Roger Gorham, Summary

Roger Gorham, World Bank, **"Prospects for 'Decarbonization' of African Transport"**

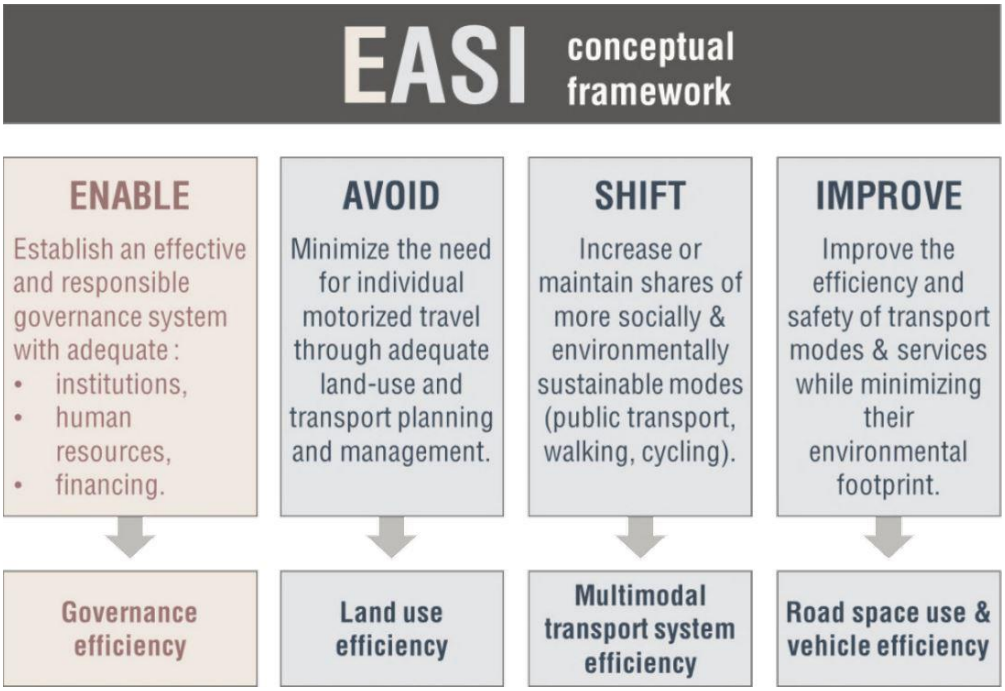
African CO_2 emissions from transport

In 2014, Africa was responsible for 3% of world's CO_2 emissions, and 4% of world's *transport-related* CO_2 emissions -- up from 3% in 2005. Transport generated 26% of all CO_2 emissions in Africa in 2014, up from 23% in 2005, and higher than world average of 23%. Furthermore, 95% of emissions produced by the transport sector in Africa come from road vehicles. Nevertheless total, per capita, *transport-related* CO_2 emissions in Africa amount to only a quarter (24%) of total transport-related per capita CO_2 emissions worldwide.[1]

Conceptual Framework for Approaching African Transportation

An effective way to conceive of the potential for the decarbonization of the transportation sector, and of the challenges that such a transformation in Africa faces, is to engage in a 'policy-based decomposition' of the transformation, using the 'EASI' conceptual framework. Its analytical components are outlined in Figure 1.

Figure 1. EASI Conceptual Framework



Source: Roger Gorham, World Bank, 2017. (??)

<u>Enable: Establish Effective Overall Local Governance</u>

This is a general, overall task and goal impacting upon all policy objectives, including both development targets and any type of transformation of the transportation sector. As such, it is not directly addressed

[1] Data from the International Energy Agency.

here in a discussion of the energy-transportation nexus in Africa and the discrete policy levers available to stimulate a decarbonizing transformation of the sector across the continent.

Nevertheless, beyond the need for better and more efficient governance, other more concrete options do exist : (1) *avoid* the need for individual motorized transport through adequate land-use planning and effective transport planning and management; (2) *shift* individual motorized transportation to more socially and environmentally sustainable modes of transportation (like public transport, cycling and walking) so as to promote an efficient 'multi-modal' transportation system; and (3) *improve* the efficiency of transport modes and services while minimizing their environmental footprint (including GHG emissions and other air pollutants) through better road space use and increased vehicle efficiency (by introducing cleaner fuels, among other measures).

