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Défis logistiques dans le transport maritime des véhicules d'occasion de l'Europe vers l'Afrique de l'Ouest

JEL : R41, R51

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Résumé:

Cet article traite des principaux défis logistiques liés au transport maritime des véhicules d'occasion de l'Europe vers l'Afrique de l'Ouest. Ainsi la méthodologie utilisée (quantitative et qualitative) analyse les données recueillies auprès de l'Organisation Internationale des Constructeurs Automobiles (OICA) de 2015 à 2023, des gouvernements et autorités portuaires pour montrer l'importance de la filière des véhicules d'occasion dans la mobilité et le déploiement des activités socioéconomiques oust-africaines. Cette analyse est couplée des enquêtes sur le terrain par l'observation directe, les enquêtes par questionnaires et entretiens auprès de 55 parties prenantes en Europe et 127 en Afrique. Les résultats démontrent que les véhicules d'occasion et pièces détachées, mais non les épaves, sont très déterminants dans la motorisation et les déplacements en Afrique de l'Ouest. Cependant, pour respecter les norms environnementales d'une mobilité durable, il faut instituer un processus systématique de traitement des véhicules avant leur exportation dans de meilleures conditions.

Mots-clés: Défis logistiques; transport de véhicules d'occasion; Europe vers l'Afrique de l'Ouest; mobilité durable.

Logistics challenges in Used Car Maritime Traffic from Europe to West Africa

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Abstract:

This paper addresses the main logistics challenges in used car maritime traffic from Europe to West Africa. Thus, the methodology (quantitative and qualitative) analyses data from the International Organization of Motor Vehicle Manufacturers (OICA), from 2015 to 2023 of government and port authorities to show the importance of used car market for mobility and socioeconomic activities. This is supplemented by surveys based on direct observation in the field, questionnaires and interviews involving in Europe 55 stakeholders and 127 in Africa. The results demonstrate that cars used and their parts, but not wrecks, are essential for motorization in West Africa. A pre-export process needs to be set up to ensure that exported vehicles are parked in better condition to meet the required common environmental standards for sustainable mobility.

Keywords: Logistics challenges, used cars traffic; Europe to West Africa; sustainable mobility.

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Logistics challenges in Used Car Maritime Traffic from Europe to West Africa

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This paper addresses the main logistics challenges in used car maritime traffic from Europe to West Africa. Thus, the methodology (quantitative and qualitative) analyses data from the International Organization of Motor Vehicle Manufacturers (OICA), from 2015 to 2023 of government and port authorities to show the importance of used car market for mobility and socioeconomic activities. This is supplemented by surveys based on direct observation in the field, questionnaires and interviews involving in Europe 55 stakeholders and 127 in Africa. The results demonstrate that cars used and their parts, but not wrecks, are essential for motorization in West Africa. A pre-export process needs to be set up to ensure that exported vehicles are parked in better condition to meet the required common environmental standards for sustainable mobility.

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1. Introduction

Humans are increasingly aware that natural resources are running out and are stepping up global pressure to fight global warming and air pollution (Dzator, et al., 2021). Like the pollution generated by industrial production, transport is a generator of numerous negative externalities for the environment and community. Sustainable and resilient mobility is a key factor in achieving sustainable development goals (UN Sustainable Development Goals 3, 9 and 11) (Lihoussou & Sossou-Agbo, 2023); (OECD, 2023). In developed countries, several forms of mobility can be observed due to the availability of different modes, infrastructures and means of transportation, with ongoing efforts to reduce their negative externalities (Liu, et al., 2024); (Mora, et al., 2024); (Van Dülmen, et al., 2022) (Selzer, 2021). As a result, strict legislation on environmental standards for active automobiles in circulation encourages the formation of a pool of used cars for export. In fact, second-hand vehicles are often damaged to such an extent that they fall below the required standards for circulation in developed countries (Perret, 2002).

As in all emerging economies, the high expectations of West African population for better transportation conditions are hampered by the failure of public transport services, leading to the use of private cars (Steck, 2012). Private cars are also perceived as a sign of social advancement and freedom of circulation. Sustainable modes such as walking, cycling and waterway transport are often considered marginal (Lihoussou & Sossou-Agbo, 2023) and therefore are rarely used. In many West African countries (like Benin, Cameroon, Cote d'Ivoire, Ghana, Nigeria), in the absence of metros, tramways, and bus rapid transit (BRT), mobility is essentially supported by motorcycle cabs (Marchais, 2009), buses and minibuses, and private vehicles, mostly due to environmental carelessness. The demand for transport is growing steadily in parallel with high urban demographics, the intensity of urbanization and the horizontal sprawl of housing (Stucki, 2015) (Guézéré, 2013) (Diaz-Olvera, et al., 2002). The used vehicle market provides a substantial response to the need to acquire lower-cost means of transport to meet increasing demand. This has led to a certain reduction in the flow of used car from Europe that no longer comply with current standards, a reduction supported by European and African legislation but poorly implemented due to abnormal practices in destination countries (Lihoussou, 2017). So this paper addresses the logistics challenges this market has to meet local demand and environmental standards. This contribution is subdivided into five sections. Section 1 presents the Introduction, Section 2 provides the literature review, and Section 3 highlights the methodology. Section 4 presents and discusses the empirical results, followed by the conclusion in Section 5.

