meant for operators.

Further results from the PCA analysis of data from personal interviews (as shown in Table 2) and data from questionnaire survey, indicates that operators viewed the use of face masks, physical distancing, cleaning of conveniences, and public enlightenment as some of the highly effective responses to the pandemic, with a mean of 4.5 and above. The questionnaire sought to elicit respondent's perception through the ranking of 51 variables on how effective they thought each variable was, as an innovation, to their response to COVID-19. This perception survey was important to generate consensus of what road transport operators in Nigeria truly consider 'innovative' in their response to the pandemic.

The analysis, with calculated mean, shows high awareness although a sizeable proportion shows moderate level of perception and a small proportion with low level of perception. The PCA analysis categorised five new technologies, processes and procedures identified by road transport operators in their response to the COVID-19 pandemic identified in Table 2 into 11 components, which accounted for 90.7% of the variance. This implies that they consider these measures to be 90.7% effective in responding to COVID-19 pandemic in Nigeria.

Figure 1: 11 categories of new technologies, processes and procedures



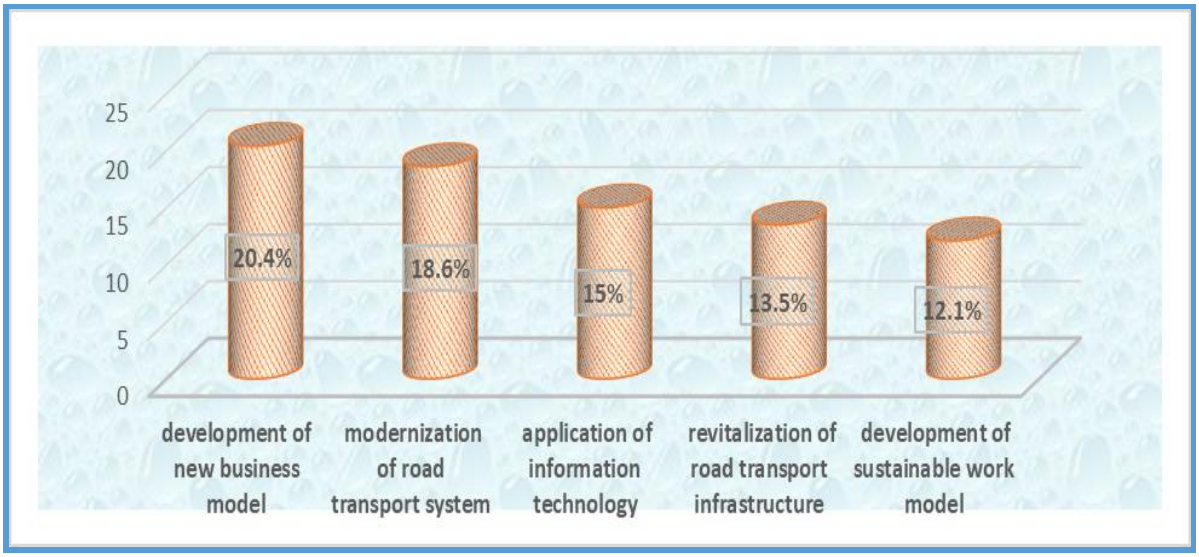
A breakdown of the PCA analysis (**Error! Reference source not found.** above) also shows that road transport regulators consider lockdown as the most effective (20%) new measure they utilised in responding to the COVID-19 pandemic in Nigeria among the 11 components. It was followed in descending order by COVID-19 safety protocols (12.6%), environmental sanitation (9.8%), the promotion of hygiene (8%), information technology (7.8%), face mask wearing (7.3%) and physical distancing (6.6%). Other responses are public enlightenment (6.2%), palliative support (5.1%), inclusiveness (4.1%) and mass media (3.4%). The implication is that road transport operators, in responding to the COVID-19 pandemic in Nigeria, effectively used the 11 categories of new technologies, processes and procedures and that the response of road transport operators to the COVID-19 pandemic is successful in Nigeria.

Objective 2: To evaluate what opportunities are available in the transport sector due to the national response, and how these opportunities can better be utilised

Responses from the face-to-face interviews (see Table 2) show that none of the three cities studied identified opportunities, such as the application of information technology, for road transport services as a result of national response. There seemed to be a sense of helplessness displayed by respondents as they identified more adversities than opportunities.

However, logistics and delivery services can be very lucrative within the COVID-19 period because, as identified in Lagos, goods were being moved during the lockdown (even though people were not commensurately moving. There is also an indication of increasing operations by digital transport firms, as is the case in Enugu. However, analysis of data from the sample questionnaire (shown in **Error! Reference source not found.** below and at Appendix C) showed that the availability of opportunities in the transport sector due to the national response could be moderate. A breakdown of the PCA results shows that developing new business models is the highest (20.4%) business opportunity that exists in Nigeria's road transport sector due to the COVID-19 pandemic response. It is followed in descending order by the modernisation of road transport systems (18.6%), application of information technology (15%), revitalisation of road transport infrastructure (13.5%) and development of sustainable work model (12.1%). This indicates that irrespective of the perception of road transport operators, the pandemic has created opportunities for the transformation of Nigeria's road transport sector.

Figure 2: Opportunities that exist due to national response



Objective 3: To collate lessons learned about infection control and public health safety measures for both formal and informal transport systems

Public transport is an essential service to provide mobility and access to health care facilities. Road transport operators are invested in maintaining their operations and keeping staff and commuters safe from infection. This study has shown that in Nigeria, the following lessons can be discerned from the operation of both formal and informal transport systems and government's response to the pandemic:

1. Timely dissemination of accurate information can improve preparedness

The study found evidence that timely information dissemination played a very key role in preparing road transport operators in Nigeria to respond to the pandemic. Respondents reported hearing about the disease through official public enlightenment channels even before the index case in Nigeria on 27th February 2020. They also reported being aware of information about the disease such as modes of transmission, high-risk behaviours and preventive approaches through information targeted at them by public agencies.

2. Efficient contact tracing and isolation is key to prevention

All road transporters interviewed reported using a passenger manifest for all their trips and making these manifests available to contact tracers on request. This helped greatly in contact tracing and the efficient isolation of persons who had been in contact with confirmed cases, and this may have contributed to slowing down transmission in Nigeria, consistent with the finding by Nachega, J. B., Atteh, R., Ihekweazu, C., et al[15] that '…the early deployment of local, human-to-human contact tracers (face-to-face and telephone calls) in African countries was crucial to control chains of transmission."

3. Inter-agency co-operation can improve response and compliance

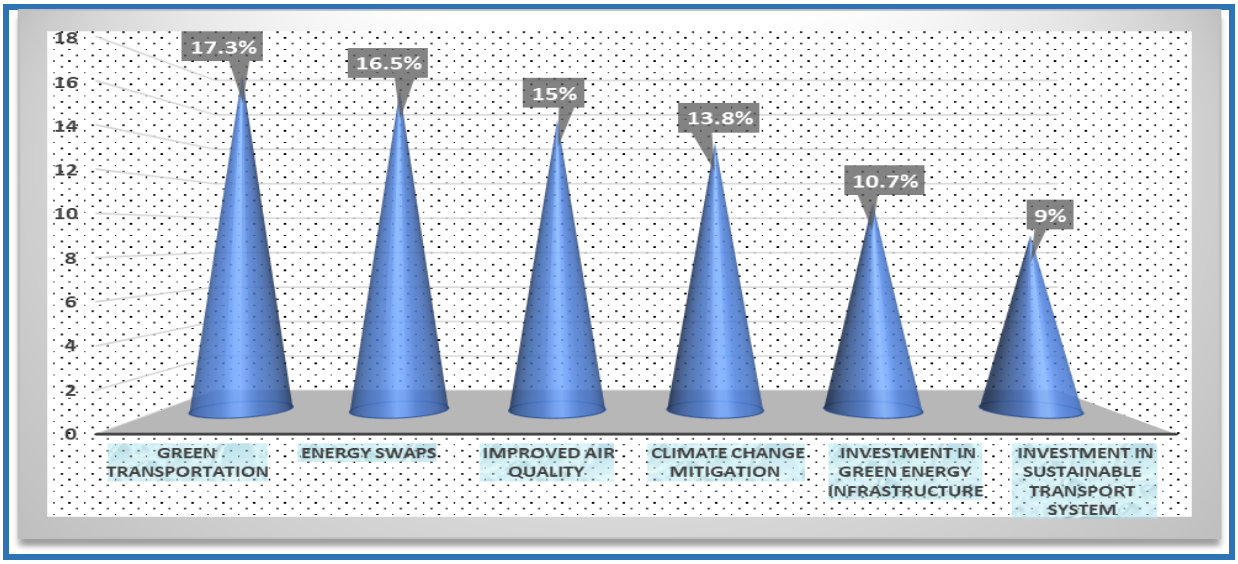
There is agreement among respondents that there was noticeable co-operation between public agencies and private sector initiatives. They recalled the roles played by the ministries of health, information and transportation respectively, and how these raised their confidence to comply with laid down guidelines. Specifically. they mentioned the sustained public enlightenment messages based on information provided by the NCDC and which the FMoT communicated to road transport operators through various channels.

Objective 4: To collate perspectives of transport operators on opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria

The study analysed the perspectives of road transport operators (generated from oral interviews) on opportunities presented by COVID-19 for transition to low carbon and cleaner transport systems in Nigeria and finds the potential for transition to green transportation in Nigeria if practices adopted in response to the pandemic are continued. These practices include greater use of logistics operators for the delivery of goods, proper maintenance of vehicles to reduce pollution, increased adoption of ICT to support delivery services, and greater adoption of active transport, especially the use of bikes. In addition, respondents in Abuja and

Lagos observed increased inter-agency co-operation among actors in the road transport sector, a factor that could stimulate policy measures to entrench these practices. However, the respondents also highlighted the increasing preference of private transport over public transport as a drawback to clean transport. Further PCA analysis of responses to the questionnaire survey collapsed the perspectives of transport operators into six opportunity components that may be spurred by national response to the pandemic in Nigeria's road transport sector. The results (Figure 3 below) suggest that clean energy transition (green transportation) presents the highest opportunity (17.3%), followed by energy swaps (16.5%), improved air quality (15%), climate change mitigation (13.8%), investment in green energy infrastructure (10.7%) and investment in sustainable transport system (9%).