Avoid: heading off need for motorized transport

A very effective way to reduce energy consumption – and with it, GHG related emissions – is to act in a way that avoids the need for 'motorized' transportation demand (current and/or future). The ideal approach would take advantage of highly-populated urban settings which are both compact and dense. Land areas in such an urban space would be dedicated to (and/or zoned for) 'mixed primary uses,' and would be easily both walkable and cycleable.

However, the African reality currently erects a number of barriers to the realization of such ideal urban contexts. First, a significant amount of infrastructure investment is required to shape cities in such a fashion; however, the growth of African cities currently is outstripping by far the inflow of investment. African cities also lack basic pedestrian and cycling facilities. Nor do their land markets function efficiently, as such cities fail to aggregate opportunities effectively, and suffer from a dominant 'homogenization' of land-uses (as opposed to mixed uses), which undermines the attempt to avoid motorized transportation, as one is forced to drive to each area for only a single objective. *As a result, as African cities further develop an articulated density, motorized travel is likely to increase*.

Shift: motorized transport from low to high capacity vehicles

Urban Transport*: Bus Reform*

Another possible policy approach would involve stimulating a shifting within the motorized transportation fleet from 'low' to 'high' passenger capacity vehicles used in urban transportation (eg, from cars to buses). An ideal context, in which such a shift might occur, would be characterized by authorities and other relevant actors capable of both: (1) facilitating appropriate business models for public transit operators, particularly with regard to the frequency, comfort and affordability of bus lines/journeys; and (2) accumulating or leveraging sufficient capital to be able to invest in large capacity and high-quality vehicles.

African urban realities are such, however, that the public bus systems are dominated by small-scales and very low margins, and they are forced to operate within a context of weak public institutions and varying degrees of 'auto-regulation.' The 'total vehicle kilometers traveled' (VKT) is therefore higher than it need be – due to the many low-capacity vehicles serving transportation demand. As a result, total GHG and other pollutant emissions are higher.

***Urban Transport**: Development of Mass Transportation*

Another form of 'shift' within the realm of urban transport would be to develop systems of mass transportation (ie, mass transit). Ideally, this would imply developing and implementing a hierarchical series of transportation services that would channel passenger mobility flows towards high-capacity 'corridors.' However, this possibility is currently held in check by: (1) a lack of adequate know-how and capacity to plan for and make decisions regarding mass transportation; (2) a similar and related lack of institutional capacity to manage mass transportation development; and (3) a shortage of investment finance capacities.

***Urban Transport**: 'last mile connectivity'*

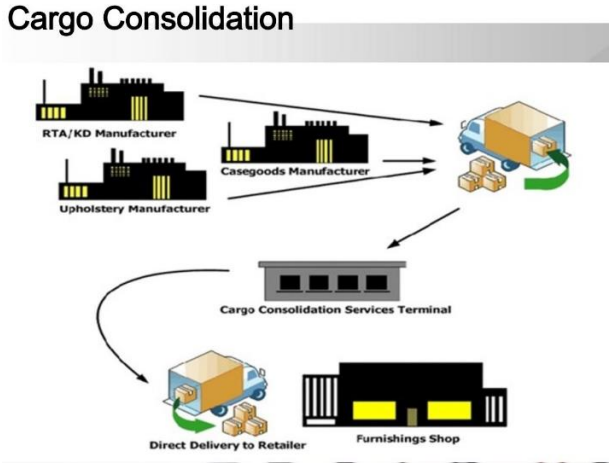
Another approach to shifting passengers to more socially and environmentally sustainable modes of transportation would be to develop and deepen 'last mile connectivity.' This would involve developing an array of information and communications technology (ICT)-facilitated seamless mobility service to facilitate and strengthen 'last mile connectivity' (ie, the beginning and ending portions of passenger journeys which rely on different forms of public transportation for the bulk of the journey, but on individual motorized transportation for the initial or final stretches of individual journeys – that is, for 'the last mile'). This could be done by developing markets and light infrastructures for the 'sharing' of cars, vans, taxis and bicycles, and through greater reliance on ICT-enabled 'paratransit' (which displaces the need to rely on physical mobility for different forms of work and communications).

Indeed, given the already high levels of ICT penetration in Africa, 'last mile connectivity' approaches actually hold enormous ready-to-tap potential (somewhat in contrast to the bus reforms and mass transit options mentioned above, which required significantly improved national and local governance as well as large investment requirements).