2. Literature review

Unlike container, bulk and other general cargo traffic, very few studies have focused on Ro-Ro traffic, and even fewer have focused on the used vehicle market. Beginning between Europe and Africa in the 1980s (Perret, 2002), this traffic has now spread from the rest of the world (USA, Canada, Japan, Dubai, China, and Korea) to Africa. The used car market has exploded due to the high turnover in the renewal of household vehicles in developed countries. Organized around Brussels-Cotonou, this Euro-African trade has significant socioeconomic, environmental, migratory, political, security, territorial, ethnic and cultural impacts (Rosenfeld, 2013a). Rosenfeld (2013b) analyzes the spatial occupation of the used-vehicle market and concludes with a change in the morphology of the Heyvaert butchery district in Brussels (Belgium), while (Perret, 2002) shows that although the port of Antwerp is the main exit point for these used vehicles, Germany is the predominant source. The market for non-new vehicles consumes a fair amount of urban space.

The irrefutable fact is the domination of the port of Antwerp in the operation of used cars as a flow-generating hub. In 2012, the West African market (mainly Benin, which is the hub of this trade) received 57% of the vehicles exported by the port of Antwerp, i.e., 293,000 vehicles, compared with 14,000 from French ports. In 2013, according to the National Bank of Belgium (NBB), some 500,000 vehicles were exported abroad. This imbalanced state is more questionable given that the Paris region is a major source of vehicles used and that the flows generated in this way escape the French economy, i.e., HAROPA (Havre-Rouen-Paris) Ports.

The used-vehicle trade between Europe and Africa is highly organized in ethnic, family, political or cultural networks and is most concentrated in the hands of Lebanese and Syrian businessmen, mainly with African importers (Beuving, 2015); (Rosenfeld, 2013a); (Beuving, 2006) (Perret, 2002). It creates traffic for ports of departure and destination, shipping companies, state services through the collection of various duties and taxes, and the economic operators involved (Godonou, 2018); (Perret, 2002). These networks, organized according to varying logics, encourage formal and informal cross-border migratory movements, a breeding ground for acts of insecurity in urban spaces (Rosenfeld, 2013a).

Since Rosenfeld (2013 a & b) and (Perret, 2002), to our knowledge, no scientific research has focused on the organization and operation of the used car sector, hence, the interest of this contribution has been to update and complete the information for a better understanding of the logistics challenges of this maritime traffic. Considering the socioeconomic importance of developing the Euro-African automobile market, this article analyses the strategic significance of the decline in vehicle flows and the urgent need to comply with current environmental standards (Mora, et al., 2024); (Van Dülmen, et al., 2022); (Dong, et al., 2021) (Brozovsky, et al., 2021) (Selzer, 2021).

3. Methods and data

The methodological approach adopted in this research is based on the mobilization of databases collected by port authorities, state authorities (land transport managers, customs, administrations and institutions in charge of registrations), and regional and international institutions (statistical data from the International Organization of Motor Vehicle Manufacturers (OICA) and the World Bank. In addition, it is based on field surveys using questionnaires for quantitative data (costs, transit time and distances) and interviews for qualitative data, with used cars and parts stakeholders in the period from July 2016 to May 2017. Finally, it is based on direct field observations of the organization and operation of various actors (in ports and cities) carried out in Europe: Brussels (Heyvaert Road) from July 4-11, 2016, and from May 21-24, 2017; the port of Antwerp (Grimaldi House, Quai 1333, Sallaum Lines port terminal) from July 11-18, 2016; Ile-de France (Aubervilliers, port of

Gennevilliers and garages in the Paris region) from July 18-23, 2016, and from February 6-12, 2017; and Le Havre from January 25 to February 20, 2017. The players surveyed in Europe are middlemen or traders, garages, freight forwarders and shipping lines involved in used vehicles and/or parts (Table 1).

Table 1. European survey sample design

Actors	Brussels	Antwerp	Ile-de-France	Total
Shipping line	01	01	00	02
Freight forwarder	06	00	05	11
Garage	05	00	02	07
import/export manager	11	03	07	21
middleman	08	00	03	11
Road carrier	00	02	01	03
Total	31	06	18	55

Source: Investigation data, July 2016 to May 2017.

The qualitative approach enabled us to gather first-hand data by observing the actors in their daily lives and listening to what they had to say, even in informal settings. The processing of this information yields original results for understanding how the European supply chain operates.

The data collected in Europe are complemented by surveys in Africa involving 127 actors, namely, Abidjan, Cotonou, Dakar, Douala, Lagos, Libreville, Lome and Tema, from September 2016 to May 2017, March to May 2022 and June to October 2023 to update the data. The 127 actors surveyed in the African step are Grimaldi's representatives (key informants), leaders in vehicle flows (Ro-Ro traffic) to West Africa, port authorities, shipping line managers and sellers, actual and/or potential buyers of used vehicles, and so on.

For efficiency and scientific rigor, the statistics collected are updated to track relevant traffic trends from 2017 to 2022. The methodological approach is based on the following:

- documentary research on the previous findings published by scientists, institutions and professionals;
- direct observation of various stakeholders in the logistics chain for used vehicle and part activities, from the time the ship docks to the time vehicles are made available to customers on the market;
- Semi-structured interviews with people directly involved in the management of this traffic, including port agents, major shipping lines and terminal operators, sellers, buyers and clearing agents, managers of non-new vehicle outlets in urban areas;
- informal interviews with people representing various social categories who are likely to buy used vehicles, such as cab drivers, economic actors and academics representing the emerging middle class;
- guided tours around ports and dedicated terminals.