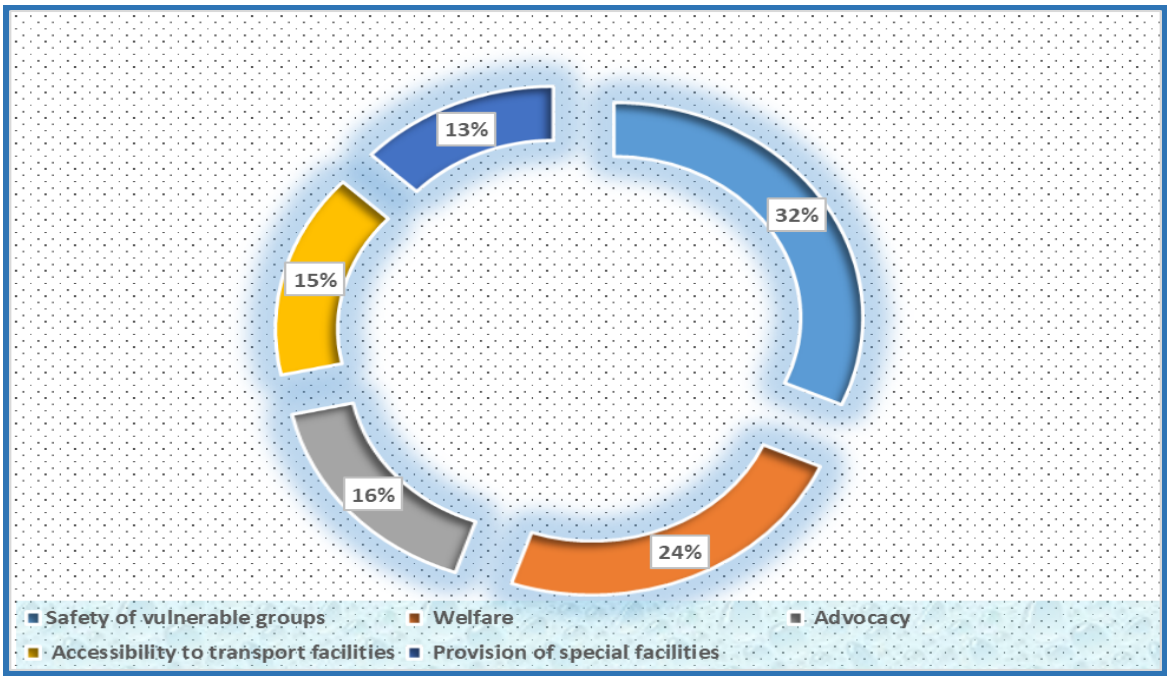
Figure 3: Opportunities for transition to low carbon transportation



Objective 5: To understand how road transport operators are grappling with issues of inclusion especially for persons with disabilities, the aged, women and children

The face-to-face interviews (see summary in Table 2 and interview guide in **Error! Reference source not found.**) indicate that inclusiveness in the provision of road transport services is optional. However, the careful handling of vulnerable persons is an integral part of the service mandate where operators consider everybody as a premium client. In Lagos, discounts in transportation fare apply to children, while physically challenged persons are exempt from paying fares. In addition, some operators, in response to the pandemic, have made changes in their boarding procedures and provided ramps to ease entry at the rear of vehicles for people who would otherwise need assistance to board. This focus on providing inclusive services is high mainly on compassionate grounds and not because of any government directive or public policy. PCA analysis of responses to the questionnaire survey (see **Error! Reference source not found.** below) also indicates that operator's perceptions of their performance with respect to the delivery of inclusive services to persons with disabilities, the aged, women and children was very high. The analysis, which divided how road transport operators are dealing with the issue of inclusion into five components, gives a performance level of 87.6%. This implies that road transport operators performed very highly on inclusiveness in their operations during this pandemic.

Figure 4: Perceived performance on issues of inclusion



Objective 6: To collate lessons learned from responses to COVID-19 for transport systems providing for emergencies and essential services

The continuous provision of essential services during emergency situations can be very challenging for health officials especially regarding the movement of personnel, various categories of patients, medicine and equipment. For health emergencies and crises like the COVID-19 pandemic and Ebola Virus, it can also pose additional challenges for personal safety and protection and risk of infection for transport operators and other frontline staff who must ensure a steady stream of supplies to keep the health system functional. Road transport operators interviewed were optimistic that they would remain afloat irrespective of the daunting challenges they have faced because of the pandemic, but there are lessons that can be useful for responding to similar emergencies in the future:

1. Simplified diagnostic procedures can help prevent transmission

Following from the enlightenment campaigns carried out by government agencies, all transporters interviewed reported carrying out temperature checks on all their passengers using hand-held infrared devices; high temperature being sign of fever, and fever itself being sign of possible infection with the disease. These procedures helped operators to appropriately regulate the movement of passengers.

2. Timely issue of travel permits/ licences to logistics companies can aid rapid response

All the logistics companies interviewed reported being in operation during the lockdown period distributing food, medicine, and other essential commodities across the country with the help of passes issued by relevant government agencies. With the passage of time however, and with reported abuse of permits, these became more difficult to obtain, significantly impeding the transport of supplies. A respondent in Lagos believed that the country missed an opportunity to offer a robust rapid response to all patients that needed to be moved to care centres by shutting out other categories of road transporters from their logistics operations.

3. Security and escort services are important considerations

A company in Enugu reported being able to function only when it had security escorts accompanying its delivery rounds, especially during the lockdown. This practice has continued post-lockdown and may eventually form part of its permanent operations moving forward.

3.3 Low-income country beneficiaries

The project has great potential for upscale to other LICs in Africa and Asia, and possibly globally, since its fundamental objective is to discover and promote 'what works' in the transport sector, which may be technologies, structures, procedures, or operations for various users especially women, the aged and people living with disabilities.

3.4 Limitations of the innovation/ approach/ design/ system

It is important to understand that the technologies, approaches and processes presented here as 'innovative' may require modification before being applied or used outside the study group or location, because no two organisations, even if they operate within the same environment, exhibit exact same characteristics especially in terms of awareness, know-how, willingness to innovate and capacity for innovation. Intended as a snapshot aimed at responding to an emergency, this study has not followed a more detailed approach or produced case studies with in-depth understanding of organisational innovativeness. It is therefore difficult to generalise its results without recognising this shortcoming. More profoundly, the low participation by women indicates that the study result may not be representative of women's perceptions and opinions. This poor level of participation by women in any sector of the economy calls for urgent policy interventions.

4. Recommendations

Although the road transport sector experienced a high level of compliance and success in its response to the COVID-19 pandemic, there is need to overcome some constraints at all levels for further containment and subsequent elimination of the pandemic. Firstly, it is likely that road transport operators will not sustain the established regime of strict response to the pandemic, which may have accounted for the high level of compliance and success recorded so far in the efforts to contain and eliminate spread of the virus. This will result in contempt for the threat of COVID-19 as services gradually return to pre-COVID-19 practice. Such compliance fatigue may contribute to a second wave of COVID-19 infections, as it is the case in many parts of the world.

The road transport sector is facing financial challenges in its response to the COVID-19 pandemic. Most operators encountered huge financial losses due to lockdown and the restriction of movement, a situation that may hinder the provision of efficient transport services. The financial constraint may hinder road transport operators' willingness to co-operate with the government and comply with its directives on the COVID-19 pandemic.

Further, the response of the road transport sector to the pandemic has highlighted policy challenges in key sectors of the nation's economy. The absence and poor implementation of policy guidelines will hinder the issues of public health safety, inclusion, and energy transition that the road transport sector is grappling with because of its response to the COVID-19 pandemic. In addition, the COVID-19 pandemic has necessitated the application of advanced ICT technology in the road transport sector in such areas as booking, ticketing and the monitoring of compliance to physical distancing rules. This poses a technical challenge to the operators in Nigeria, as many of them do not have the technical and financial capacities to adapt to the new challenges.

It is also evident that the pandemic has caused an abrupt change in working conditions necessitating some the companies to adopt a work-from-home schedule for their employees. It is most likely that this operational change may not be sustainable because of the high cost of operations and the unreliable telecommunication infrastructure. Employers for instance, reimburse employees who worked from home during the pandemic for their reasonable and necessary home office expenses. The COVID-19 pandemic therefore poses additional financial liability on the road transport sector. Overall, overcoming these barriers is necessary for the development of effective strategies for the containment and elimination of the pandemic in the road transport sector at national and regional levels.

To overcome these constraints, respond adequately to the pandemic, and make quick post-COVID-19 economic recovery possible, this study makes the following recommendations:

1. Continuing vigilance and application of measures that have worked well by all stakeholders

Contempt for the threat of COVID-19 is beginning to manifest as road transport services gradually return to pre-COVID-19 practice. Road transport operators should not lower their guard in response to the pandemic. Rather, they should continue the strict application of the new technologies, processes and procedures that have been perceived as being effective until the threat of the pandemic subsides. Consequently, observance of lockdown directives, which have proven to be the most effective response, should always apply. The observance of COVID-19 safety protocols, environmental sanitation, the promotion of hygiene, the wearing of face masks, and physical distancing should still be paramount among staff and commuters in the road transport sector. In addition, there is a need to expedite public enlightenment, use information technology and mass media, and demonstrate inclusiveness as well as palliative measures to cushion the effect of the pandemic.

The euphoria of government responses is fizzling out rapidly in anticipation of a rebound in the transportation business. Consequently, road transport operators must continue to show strong willingness to co-operate with the government and comply with its directives. This will go a long way in preventing a second wave of COVID-19 infection in the country. The response of road transport operators to the COVID-19 pandemic also has policy implications for the road safety, emergency and essential services sectors. There is therefore the need to review the nation's road safety and emergency response policies in line with the lessons from road transport response to the COVID-19 pandemic. This will aid making the sectors more responsive to the challenges posed by the pandemic.

2. Tap into opportunities presented by COVID-19

There are many opportunities available in the transport sector in Nigeria because of the national response to the COVID-19 pandemic. The opportunities are in the areas of developing new business models as demonstrated by Pamdrive, a ride-hailing service provider which has incorporated courier and logistics services into its operations in response to challenges posed by the pandemic on road transportation in Port Harcourt, modernisation of the road transport system, application of information technology, revitalisation of road transport infrastructure, and development of a sustainable work model.

