Transport Starter Data Kit: Historical socio-transport data for Nigeria

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Abstract

Data on transport activity is an important element for the development of national transport decarbonisation strategies. By having freight and passenger transport information, the impacts on vehicle and fuel consumption changes from replacing internal combustion engine vehicles with electric vehicles can be calculated. The development of a national decarbonisation strategy requires significant efforts. However, access to data is often a barrier to starting transport system modelling in developing countries, thereby causing delays. This article provides data that can be used to support a model for Nigeria, which may act as a starting point for further model development and scenario analysis. The data are collected entirely from publicly available and accessible sources, focusing on national reports, statistical yearbooks, and academia.

Keywords

U4RIA

Transport data

Transport modelling

MAED

Nigeria

Specifications Table

Subject	Transport
Specific subject area	Transport Data
Type of data	Tables Graphs
How data were acquired	Literature survey (databases and reports from international organisations; journal articles)
Data format	Raw and analysed
Parameters for data collection	Data collected based on inputs required to create an energy system model for Nigeria
Description of data collection	Data were collected from the websites, annual reports and databases of international organisations, as well as from academic articles and existing modelling databases.
Data source location	Not applicable
Data accessibility	With the article and in a repository. Repository name: Zenodo. Direct URL to data: https://doi.org/10.5281/zenodo.6539979

Value of the Data

- The data can be used to develop national transport demand models to inform national investment outlooks and decarbonisation strategies.
- The data are useful for country analysts, policy makers, and the broader scientific community, as a zero-order starting point for model development.
- This data could be used to examine a range of possible transport pathways, in addition to the examples given in this study, to provide further insights into the evolution of Nigeria's transport system.
- The data can be used both for conducting an analysis of transport activity and emissions, but also for capacity building activities.
- The data can be used as a call to action in addressing transport data gaps and establishing parameters for data collection to improve the consistency of transport-climate research in these countries.

1. Data Description

The data provided in this paper can be used to support the development of a transport model for Nigeria. The data provided were collected from publicly available sources, including statistical yearbooks, transport ministry reports, statistics from national authorities and affiliated research institutions, academia, and journal articles. Global datasets (primarily from the World Bank) were only consulted if severe data gaps existed. The dataset includes parameters on passenger and freight transport activity, disaggregated by transport mode (road, rail, aviation, etc.) and geographic scale (inter-city or inner-city), if available. The dataset also covers the size of the vehicle fleet, disaggregated by vehicle types. The data coverage and subtypes vary among the parameters. The overall ambition is to include the most recent available year(s).

Item	*Description of Content*
Figure 1	A graph showing total population (million people), as well as the share of urban and rural population in Nigeria.
Figure 2	A graph showing total GDP (million USD in 2015), as well as the share of the different sectors contributing to GDP in Nigeria: agriculture, construction, mining, manufacturing, service, and energy.
Tables 1 to 3	Tables showing passenger transport activity in Nigeria for the most recent year data was available. The data are curated from national statistics agencies or other government-affiliated agencies.
Table 4	An additional table showing passenger transport activity in Nigeria based on UN DESA Statistics Division data (see explanation below). The data feature information for 2018.
Tables 5 to 7	Tables showing freight transport activity in Nigeria for the most recent year data was available.
Table 8	An additional table showing freight transport activity in Nigeria based on UN DESA Statistics Division data (see explanation below). The data feature information for 2018.
Tables 9 to 10	Tables showing vehicle fleet data in Nigeria for the most recent year data were available.

For the parameters on passenger and freight transport activity, an additional dataset was included in Table 4 and Table 8. The UN DESA Statistics Division modelled passenger activity and freight activity for every country in support of SDG Indicator 9.1.2[1]. Passenger activity data provide information for road, rail, and air transport. Freight data cover road, rail and inland water, and aviation. The passenger-km and tonnes-km data originate from the Open SDG Data Hub. In this dataset, only the data for International Transport Forum (ITF) (representing mostly OECD countries) and UNECE countries (mostly European countries) are based on national reporting. For non-ITF/UNECE countries, the data are estimated using the ITF model, which uses several covariates such as GDP, population, and transport network coverage. A description of the model can be found in the ITF Transport Outlook 2017.

1.1 Population

Population data including total population, population growth, and split by rural or urban was gathered from The World Bank Open Data platform[2]. Figure 1 displays the total population disaggregated by urban and rural in Nigeria.

