

Review

A view of road transport in Africa

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Transport sector is usually divided into four main modes: road, air, maritime and rail modes. In sub-Saharan Africa, road appears as the dominant mode. Railways were developed during the colonial period but almost abandoned since the independence in most countries. Air transport once seen as sign of economic prosperity and instrument of sovereignty is far from being competitive. Maritime transport is mainly on coastal areas, and still controlled by foreign companies. In this context, road transport, favored by the low purchasing power of the population and the geography of the continent, made of landlocked territories, becomes the main mode of transportation. This mode however is facing many challenges including: Poor maintenance, pollution, frequent accidents, lack of local industry, etc. Therefore, critical thinking and innovative ideas from various actors of this sector will be important to bring solutions to most issues.

Key words: Road, transport, car, infrastructures, innovation.

INTRODUCTION

Transport is an essential component of the economy allowing people and goods to flow from one area to another. The evolution of transport in Africa is well understood if historical approach is applied. Three eras are distinguish (Tchanche, 2013): the precolonial, the colonial and the post-colonial period. The precolonial period is marked by low development of infrastructure. The colonial period saw a development of differentiated areas, cities where stayed rulers and sub-urban and rural where most indigenous people live. In this period most transport infrastructures were built, and in some countries cities' master plan still follow that established decades ago by colonial masters. Most roads were built around the area where civil servants were living and few linking residential areas and farms. Exploitation of natural

resources was one of the main reasons for colonization, and as such laborers and transport infrastructures were needed as well. Railways were then built to transport cotton, rubber, diamond, gold, etc., from mines and farms located in mainland to the coastal areas where they could be shipped to Europe (Pourtier, 2007). After the independence, most countries decided to establish plan for long term development, and there appeared a shift in policy. Newly chosen or elected governments decided to build infrastructure that will connect all parts of the country and sustain economic growth. Then the rail that was seen as a priority was relegated to a second position, and this is how the road progressively became the main mode of transport. The growing African population is bringing a lot of challenges to governments.

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Among these are energy, water, food, transport and mobility. All those who have travelled in African countries would acknowledge the critical situation of road transports on the continent. After more than a half century of independence, African citizens were expecting good infrastructure and better mobility conditions but all turn to disappointment. This study aims at reviewing road transport and poor conditions surrounding mobility in Africa, before solutions can be proposed. The paper is divided into three main aspects: (1) road analysis, (2) problems facing road transport and (3) suggestions for better mobility in Africa.

ROAD TRANSPORT ANALYSIS

Road transport is made up of several sub-modes that will be described and analyzed here: walk, animal carriages, taxis, motor bikes, buses, etc.

The walk

Walking is a common thing in developing African countries (Kumar and Barrett, 2008; Faye, 2012; Tchanche, 2018). People walk in urban areas to reach their houses, their job place, schools, hospitals, markets, etc. Although other means exist, people would prefer to move by foot. In fact, in urban areas private and public transports co-exist. Public transport is represented by taxis (known through specific colors), motorbikes (imported from Asia), minibuses, buses and other transport cars. In African megacities like Dakar, Abidjan, Lagos, Accra, Cotonou, and Douala, more than 70% of population use their feet for short distances (Faye, 2012). The choice of the walk as main mean of mobility is justified by the low purchasing power of the population and low development level of infrastructures (Kumar and Barrett, 2008). Walk requires a minimum number of conditions to be met. First shoes worn should be well adapted to the foot and to the type of road and weather. Second, dedicated space should be made available. Walking implies muscular effort for the walker which translates into skin transpiration. Walk exposes to random atmospheric conditions, insolation, wind, dust, rain and even tornado in some cases.

Walkers in urban areas do compete with cars on streets. On pavements, due to the small width walkers are forced to leave more often and confront the lane dedicated to the motorized vehicles. In some places, pavements disappear when some sellers use roads as marketplace pushing the walkers to walk on forbidden zones and putting their lives at risk. Crossing roads can be a very difficult exercise (Tchanche, 2018). Traffic lights are not common on most roads and where they are present they are rarely functioning because of lack of maintenance or not respected when they are in good

conditions. Pedestrians then put their life at risk, while crossing or will spend a lot of time waiting for a kind driver to stop and allow them to cross. Because of the high speed and frequent accidents, authorities find useful to install "speed bumps", often poorly designed to force the drivers to slow the speed and in some areas, they install a bridge to allow pedestrians to cross safely. However, they are not always adapted for people with disabilities and some of these underground bridges, are transformed into traps during nights and people will be reported attacked by armed robbers.