3. Lessons on infection control should guide the response going forward

Timely dissemination of accurate information, efficient contact tracing using passenger manifests, and inter-agency co-operation are some of the best practice lessons learned from the response so far in Nigeria. These lessons on infection control and public health safety should be the basis for strict enforcement of safety protocols. Formal and informal public road transport operators should ensure that new technologies, processes and procedures used in responding to the COVID-19 pandemic are enforced to the letter and should specifically focus on observing the lockdown call, COVID-19 safety protocols, environmental sanitation, physical distancing and the promotion of hygiene. Other responses include the application of information technology, the wearing of face masks, public enlightenment, the promotion of inclusiveness, effective use of mass media and the use of stimulus package to stimulate rapid economic recovery.

4. Opportunities presented by COVID-19 for transition to low carbon and cleaner transport systems in Nigeria

The study finds the potential for transition to green transportation in Nigeria if practices adopted in response to the pandemic are continued. It is therefore imperative to entrench these practices to achieve this purpose by making new policies or strengthening existing policies to promote greater use of logistics operators for the delivery of goods, proper maintenance of vehicles to reduce pollution, increased adoption of ICT to support delivery services, greater adoption of active transport especially the use of bikes, and increased inter-agency co-operation among actors in the road transport sector. It is equally important to increase people's confidence in the safety of public transport by ensuring the ready availability of public vehicles and the enforcement of strict compliance with all safety protocols. This can reduce people's preference for private cars over public transport and ultimately reduce vehicular emissions in the country.

5. Introduce policies for inclusion especially for persons with disabilities, the aged, women and children

Road transport operators, by their own assessment, complied very highly with inclusiveness in their operations during this pandemic. However, they consider the careful handling of vulnerable persons an integral part of their service mandate where everybody is seen as premium client. This is based entirely on compassionate and business grounds rather than them being aware of any government policy in that regard. There is therefore the need to review the nation's transport policy to ensure that all subsets of the entire population, especially women, have equal, unhindered access to road transport infrastructure, opportunities and participation. This can be achieved by continuous engagement with all policy officials.

6. Utilise lessons learned for transport systems providing for emergencies and essential services to guide future responses to COVID-19 and similar pandemics

The most devastating Ebola Virus outbreaks occurred in West Africa from 2014 to 2016.[16] A total of 28,652 infections and 11,325 deaths were recorded in Liberia, Sierra Leone, Senegal, Nigeria, Ghana, Guinea, and Mali before the epidemic was stopped from escalating to a pandemic. The lessons learned during the Ebola Virus outbreaks in West Africa seem to have informed actions taken by the NCDC and other regulatory agencies regarding movement of people, medicines and essential commodities. These actions, which have become good-practice lessons, include simplified diagnostic procedures that have contributed to preventing transmission and timely issue of travel permits to logistics companies that aided rapid response operations. Other lessons from the response to the Ebola outbreak include rapid testing and results, a survivor support programme, sustained community engagement, a multi-stakeholder funding mechanism, and research and development. Policy officials and implementing agencies should utilise these lessons to guide planning and implementation of future responses.[17]

5. Research uptake and next steps

The findings of this study will advance response to the COVID-19 pandemic challenges by informing policy measures aimed at providing robust road transport operations and services now and in the future.

This report will be available in soft (PDF) and hard copy and widely distributed online through social media platforms. These resources will also be made available to transport operators and policy officials through workshops and consultative meetings.

These activities will ensure that intended beneficiaries of this project adequately understand and are able to utilise the findings. The project will also seek to extract commitments from road transport operators and policy officials to implement recommendations of this report. Through these targeted uptake activities, findings of the study will be published in journals and circulated through online hubs for information relating to COVID-19 and transportation such as HVT's www.transport-links.com.

5.1 Planned next steps

- Produce 1,000 hard copy booklets;
- Distribute report online in open access formats;
- Produce video highlights and host on HVT YouTube channel;
- Promote on social media (Twitter, LinkedIn, Facebook and Instagram); and
- Make report available to policy officials during three consultative meetings.

5.2 Low-income countries planned for upscale

The project is ready for upscale to Ghana and The Gambia, two Anglophone West African countries with organisations and persons that can play key roles in the process. This report will be circulated in digital formats through social media and other online platforms among stakeholders in these countries, as the study's findings and recommendations contain specific elements that can contribute to these countries immediate responses to the pandemic.

6. Conclusion

This study examined how road transport operators in Nigeria have coped with (or responded to) COVID-19 challenges as well as how lessons learned can be used for future programmes. The results show that road transport operators perceive their responses to the COVID-19 pandemic in Nigeria as 90.7% effective. A breakdown shows that observing a lockdown directive was the most effective response to the COVID-19 pandemic in Nigeria. It was followed in descending order by COVID-19 safety protocols, environmental sanitation, the promotion of hygiene, information technology, the use of face masks and physical distancing. Other responses include public enlightenment, palliative support, inclusiveness, and mass media.

There are moderate opportunities in the transport sector as a result of the national response to the pandemic. Analysis of responses to the questionnaire survey showed that there are opportunities available in the areas of developing new business models, the modernisation of road transport systems, the application of information technology, the revitalisation of road transport infrastructure, and development of sustainable work models.

The lessons that have been learned about infection control and public health safety should continue to inform interventions aimed at curtailing the pandemic. The study has shown that road transport operators contributed to contact tracing through strict use of passenger manifests, and that timely dissemination of accurate information can improve operators' preparedness and operational responses.

The study finds that the pandemic has prompted greater use of logistics operators for delivery of goods in Nigeria, and that there has been increased adoption of ICT to support delivery services, as well as greater adoption of active transport, especially the use of bikes. It recommends stronger inter-agency co-operation among actors in the road transport sector to stimulate policy measures that can entrench these practices.

Measures being taken by some transport operators in Nigeria to address issues of inclusion especially access to services by vulnerable and marginalised persons, such as provision of ramps to ease entry for people who would otherwise need assistance, discounts in fare to children, and free charges for physically challenged persons should be encouraged. This study recommends that given the current gender imbalance in the road transport sector, efforts should be made to lower the barriers that prevent women from playing significant roles in the sector.

The lessons learned from combating previous disease outbreaks such as the Ebola Virus have helped relevant public agencies such as the NCDC to formulate and implement policies that raised road transporter's awareness of Coronavirus and facilitated simplified diagnostic procedures, the timely issue of travel permits to logistics companies, and movement of people, medicines and essential commodities during the pandemic. The study recommends continuation of such good-practice lessons.

It is hoped that the findings and recommendations of this study are given due attention by relevant stakeholders even as current efforts in fighting the COVID-19 pandemic have been boosted by the development of vaccines by Pfizer-BioNTech, Moderna, AstraZeneca-Oxford and Johnson & Johnson. Millions of these vaccines have been administered around the globe to curb the spread of the virus. This development is significant but must be complemented with measures that have so far proven to be helpful in containing the virus.

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APPENDIX A: INTERVIEW GUIDE

This guide is intended to help interviewer generate necessary info that can be analysed to achieve objectives of this study.

PROCEDURE:

i. Interviewer asks respondent an open ended question, and while respondent answers, interviewer should check boxes that are in the affirmative (using the questionnaire as template;

ii. While it is advised that respondents are allowed to talk exhaustively, it is proper for interviewers to seek clarifications and make notes for further info

iii. Interview length should be about 30 minutes.

Objective 1: To identify and categorise new technologies, processes and procedures used by road transport operators to respond to the pandemic in Nigeria

Sample question: What have you done differently (any new technologies, processes or procedures that you have used) within this period in response to the pandemic?

Such responses can be tailored to:

- Terminal operations
- Route/fleet management
- Personnel/commuters
- Administration and regulation

Objective 2: To evaluate what opportunities are available in the transport sector because of national response, and how these opportunities can better be utilised

Sample Questions: What opportunities can you identify for road transport from the government's response to the pandemic so far?

[For regulators, i.e. Ministries of Transport] What plans generally, did your ministry put in place to ease economic difficulties of transporters and commuters?

Objective 4: To collate perspectives of transport operators on opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria

Sample question: What do you consider as opportunities presented by COVID-19 for a shift towards low carbon and cleaner transport systems in Nigeria, and how is your organisation keying into these opportunities?

Objective 5: To understand how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children

Sample question: What policies and plans do you have in place to ensure that persons with disabilities, the aged, and women are not marginalised either as commuters or road transport operators?

APPENDIX B: SAMPLE QUESTIONNAIRE

QUESTIONNAIRE ON A SURVEY OF INNOVATIVE ROAD TRANSPORT SOLUTIONS IN NIGERIA IN RESPONSE TO COVID-19

NOTE: There is no wrong answer. Your honest view is what is required

1. To what extent do you think that the under listed new measures, processes, technologies, and procedures used by road transport operators have been innovative and effective in responding to the pandemic in Nigeria?

