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

Authors

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Abstract

Mali is a landlocked country located in the western region of Africa, largely in the Saharan and Sahelian regions of the continent. Mali is the eighth largest country in mainland Africa, covering a land area of 1.24 million square kilometres, with a population of 21.9 million inhabitants. Approximately three-fifths of the population is rural. Mali is traditionally divided into the nomadic region of the Sahel and the Sahara and the agricultural region of the Sudanic zone. The country is bordered by Algeria in the north, Niger and Burkina Faso in the east, Cote d'Ivoire and Guinea in the south, and Senegal and Mauritania in the west. Subsistence and commercial agriculture are the basis of the Mal economy, which accounts for 80 % of all exports.

The transport system is of poor quality in Mali. A quarter of the roads are paved and the vehicles are mostly old, unsafe vehicles. Private car ownership is low Despite being landlocked, water transport handles the majority of Mali's trade activity. There are 1,815 km of inland waterways.[1] Mali's most recent Nationally Determined Contribution features an increase of biodiesel for road vehicles.[2]

Transport demand modelling can be used to assess the implications of different scenarios and support improved policymaking. 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 Mali, which may act as a starting point for

[1] https://en.wikipedia.org/wiki/Transport_in_Mali

[2] https://changing-transport.org/ndc_country/mali/

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

Mali

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 Mali
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.7997657

Value of the Data

- These data can be used to develop national transport demand models to inform national transport investment outlooks and policy plans, as well as provide insights on the evolution of total final energy demand.
- The data are useful for country analysts, policy makers, and the broader scientific community, as a zero-order starting point for model development.
- These 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 the country's power system.
- The data can be used for conducting an analysis of transport activity and capacity-building activities. Additionally, the methodology of translating the input data into modelling assumptions for a demand projection tool is presented in this article, which is useful for developing a zero-order national transport demand model. This is consistent with the U4RIA goals.

- The data can also 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 as input data to develop transport demand models for Mali. The data provided in this paper can be used to support the development of a transport model for Mali. 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 sub-types 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 Mali.
Figure 2	A graph showing total GDP (million USD in 2015), as well as the share of the different sectors contributing to GDP in Mali: agriculture, construction, mining, manufacturing, service, and energy.
Table 1	A table showing passenger transport activity in Mali for the most recent year data was available. The data are curated from national statistics agencies or other government-affiliated agencies.
Table 2	An additional table showing passenger transport activity in Mali based on UN DESA Statistics Division data (see explanation below). The data feature information for 2019.
Table 3	A table showing freight transport activity in Mali for the most recent year data was available. The data are curated from national statistics agencies or other government-affiliated agencies.
Table 4	A table showing freight transport activity in Mali based on UN DESA Statistics Division data (see explanation below). The data feature information for 2019.
Table 5	A table showing the energy intensity levels (MJ per passenger-km) for urban transport in 2013. It is based on a study for Cape Town (South Africa) and it is intended to support estimations for this parameter in the country.
Table 6	A table showing load factors (average number of people per vehicle) for urban transport in 2013, based on the same study for Cape Town (South Africa).
Table 7	A table showing vehicle fleet data in Mali for the most recent year data was available.

For the parameters on passenger and freight transport activity, an additional dataset was included in Table 2 and Table 4. The UN DESA Statistics Division modelled passenger activity and freight activity for every country in support of SDG Indicator 9.1.2[3]. Passenger activity data provide information for road, rail and air transport. Freight data cover road, rail and inland water, 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[4]. Figure 1 displays the total population disaggregated by urban and rural in Mali.