[1] Freight: https://www.sdg.org/datasets/undesa::indicator-9-1-2-freight-volume-by-mode-of-transport-tonne-kilometres/about ;
Passenger: https://www.sdg.org/datasets/undesa::indicator-9-1-2-passenger-volume-passenger-kilometres-by-mode-of-transport/about

[2] https://data.worldbank.org/

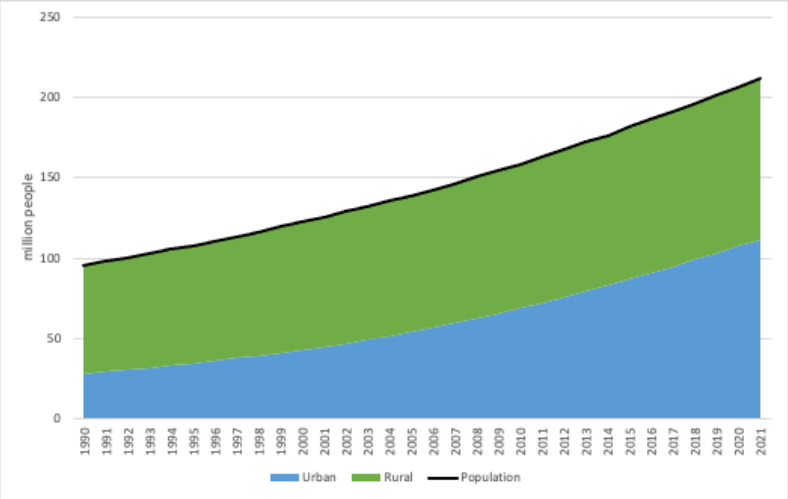

Figure 1: Total population (million people) disaggregated by urban and rural in Nigeria

1.2 Gross domestic product (GDP)

GDP data including total GDP, GDP growth, and GDP share by sector (agriculture, manufacturing, service) was collected from The World Bank Open Data platform[2]. Where data was not available, data processing was done. Figure 2 shows the total GDP, as well as the share by sector, in Nigeria.

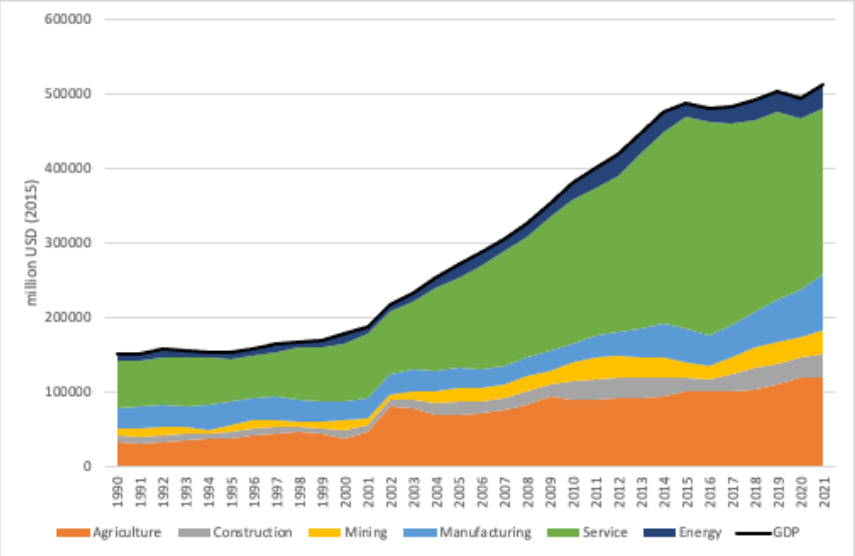

Figure 2: Total GDP (million USD in 2015) disaggregated by share in Nigeria

1.3 Passenger transport activity

Information on passenger transport activity in Nigeria exists for all land transport modes. Three different datasets have been included because each dataset covers information for a different year, and they use different typologies for transport modes. In Table 1, the passenger transport activity for 2010 from a low-

carbon energy study is covered. Table 2 shows road transport activity for 2016, published by the government of Nigeria. The third table only provides rail transport information, sourced from the World Bank.

The low-carbon energy study believes that private cars recorded 268800 million passenger-km, taxis 77800 million passenger-km, and motorcycles 43300 million passenger-km in 2010. Rail represents the smallest contribution to passenger transport activity with just 800 million passenger-km.