Terminal, Vehicle and Route operations							
S/n	New technologies, processes and procedures	Very High	High	Moderate	Low	Very low	Not at all
1	Public enlightenment on the prevention and control of COVID-19 both inside the terminals and transport vehicles, (e.g. use of posters)						
2	Social distance both inside the terminal and transport vehicles						
3	Temperature check both in the terminal and transport vehicles						
4	Provision of facilities for washing of hands with soap under running water						
5	Provision of alcohol-based hand sanitizers for cleaning of hands						
6	Promotion of avoiding touching your eyes nose and mouth with unclean hands						
7	Promotion of the use of elbow to cover your face or tissue when coughing and sneezing						
8	The use of face mask both inside the terminal and transport vehicles						
9	Medical response both inside the terminal and transport vehicles (Medical team and facilities that will respond to the health needs of both passengers and staff)						
10	The use of official channels for covid-19 updates						
11	Cleaning of the seats regularly with disinfectant both inside the terminal and transport vehicles						
12	Cleaning of the place of convenience regularly with disinfectant						
13	Regular cleaning of the terminal and transport vehicles with disinfectant						
14	Fumigation of the terminal and transport vehicles regularly						
15	Online booking/use of e-ticket						
16	Online payment/ electronic transfer payment						
17	Good ventilation and respiratory hygiene both inside the terminal and transport vehicles						
18	Shift work schedule for staff						
19	Modification of departure/arrival schedule for passengers(changes in the time of departure and arrival of passengers to reflect COVID-19 safety protocols)						
20	Modification of boarding and loading system (changes in the method of boarding and disembarking of passengers to reflect COVID-19 safety protocols)						

Terminal, Vehicle and Route operations							
S/n	New technologies, processes and procedures	Very High	High	Moderate	Low	Very low	Not at all
21	Use of social media, television, radio, local town-criers and podcast for dissemination of information and other issues						
22	Prohibition of touting in the terminal and transport vehicles						
23	Provision of waste disposal facilities inside the vehicles and terminal						
24	Proper and frequent disposal of wastes						
25	Promotion of inclusiveness in your services with regards to the elderly, persons with disability, women and children						
26	Health declaration(COVID-19 health declaration form for passengers)						
27	Provide guidelines on Do's and Don'ts to every passenger who accesses your public service vehicles such as Cover your mouth and nose with tissue or a handkerchief when coughing and sneezing						
28	Keeping the manifest of the passengers for contact tracing						
29	Avoiding routes with traffic congestions						
30	Restriction on inter-state and inter-city travel						
31	Dedication of special routes						

	Administration						
	New technologies, processes and procedures	Very high	High	Moderate	Low	Very low	Not at all
32	Identification of essential functions within the organisation and provide separate facilities for them if needed						
33	Developing an inventory of staff qualifications, licenses, etc. in order to identify employees, who could act as back up for critical positions						
34	Review the stock and availability of essential protection and cleaning equipment and supplies and plan their distribution and refill						
35	Review stock and supply chains for operational material, such as fuel, lubricants or spare parts and investigate alternative suppliers if possible						
36	Development of communication messages for public transport operator staff (internal websites providing basic information for employees about the outbreak, its impact on the public transport systems and measures being taken)						
37	Equipping Staff washing and dressing rooms, meeting rooms and offices with hand disinfectants and paper tissues						
38	Ensuring that every staff wears a mask when tending to customers						
39	Adopting a cleaning routines(employees should be equipped with the necessary means and be made responsible to remove any waste and disinfect surfaces before taking over as part of						

	Administration						
	New technologies, processes and procedures	Very high	High	Moderate	Low	Very low	Not at all
	the routine)						
40	Protection to staff attending to sick people(Staff that has to tend sick travellers, clean body fluids or potentially contaminated items and surfaces, should wear disposable gloves						
41	Ensure strict enforcement of NCDC COVID-19 protocol						
42	Customer service staff should only be available in information booths or desks with sufficient distance to passengers						
43	Rear door boarding may temporarily replace the front door access of buses, in order to protect drivers that have no separate cabins						
44	The need for ticket inspection during an outbreak should be changed because ticket inspectors would be exposed to a very high risk of getting infected						
45	Valuable back-up staff for other critical positions						
47	Promotion of working from home						
46	Promotion of telephone/ zoom meetings						
48	Service amendment (Closing of canteens and others						
49	Regular routine Maintenance for equipment and rolling stock						
50	Information sharing with local authorities to align crisis plans						
51	Obtaining and keeping contact address of all passengers						

2. To what extent do you think that the under listed opportunities are available in the transport sector as a result of national response?

S/n	Opportunities	Very high	High	Moderate	low	Very low	Not at all
1	Self-reliance in the provision of transport infrastructure						
2	Promotion of working from home (less demand on traffic and office space)						
3	Greater need for portable hardware and devices (e.g. laptops, tablets and mobile devices)						
4	Need for more vehicles						
5	Standardisation of terminal						
6	Increase in individual and small group travels						
7	Greater need for personal protection equipment and cleaning						
8	Increase in COVID-19 related legal disputes						
9	Demand for IT and its application						
10	Business and carrier planning						
11	Specialist cleaners						
12	Safety						
13	Congestion						

S/n	Opportunities	Very high	High	Moderate	low	Very low	Not at all
14	Fixing the broken road transport system						
15	Inclusiveness and supportive policies						
16	Rethinking the broken business models						
17	Shift in mode share						
18	Rethinking the operations of public transit						

3. To what extent do you think that the under listed opportunities presented by COVID-19 could result in a transition to low carbon and cleaner transport systems in Nigeria?

S/n	Opportunities that could lead to clean energy transition	Very high	High	Moderate	Low	Very low	Not at all
1	Decrease in demand for fuel						
2	Investment in renewal energy						
3	Clean energy transition (changing from the use of petrol to solar, electric etc.)						
4	Improvement in air quality(as result reduction air pollution arising from carbon emissions from vehicles)						
5	Energy efficiency (Consumption of less fuel vehicles)						
6	Job opportunities						
7	Construction of low carbon infrastructure,						
8	Energy swaps (moving money from fuel subsidies to solar energy- Just transition opportunities)						
9	Climate-smart-transport (Electric mobility)						
10	Cleaner and more sustainable transport (walking, bicycling, intra-city bus, rail system)						
11	Reduction in greenhouse gas emissions (Pollution)						
12	Growth in renewal energy						
13	Reduction in Urban Heat Island effect(global warming)						
14	Digital solutions (e.g. smart phones apps are facilitating the development of ridesharing and bike-sharing. Online platforms are creating ways to match the supply and demand of transport services real time transit information is making public transport more attractive)						
15	Reform of oil subsidies						
16	Support to vulnerable people such as the elderly, women, children, and physically challenge persons (they suffer consequences of air pollution as a result of carbon emission)						
17	Government support to cleaner transport						
18	Innovative technologies to low carbon emissions						
19	Virtual connectivity (working from home)						
20	Green transportation (transport system that does not pollute the environment)						

4. To what extent does your organisation ensure inclusiveness in its services especially with regard to persons with disabilities, the aged, women and children during this pandemic in the following aspect?

S/n	Inclusiveness	Very high	High	Moderate	Low	Very low	Not at all
1	Public enlightenment to the vulnerable persons on the risk of COVID-19 and safety protocols						
2	Special attention to the vulnerable commuters						
3	Sufficient space for all passengers including wheelchair and persons travelling with children						
4	Access to transport facilities and services without causing confusion and anxiety						
5	Identification of their mobility needs and factoring them into your operation						
6	Training your staff to understand the needs of the vulnerable persons						
7	Safety measures especially for elderly, children, women and physically challenge persons						
8	Introduction of adequate measures to aid their travel						
9	Promotion of special transport to meet their needs						
10	Free-phone help line						
11	Do not criminate against them						
12	Designating a staff or section to handle their affairs						
13	Designate a safe part of the transport facility for the vulnerable						

APPENDIX C: DESCRIPTIVE ANALYSIS OF TABLES

The PCA results in Table 3 identified and collapsed the opportunities that are available in the transport sector due to the national response to the COVID-19 pandemic into five components which accounted for 79.6% of variability in the original 18 variables. Component one loaded significantly on five factors. These are, in descending order, rethinking the broken business models (.874), greater need for public-private partnership (.829), shift in mode share (.715), increased demand for vehicles (.684) and self-reliance in the provision of transport infrastructure (.675). It has an eigenvalue of 3.676 and accounts for 20.4% of variance that explained the opportunities that are available in the transport sector because of the national response to the pandemic. Component one is an index for measuring new (strategic) business model as distinct opportunity that is available to Nigeria's road transport sector because of the nation's response to the pandemic. The defining variable is rethinking the broken business models with the factor loading of .874.

Component two loaded significantly on 6 factors namely, increase in individual and small group travels (.807), standardization of terminals(.707), rethinking the operations of public transport (.672), specialist cleaners (.659), safety (,604) and increase in COVID-19 related legal disputes (.585). It has an eigenvalue of 3.287 and accounts for 18.6% of the variance that explained the opportunities that are available in the transport sector because of national response to the pandemic. Component two is an index for measuring modernisation of road transport as a distinct opportunity that exists in road transport sector because of the nation's response to the pandemic. The defining variable is increase in individual and small group travels with the factor loading of .807.

Component three loaded significantly on three factors and these are demand for ICT and its application (.855), business and career planning (.853), and special cleaners (.626). It has an eigenvalue of 2.708 and accounts for 15% of variance that explained the opportunities that are available in the transport sector because of national response to the pandemic. Component three is an index for measuring application of information technology as a distinct opportunity that exists in road transport sector because of the nation's response to the pandemic. The defining variable is demand for ICT and its application with factor loadings of .855.

Component four also loaded significantly on three factors which include fixing the broken road transport infrastructure (.895), reduction in traffic congestion (.716) inclusiveness and supportive policies (.601). It has an eigenvalue of 2.479 and accounts for 13.8% of the variance that explained the opportunities that are available in the transport sector because of national response to the pandemic. Component four is an index for measuring revitalisation of road transport infrastructure as a distinct opportunity that exists in road transport sector because of the nation's response to the pandemic. The defining variable is fixing the broken road transport infrastructure with factor loading of .895.

Component five loaded significantly on the two factors of promotion of working from home (.918) and greater need for portable hardware and devices (.722). It has an eigenvalue of 2.185 and accounts for 12.1% of variance that explained the opportunities that are available in the transport sector due to the national response to the pandemic. Component five is an index for measuring sustainable work model as a distinct opportunity that exists in road transport sector because of the nation's response to the pandemic. The defining variable is promotion of working from home with factor loading of .918.

Table 3: Opportunities available because of national response

Factor	Component				
	1	2	3	4	5
Rethinking the broken business models	.874				
Greater need for public-private partnership	.829				
Shift in mode share	.715				
Increased demand for vehicles	.684				
Self-reliance in the provision of transport infrastructure	.675				
Increase in individual and small group travels		.807,			
Standardization of terminals		.707,			
Rethinking the operations of public transport		.672,			

Factor	Component				
	1	2	3	4	5
Specialist cleaners		.659,	.626		
Safety		.604			
Increase in COVID-19 related legal disputes		.585			
Demand for ICT and its application			.855,		
Business and career planning			.853,		
Fixing the broken road transport system				.895,	
Reduction in Congestion				.716	
Inclusiveness and supportive policies				.601	
Promotion of working from home					.918
Greater need for portable hardware and devices					.722
Eigenvalue	**3.676**	**3.287**	**2.708**	**2.479**	**2.185**
% of variance	**20.4**	**18.3**	**15.0**	**13.8**	**12.1**
Cumulative %	**20.4**	**38.7**	**53.7**	**67.5**	**79.6**

Source: Principal Component Analysis results

The PCA results in Table 4 identified and collapsed the perspectives of transport operators on opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria into six components which accounted for 82.1% of variability in the original 20 variables. Component one loaded significantly on five factors. These are, in descending order, growth in renewable energy (.871), reduction in urban heat island effect (.775), energy efficiency (.714), decrease in demand for fuel (.700) and cleaner and more sustainable transport (.590). It has an eigenvalue of 3.465 and accounts for 17.3% of variance that explained the opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. Component one is an index for measuring clean energy transition (green transportation) as a distinct opportunity presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. The defining variable is growth in renewable energy with a factor loading of .871.