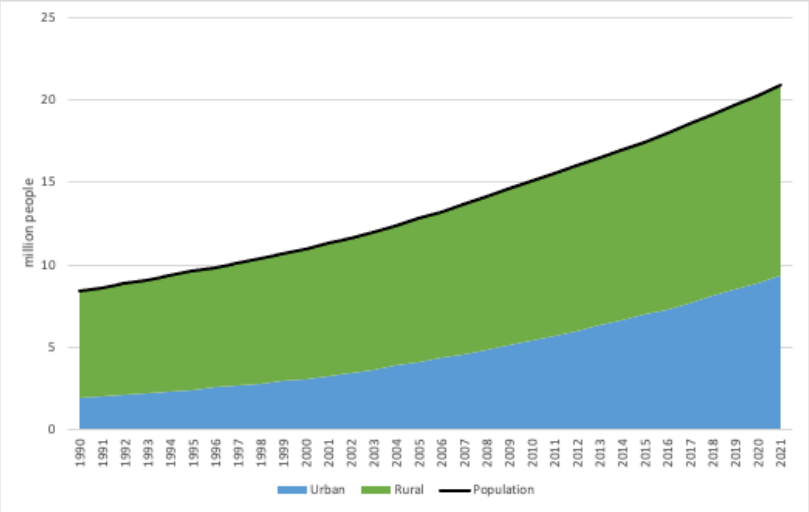

Figure 1: Total population (million people) disaggregated by urban and rural in Mali

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[4]. Where data was not available, data processing was done. Figure 2 shows the total GDP, as well as the share by sector, in Mali.

[3] UN DESA (2020), Indicator 9.1.2: Freight volume by mode of transport (tonne kilometres), https://unstats-undesa.opendata.arcgis.com/datasets/4a5d7189e27148c48f045729ef9e40c8_0/about;
UN DESA (2020), Indicator 9.1.2: Passenger volume (passenger kilometres) by mode of transport, https://hub.arcgis.com/datasets/undesa::indicator-9-1-2-passenger-volume-passenger-kilometres-by-mode-of-transport-5/about

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

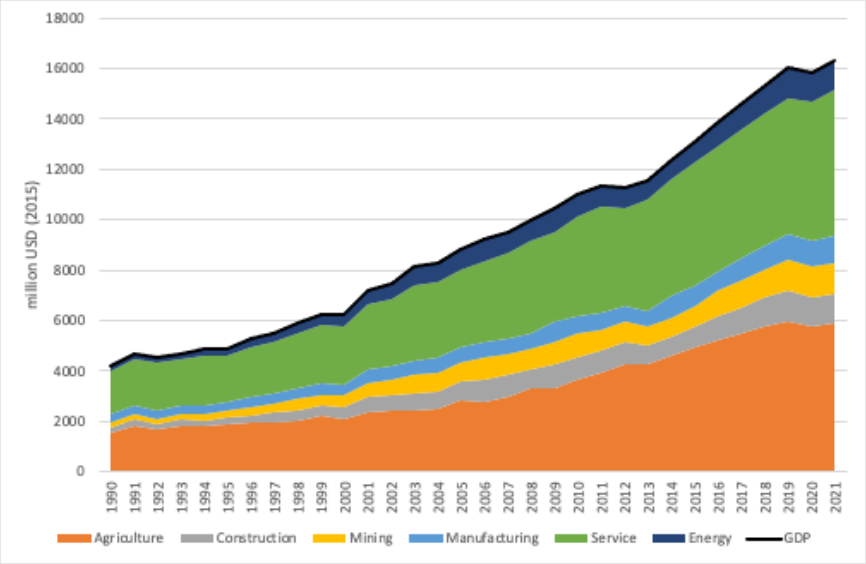

Figure 2: Total GDP (million USD in 2015) disaggregated by share in Mali

1.3 Passenger transport activity

Mali has severe data gaps. The country reporting does not cover any of the data points on roads aviation or other modes. Information on passenger transport activity in Mali is not released by country statistics. IRF World Road Statistics provides rail passenger activity from 2015 to 2017. In 2017, the value for passenger activity was 513 million passenger-km.

Table 1: Passenger transport activity (million passenger-km) in Mali

Mode	2015	2016	2017
Rail	14.673	4.306	513.909

Source: UN DESA (2020), Indicator 9.1.2: Passenger volume (passenger kilometres) by mode of transport, https://hub.arcgis.com/datasets/undesa::indicator-9-1-2-passenger-volume-passenger-kilometres-by-mode-of-transport-5/about, last accessed April 2022.

According to the UN DESA modelled data, it is estimated that the passenger activity in Mali recorded over 18716 million passenger-km for road and 130 million passenger-km for rail in 2019. The large majority of passenger activity is conducted through road transport.

