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**T H E M E : _____
INFRASTRUCTURE
DEVELOPMENT
IN AFRICA**

Presentation:

**Transportation Infrastructure Development - A
Focus on Environmental Impacts**

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TRANSPORTATION INFRASTRUCTURE DEVELOPMENT: A FOCUS ON ENVIRONMENTAL IMPACTS

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Background

Infrastructure is a basic structure that is essential for the facilitation of society in terms of the provision of the basic framework required for economy output.

According to the Burh, Infrastructure can be broken down into 3:

- *Institutional Infrastructure* i.e. all customary and established rules,
- *Systems/ Personal Infrastructure* i.e. Human Capital,
- *Material Infrastructure* e.g. Transportation, Health, Education.

Infrastructure Development

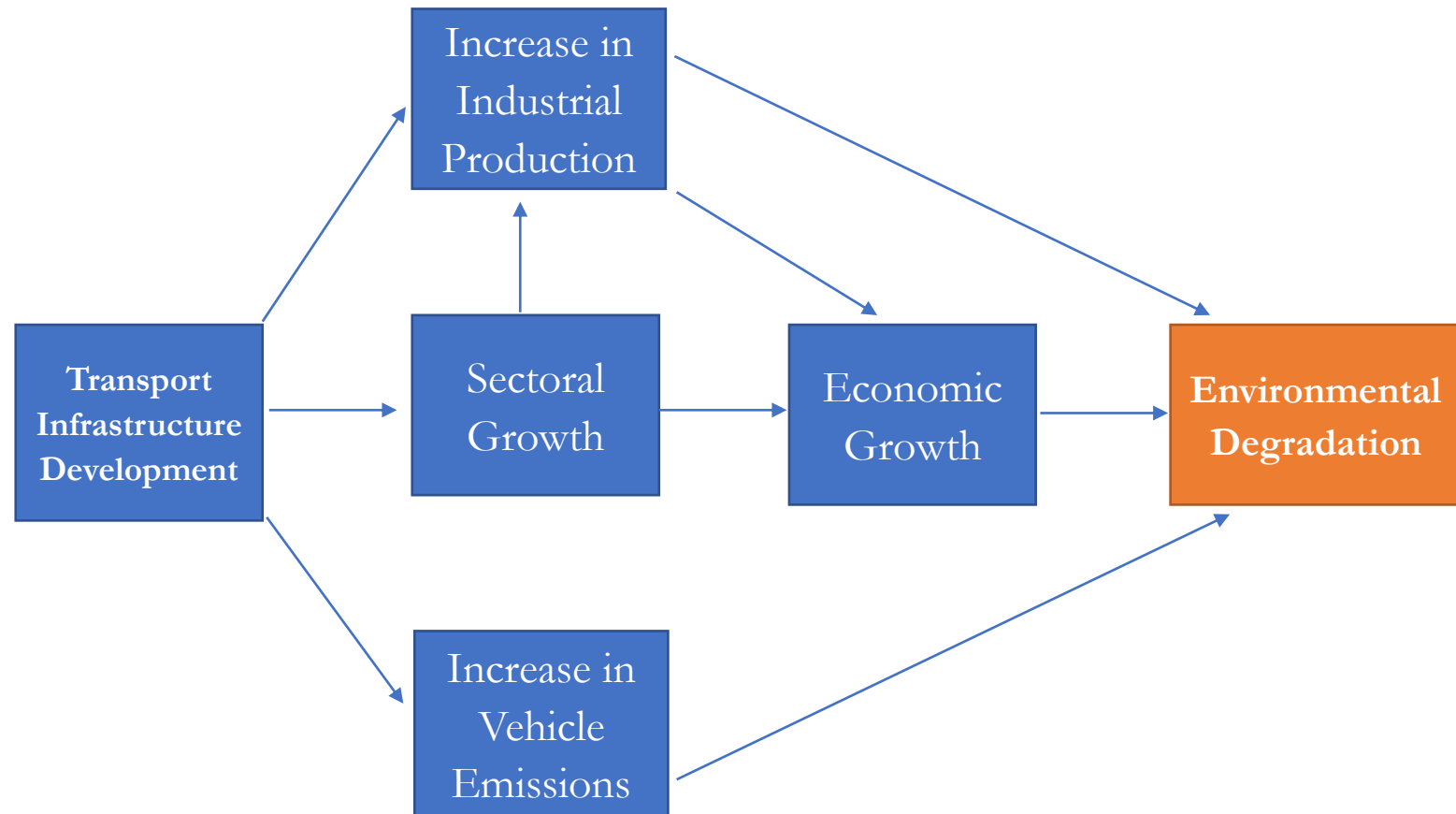
- Overall, infrastructure development contributes to the development of the economy of any nation.
- Despite the importance, there are direct impacts and indirect/ cumulative impacts of infrastructure development on the environment as well as varying total impact intensity.
- In pursuing infrastructure development, the world **must be deliberate in minimizing the impact on environment.**