The information gathered forms the basis for analysis of the importance and organization of the Europe-Africa vehicle market and the competition between the ports of Antwerp and HAROPA.

4. Empirical results and discussion

4.1. The African car market in booming

Vehicle production in the world is collected and analyzed in order to appreciate African vehicle market. This is very pertinent to highlight the importance of used vehicle market in Africa by addressing mobility needs. So, analyzing the flow of vehicle requires access to accurate data. In Africa, such data are not practically available and must be reconstructed with uncertainties.

The analysis is based on the data compiled each year by the International Organization of Motor Vehicle Manufacturers (OICA), which clearly states that these data are estimates rather than hard facts.

4.1.1. Low vehicle production in Africa

On a global level, automobile production is greater in emerging countries than in developed countries (Fig. 1).

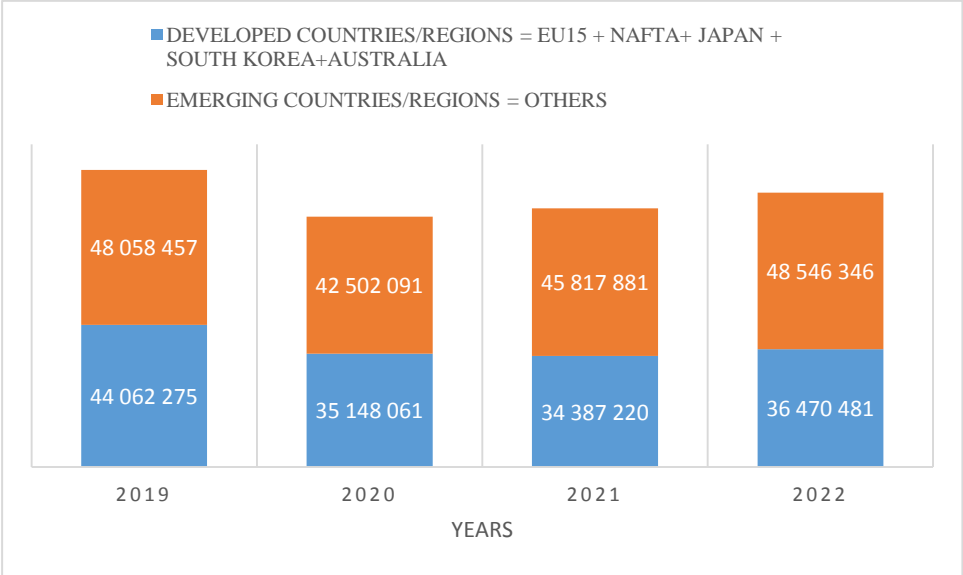


Fig. 1: World vehicle production per region (2019-2022)

Source: OICA, 2023 (<https://www.oica.net/category/production-statistics/2023-statistics/>)

Figure 1 shows that in developed countries, vehicle production decreases from 2019 (44 M) to 2021 (34 M) and increases from 2021 to 2022 (36 M). In emerging countries, vehicle production decreases from 2019 (48 M) to 2020 (42.5 M) and increases from 2020 to 2022 (48.5 M).

Therefore, in Africa, automobile production is very low compared to rest of the world (Fig. 2).

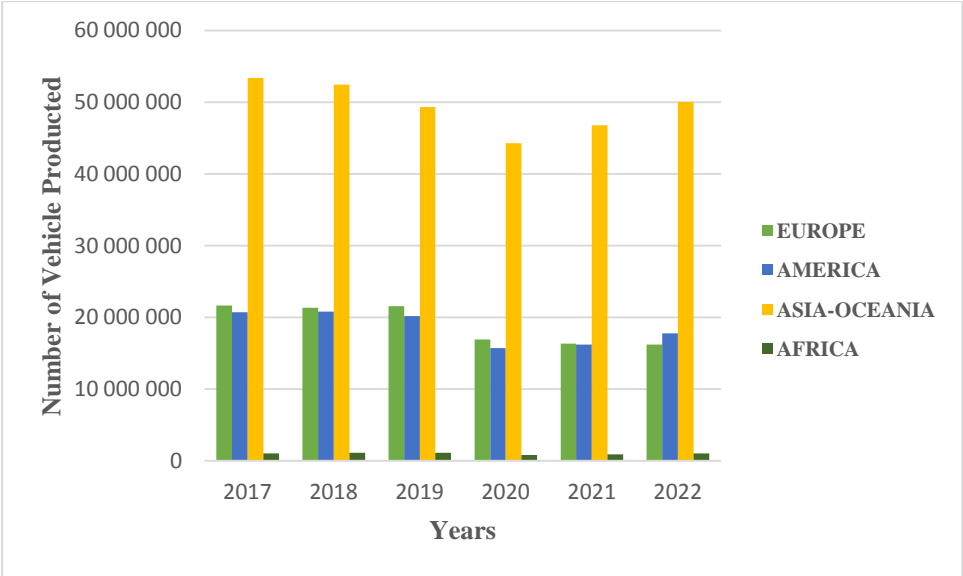


Fig. 2: Vehicle Production as per World Region 2017-2022

Source: OICA, 2023 (<https://www.oica.net/category/production-statistics/2023-statistics/>)

From 2017 to 2022, vehicle production is very higher in Asia-Oceania respectively than Europe, America and Africa. Indeed, African vehicle production (about 1 M per year) is very low. The Figure 3 below shows the best vehicle production countries in Africa.