Table 1: Estimated passenger transport activity (million passenger-km) in Nigeria

Mode	2010
Motorcycles	43300
Private cars	268800
Taxis	77800
Light buses	2600
Coaches	12000
Rail	800

Source: Dioha, M. and Kumar, A., 2020, Sustainable energy pathways for land transport in Nigeria, Utilities Policy, Volume 64, 101034, ISSN 0957-1787,https://doi.org/10.1016/j.jup.2020.101034., https://www.sciencedirect.com/science/article/abs/pii/S0957178720300291?via%3Dihub

Table 2 provides data for 2016 and it disaggregates road transport modes by fuel type (diesel and gasoline). This dataset includes light duty trucks because it covers light passenger commercial buses. The total passenger transport activity is indicated as 552800 million passenger-km for 2016. Comparing it to the road transport data in Table 1, it shows an increase of 36% between 2010 and 2016. Such a steep increase has to be seen with caution and it has to be understood that the two datasets underlie different methodologies and are not directly comparable.

Further, the information on fuel type shows that 98% of private car activity and 75% of light duty truck activity rely on gasoline. The fuel usage of heavy duty buses is equally divided between diesel and gasoline usage. The data is part of the Third National Communication of the Federal Republic of Nigeria, and it is the basis for future projections on transport development and related greenhouse gas emissions.

Table 2: Passenger transport activity (million passenger-km) by fuel type in Nigeria

Mode	Sub-type	2016
Cars	Gasoline	168482.384
Cars	Diesel	3438.416
Motorcycles	Gasoline	28192.8
Light duty trucks (incl. light passenger commercial buses)	Diesel	227200.8
Light duty trucks (incl. light passenger commercial buses)	Gasoline	75733.6
Heavy duty buses	Diesel	24876
Heavy duty buses	Gasoline	24876

Source: Federal Republic of Nigeria, 2020, Third National Communication of the Federal Republic of Nigeria, https://unfccc.int/sites/default/files/resource/NIGERIA_NC3_18Apr2020_FINAL.pdf

Both datasets only provide a single year. To outline at least the development of rail passenger transport activity, the data by the World Bank is included in Table 3. It shows the development from 1990 to 2005. The quality of data is concerning in this case because there is very large variation throughout the years.

Table 3: Recorded rail passenger transport activity (million passenger-km) in Nigeria

Mode	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	20
Rail	1269	689	105		471			479					593	

Source: World Bank, 2022, Railways, passengers carried (million passenger-km) - Nigeria, https://data.worldbank.org/indicator/IS.RRS.PASG.KM?locations=NG

Overall, it shows that there are major data gaps for passenger transport activity data in Nigeria. There are no frequent updates, and the data collection does not seem to be institutionalised with clear responsibility given to a national authority.

Examining the UN DESA modelled data, it is estimated that road passenger activity in Nigeria is 217953 million passenger-km in 2018 (Table 4). Rail only represents 190 million passenger-km and aviation 4087 million passenger-km in 2018. Comparing it to the datasets above, the values for road transport are half of the other datasets. Rail data by UN DESA is similar to the World Bank but significantly lower than the dataset in Table 1.

Table 4: Modelled passenger transport activity (million passenger-km) in Nigeria

Mode	2018
Aviation	4087.96
Rail	190.68
Road	217953.94

1.4 Freight transport activity

Information on freight activity for Nigeria is available for trucks and rail. Again, the same three datasets have been included because they share different insights into the situation in the country. Trucks recorded 67300 million tonnes-km in 2010. Rail records 700 million tonnes-km in the same year. The data is sourced from a sustainable energy pathway study for land transport in Nigeria.

Table 5: Freight transport activity (million tonnes-km) in Nigeria

Mode	2010
Trucks	67300
Rail	700

Source: Dioha, M. and Kumar, A., 2020, Sustainable energy pathways for land transport in Nigeria, Utilities Policy, Volume 64, 101034, ISSN 0957-1787,https://doi.org/10.1016/j.jup.2020.101034., https://www.sciencedirect.com/science/article/abs/pii/S0957178720300291?via%3Dihub

Freight transport relies completely on diesel, where trucks are estimated to record 69247 million tonnes-km in 2016. It is a minor increase from the 2010 values, but the compatibility is limited as described in the subsection above.