Freight transport: trucking shipment consolidation

In the freight/cargo segment of the transportation sector, another approach would encourage shipment consolidation in trucks in order to reduce VKT (vehicle kilometers travelled). This might be achieved through the use of ICT in order to consolidate shipments at an earlier point in the logistics chain, and to minimize empty 'backhauling.' Figure 2. Illustrates this process.

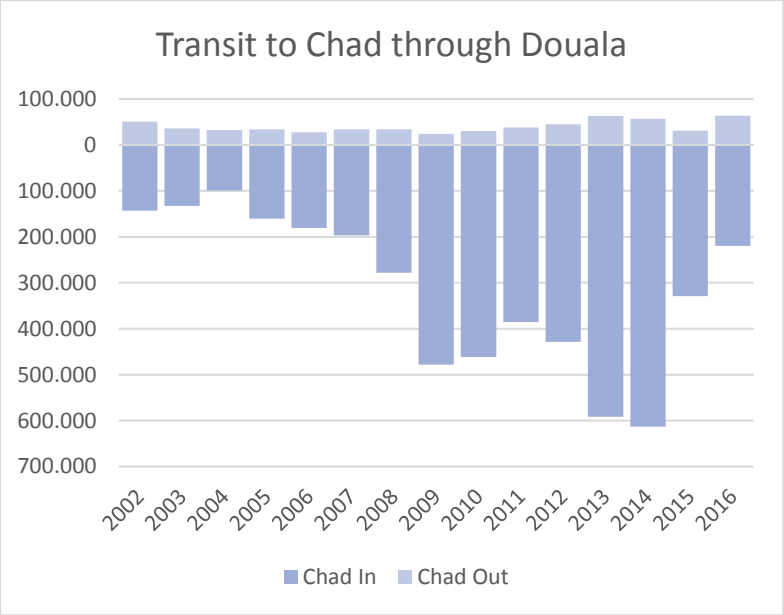
Figure 2.



Source: ??

However, the low rural densities in Africa and the sparseness of the continent's road networks both work to limit opportunities for such early consolidation of trucking shipments. Furthermore, the unbalanced directionality of goods flows in many road corridors in Africa makes empty backhauling almost inevitable. Figure 3 illustrates this phenomenon of unbalanced cargo directionality and the result empty backhauls in freight transported to Chad from Cameroon.

Figure 3. Unbalanced Directionality of Cargo Flows, Cameroon-Chad



Source: ??

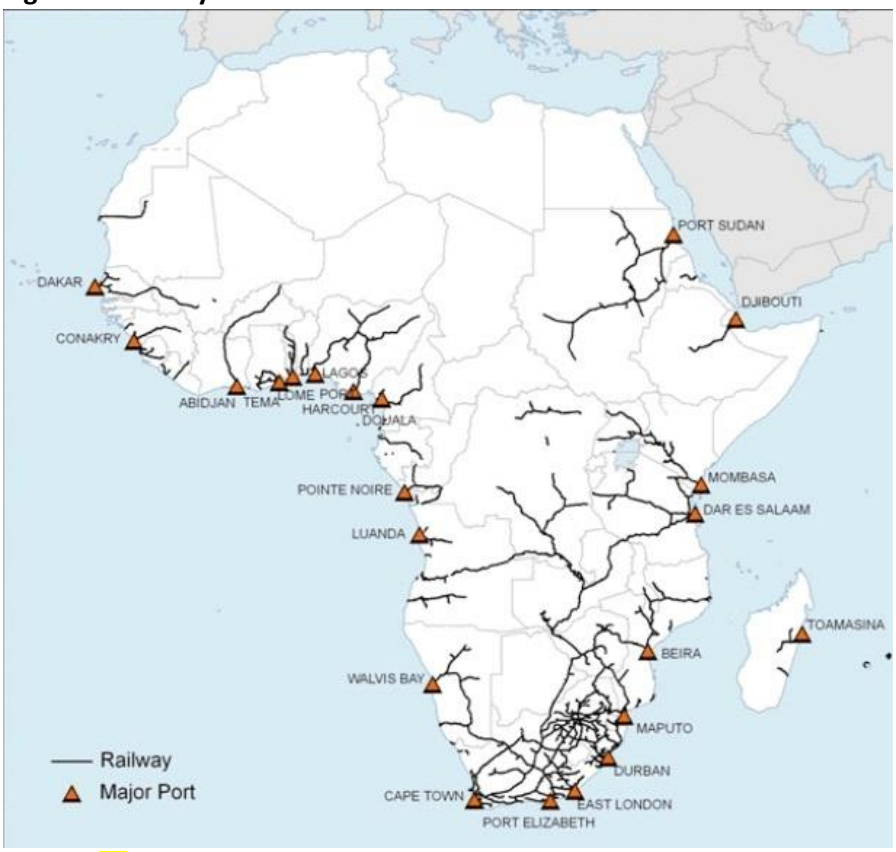
Nevertheless, ICT access and innovation in Africa is not as much a constraint as might be expected, lending this approach some promise.