Rural areas usually receive less investments for infrastructure development (Tchanche and Diaw, 2017). Roads are more often in poor condition, unpaved and limited to tracks that allow people to visit their neighbors or relatives and to move to farms. This situation hampers the development of these areas which present very few opportunities, and the peasants cannot transport safely and efficiently agricultural products on the markets and thus most of their harvest is wasted. Health care facilities are usually far from the village and people will move to the nearest city, and this does not allow patients to be transferred easily and safely.

Animal carriages

Animal carriage is a mode of transport that involves animals pulling a mechanical structure. Animals often chosen are cows, donkeys and horses. Usually, we have one or more animals in front of a tray mounted on two wheels. They serve in rural areas and in urban areas as well, for the transport of people and goods (Tchanche, 2018). They are very popular in some countries and offer some advantages: affordability and flexibility (Faye, 2013). The average price for a trip is usually low, affordable for populations with low revenues. They easily adapt to unpaved roads and can stop almost everywhere to carry and debark passengers. Their speed is higher than that of a walker but very low compared to motorized systems. The carriages are usually locally manufactured by self-taught craftsmen, and the manufacturing time around three months. For owners, it constitutes an important source of income. Animals must be fed and well maintained. This transport means although popular has not attracted a lot of attention and needs to be examined (Tchanche, 2018). The identification of carriages is not always addressed. Dedicated lanes are not developed and they hamper the movement of motorists. The signalling systems do not exist as well as the lighting system.

Taxi bikes

Motorcycles are first used as private means of transport, and are characterized by their limited number of places, normally two the most. These engines have gradually

been transformed into a means of public transport in the recent history of Africa (Kumar and Barrett, 2008). They are known with different names (Hemchi, 2013; Kassidjodjo, 2013): boda boda, benskin, jakarta, etc. They display many advantages: low investment cost, low operating cost, service affordability and flexibility. Usually, the driver takes a passenger with reduced luggage. It is very useful on tracks and areas not reachable by cars. These motorcycles are imported from Asia and especially China for their low cost of about US\$ 600. In many countries where unemployment rate is relatively high among youth, it is considered as a fulltime job (Tchanche, 2017). However, their activities are not regulated or recognized by the authorities. There is no training provided to drivers and they use to learn by themselves. As consequence, they don't have a stable activity and at any moment they could be forbidden or imposed a specific tax by authorities. They have no insurance, and frequent accident may leave some with disabilities or lead to death (Kumar and Barrett, 2008). Some have seen it as a lucrative activity and hold small companies with several motor bikes. In this case the driver has a fixed amount to deliver per day, 3 up to US\$ 5.

Taxi cabs

Taxis in African cities are five seats vehicles painted with specific colour: yellow, green, mix of yellow and black, etc. Depending on countries or cities the driver could carry one or several passengers for one or several directions. The cost of the trip is either adopted by the government or negotiated with the passenger. A taxi may have a specific area or could move in the entire city. In many countries, drivers and owners use to organize themselves in unions to defend their interest. They need a license and regularly pay insurance and other taxes related to their activity.

Minibuses and buses

Minibuses have appeared in most megacities to complement the limited offer of taxis and buses. They generally serve the popular neighbourhoods located on the outskirts of the city. They operate on specific destinations, linking sub-urban areas with the centre of the city. They are known with various names (Kumar and Barrett, 2008): trotro (Ghana), ndianga ndiaye or car rapid (Senegal), Gbaka (Ivory Coast), etc. Usually, drivers and owners have a specific station and organize themselves in trade unions. Like for taxis, owners acquire a license and pay relevant taxes. Cars used as minibuses are imported from other continents, then modified to increase the number of seats and maximize profitability. Two individuals, the driver and his assistant manage the vehicle. One drives while the other takes care of boarding

the passengers. Intra-urban bus transport is an endeavour with more or less experience in African cities. In an effort to organize urban transport, some governments established public transport companies: Dakar Dem Dik (Senegal), Sotra (Ivory Coast), Stecy (Cameroon), etc. They are managed by two individuals, the driver and the ticket vendor. The routes are well determined but the stopping points are not always visible and clearly identified. Maps of the route are quite rare or do not exist.