Component two also loaded significantly on five factors. These are reform of oil subsidies (.793), virtual connectivity (.781), digital solutions (.762), green transportation (.686) and innovative technologies to low carbon emissions (.526). It has eigenvalue of 3.277 and accounts for 16.4% of variance that explained the opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. Component two is an index for measuring energy swaps as a distinct opportunity presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. The defining variable is reform of oil subsidies with a factor loading of .793.

Component three loaded significantly on three factors namely reduction in greenhouse gas emissions (.881), energy swaps (.831) and cleaner and more sustainable transport (.593). It has an eigenvalue of 2.990 and accounts for 15% of variance that explained the opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. Component three is an index for measuring improved air quality as a distinct opportunity presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. The defining variable is reduction in greenhouse gas emissions with a factor loading of .881.

Component four loaded significantly on four factors and these are improvement in air quality (.892), clean energy transition (.836), support to vulnerable people (.696) and decrease in demand for fuel (.594). It has an eigenvalue of 2.762 and accounts for 13.8% of variance that explained the opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. Component four is an index for measuring investment in climate change mitigation as a distinct opportunity presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. The defining variable is reduction in improvement in air quality with a factor loading of .892.

Component five loaded significantly on three factors namely construction of low carbon infrastructure (.777), government support to cleaner transport (.728) and innovative technologies to low carbon emissions (.652). It has an eigenvalue of 2.131 and accounts for 10.7% of variance that explained the opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. Component five is an index for measuring investment in green energy infrastructure as a distinct opportunity presented by COVID-19 for

a transition to low carbon and cleaner transport systems in Nigeria. The defining variable is construction of low carbon infrastructure with a factor loading of .777.

Component six loaded significantly on the factors of investment in renewable energy (.875) and climate-smart-transport (501). It has an eigenvalue of 1.794 and accounts for 9% of variance that explained the opportunities presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. Component six is an index for measuring investment in sustainable transport as a distinct opportunity presented by COVID-19 for a transition to low carbon and cleaner transport systems in Nigeria. The defining variable is investment in renewal energy with a factor loading of .875.

Overall, the opportunities that could lead to the transition to a low carbon and cleaner transport system were classified into 6 categories. These are in descending order clean energy transition, (17.3%), energy swaps (16.5%), improved air quality (15%), climate change mitigation (13.8%), investment in green energy infrastructure (10.7%) and investment in sustainable transport system (9%).

Table 4: Opportunities for transition to low carbon transport in Nigeria

Factor	Component					
	1	2	3	4	5	
Growth in renewal energy	.871					
Reduction in urban heat island effect	.775					
Energy efficiency	.714					
Decrease in demand for fuel	.700			.594		
Cleaner and more sustainable transport	.590		.593			
Reform of oil subsidies		.793				
Virtual connectivity		.781				
Digital solutions		.762				
Green transportation		.686				
Innovative technologies to low carbon emissions		.526			.652	
Reduction in greenhouse gas emissions			.881			
Energy swaps			.831			
Improvement in air quality				.892		
Clean energy transition				.836		
Support to vulnerable people				.696		
Construction of low carbon infrastructure					.777	
Government support to cleaner transport					.728	
Investment in renewal energy						.875
Climate-smart-transport						.501
Eigenvalue	**3.465**	**3.277**	**2.990**	**2.762**	**2.131**	**1.794**
% of variance	**17.3**	**16.4**	**15**	**13.8**	**10.7**	**9**
Cumulative %	**17.3**	**33.7**	**48.7**	**62.5**	**73.1**	**82.1**

Source: Principal Component Analysis results

The PCA results in Table 5 identified and collapsed how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children into five components which accounted for 87.6% of variability in the original 13 variables. Component one loaded significantly on four factors. These are safety measures especially for elderly (.905), special attention to vulnerable commuters (.896), sufficient space for all vulnerable passengers (.883), and introduction of adequate measures to aid their travel (.814). It has an eigenvalue of 3.605 and accounts for 27.7% of variance that explained how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. Component one is an index for measuring safety as a distinct factor that explains how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. The defining variable is safety measures especially for elderly with a factor loading of .905.

Component two loaded significantly on five factors namely training of staff to understand safeguard measures and vulnerability issues (.923), identification of their mobility needs (.871), promotion of special transport to meet their needs (.640), toll free help line (.570) and designating a staff or section to handle their affairs (.512). It has an eigenvalue of 2.689 and accounts for 20.7% of variance that explained how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. Component two is an index for measuring welfare as a distinct factor that explains how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. The defining variable is training your staff to understand safeguard measures and vulnerability issues with a factor loading of .923.

Component three loaded significantly on three factors namely public enlightenment (.819), identification of mobility needs of special commuters (714) and promotion of special transport to meet their needs (.640). It has an eigenvalue of 1.859 and accounts for 14.3% of variance that explained how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. Component three is an index for measuring advocacy as a distinct factor that explains how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. The defining variable is public enlightenment with a factor loading of .819.

Component four loaded significantly on two factors namely access to transport facilities (.885) and toll free help line (.630). It has an eigenvalue of 1.761 and accounts for 13.5% of variance that explained how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. Component four is an index for measuring accessibility as a distinct factor that explains how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. The defining variable is access to transport facilities with a factor loading of .885.

Component five loaded significantly on the factors of designating a safe part of the transport facility (.884). It has an eigenvalue of 1.477 and accounts for 11.4% of variance that explained how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. Component five is an index for measuring provision of special facilities as a distinct factor that explains how road transport operators are grappling with issues of inclusion especially with regard to persons with disabilities, the aged, women and children. The defining variable is designating a safe part of the transport facility with a factor loading of .884.

Overall, road transport grappling with the issue of inclusiveness in response to the pandemic was classified into five categories. These are the safety of the vulnerable groups (27.7%), welfare (20.7%), advocacy (14.3%), accessibility to transport facilities (13.5%) and provision of special facilities (11.4%).

Table 5: Technologies and measures that promote inclusion

Factor	Component				
	1	2	3	4	5
Safety measures especially for elderly	.905				
Special attention to the vulnerable commuters	.896				
Sufficient space for all passengers	.883				
Introduction of adequate measures to aid their travel	.814				
Training your staff to understand		.923			
Identification of their mobility needs		.871			
Promotion of special transport to meet their needs		.640			
Designating a staff or section to handle their affairs		.512	.664		
Free phone help line		.570		.630	
Public enlightenment			.819		
Do not criminate against them			.714		
Access to transport facilities				.885	
Designate a safe part of the transport facility					.884

Eigenvalue	3.605	2.689	1.859	1.761	1.477
% of variance	27.732	20.684	14.300	13.544	11.361
Cumulative %	27.732	48.416	62.717	76.261	87.622

Table 6: Frequency of new technologies, processes and procedures (Objective 1)

Options	VH	H	M	L	VL	NA	Mean	SD	Decision
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)			
Public enlightenment	12 (60)*	6 (30)	2(10)	-	-	-	4.5	0.7	High
Social distance	15 (75)*	3 (15)	2 (10)	-	-	-	4.7	0.7	High
Temperature check	10 (50)*	7 (35)	3 (15)	-	-	-	4.4	0.7	High
Provision for facilities	10 (50)*	8 (40)	1 (5)	-	-	1 (5)	4.3	1.1	High
Provision of sanitisers	8 (40)	10 (50)*	2 (10)	-	-	-	4.3	0.7	High
Promotion of avoiding touch	11 (55)*	4 (20)	5 (25)	-	-	-	4.3	0.9	High
Promotion of covering nose	7 (35)	7 (35)*	6 (30)	-	-	-	4.1	0.8	High
Use of face mask	15 (75)*	5 (25)	-	-	-	-	4.8	0.4	High
Medical response	6 (30)	6 (30)*	5 (25)	2 (10)	-	1 (5)	3.7	1.3	High
Use of official channels	5 (25)	9 (49)*	4 (20)	2 (10)	-	-	3.9	0.9	High
Cleaning of seats	8 (40)*	7 (35)	2 (10)	3 (15)	-	-	4.0	1.1	High
Cleaning of convenience	13 (65)*	6 (30)	1 (5)	-	-	-	4.6	0.6	High
Cleaning of terminal	8 (40)	8 (40)*	3 (15)	1 (5)	-	-	4.2	0.9	High
Fumigation of terminal	9 (45)*	7 (35)	2 (10)	2 (10)	-	-	4.2	1.0	High
Use of e-ticket	4 (20)	6 (30)*	3 (15)	2 (10)	-	5 (25)	2.9	1.9	Low
Electronic transfer payment	4 (20)	9 (45)*	4 (20)	-	1 (5)	2 (10)	3.5	1.5	High
Respiratory hygiene	6 (30)	8 (40)*	6 (30)	-	-	-	4.0	0.8	High
Shift work schedule	5 (25)	9 (45)*	3 (15)	1 (5)	-	2 (10)	3.6	1.5	High
Modification of schedule	2 (10)	8 (40)*	5 (25)	5 (25)	-	-	3.4	1.0	High
Modification of boarding system	4 (20)	4 (20)	8 (40)*	4 (20)	-	-	3.4	1.0	High
Use of social media	5 (25)	11 (55)*	2 (10)	1 (5)	-	1 (5)	3.9	1.2	High
Prohibition of touting	9 (45)*	7 (35)	1 (5)	2 (10)	1 (5)	-	4.1	1.1	High
Provision of waste disposal facilities	11 (55)*	5 (25)	2 (10)	1 (5)	1 (5)	-	4.2	1.2	High
Proper disposal of wastes	11 (55)*	8 (40)	-	-	-	1 (5)	4.4	1.1	High
Promotion of inclusiveness	7 (35)*	6 (30)	6 (30)	1 (5)	-	-	4.0	0.9	High
Health declaration	4 (20)	4 (20)	6 (30)*	4 (20)	1 (5)	1 (5)	3.2	1.3	High
Provision of guidelines	7 (35)	10 (50)*	2 (10)	-	1 (5)	-	4.1	1.0	High
Storage of manifest	8 (40)*	4 (20)	6 (30)	-	2 (10)	-	3.8	1.3	High
Avoiding routes	4 (20)	4 (20)	7 (35)*	-	2 (10)	3 (15)	3.0	1.3	High
Restriction of travels	7 (35)	7 (35)*	4 (20)	-	-	2 (10)	3.8	1.5	High
Use of special routes	3 (15)	7 (35)*	5 (25)	3 (15)	-	2 (10)	3.2	1.4	High
Identification of essential functions	5 (25)	9 (45)*	5 (25)	1 (5)	-	-	3.9	0.9	High
Development of inventory	3 (15)	12 (60)*	5 (25)	-	-	-	3.9	0.9	High
Reviewing the stock	9 (45)*	5 (25)	5 (25)	1 (5)	-	-	4.1	1.0	High
Reviewing stock and supply chains	8 (40)*	6 (30)	4 (20)	2 (10)	-	-	4.0	1.0	High
Development of communication messages	2 (10)	8 (40)*	6 (30)	2 (10)	-	2 (10)	3.2	1.4	High
Equipping staff washing rooms	7 (35)	7 (35)*	3 (15)	2 (10)	-	1 (5)	3.8	1.3	High
Ensuring staff compliance with mask wearing	13 (65)*	4 (20)	3 (15)	-	-	-	4.5	0.8	High
Adopting a cleaning routine	14 (70)*	2 (10)	4 (20)	-	-	-	4.5	0.8	High