Transportation Infrastructure Development

- Transportation is very critical to the success of any economy.
- Transportation is directly linked to economic development, as such, many cities prioritise the development of their transportation network and infrastructure
- Transportation infrastructure specifically is identified world over as the main driver in generating economic growth and development due to its constructive impact on multidimensional aspects of the society (Shariff, 2021)

Transport Infrastructure and the environment

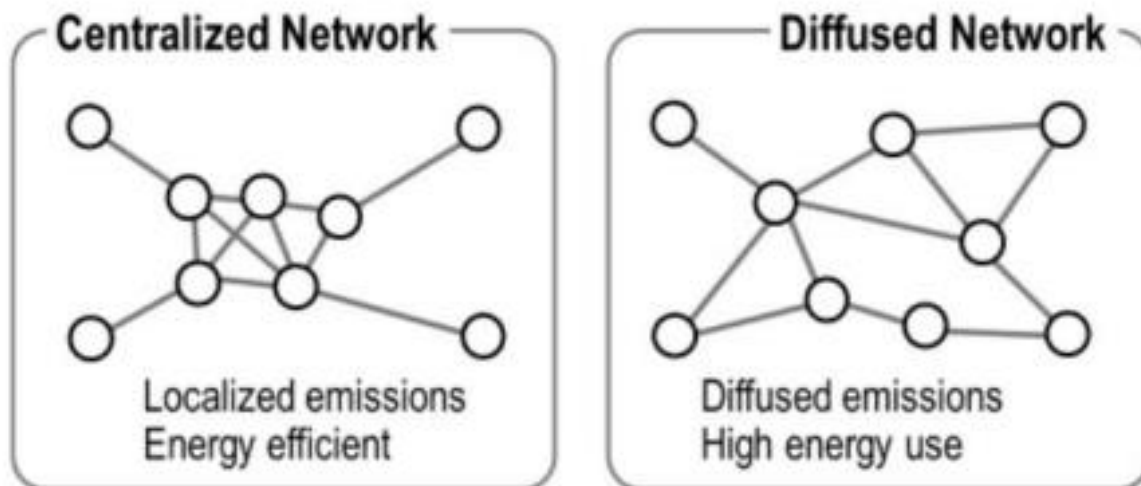
Transportation infrastructure development by its inherent characteristics, has an impact on the environment



Evaluating the Impacts

Distinguishing the drivers of environmental impacts requires an understanding of spatial characteristics of the transportation infrastructure development. This includes the transportation ‘network’ and ‘mode’.