ISSUES SURROUNDING ROAD TRANSPORT

Urban transport management

The management of urban transport is a real headache in developing countries. Very often, the central authorities intervene only to regulate or collect taxes, the structuring being left to carriers who manage their best to find solutions. In order to defend their interests, they are often organized in trade unions or associations whose relations with the authorities are often tumultuous. Creation of transport authorities have been observed across the continent, in Senegal, Burkina-Faso, Nigeria, or Ivory Coast (Godard, 2013). Their success is clearly linked to the way they are funded. The example of the city of Dakar in Senegal with CETUD (Conseil Executif des Transports Urbains de Dakar) shows the need for such instruments. Such centre will be more effective in organizing city transport if their missions are well defined such as to avoid conflicts with supervising authorities that are the Ministry of Transport on the one hand and the local authorities on the other hand.

Road design

It is widely accepted that there is a correlation between the number of vehicles per inhabitant and the wealth, related to the gross domestic product (GDP) or more exactly to per capita income (Poiani and Stead, 2015). A high income would likely favour the acquisition of vehicles by the households. However, in developing countries, revenues are generally low compared to those of developed nations. This is seen from the following figures, in developed nations, the ratio is about 300 to 500 cars per 1000 inhabitants, while in Senegal the ratio is just 30. Therefore, road infrastructures cannot be conceived in developing countries as in developed ones. In developing countries, more than 70% of trips are done by foot and sometimes by animal carriages. When designing roads, it is essential to take this reality into account. In this regard, wide strips should be reserved for pedestrians so as to avoid promiscuity and provide benches in case of fatigue and even places to drink or shelter (for example in case of rain or heavy heat wave).

In case animals are used (camels, horses and donkeys), it is necessary to envisage another band of circulation and to organize the collection of the poop, to place drinkers. The road will then be reserved exclusively for motorized transport (tram, train, motorcycle, and other vehicles).

The profitability of transport equipment

A commercial transportation system to last long must be profitable. The economic criteria must then be applied, taking into account the socio-economic context. Investment and operating costs must be well evaluated. Investments include the purchase, start-up fees, and the shipping costs. Operating costs include the driver's and assistance salaries, insurance, miscellaneous taxes, maintenance and fuel costs. The calculation must incorporate inflation on fuels whose price volatility is well known. In most African countries, equipment and spare parts are often imported. Very few experiences of local automotive industries exist in Africa. In many countries including oil producing ones, fuel consumed is often imported from western countries as well. Expenditures must therefore be offset by the ticket price coupled with the vehicle's capacity and the frequency of the trips. An economic context marked by imports, low competitiveness and the poverty makes the development of transport companies difficult.

The maintenance of the car fleet

The maintenance of the car fleet is an absolute necessity. A number of systems must be frequently controlled: braking system, engine, tires, etc. A guide is usually provided by the manufacturer to help customers. However, maintenance is not taken seriously at it should be most of time, and the owner or the driver will find himself into trouble because of lack of maintenance. Maintenance is useful not only for security but also for the good operation of the car by keeping it in good condition. It's the owner or the company who decide what needs to be done, and the maintenance becomes less important. In case cars are used for business, what is most important is the revenue generated not the state of the means of transport. In a context of widespread poverty, the cost of maintenance may sometimes seem prohibitive and not considered as a priority. Hence, car fleet in most African nations are in poor condition. Periodic technical control is an obligation in many countries. It is necessary to periodically check the vehicle, and an expert is supposed to testify the good condition of the vehicle. During this process, all compartments should be carefully examined. Depending on the country, it can be done in a specialized or approved centre. However, drifts are often observed where the controls are not strict, or when the

process is limited to a visual control and no technical test carried out with dedicated devices. The amazing case is when the owner without showing the car pays the fees and receives a certificate testifying the good condition of the vehicle.