Freight transport: mode shift to rail

Another approach which could reduce VKT and total emissions would be to shift the dominant mode of freight transport from road (truck) to railroad. This would entail developing rail freight corridors as viable alternatives to road-based corridors.

Most existing rail facilities in Africa, however, remain colonial-era facilities oriented toward moving bulk goods from sites of extraction to ports (see Figure 4). There has been some post-colonial development of so-called 'Primate-city-to-Port lines' (e.g. Addis Ababa to Djibouti), but the economic viability of such rail lines continues to be questioned. In the current African context, 'unbalanced directionality' of goods flows is even more challenging for rail than for trucking operations. This leaves ineffective governance, and therefore insufficient investment, as the primary obstacles to such a modal shift in cargo transport.

Figure 4. Railway Lines in Africa



Source: ??

<u>Improve: the characteristics of vehicles and the systems they operate on</u>

Beyond avoiding (or displacing) motorized transportation demand, or shifting it into other modes of transport, there remains the option of *improving* the energy and emissions efficiency of current transport modes and services. There are three generally accepted strategic approaches to the improvement of 'motorized' transportation, the currently dominant mode in Africa.

The first is to attempt to improve energy efficiency of vehicles. A second would be to improve the performance outcomes of transportation networks and the behavior of transport operators so as to reduce number of accelerations per vehicle kilometer travelled (accelerations per VKT). This could be achieved through superior traffic management, 'eco-driving,' and an application of the coming 'internet of things' which would 'connect' vehicles in a 'smart transportation network.' A third strategy would be to endeavor to reduce the carbon content of motor vehicle fuels (and/or drive trains) by increasing either the share of bio-diesel within the transportation fuel mix or the share of electric vehicles (EVs) within the transportation fleet.

Nevertheless, all such strategies are currently constrained by the same barriers mentioned above in relation to the avoid and shift policy options, and by a further an additional obstacle dealt with further below.

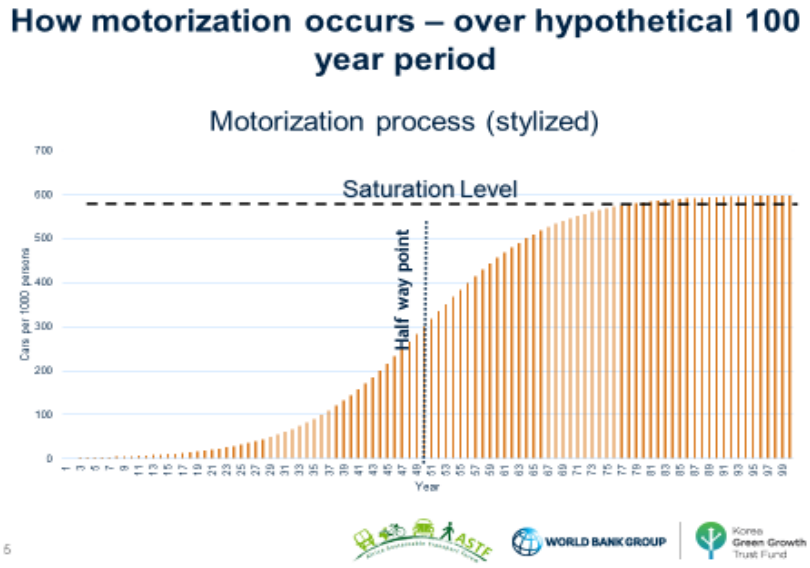
Motorization in Africa

The vehicle fleet in Africa is growing exponentially and is dominated by 2nd hand cars and new two-wheelers (ie, motorcycles). A recent pilot study conducted by the World Bank reveals this reality in two emblematic countries. In Ethiopia, for example, the growth rate of motorcycles on the road is 25% per year, while 85% of imported cars (which dominate the fleet) are 2nd hand vehicles. Meanwhile, in Kenya, 85 % of all imported cars and trucks are 2nd hand.