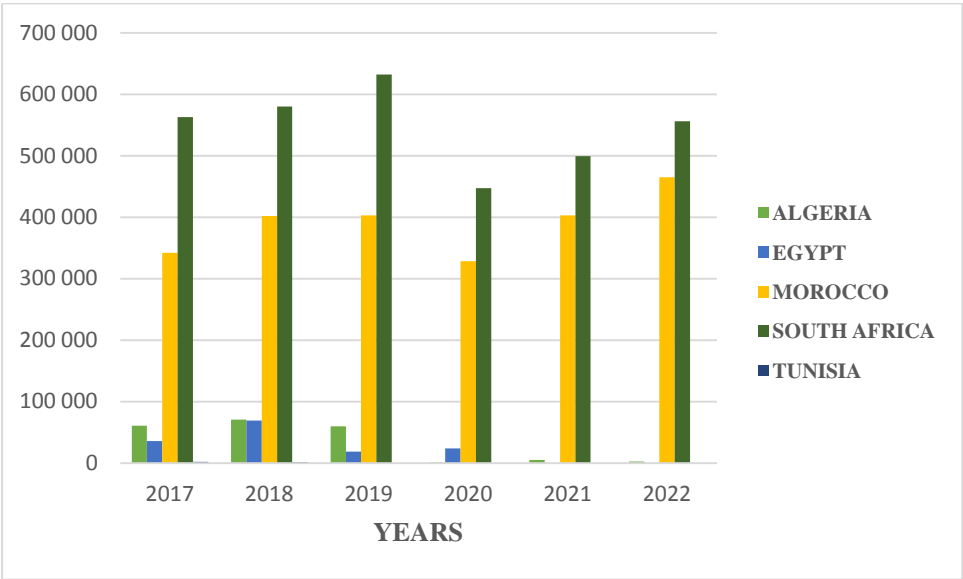


Fig. 3: African vehicle production per country (2017-2022)
 Source: OICA (2023) (<https://www.oica.net/category/production-statistics/2023-statistics/>)

From 2017 to 2022, the African biggest vehicle producers are respectively South Africa, Morocco, Algeria, Egypt and Tunisia. In Africa, only a few countries (South Africa and Morocco) stand out, producing far greater volumes of vehicles than other African countries. With lower volume of vehicle production, it will be interesting to analyze vehicle in use in Africa comparatively to the rest of the world.

4.1.2. African fleet growth thanks to used car market

Europe dominates the population motorization ranking in 2015, position confirmed in 2020 with 2% annual average growth rate, while Africa is at the last position, but with 4% average annual growth rate, like the world annual average rate (Fig. 4).

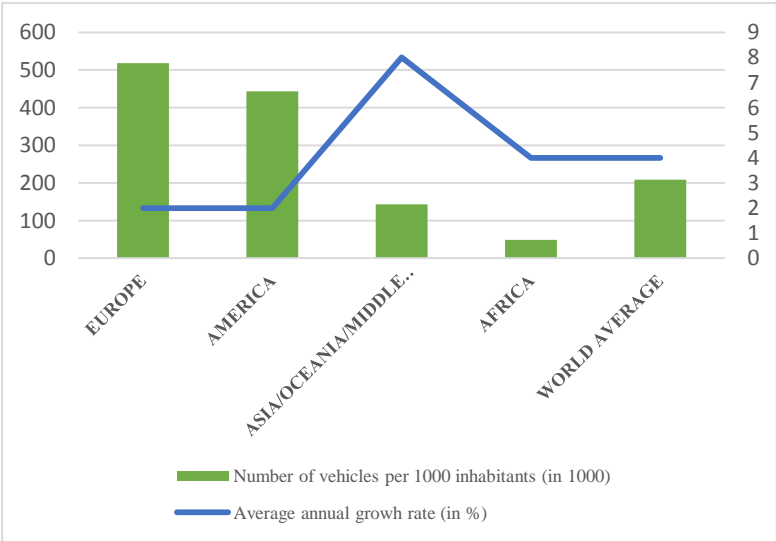


Fig. 4: World motorization rate per 1,000 inhabitants (2020)
 Source: OICA, 2023 (<https://www.oica.net/category/vehicles-in-use/>)

It is pertinent to bear in mind the financial capacity of West African people. This varies enormously from one country to another. With the exception of those who have benefited

from the oil windfall but who are also subject to fluctuating oil prices, most have limited resources. Using the World Bank data, purchasing power parity-adjusted expressed in US\$, demonstrates a substantial picture of the situation in 2016 but is still relevant in terms of magnitude. (Fig. 5).