Options	VH	H	M	L	VL	NA	Mean	SD	Decision
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)			
Protection of staff	9 (45)*	6 (30)	3 (15)	1 (5)	-	1 (5)	4.0	1.3	High
Ensuring strict enforcement of NCDC	12 (60)*	6 (30)	1 (5)	1 (5)	-	-	4.5	0.8	High
Availability of customer service staff	10 (50)*	6 (30)	3 (15)	1 (5)	-	-	4.3	0.9	High
Rear door boarding	6 (30)	6 (30)	6 (30)*	1 (5)	1 (5)	-	3.8	1.1	High
Need for ticket inspection	11 (55)*	1 (5)	5 (25)	1 (5)	1 (5)	1 (5)	3.9	1.5	High
Valuable back up staff	7 (35)	7 (35)*	2 (10)	4 (20)	-	-	3.9	1.1	High
Promotion of working from home	6 (30)	8 (40)*	3 (15)	2 (10)	-	1 (5)	3.8	1.3	High
Promotion of zoom meetings	9 (45)*	5 (25)	3 (15)	2 (10)	-	1 (5)	3.9	1.4	High
Service amendment	9 (45)*	2 (10)	5 (25)	3 (15)	1 (5)	-	3.8	1.3	High
Regular routine maintenance	10 (50)*	5 (25)	4 (20)	1 (5)	-	-	4.2	1.0	High
Information sharing with local authorities	9 (45)*	6 (30)	4 (20)	1 (5)	-	-	4.2	0.9	High
Obtaining and keeping contact address of passengers	8 (40)*	6 (30)	2 (10)	3 (15)	1 (5)	-	3.9	1.3	High

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 7: Matrix of perception of effectiveness of new technologies (Objective 1)

Matrix	Freq.	Percentage (%)
VH	27	52.9
H	20	39.2
M	04	07.8
L	-	-
VL	-	-
NA	-	-
Total	**51**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 8: Distribution of calculated 'mean' of perceived effectiveness (Objective 1)

OPTIONS (Criteria)	VH	H	M	L	VL	NA	Mean
	≥4.5	≥4.0	≥3.5	≥3.0	≥2.5	≥2.0	
Public enlightenment	X	-	-	-	-	-	4.5
Social distance	X	-	-	-	-	-	4.7
Temperature check	-	X	-	-	-	-	4.4
Provision for facilities	-	X	-	-	-	-	4.3
Provision of sanitisers	-	X	-	-	-	-	4.3
Promotion of avoiding touch	-	X	-	-	-	-	4.3
Promotion of covering nose	-	X	-	-	-	-	4.1
Use of face mask	X	-	-	-	-	-	4.8
Medical response	-	-	X	-	-	-	3.7
Use of official channels	-	-	X	-	-	-	3.9
Cleaning of seats	-	X	-	-	-	-	4.0
Cleaning of convenience	X	-	-	-	-	-	4.6
Cleaning of terminal	-	X	-	-	-	-	4.2
Fumigation of terminal	-	X	-	-	-	-	4.2
Use of e-ticket	-	-	-	-	x	-	2.9
Electronic transfer payment	-	-	X	-	-	-	3.5
Respiratory hygiene	-	X	-	-	-	-	4.0

OPTIONS (Criteria)	VH	H	M	L	VL	NA	Mean
	≥4.5	≥4.0	≥3.5	≥3.0	≥2.5	≥2.0	
Shift work schedule	-	-	X	-	-	-	3.6
Modification of schedule	-	-	X	-	-	-	3.4
Modification of boarding system	-	-	X	-	-	-	3.4
Use of social media	-	-	X	-	-	-	3.9
Prohibition of touting	-	X	-	-	-	-	4.1
Provision of waste disposal facilities	-	X	-	-	-	-	4.2
Proper disposal of wastes	-	X	-	-	-	-	4.4
Promotion of inclusiveness	-	X	-	-	-	-	4.0
Health declaration	-	-	-	X	-	-	3.2
Provision of guidelines	-	X	-	-	-	-	4.1
Storage of manifest	-	-	X	-	-	-	3.8
Avoiding routes	-	-	-	X	-	-	3.0
Restriction of travels	-	-	X	-	-	-	3.8
Use of special routes	-	-	-	X	-	-	3.2
Identification of essential functions	-	-	X	-	-	-	3.9
Development of inventory	-	-	X	-	-	-	3.9
Reviewing the stock	-	X	-	-	-	-	4.1
Reviewing stock and supply chains	-	X	-	-	-	-	4.0
Development of communication messages	-	-	-	X	-	-	3.2
Equipping staff washing rooms	-	-	X	-	-	-	3.8
Ensuring staff compliance with mask wearing	X	-	-	-	-	-	4.5
Adopting a cleaning routine	X	-	-	-	-	-	4.5
Protection of staff	-	X	-	-	-	-	4.0
Ensuring strict enforcement of NCDC	X	-	-	-	-	-	4.5
Availability of customer service staff	-	X	-	-	-	-	4.3
Rear door boarding	-	-	X	-	-	-	3.8
Need for ticket inspection	-	-	X	-	-	-	3.9
Valuable back up staff	-	-	X	-	-	-	3.9
Promotion of working from home	-	-	X	-	-	-	3.8
Promotion of zoom meetings	-	-	X	-	-	-	3.9
Service amendment	-	-	X	-	-	-	3.8
Regular routine maintenance	-	X	-	-	-		4.2
Information sharing with local authorities	-	X	-	-	-	-	4.2
Obtaining and keeping contact address of passengers	-	-	X	-	-	-	3.9
TOTAL	**7**	**20**	**19**	**4**	**1**	**-**	**51**
Percentage (%)	**13.7**	**39.2**	**37.3**	**7.8**	**2.0**	**-**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

The variables above were measured to determine operators' perception of the effectiveness of new technologies, processes and procedures they used.

Table 9: Frequency of opportunities because of national response (Objective 2)

Options (Criteria)	VH	H	M	L	VL	NA	Mean	SD	Decision
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)			
Self-reliance	8 (40)*	4 (20)	5 (25)	3 (15)	-	-	3.9	1.1	High
Promotion of working from home	7 (35)	1 (5)	7 (35)*	5 (25)	-	-	3.5	1.2	High
Greater need for portable hardware and devices	4 (20)	3 (15)	7 (35)*	6 (30)	-	-	3.2	1.1	High
Need for move vehicles	6 (30)	8 (40)*	2 (10)	3 (15)	-	1 (5)	3.7	1.3	High
Standardisation of terminal	6 (30)*	5 (25)	3 (15)	5 (25)	1 (5)	-	3.5	1.3	High
Increase in individual and small group travels	5 (25)	1 (5)	10 (50)*	4 (20)	-	-	3.4	1.1	High

Options (Criteria)	VH	H	M	L	VL	NA	Mean	SD	Decision
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)			
Greater need for PPE	7 (35)	7 (35)*	2 (10)	4 (20)	-	-	3.9	1.1	High
Increase in COVID-19 related legal disputes	3 (15)	1 (5)	9 (45)*	5 (25)	1 (5)	1 (5)	2.9	1.3	Low
Demand for IT and its application	3 (15)	3 (15)	6 (30)	7 (35)*	1 (5)	-	3.0	1.2	High
Business and carrier planning	3 (15)	5 (25)	6 (30)*	4 (20)	1 (5)	1 (5)	3.1	1.3	High
Specialist cleaners	5 (25)	5 (25)	3 (15)	6 (30)*	-	1 (5)	3.3	1.4	High
Safety	7 (35)*	5 (25)	4 (20)	4 (20)	-	-	3.8	1.6	High
Congestion	2 (10)	2 (10)	6 (30)	8 (40)*	1 (5)	1 (5)	2.6	1.2	Low
Fixing the broken road transport system	4 (20)	3 (15)	4 (20)	5 (25)*	3 (15)	1 (5)	2.9	1.5	Low
Inclusiveness	4 (20)	5 (25)	6 (30)*	4 (20)	1 (5)	-	3.4	1.2	High
Rethinking the broken business modes	4 (20)	5 (25)	4 (20)	5 (25)*	2 (10)	-	3.2	1.3	High
Shift in mode share	2 (10)	2 (10)	9 (45)*	4 (20)	3 (15)	-	2.8	1.2	Low
Rethinking the operations of public transit	6 (30)	3 (15)	3 (15)	7 (35)*	1 (5)	-	3.3	1.3	High

*Preferred perception; VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 10: Matrix of preferred perception of opportunities (Objective 2)