Drivers' training

In principle, any driver of any vehicle must have a driving license. It is then necessary to follow a training for several weeks and to pass a final examination. During the training period, the apprentice learns how to drive and to keep the car. However, it is observed that in many cities the process of acquiring a driving license is not strict or appropriate. If there is a fraction that actually follows the training, there is another fraction that escapes. The license is often obtained against payment without having followed the necessary training and exams. Others use false documents or that belonging to a third party. There are drivers who have learned illegally and drive without any documents. Training materials is questionable and seems not to be adapted to the reality. They are usually imported from abroad. Since most African countries do not have their own traffic laws, they use those of developed countries which in no way correspond to the local reality. The learner must master panels he will ever see on roads. The reality is made up of unpaved roads, dust, rain, disorderly traffic, and traffic jams.

Breakdowns and assistance on the roads

It is common to find vehicles parked in cities as on major roads or see vehicles that are regularly towed by others. Breakdowns in full circulation are frequent and generate traffic jams. They provoke roads accidents. Buses often leave passengers in disarray who have to spend hours on a road hoping for a possible solution. This generates loss of time and money. Embarked on a journey where we are supposed to do two hours we end up spending all day. A traffic control system or a garage tracking system could help rescue motorists. Insurers should take assistance into account but it is rarely integrated into the products offered, and motorists must rely on their friendships or family solidarity to find a solution.

Layout, parking and track maintenance

Three types of roads are usually observed: paved roads, unpaved roads and tracks. Asphalt roads can in turn be classified into several categories, two-way roads and highways. Two-way paved roads with narrowed widths dominate because of their less prohibitive costs. The urbanization observed in recent years has been

accompanied by mobility difficulties with the congestion of roads and the slowing down of traffic, which is causing considerable economic losses. It is therefore necessary to develop new ways or to enlarge existing ones or sometimes to simply reorganize transport. In some cities the authorities have introduced the tram, as in Algiers or Tunis. However, track maintenance is a real problem. Roads are often left without maintenance, and include potholes, water ponds, damaged signalization system, failed traffic lights, and so on. Failure in maintenance can be costly for the community when finally, the infrastructure becomes useless (Faye, 2013). In an attempt to avoid accidents, poorly designed speed bumps are installed, which considerably slow traffic and increase air pollution. Parking for cars in African megacities is a serious problem. Parking areas are usually not well limited if not provided while the number of cars is constantly increasing. As consequence, drivers are obliged to leave their vehicles on the road or at best on the sidewalk or could spend a lot of time while trying to look for a parking. It would therefore be appropriate when designing pathways to incorporate this issue.

Insurance system

In a modern state, insurance system is made to provide drivers and car owners' minimum protection and support after an accident. A contract is mandatory for any vehicle, as is the registration card and driver's license. Insurance companies offer several levels of insurance: liability, theft, broken glass, travellers' protection, etc. The cost depends on the level requested by the customer, the more you are covered the higher the amount of the contract. However, in a context of widespread poverty, many vehicles circulate without insurance or the owners prefer to take the minimum level of coverage. On the other hand, misunderstandings remain about the role of insurance. When signing the contract, the insurance company assures the customer that it will be rescued in case an accident occurs. But, usually mistrust persists between both parties. The duration of litigation can be long, discouraging customers who in case of accident prefer an arrangement, as long as it is possible. The products offered are often insufficient. For example, technical assistance is non-existent for many companies and some products are exclusively for vehicles of less than five years old, whereas the average age of fleets is close to twenty years, and the fraction of vehicles of less than five is negligible.

Lifespan of vehicles

Motorized transport in Africa relies mainly on imported vehicles from other continents. Formerly carried out only by Europeans, during the colonial period, automotive

sales have become an important activity of the diaspora, and African seaports are flooded with vehicles of all trademarks. Assembly plants exist in several countries, like Nigeria, Senegal, South Africa and Morocco, but the competition is fierce. The experiences of African manufacturers are still very limited. The only regulations that are imposed on imported vehicles concern only the age that varies from one country to another. In Senegal, for instance, the five-year age limit increased to eight in 2012. The quality of the vehicles: pollution level, braking system, engine quality, etc., are not checked. The lifespan is infinite and vehicles of almost forty years old in poor condition are still found on roads. The average age of the car fleet in Senegal for example is twenty years Tchanche and Diaw (2017). The obsolescence raises the question of reliability, safety and air pollution.