Table 6: Freight transport activity (million tonnes-km) by fuel type in Nigeria

Mode	Sub-type	2016
Heavy duty trucks	Diesel	69246.9735
Rail	Diesel	104.0265

Rail freight activity by the World Bank is outdated as 2005 is the most recent year with data. It indicates 77 million tonnes-km, which is significantly less than Table 5 and slightly less than Table 6. Thus, the data has to be taken with caution.

Table 7: Freight transport activity (million tonnes-km) in Nigeria

Mode	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	20
Rail	178.2	213.3	183.6	95.4	95.4	-	-	480	-	54	-	-	44	39	57.214	76

Source: World Bank, 2022, Railways, good transported (million ton-km) - Nigeria, https://data.worldbank.org/indicator/IS.RRS.GOOD.MT.K6?locations=NG

According to the UN DESA modelled data, freight activity for 2018 in Nigeria is 73112 million tonnes-km for road, 12156 million tonnes-km for rail, 5144 million tonnes-km for waterways, and 19 million tonnes-km for aviation. Freight transport is mostly achieved through road transport.

Table 8: Modelled freight transport activity (million tonnes-km) in Nigeria

Mode	2018
Aviation	19.42
Inland waterways	5144.63
Rail	12155.96
Road	73112.17

1.5 Vehicle fleets

For the vehicle fleet in Nigeria, official statistics by the National Bureau of Statistics capture private vehicles, commercial vehicles, government vehicles, and diplomatic vehicles. In total, there are 11.8 million vehicles

as of 2018. Data is available for 2016, 2017, and 2018. The statistics show an average annual growth of 2%. 58% of the fleet are commercial vehicles, followed by 41% private vehicles.

Table 9: Official vehicle fleet numbers in Nigeria

Mode	2016	2017	2018
Private	4628060	4682309	4819251
Commercial	6741871	6756372	6785956
Government	131178	138761	149470
Diplomatic	2301	5889	6194
Total fleet	11503410	11583331	11760871

Source:

- Data for 2016: National Bureau of Statistics, Nigeria, 2017, Road Transport Data (Q2 2017), https://www.nigerianstat.gov.ng/pdfuploads/Road_Transport_Data_%E2%80%93_Q2_2017_.pdf;
- Data for 2017 and 2018: National Bureau of Statistics, Nigeria, 2018, Road Transport Data (Q2 2018), https://nigerianstat.gov.ng/elibrary/read/813

An additional dataset from a Nigerian case study exploring the future transition to electric vehicles features detailed information on the light-duty vehicle fleet by fuel type. The data is created by the author based on an another study from 2013[3]. It assumes that 98% of private cars as well as 98% of light commercial vehicles are powered by gasoline. This data singles out motorcycles, representing 41% of all light-duty vehicles in Nigeria.

Table 10: Assumed vehicle fleet numbers by fuel type in Nigeria

Mode	Sub-type	2015
Total fleet	-	12700562
Motorcycles	Gasoline	5240981
Motorcycles	Electric	0
Private Car	Gasoline	6382022
Private Car	Diesel	130245
Private Car	Electric	0
Light commercial vehicle	Gasoline	919551
Light commercial vehicle	Diesel	18766
Light commercial vehicle	Electric	0
Light bus	Gasoline	8817
Light bus	Diesel	180
Light bus	Electric	0

Source: Dioha, M. O. et al., 2022, Exploring the role of electric vehicles in Africa's energy transition: A Nigerian case study, iScience, Volume 25, Issue 3, 103926, https://www.cell.com/iscience/fulltext/S2589-0042(22)00196-1

[3] Cervigni, R., Rogers, J.A., and Dvorak, I., 2013, Assessing Low-Carbon Development in Nigeria: An Analysis of Four Sectors (The World Bank), https://doi.org/10.1596/978-0-8213-9973-6.

2. Methodology

The focus is on national data for passenger activity (passenger-km), freight activity (tonnes-km) and modes of transport (number of vehicles). The priority is to collect data released by national governments, government-affiliated organisations, or country-specific studies. The research identifies the most recent available data and any data available from 1990 onwards. The priority was for any data after 2010, because transport is a very dynamic growth sector and anything before 2010 adds limited value to understanding the current real-world situation.

Desk research is the main data collection approach for the Transport Starter Data Kits. The desk research examined annual yearbooks, transport statistics, country reporting, and any national statistical portals. Websites of the national government, transport ministries, statistical institutes and other related authorities were examined. Only when severe data gaps exist, global datasets are consulted. In some cases, World Bank data[4] on rail passenger and rail freight is included.