Motorization management

'Motorization management' is the process of shaping, through public policies and programs, the profile, quality and quantity of the motor vehicle fleet as motorization unfolds. Given the current economic structures dominant in Africa, and given assumed future economic growth, the process of motorization will continue (as suggested by Figure 5).

Figure 5.



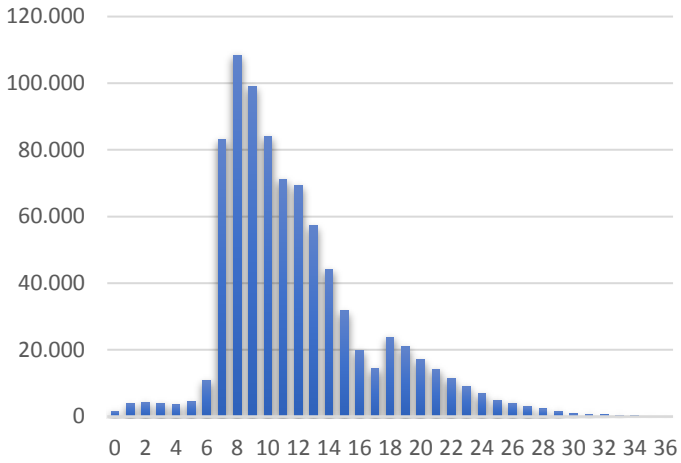
Source: ASTF, World Bank, Korean Green Growth Trust Fund

Unfortunately, motorization management is not widely or effectively practiced in Africa at present. Still, how might it be utilized to head off growth in fossil fuel consumption from a predominantly 2nd hand fleet?

Between 25 and 35 million light duty vehicles are estimated to move internationally as 2nd hand vehicles. Yet very little is known about these vehicles, and what is known is based on scant data and research. Clearly, fuel economy standards are not appropriate in the face of a fleet consisting primarily of imported 2nd hand vehicles. The best mechanism to reduce the age profile of Africa's largely 2nd hand fleets would be to use fiscal incentives, such as feebates, to periodically retire from use the oldest, least efficient and most polluting vehicles.

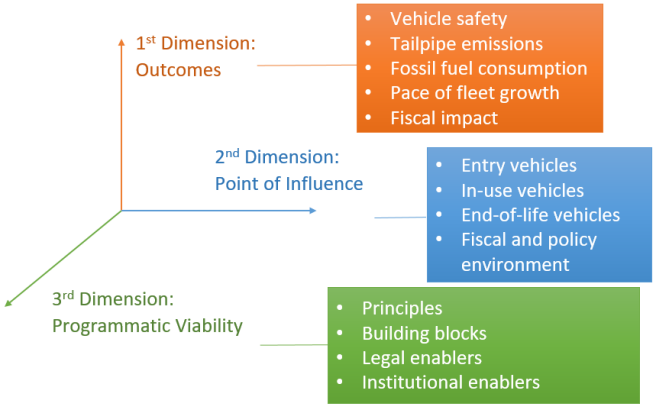
Such motorization management would reduce and maintain the age profile of these 2nd hand vehicles on the road. Under such a management process, the age profile of the Kenya light vehicle fleet, for example, would fall with time, shifting the bulk of the fleet to the left of the graph (as presented in Figure 6). This would at least allow for 2nd hand imports to progressively reflect, even with a lag, the increasingly stringent fuel economy standards adopted in the typically 'developed country' origins of such 2nd hand vehicles.

Figure 6. Kenyan Car Fleet, Age Profile



Source: ??

Figure 7. Multiple Dimensions of Motorization Management



<u>12 key programs identified through the World Bank pilot study</u>

- Motor vehicle information management system (MVIMS)
- Public engagement and sensitization
- Process to establish Dynamic Profile of Standards (DPOS) for emissions and fuel quality

- Process to establish DPOS for safety and fuel economy
- Import certification
- In-use inspection and maintenance
- Vigorous programs of on-road enforcement
- Mechanics' training and certification
- Quality assurance measures for vehicle parts used in maintenance
- Development and enforcement of regulatory standards for vehicle body construction & modification
- Fuel quality testing regime and protocol
- End-of-Life Vehicles management