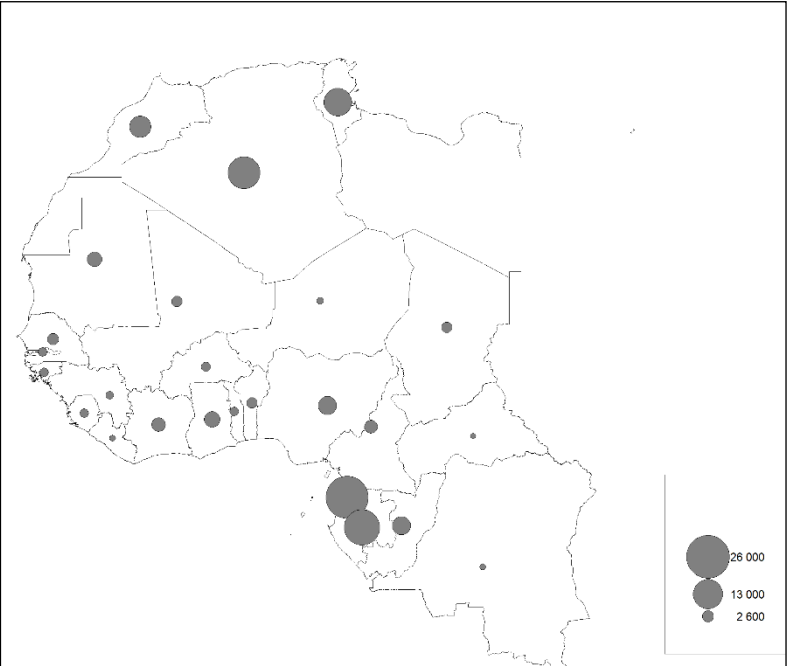


Figure 5: Financial power through GDP per capita in USD 2016
 Source: World Bank, 2017 (<https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD?locations=A9>) visited on June 2017.
 Figure 4 shows high GDP per capita respectively in Central Africa (Equatorial Guinea, Gabon, Republic of Congo), in North Africa (Algeria, Tunisia, Morocco) than West Africa (Nigeria, Ghana, Dakar and Côte d’Ivoire). Although far removed from the figures for car fleets in northern countries, the statistics for West Africa are perceptible (Fig. 6).

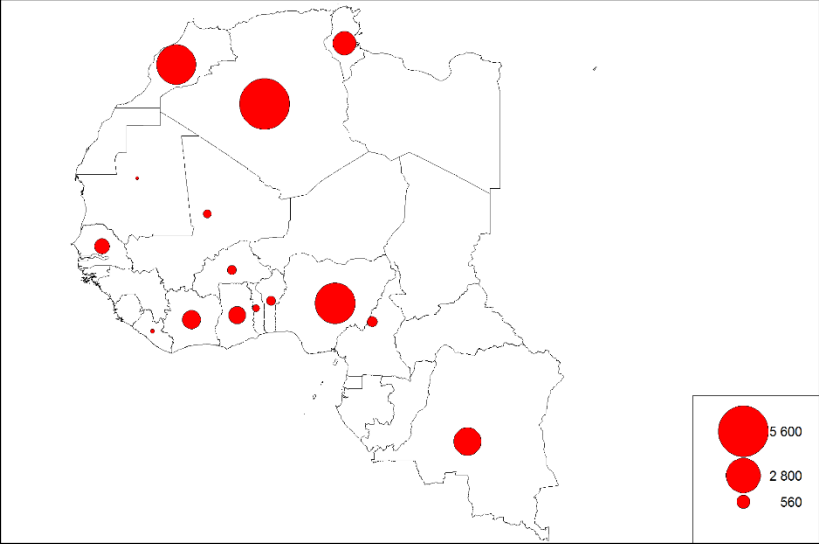


Fig. 6: African vehicles in use (2015)
 source: OICA, 2020 (<https://www.oica.net/category/vehicles-in-use/>)
 They reveal major disparities between states and the undeniable weight of Nigeria in West Africa, even if the comparison proposed in the map with North Africa shows the gap that remains between the two shores of the Sahara.
 This situation calls for further comments to help orient West Africa in the world's vehicle fleets. The proportion of commercial vehicles used for goods transportation or for public transport remains high, a sign of less individualization of the fleet, which is linked to the

lower financial capacity of individuals. This is a sign of the ease with which a sustainable and resilient transport system can be built. Around an African average of 31% and a world average of 26%, West Africa is above these averages: seven (7) states are above the world average, and 6 are above the African average, with a record for Liberia (Fig. 7).