Each Transport Data for Starter Data Kit set contains an additional dataset, which is sourced from the United Nations Department of Economic and Social Affairs (UN DESA) Statistics Division. It is included as a secondary priority because this dataset is the result of a modelling exercise and covers every country. The UN DESA modelled passenger activity and freight activity has the purpose to support the Sustainable Development Goal Indicator 9.1.2[5]. The passenger activity provides information for road, rail, and air transport. Freight data covers the road, rail and inland water, and aviation. The passenger-km and tonnes-km data originate from the Open Sustainable Development Goals (SDG) Data Hub. In the UN DESA dataset, only the data for countries participating in the International Transport Forum (ITF) (representing mostly member countries of the Organisation for Economic Co-operation and Development (OECD)) and the United Nations Economic Commission for Europe (UNECE) (mostly European countries) are based on national reporting. For non-ITF/UNECE countries, data are estimated using the ITF model, which uses several covariates such as gross domestic product, population, and transport network coverage. A description of the model can be found in the ITF Transport Outlook 2017[6]. The UN DESA dataset is included in the Transport Data for Starter Data Kits as additional tables to fill in the incomplete picture that most countries present. The UN DESA modelled data is less accurate and it shall only be regarded as offering the wider picture of transport activity in the country.

The collected data have been shared with a group of relevant SLOCAT partners to validate and explore any additional sources. The SLOCAT partners were selected based on their actions to lead projects in the region and their involvement in data-focused knowledge products or projects. The consultation involved ten anonymous organisations.

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[4] Rail passenger data: World Bank, 2022, Railways, passengers carried (million passenger-km), https://data.worldbank.org/indicator/IS.RRS.PASG.KM; rail freight data: World Bank, 2022, Railways, goods transported (million ton-km), https://data.worldbank.org/indicator/IS.RRS.GOOD.MT.K6

[5] UN DESA, 2021, Indicator 9.1.2: Freight volume by mode of transport (tonne kilometres): https://www.sdg.org/datasets/undesa::indicator-9-1-2-freight-volume-by-mode-of-transport-tonne-kilometres/about ;
UN DESA, 2021, Indicator 9.1.2: Passenger volume (passenger kilometres) by mode of transport: https://www.sdg.org/datasets/undesa::indicator-9-1-2-passenger-volume-passenger-kilometres-by-mode-of-transport/about

[6] ITF, 2017, ITF Transport Outlook 2017, https://www.itf-oecd.org/transport-outlook-2017

Desk research is an approach that limits the research to material available on the internet, accessible through search engines and linked to government and statistical institutes' websites. However, this does not pose a major limitation to obtaining data. Nearly every country has functional websites for statistics and transport authorities. In a few cases, websites are not well maintained, resulting in missing or broken hyperlinks to reports. By using services that provide access to archived websites, some of these broken pages can be retrieved. The collected information has been shared with partners and no additional information has been received.

While over 1,500 languages are spoken across Sub-Saharan Africa, government datasets are generally published in a smaller subset of languages including English, French, Portuguese and others. Nonetheless, language is not a barrier to navigating through the material and identifying the relevant parameters. The involved team members can navigate through reports in such languages. If needed, automatic translation tools were used.

The World Bank's data platform provided GDP share by sector for agriculture, manufacturing, and services. However, GDP share by construction, mining, and energy was also needed to align the data structure with the MAED tool. To address the lack of data available for these sectors, the authors assumed that construction, mining, manufacturing, and energy all fall within the industry sector. Thus, to obtain data for the three remaining sectors, the remaining percentage after considering agriculture, manufacturing, and services from The World Bank's data platform, was divided by three. It is therefore assumed that the GDP share of the construction, mining, and energy sectors are the same.

3. Ethics Statement

Not applicable.

4. CRediT Author Statement

Naomi Tan: Investigation, Conceptualisation, Methodology; Data Collection; Visualization, Writing and Editing; **Robert Ambunda:** Data Collection; Investigation; Writing and Editing; **Nikola Medimorec:** Conceptualisation; Methodology; Data Collection; Investigation; Writing, Review & Editing; Supervision; **Angel Cortez:** Data Collection; **Agustina Krapp:** Data Collection; **Erin Maxwell:** Data Collection; **John Harrison:** Supervision; **Mark Howells:** Supervision

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Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.