Table 2: Modelled passenger transport activity (million passenger-km) in Mali

Mode	2019
Rail	130.7090909
Road	18716.18182

Source: UN DESA (2020), Indicator 9.1.2: Passenger volume (passenger kilometres) by mode of transport, https://hub.arcgis.com/datasets/undesa::indicator-9-1-2-passenger-volume-passenger-kilometres-by-mode-of-transport-5/about, last accessed April 2022.

1.4 Freight transport activity

Mali has data gaps for freight transport activity. Information on freight activity has been retrieved for 2013 for all major modes by ITF World Road Statistics 2022.

Table 3: Freight transport activity (million tonnes-km) in Mali

Mode	2013
Road Transport	4.369
Railway Transport	0.289
Inland Water Transport	0.00795
Total Surface Freight	4.66595

Source: IRF (2023), World Road Statistics 2022, International Road Federation, https://worldroadstatistics.org/

The UN DESA modelled data estimates that freight activity through roads surpasses 2141 million tonnes-km for 2019. Rail is assumed to transport 569 million tonnes-km in 2019.

Table 4: Modelled freight transport activity (million tonnes-km) in Mali

Mode	2019
Rail	569.8
Road	2141.4

Source: UN DESA (2020), Indicator 9.1.2: Freight volume by mode of transport (tonne kilometres), https://unstats-undesa.opendata.arcgis.com/datasets/4a5d7189e27148c48f045729ef9e40c8_0/about, last accessed April 2022.

1.5 Energy intensities for transport

To further understand the efficiency of the transport system, information on the transport energy intensity is relevant. It is together with load factors (see *1.4 Load Factors*) inputs to MAED. However, such information is difficult to retrieve and there were no values available for this country. A study on urban transport in Cape Town (South Africa) provides estimates for some road transport modes.[5]

Table 5: Energy intensity levels (MJ per passenger-km) for urban transport

Mode	MJ per passenger-km for 2013
Electric Car	0.55
Hybrid Car	1.56
Petrol Car	2.22
Minibus taxi (petrol)	0.66

[5] Kane, L. (2016), What do we mean by low carbon transport: Understanding how people move in Cape Town, https://www.researchgate.net/publication/308899067_What_do_we_mean_by_low_carbon_transport_Understanding_how_people_move_in_Cape_Town

Source: Kane, L. (2016), What do we mean by low carbon transport: Understanding how people move in Cape Town, https://www.researchgate.net/publication/308899067_What_do_we_mean_by_low_carbon_transport_Understanding_how_people_move_in_Cape_Town

1.6 Load factors

The load factors in the Starter Data Kits for Transport focuses on the average number of people transported by one unit in each transport mode. For example, for a bus, it is the average number of people per trip. In some cases, it might be also referred to as 'occupancy levels' for passenger transport. There were no values available for the country, but a study for urban transport in Cape Town (South Africa) provides some insights that can support estimating values in other cities or countries.

Table 6: Load factors

Mode	Load factors for 2013
Electric Car	1.4
Hybrid Car	1.4
Petrol Car	1.4
Minibus taxi (petrol)	7.8

Source: Kane, L. (2016), What do we mean by low carbon transport: Understanding how people move in Cape Town, https://www.researchgate.net/publication/308899067_What_do_we_mean_by_low_carbon_transport_Understanding_how_people_move_in_Cape_Town

1.7 Vehicle fleet

Mali has a total of 230660 road vehicles, as of 2013. Official records cover information only for this year. The vehicle fleet data is sourced from the IRF World Road Statistics 2022.

Table 7: Vehicle fleet in Mali in 2013

Mode	Value
Passenger Cars In Use	139769
Buses and Motor Coaches In Use	26150
Vans and Pickups In Use	22712
Lorries and Road Tractors In Use	42029
Total Vans, Pickups, Lorries and Road Tractors In Use	64741
Total Vehicles In Use	230660
Motorcycles and Mopeds In Use	48369

Source: IRF (2023), World Road Statistics 2022, International Road Federation, https://worldroadstatistics.org/

2. Experimental Design, Materials, and Methods

The above data were gathered through extensive desk research. This included material from international organisations, journal articles, and media reports. Due to missing values in the country's historical GDP data, extrapolation between available years was done by the authors to address this. 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. The transport data was also compiled, presented, and discussed with local stakeholders to reach a consensus on the main data and assumptions.

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.