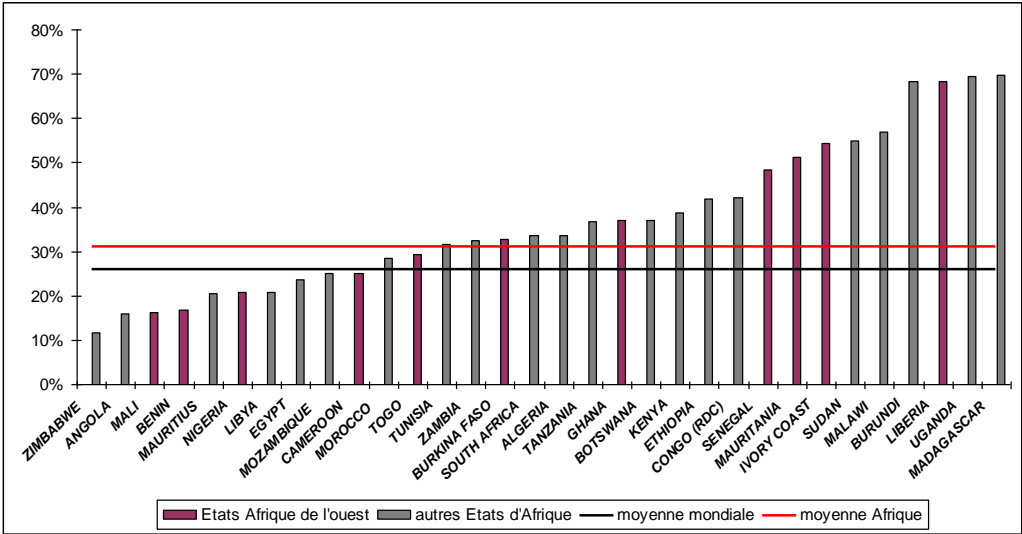


Fig. 7: Light commercial vehicles in total fleets (2015)
 source: OICA (2017) (<https://www.oica.net/category/production-statistics/2017-statistics/>) visited on June 2017

Although it is difficult to analyze this situation on a case-by-case basis, commercial vehicles are a major development tool, and their market is clearly promising for the future. The existing fleet is aging and no longer meets the standards that are gradually being imposed and the requirements of the major global operators who control door-to-door logistics chains. An analysis of data published by OICA (2017) revealed diversified growth in African vehicle fleets (Fig. 6). The average growth in Africa (red line-73%) was greater than the global average (black line-43%) between 2005 and 2016.

Although African countries started from a very low basis, this vigorous performance clearly demonstrates Africa's overall dynamism in the global economy and points to positive scenarios for the future. Ghana, Madagascar, Tanzania, Angola and Burkina Faso have the highest rates, far ahead of Nigeria, which nevertheless has an above-average rate. This could be explained by the fact that the volume of the existing Nigerian vehicle fleet is already very high, especially given that this country has hosted car assembly plants in the past, which may reduce the fleet renewal ratio. The country's recent crisis may also provide an additional element of explanation. In regard to West African countries, the ranking reveals a few surprises, given the commonly accepted images of Africa. Ghana enjoys a high degree of stability and openness, which is conducive to growth. Burkina Faso behaves as a stranger in this good position.

Poverty, recent instability and the geopolitical crisis that concerns it should be favorable to slower growth, but growth is always relative, and the starting point was very low. Côte d'Ivoire, which has regained a degree of prosperity, even if all the after-effects of the years of near-civil war have not yet been fully resolved, suffered from the downturn of the 2000s, and its car fleet did not enjoy the growth it should have and is now enjoying again (Fig. 8).

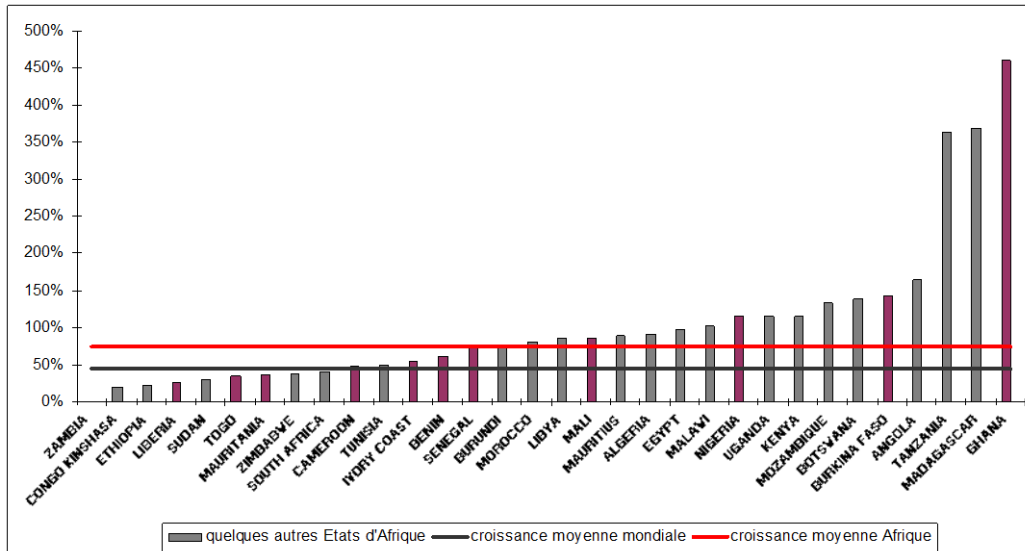


Fig. 8: In-use fleet growth of West African vehicles (2005-2015)

source: OICA (2017) (<https://www.oica.net/category/production-statistics/2017-statistics/>) visited on June 2017.

However, it is now picking up again, with the SOTRA now operating assembly lines for new vehicles "made in Côte d'Ivoire" to fill the gap. These comments need to be qualified by taking into account the resident population. The classic calculation, which establishes the number of vehicles on the road per 1,000 inhabitants, provides a completely different picture (Fig. 9).