Matrix	Freq	Percentage (%)
VH	03	16.7
H	02	11.1
M	07	38.9
L	06	33.3
VL	-	-
NA	-	-
Total	**18**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 11: Distribution of calculated 'mean' of perceived availability of opportunities (Objective 2)

Options (Criteria)	VH	H	M	L	VL	NA	Mean
	≥4.5	≥4.0	≥3.5	≥3.0	≥2.5	≥2.0	
Self-reliance	-	-	X	-	-	-	3.9
Promotion of working from home	-	-	X	-	-	-	3.5
Greater need for portable hardware and devices	-	-	-	X	-	-	3.2
Need for move vehicles	-	-	X	-	-	-	3.7
Standardisation of terminal	-	-	X	-	-	-	3.5
Increase in individual and small group travels	-	-	-	X	-	-	3.4
Greater need for PPE	-	-	X	-	-	-	3.9
Increase in COVID-19 related legal disputes	-	-	-	-	X	-	2.9
Demand for IT and its application	-	-	-	X	-	-	3.0
Business and carrier planning	-	-	-	X	-	-	3.1
Specialist cleaners	-	-	-	X	-	-	3.3
Safety	-	-	X	-	-	-	3.8
Congestion	-	-	-	-	X	-	2.6
Fixing the broken road transport system	-	-	-	-	X	-	2.9
Inclusiveness	-	-	-	X	-	-	3.4

Options (Criteria)	VH	H	M	L	VL	NA	Mean
	≥4.5	≥4.0	≥3.5	≥3.0	≥2.5	≥2.0	
Rethinking the broken business modes	-	-	-	X	-	-	3.2
Shift in mode share	-	-	-	-	X	-	2.8
Rethinking the operations of public transit	-	-	-	X	-	-	3.3
TOTAL	**-**	**-**	**6**	**8**	**4**	**-**	**18**
Percentage (%)	**-**	**-**	**33.3**	**44.4**	**22.2**	**-**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 12: Frequency of opportunities that could lead to clean energy transition (Objective 4)

Options (Criteria)	VH	H	M	L	VL	NA	Mean	SD	Decision
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)			
Decrease in demand for fuel	9 (45)*	5 (25)	3 (15)	2 (10)	-	1 (5)	3.9	1.3	High
Investment in renewal for energy	11 (55)*	6 (30)	2 (10)	1 (5)	-	-	4.4	0.9	High
Clean energy transition	10 (50)*	7 (35)	-	-	2 (10)	1 (5)	4.0	1.5	High
Improvement in air quality	10 (50)*	6 (30)	2 (10)	-	2 (10)	-	4.1	1.2	High
Energy efficiency	7 (35)	10 (50)*	3 (15)	-	-	-	4.2	0.7	High
Job opportunities	3 (15)	5 (25)	6 (30)*	4 (20)	2 (10)	-	3.2	1.2	High
Construction of low carbon infrastructure	3 (15)	5 (25)	6 (30)*	5 (25)	-	1 (5)	3.2	1.3	High
Energy swaps	4 (20)	11 (55)*	3 (15)	2 (10)	-	-	3.9	0.9	High
Climate smart transport	4 (20)	11 (55)	3 (15)	1 (5)	-	1 (5)	3.7	1.3	High
Sustainable transport	7 (35)	7 (35)*	2 (10)	4 (20)	-	-	3.9	1.1	High
Reduction in pollution	5 (25)	11 (55)*	3 (15)	1 (5)	-	-	4.0	0.8	High
Growth in renewal energy	6 (30)	8 (40)*	2 (10)	3 (15)	-	1 (5)	3.7	1.3	High
Reduction in urban heat island effect	8 (40)*	5 (25)	2 (10)	2 (10)	-	3 (15)	3.5	1.8	High
Digital solutions	8 (40)*	4 (20)	7 (35)	1 (5)	-	-	4.0	1.0	High
Reform of oil subsidies	2 (10)	4 (20)	6 (30)*	5 (25)	2 (10)	1 (5)	2.8	1.3	Low
Support to vulnerable people	1 (5)	11 (55)*	7 (35)	1 (5)	-	-	3.6	0.7	High
Government support	8 (40)*	5 (25)	4 (20)	2 (10)	1 (5)	-	3.9	1.2	High
Innovative technologies	4 (20)	6 (30)*	7 (35)	2 (10)	1 (5)	-	3.5	1.1	High
Virtual connectivity	3 (15)	7 (35)*	5 (25)	1 (5)	3 (15)	1 (5)	3.2	1.5	High
Green transportation	5 (25)	5 (25)	8 (40)*	2 (10)	-	-	3.7	1.0	High

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 13: Matrix of perception of opportunities for transition to clean energy (Objective 4)

Matrix	Freq	Percentage (%)
VH	7	35.0
H	8	40.0
M	5	25.0
L	-	-
VL	-	-
NA	-	-
Total	**20**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 14: Calculated 'mean' of opportunities for transition to clean energy (Objective 4)

Options (Criteria)	VH	H	M	L	VL	NA	Mean
	≥4.5	≥4.0	≥3.5	≥3.0	≥2.5	≥2.0	
Decrease in demand for fuel	-	X	-	-	-	-	3.9
Investment in renewal for energy	-	X	-	-	-	-	4.4
Clean energy transition	-	X	-	-	-	-	4.0
Improvement in air quality	-	X	-	-	-	-	4.1
Energy efficiency	-	X	-	-	-	-	4.2
Job opportunities	-	-	-	X		-	3.2
Construction of low carbon infrastructure	-	-	-	X	-	-	3.2
Energy swaps	-	-	X	-	-	-	3.9
Climate smart transport	-	-	X	-	-	-	3.7
Sustainable transport	-	-	X	-	-	-	3.9
Reduction in pollution	-	X	-	-	-	-	4.0
Growth in renewal energy		-	X		-	-	3.7
Reduction in urban heat island effect	-	-	X	-	-	-	3.5
Digital solutions	-	X	-	-	-	-	4.0
Reform of oil subsidies	-	-	-	-	X	-	2.8
Support to vulnerable people	-	-	X	-	-	-	3.6
Government support	-	-	X	-	-	-	3.9
Innovative technologies	-	-	X	-	-	-	3.5
Virtual connectivity	-	-	-	X	-	-	3.2
Green transportation	-	-	X	-	-	-	3.7
TOTAL	**-**	**7**	**9**	**3**	**1**	**-**	**20**
Percentage (%)	**-**	**35.0**	**45.0**	**15.0**	**05.0**	**-**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 15: Frequency of operations that promote inclusion (Objective 5)

Options (Criteria)	VH	H	M	L	VL	NA	Mean	SD	Decision
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)			
Public enlightenment	14 (70)*	5 (25)	-	1 (5)	-	-	4.6	0.8	High
Special attention	9 (45)*	6 (30)	4 (20)	-	-	1 (5)	4.1	1.2	High
Sufficient space for all	10 (50)*	4 (20)	5 (25)	-	-	1 (5)	4.1	1.3	High
Access to transport facilities	10 (50)*	5 (25)	5 (25)	-	-	-	4.3	0.9	High
Identification of mobility needs	11 (55)*	4 (20)	4 (20)	1 (5)	-	-	4.3	1.0	High
Training staff to understand mobility needs	7 (35)	9 (45)*	3 (15)	1 (5)	-	-	4.1	0.9	High
Ensuring safety measures	9 (45)*	5 (25)	5 (25)	1 (5)	-	-	4.0	1.3	High
Introduction of adequate measures	10 (50)*	8 (40)	1 (5)	-	-	1 (5)	4.3	1.2	High
Promotion of special transport	8 (40)*	4 (20)	6 (30)	-	1 (5)	1 (5)	3.8	1.4	High
Free-phone help line	7 (35)*	6 (30)	2 (10)	3 (15)	1 (5)	1 (5)	3.6	1.5	High
Do not discriminate against them	11 (55)*	8 (40)	1 (5)	-	-	-	4.5	0.6	High
Designating a staff or section to handle their affairs	8 (40)*	7 (35)	4 (20)	-	1 (5)	-	4.1	1.1	High
Designate a safe part of the facility for the vulnerable	6 (30)	5 (25)	6 (30)*	-	1 (5)	2 (10)	3.5	1.6	High

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 16: Matrix of operations that promote inclusion (Objective 5)

Matrix	Freq	Percentage (%)
VH	11	84.6
H	01	07.7
M	01	07.7
L	-	-
VL	-	-
NA	--	-
Total	**13**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020

Table 17: Calculated 'mean' of perceived compliance on inclusion (Objective 5)

Options (Criteria)	VH	H	M	L	VL	NA	Mean
	≥4.5	≥4.0	≥3.5	≥3.0	≥2.5	≥2.0	
Public enlightenment	X	-	-	-	-	-	4.6
Special attention	-	X	-	-	-	-	4.1
Sufficient space for all	-	X	-	-	-	-	4.1
Access to transport facilities	-	X	-	-	-	-	4.3
Identification of mobility needs	-	X	-	-	-	-	4.3
Training staff to understand mobility needs	-	X	-	-	-	-	4.1
Ensuring safety measures	-	X	-	-	-	-	4.0
Introduction of adequate measures	-	X	-	-	-	-	4.3
Promotion of special transport	-	-	X	-	-	-	3.8
Free-phone help line	-	-	X	-	-	-	3.6
Do not criminate against them	X	-	-	-	-	-	4.5
Designating a staff or section to handle their affairs	-	X	-	-	-	-	4.1
Designate a safe part of the facility for the vulnerable	-	-	X	-	-	-	3.5
TOTAL	**2**	**8**	**3**	**-**	**-**	**-**	**13**
Percentage (%)	**15.4**	**61.5**	**23.1**	**-**	**-**	**-**	**100**

* VL – Very low; L. – Low; M. – Moderate; H. – High; VH. – Very high and NA – Not at all
Source: Researcher's Survey, 2020.