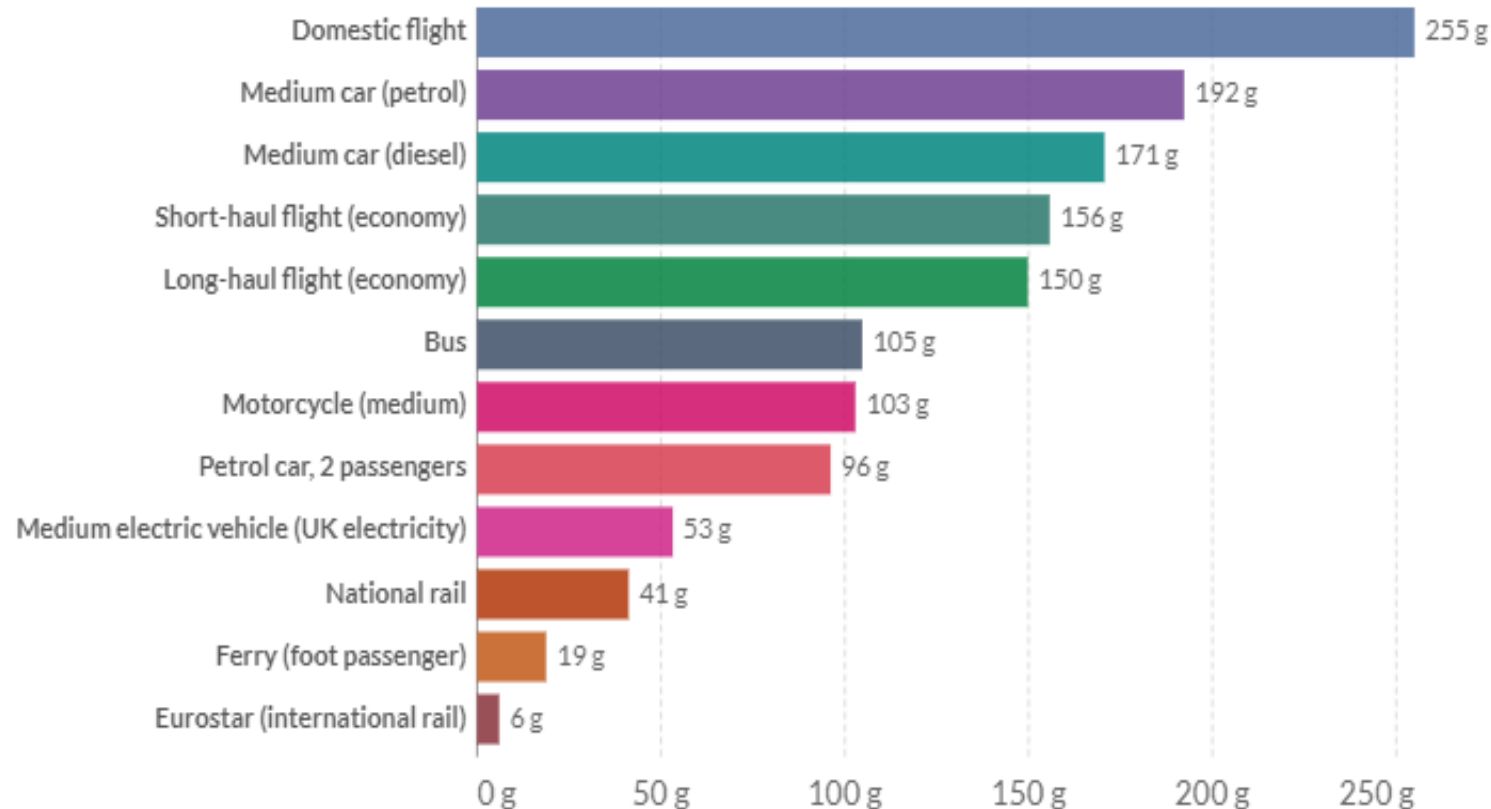
The type of **network** influences the spatial distribution of emissions - a centralized network has more local externalities while a diffused network has more global externalities



Across **centralized networks**, there **is faster integration and less number of trips** which reduces idling time of the transport vessels, thereby **decreasing emissions**

Evaluating the Impacts

Each transportation mode is characterized with specific emissions with each mode having different energy requirements and levels of efficiency.