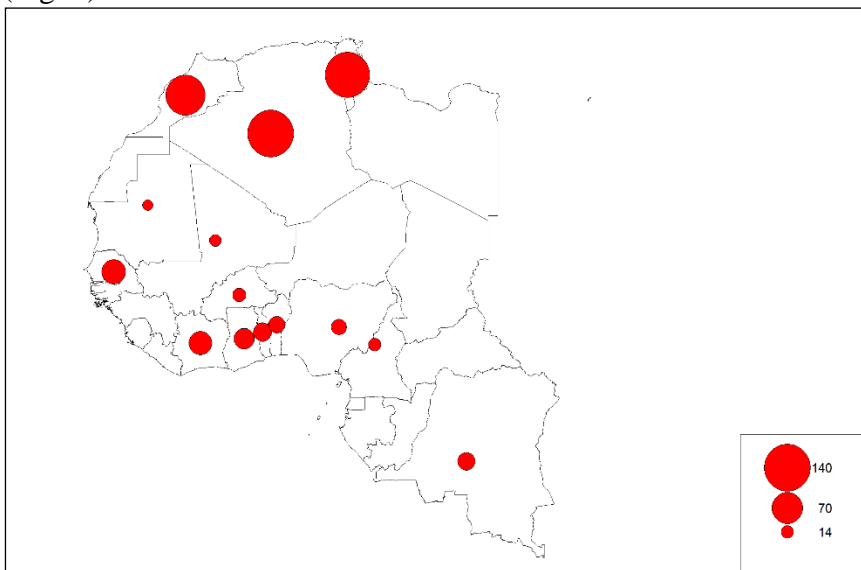


Fig. 9: Africa motorization rate per 1,000 inhabitants (2015)

Source: OICA, 2017 (<https://www.oica.net/category/production-statistics/2017-statistics/>) visited on June 2017.

Figure 9 confirms high motorization rates per 1,000 inhabitants in North African countries (respectively Algeria, Tunisia and Morocco) compared to West African countries (respectively Senegal, Côte d'Ivoire, Ghana, Benin, Togo and Nigeria). Admittedly, West African countries are not the best equipped in the whole of Africa, but some have achieved rates close to African averages, even if they remain far from world averages (Fig. 10).

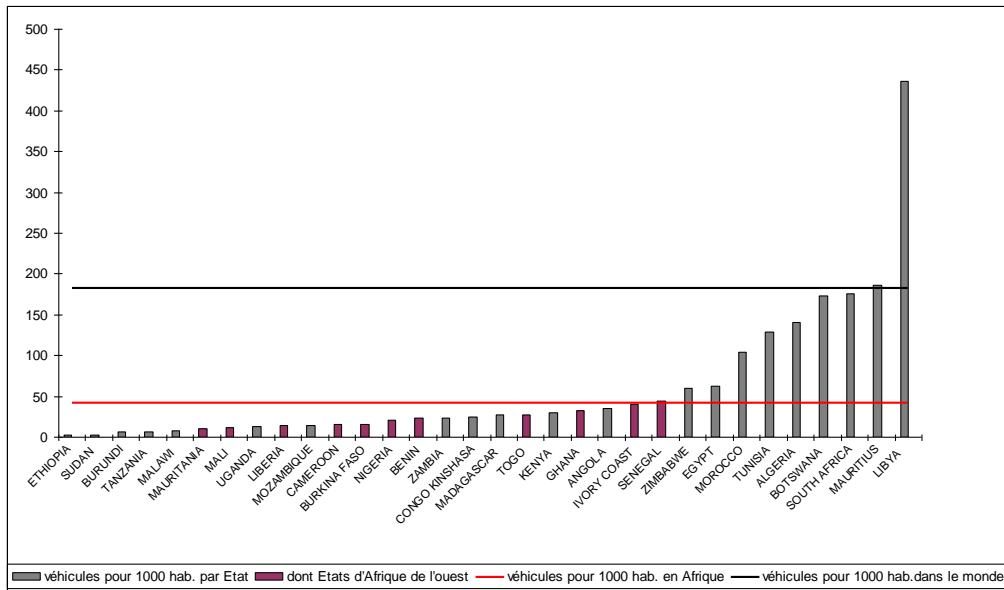


Figure 10: Number of vehicles in use per 1,000 inhabitants (2015)

Source: OICA, 2017 (<https://www.oica.net/category/production-statistics/2017-statistics/>) visited on June 2017.

Senegal and Côte d'Ivoire are equipped with vehicles in Africa, with an average of approximately 45 vehicles per 1,000 inhabitants. All the others are below this average. Libya dominates all other countries, with a population motorization level very close to that of Europe and an additional 4% annual average growth rate. All other countries are below the world average of 209,000 vehicles per 1,000 inhabitants. Nigeria in West Africa is above the African average, with an annual average growth rate of 5% (Fig. 11).