Principal Component Analysis

The PCA results in Appendix Table 18 below identified and categorised new technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria into 11 components which accounted for 90.7% of variability in the original 51 variables. Component one loaded significantly on 16 factors. These are restriction on inter-state and inter-city travel (.904), keeping the manifest of the passengers for contact tracing (.896), provision of waste disposal facilities inside the vehicles and terminal (.895), prohibition of touting in the terminal and transport vehicles (.862), dedication of special routes (.819) and obtaining and keeping contact address of all passengers (.761). Others are providing guidelines on do's and don'ts to every passenger (.719), valuable back up staff for other critical positions (.667), rear door boarding may temporarily replace the front door access (.639), modification of boarding and loading system (.629), modification of departure/arrival schedule for passengers (.582), regular routine maintenance (.563), disinfectant both inside the terminal and transport vehicles (.563), identification of essential functions within the organisation (.528), the use of official channels for covid-19 updates (.528) and customer service staff should only be available in information booths (.511). It has an eigenvalue of 9.815 and accounts for 20 % of variance that explains effectiveness of the new technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component one is an index for measuring lockdown as distinct new procedure that has been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is restriction on inter-state and inter-city travel with a factor loading of .904.

Component two loaded significantly on nine factors. These ensure strict enforcement of NCDC COVID-19 protocol (.873), adopting constant cleaning routines (.821), ensuring that every staff attending to sick people (.808), customer service staff should only be available in information booths (.723), promotion of telephone/Zoom meetings (.673) and routine maintenance (.635). Others are protection to staff attending to sick people (.604), obtaining and keeping contact address of all passengers (.537) and information sharing with local authorities to align crisis plans (.535). It has an eigenvalue of 6.149 and accounts for 12.6 % of variance that explains effectiveness of the new technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component two is an index for measuring COVID-19 safety protocol as distinct new processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is ensuring strict enforcement of NCDC COVID-19 protocol (.873) with a factor loading of .904.

Component three loaded significantly on seven factors. These are regular cleaning of the terminal and transport vehicles with disinfectant (.844), review of stock and supply chains for operational material (.798), public enlightenment on the prevention and control of covid-19 both inside the terminal and during transit (.667) and promotion of the use of elbow to cover the face or tissue when coughing and sneezing (.633). Others are fumigation of the terminal and transport vehicles regularly (.625), review the stock and availability of essential protection (.607) and cleaning of the place of convenience regularly with disinfectant (.583). It has an eigenvalue of 4.818 and accounts for 9.8 % of variance that explains effectiveness of the new technologies and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component three is an index for measuring environmental sanitation as a distinct new technology and procedure that has been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is regular cleaning of the terminal and transport vehicles with disinfectant (.844).

Component four loaded significantly on five factors. These are the provision of facilities for washing of hands with soap under running water (.832), promotion of avoiding touching your eyes nose and mouth with unclean hands (.823), good ventilation and respiratory and respiratory hygiene both inside the terminal and transport vehicles (.678), modification of boarding and loading system (.533) and modification of departure/arrival schedule for passengers (.507). It has an eigenvalue of 3.913 and accounts for 8 % of variance that that explains effectiveness of the new technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component four is an index for measuring promotion of hygiene as a distinct new procedure that has been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is the provision of facilities for washing of hands with soap under running water (.832).

Component five also loaded significantly on five factors. These are online payment/ electronic transfer payment (.861), shift work schedule for staff (.846), online booking/ use of e-ticket (.705), health declaration (.698) and avoiding routes with traffic congestion. It has an eigenvalue of 3.818 and accounts for 7.8 % of variance that explains effectiveness of the new technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component five is an index for measuring information technology as a distinct new technology and procedure that has been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is online payment/electronic transfer payment (.861).

Component six loaded significantly on four factors. These are the use of face masks both inside the terminal and transport vehicles (.870), temperature checks both in the terminal and transport vehicles (.851), disinfectant both inside the terminal and transport vehicles (.610) and protection of staff attending to sick people (.561). It has an eigenvalue of 3.580 and accounts for 7.3 % of variance that explains effectiveness of the new technology that has been used by road transport operators to respond to the pandemic in Nigeria. Component six is an index for measuring face masks as a distinct new technology. The defining variable is the use of face masks both inside the terminal and transport vehicles (.870).

Component seven also loaded significantly on four factors. These are proper and frequent disposal of waste (.884), social distance both inside the terminal and transport vehicles (.754), the use of official channels for covid-19 updates (.560) and modification of departure/ arrival schedule for passengers (.512). It has an eigenvalue of 3.220 and accounts for 6.6 % of variance that that explains the effectiveness of the new technologies, processes and procedures that have been used by road transport operators to respond to the

pandemic in Nigeria. Component seven is an index for measuring physical distancing as a distinct new technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is proper and frequent disposal of wastes (.884).

Component eight loaded significantly on three factors namely development of communication messages (.836), equipping staff washing and dressing rooms (.716) and developing an inventory of staff qualifications, licenses, etc. It has an eigenvalue of 3.004 and accounts for 6.2 % of variance that explains the effectiveness of the new procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component eight is an index for measuring public enlightenment as a distinct new procedure that has been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is development of communication messages (.836).

Component nine loaded significantly on two factors which are provision of alcohol-based hand sanitisers for cleaning of hands (.780) and cleaning of the place of convenience regularly with disinfectant (.568). It has an eigenvalue of 2.476 and accounts for 5.1 % of variance that explains the effectiveness of the new technologies and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component nine is an index for measuring palliative support as a distinct new procedure. The defining variable is provision of alcohol-based hand sanitisers for cleaning of hands (.780).

Component ten loaded significantly only on factor of promotion of inclusiveness in services with regard to the elderly, persons with disability, women and children (.747). It has an eigenvalue of 1.988 and accounts for 4.1 % of variance that explains the effectiveness of the new policy that has been used by road transport operators to respond to the pandemic in Nigeria. Component ten is an index for measuring inclusiveness as a distinct new policy used by road transport operators to respond to the pandemic in Nigeria. The defining variable is provision of alcohol-based hand sanitisers for cleaning of hands (.780).

Component eleven loaded significantly on only factor of use of social media, television, radio, local town-criers and podcasts for dissemination of information and other issues (.634). It has an eigenvalue of 1.648 and accounts for 3.4 % of variance that explains the effectiveness of the new technologies, processes and procedures that have been used by road transport operators to respond to the pandemic in Nigeria. Component eleven is an index for measuring mass media as a distinct new technology, process and procedure that has been used by road transport operators to respond to the pandemic in Nigeria. The defining variable is use of social media, television, radio, local town-criers and podcast for dissemination of information and other issues (.634).

Overall, the 51 new technologies, processes and procedures used by road transport operators in responding to the COVID-19 pandemic in Nigeria are classified into 11 categories. These are lockdown (20%), COVID-19 safety protocols (12.6%), environmental sanitation (9.8%), promotion of hygiene (8%), information technology (7.8%), face masks (7.3%) and physical distancing (6.6%). Others are public enlightenment (6.2%), palliative support (5.1%), inclusiveness (4.1%) and mass media (3.4%).

Table 18: PCA results on identified categories of new technologies and procedures

Factor	Component										
	1	2	3	4	5	6	7	8	9	10	11
Restriction on inter-state and inter-city travel	.904										
Keeping the manifest of the passengers for contact tracing	.896										
Provision of waste disposal facilities inside the vehicles and terminals	.895										
Prohibition of touting in the terminal and transport vehicles	.862										
Dedication of special routes	.819										
Obtaining and keeping	.761	.537									

Factor	Component										
	1	2	3	4	5	6	7	8	9	10	11
contact address of all passengers											
Provide guidelines on do's and don'ts to every passenger	.719										
Valuable back up staff for other critical positions	.667										
Rear door boarding may temporarily replace the front door access	.639										
Modification of boarding and loading system	.629			.533							
Modification of departure/arrival schedule for passengers	.528			.507			.512				
Identification of essential functions within the organisation	.528										
Customer service staff should only be available in information booths	.511	.723									
Regular routine maintenance	.563	.635									
Disinfectant both inside the terminal and transport vehicles	.563										
The use of official channels for covid-19 updates	.528										
Ensure strict enforcement of NCDC COVID-19 protocol		.873									
Adopting a cleaning routines		.821									
Ensuring that every staff attending to sick people		.808									
Promotion of telephone/zoom meetings		.673									
Protection to staff attending to sick people		.604				.561					
information sharing with local authorities to align crisis plans		.535									
Regular cleaning of the terminal and transport vehicles with disinfectant			.844								
Review stock and supply chains for operational material			.798								
Public enlightenment on the prevention and control of covid-19 both inside the terminal terminals and transport			.667								
Promotion of the use of elbow to cover your face			.633								

Factor	Component										
	1	2	3	4	5	6	7	8	9	10	11
or tissue when coughing and sneezing											
Fumigation of the terminal and transport vehicles regularly			.625								
Review the stock and availability of essential protection			.607								
Cleaning of the place of convenience regularly with disinfectant			.583						.568		
Provision of facilities for washing of hands with soap under running water				.832							
Promotion of avoiding touching your eyes nose and mouth with unclean hands				.823							
Good ventilation and respiratory and respiratory hygiene both inside the terminal and transport vehicles				.687							
Online payment/electronic transfer payment					.861						
Shift work schedule for staff					.846						
Online booking/use of e-ticket					.705						
Health declaration					.698						
Avoiding routes with traffic congestion					.530						
The use of face mask both inside the terminal and transport vehicles						.870					
Temperature check both in the terminal and transport vehicles						.851					
Cleaning of the seats regularly with disinfectant both inside the terminal and transport vehicles						.610					
Proper and frequent disposal of wastes							.884				
Social distance both inside the terminal and transport vehicles							.754				
The use of official channels for covid-19 updates							.560				
Development of communication messages								.836			
Equipping staff washing and dressing rooms								.716			
Developing an inventory of staff qualifications,								.577			

Factor	Component										
	1	2	3	4	5	6	7	8	9	10	11
licenses, etc.											
Provision of alcohol-based hand sanitisers for cleaning of hands									.780		
Promotion of inclusiveness in your services with regards to the elderly, persons with disability, women and children										.747	
Use of social media, television, radio, local town-criers and podcast for dissemination of information and other issues											.634
Eigenvalue	**9.815**	**6.149**	**4.818**	**3.913**	**3.818**	**3.580**	**3.220**	**3.004**	**2.476**	**1.988**	**1.648**
% of variance	**20.031**	**12.549**	**9.833**	**7.986**	**7.305**	**7.305**	**6.572**	**6.132**	**5.054**	**4.058**	**3.364**
Cumulative %	**20.031**	**32.579**	**42.412**	**50.398**	**58.189**	**65.495**	**72.066**	**78.198**	**83.252**	**87.310**	**90.673**

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