Key takeaways:

- *Trains are nearly always the winning option over moderate-to-long distances;*
- *Public Transportation (Bus Based) will massively reduce your footprint – it also helps to reduce local air pollution and congestion*

Mitigating Impacts

In mitigating the impacts on the environment, it is essential to consider and identify the environmental and sustainability impacts that can occur early on in the project. In addition, it is essential to identify the impacts at the various stages of the project. Some impacts to be considered include,

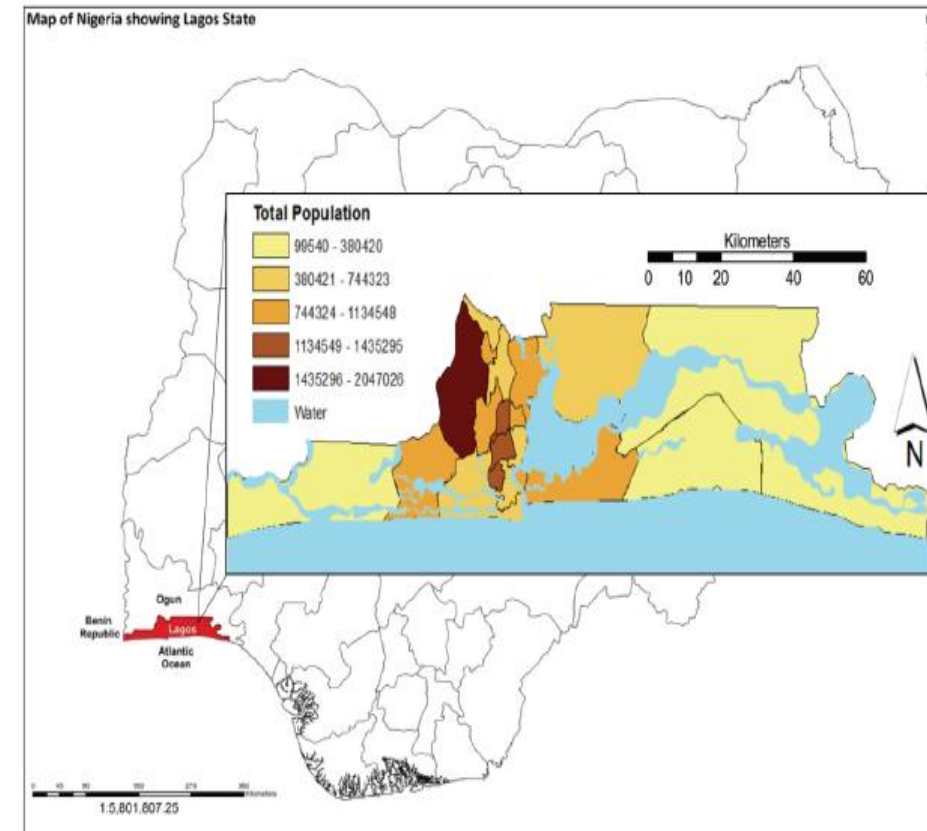
- Pollution (air, water, soil, noise etc.);
- land use change;
- damage to biodiversity and ecosystems;
- use of limited raw materials and resources;
- impacts on the local community including indigenous populations, animals;
- resilience to extreme weather events etc.

Environmental and Social Impact Assessments are necessary for major infrastructure projects. ESIA's would identify all potential environment and social issues that the project may have. It would also provide plans and actions to eliminate, reduce or transfer these impacts.