DISCUSSION AND WAY FORWARD

Road transport as outlined earlier, is surrounded by a certain number of issues which of course need to be addressed. It is said having in mind this quote by Albert Einstein: "we cannot solve our problems with the same thinking we used when we created them," in: A life of a genius, by Alexander Kennedy. Critical analysis and innovation are therefore highly needed. Critical analysis helps understand the issue and establishes the causes that created it. From there innovative ideas will bring out the solution to the problem. Innovation here is seen as a new idea, a new technology or a new method and involves improvement, originality and effectiveness. Innovative ideas can thus be applied to transport systems to make them more effective.

Management of transport systems

In most developing African nations, management of transport systems is a major concern and most of them failed in setting up a transport agency which would have helped finding solutions to transport issues. This is due to the lack of concertation among actors, lack of funds and the fear from already established authorities to lose the control of the sector while transferring some competencies to the new body. Innovative ideas would be in the form of a suitable framework for dialogue and appropriate financial arrangements, this being by tax collection or subsidies from the government.

Information technologies and development of assistance service

Assistance service on roads is very important. It allows drivers and passengers to travel safely and be rescued timely. In developing African nations, breakdowns and

accidents are frequent and most people lose their lives because of lack of rapid and appropriate intervention. Using information technologies, repair shops, restaurants, hotels, police stations and hospitals can be mapped so as to provide these information to passengers through their phones.

Improvement of drivers' training

Drivers training are another important issue. In some countries the literacy rate is low, and therefore training for this category of people should be available, and measures taken to reduce fraudulent driving licenses. Moreover, the training should be customized and adapted to the country instead of being a copy of what is done in developed countries while the environments are completely different. Frequent updates should be taken by drivers in specialized centres so as to provide them with new knowledge.

Setting an age limit for automotive vehicles

The lifespan of automotive vehicles is a major concern in African developing nations. While the age of the car fleet is found around 7 years in developed nations, in Africa it is above 20. In order to reduce the average age of their car fleet, some countries have fixed the age of the incoming imported cars, but this is insufficient. While a five years old car would enter the country, it could remain forever as there is no plan to phase out old vehicles. An age limit should be set, after what a car should be recycled. A proper mechanism could be put in place in order to retrieve old vehicles and replace them by new or more comfortable ones. An important benefit will be the reduced level of pollution and better air quality.

Improving technicians' skills

Cars are usually repaired in artisanal repair shops, where technicians have not received proper training and have learned by themselves. Programs could be set to allow them to follow established curricula, and seminars to adapt to the changes taking place in the automotive industry. If this is not done, most of new developed high-tech cars will not be suitable and well adapted for Africa because of lack of skilled technicians.

Increasing profitability of transport business

In developing African nations, transport business is usually risky. Usually cars are imported along with spare parts and fuels. This makes transport expensive for passengers and lead to low profit for transport companies. A solution for high fuel cost will be the construction of

local and well adapted refinery plants, instead of importing low quality and expensive fuels. In order to lower the investment costs in transport, local automotive industry should be developed or at least some spare parts manufactured locally and assembly lines established.

CONCLUSION

Road transport plays an important role in African economies. The often-insufficient human and financial resources limit the choice of states in the selection of modes of transport. As a result, road transport remains predominant in most countries. The road sub-sector is divided into several segments according to the type of equipment used: walking, horse-drawn, motorcycle, and automobile following the use, public and private. Each of them has its own mode of operation and organization. The main infrastructure is the road, which because of the multiplicity of actors that interact on it must be designed taking into account this complexity and satisfy all users. However, this complexity is not always taken into account and the road sector generally operates in anarchy, which costs a lot to the economy of the African countries. The search for solutions should be based entirely on the sense of innovation of the various actors, who must invent new rules that fit the realities of the territories

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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