CASE STUDY: Lagos, Nigeria

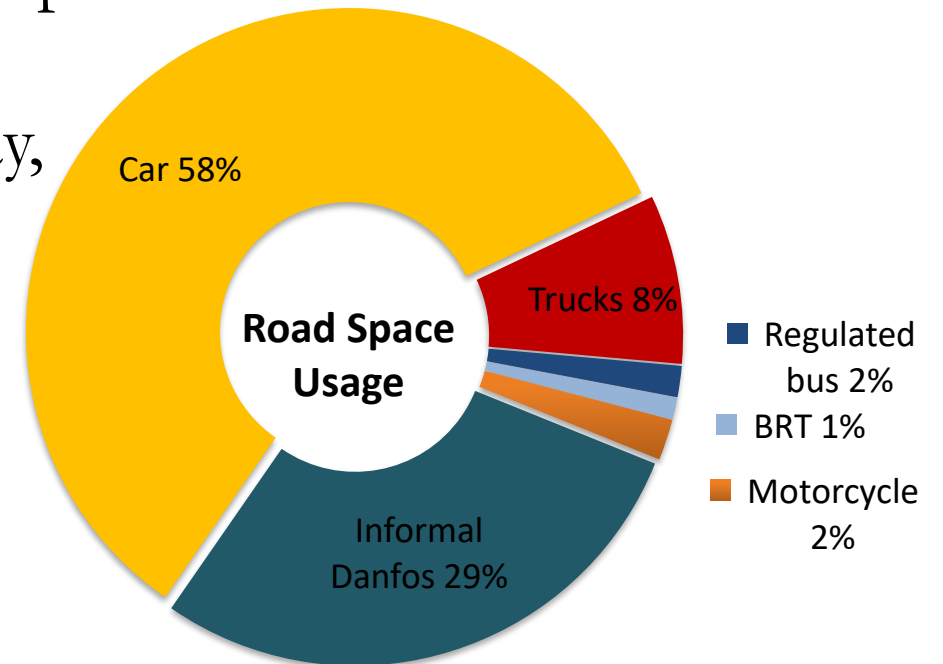
Overview of Lagos

- Lagos is the commercial nerve centre of Nigeria and a major financial centre in Africa.
- It occupies 0.5% of Nigeria's total area, making it the smallest state but the most populated city in the country, with an estimated population of over 22 million people
- Lagos urbanises at 6% yearly and has an urban population density of about 20,000 people per km²



Transportation in Lagos

- Transportation in Lagos has over the years been plagued with many challenges from insufficient public transport modes, chronic traffic congestion, and non-regulation of public transport as well as insufficient transport infrastructure
- There are an estimated 22 million trips per day, 40% of which are walking trips, leaving approximately 12 million trips being mechanised trips.



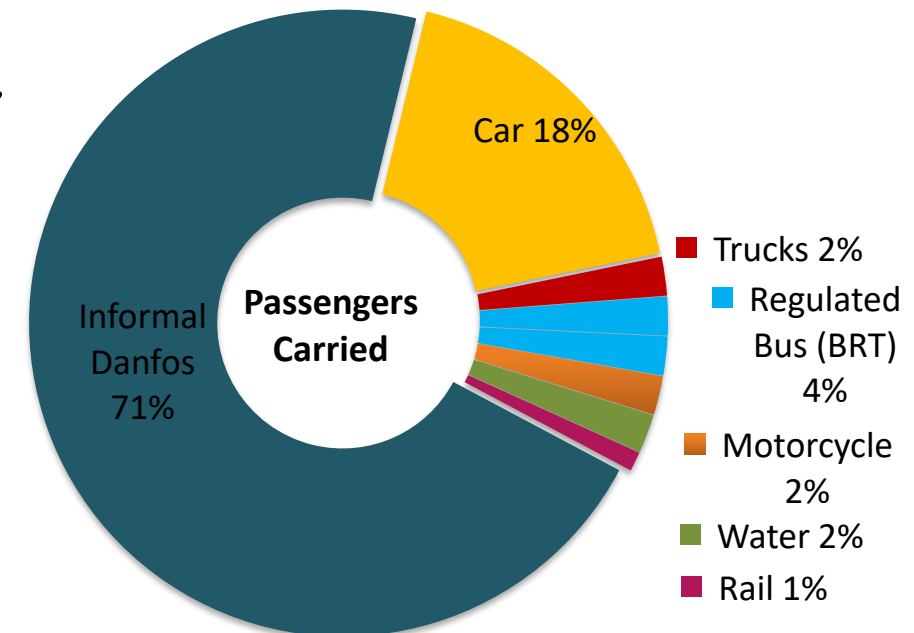
- These numbers show that transportation infrastructure development has been predominately road based and that the implementation of mass public transport must be actively pursued.

Transportation in Lagos

- Historically public transportation in Lagos is not only road dependent but is being carried out majorly using unregulated danfos (mini buses) whose capacity averagely is circa 13 passengers/bus. These danfos are supported by kekes (tricycles) and okadas (motorcycles).

Lagos has over *100,000 danfos* and over *50,000 kekes*.

The emissions for these modes are very high which has contributed to Lagos' **annual mean of $PM_{2.5}$ concentration level of above $68 \mu\text{g}/\text{m}^3$ emissions**; this is categorized as severe – WHO recommends an **acceptable annual mean $PM_{2.5}$ concentration of $10 \mu\text{g}/\text{m}^3$** (World Bank, 2020).



Lagos Transportation Infrastructure Delivery

- Lagos Metropolitan Area Transport Authority (LAMATA) was established for the very purpose of planning, implementing and regulating a multi-modal integrated public transport system that ensures seamless mobility.
- The Strategic Transport Master Plan (STMP) was developed with a mindset of mass transportation.
- The STMP identified 6 rail lines, 1 monorail and 14 Bus Rapid Transit routes as the main mass transportation options supported by a hierarchy of buses and a robust water transportation network to ensure seamless mobility whilst reducing emissions per person.

The Lagos Rail Mass Transit Network

- The LRMT network is a major transport infrastructure development that would ensure full integration with planned and existing water transport and bus routes.
- Lagos State, through LAMATA is implementing 2 of the 6 rail lines: *the Blue Line (27km) from Okokomaiko to Marina* (east to west of Lagos) and *the Red Line (37km) from Agbado to Marina* (north to south of Lagos).
- These 2 lines are expected to move circa 1.5 million passengers a day.
- In addition to the LRMT, 3 BRT lanes have been implemented which has the capacity for over 1 million passengers per day with high capacity buses.

The Lagos Rail Mass Transit Network

- The ability to move the projected passenger numbers as well as the intermodal connectivity that is inherent in the design of the Rail mass transit network
- The Red line will integrate with the Blue Line rail at **Marina** (in Lagos Island)
- This allows for both intra-modal and Intermodal integration, whereby the Red and Blue line rails meet with the various bus schemes operational at Marina (Bus Rapid Transit, Standard Routes and First and Last Mile) as well as Ferry services



Figure 7: Visual Illustration of 'Marina Interchange' showing the intermodal integration and overpasses



The Impact on the Environment

- The impact of the rail infrastructure development on the environment cannot be overlooked.
- Following best practices, LAMATA assessed potential Impacts on the environment in three stages:
 - *Prior to construction,*
 - *During construction and,*
 - *Post construction.*

Prior to Construction

Prior to the commencement of construction,

- LAMATA carried out an **Environmental Impact Assessment (EIA)** study aimed at identifying the potential impacts of the rail line on the environment and mitigation actions.
- LAMATA defined the best construction method based on the outcome of the EIA. Dismantling methods were considered in this phase, with plans for disposal appropriately considered.
- Risks were identified alongside mitigating factors

During Construction

- During construction, there is an increase in *noise and vibration levels* within the project environment during construction.
- In addition to the increased noise levels, there is an increase in emissions from generators and construction equipment. The increase in noise pollution and emissions shall be netted off when construction is completed.
- In addition to that, LAMATA incorporated this potential impact in the construction equipment approved for use - the equipment have noise minimizers in order to reduce the increase noise level impact.

Post Construction

- The LRMT once completed is expected to move about 1.5 million passengers a day with varying capacity rail cars e.g. the Red line shall utilize ‘1500 capacity’ rail cars.
- It is projected that the resultant modal shift from private cars and old rickety *danfo* buses (*Informal Bus Sector*) to an advanced train engine, shall **result in the emissions along the corridors being reduced by up to 46%** (LAMATA, 2021).
- Thus, upon completion of the construction, the Lines shall contribute significantly to the achievement of cleaner mobility with reduced emissions.
- The rail lines are proposed to run on a mix of Electric and fossil fuelled energy, with most lines using electricity via a third rail system. This is aimed at curbing Green house gas (GHG) emissions from the train operations.

Conclusion

- Large transportation infrastructure projects such as the Lagos Rail Mass Transit (LRMT) shall have significant impact on the environment, however, processes have been implemented to minimize this impact. A robust environmental and social impact assessment carried out at the onset of the project with its findings and recommendations taken into consideration for the design, construction as well as utilization will ensure that infrastructural projects are sympathetic to the environment.
- LRMT is a dispersed transport network, however, the environmental impacts are minimized, both locally and network wide.
- In conclusion, understanding the characteristics of impacts of Transport infrastructure development on the environment is the first step for devising policy and plans for addressing its impacts to ensure sustainable transportation infrastructure



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