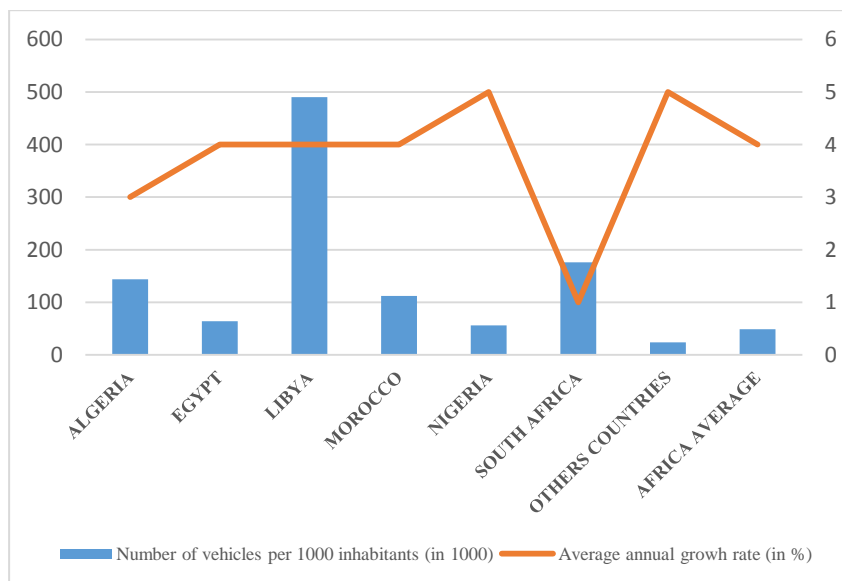


Fig. 11: Africa motorization rate per 1,000 inhabitants (2020)

Source: OICA, 2023 (<https://www.oica.net/category/vehicles-in-use/>)

This suggests that there is considerable scope for growth in used vehicle flows over next years. The potential origins are also clearly identified: Europe and North America.

The growth of African car fleets is partly due to the purchase of new vehicles. Africa still accounts for only 2% of global sales. West Africa weighs even less. Nigeria stands out, but with only 0.03% of the world market. Fluctuations can appear abruptly, as in the case of Ghana. The others, at very low levels, are slightly more stable. This ranking seems consistent with our field observations and could be justified by the quality of road infrastructure (Lihoussou, 2017), efforts to comply with age limit standards for imported vehicles, the state

economy, direct access to port services and active population in these countries. In fact, all the reference countries have a port, and the landlocked countries come last. Nigeria's position is linked to its large population and the permanent inaccuracy of its data.

The outlook is for growth, but for the time being, it is clear that the purchase of used vehicle remains the driving force behind the gradual progress of these countries (Fig. 12).

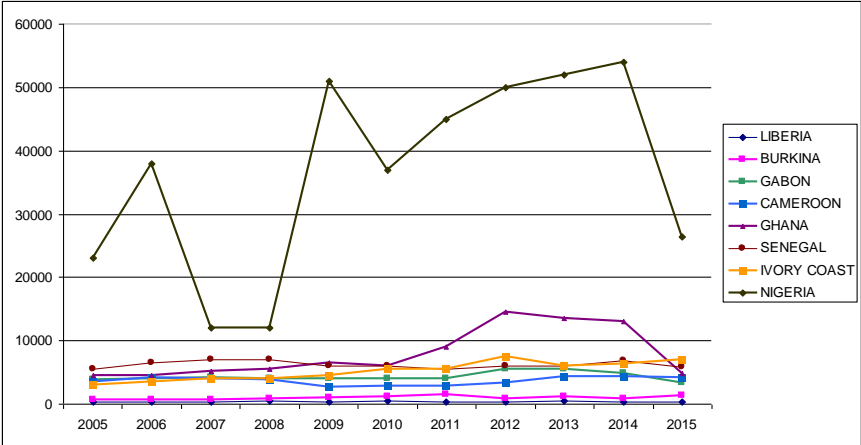


Fig. 12: New vehicle purchase growth for some African countries (2005-2015)
Source: OICA, 2017

The contribution of used vehicle purchases to fleet growth is very high. Between 2005 and 2015, it accounts for more than 60% of the total fleet growth in West African countries (Fig. 13), with values often exceeding 75%.

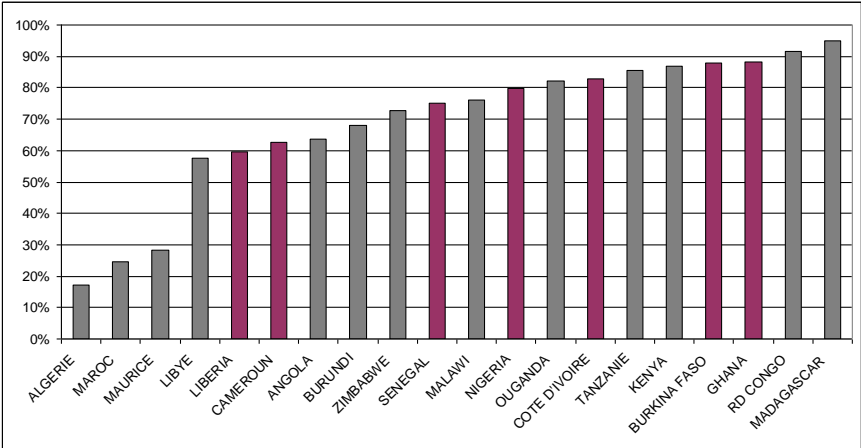


Fig. 13: Contribution of used cars to the growth of some African vehicle fleets (2005-2015)
Source: OICA (2017)

The secondhand car market therefore has excellent development prospects in the years ahead. However, the real question remains as to the characteristics of vehicles used by the increasingly important emerging middle classes. The continent's economically powerful countries are those that buy more new vehicles. These include South Africa, Egypt, Algeria, Morocco and Libya. They are all outside the study zone of this survey.

In conclusion, used cars are making a significant contribution to fleet renewal in sub-Saharan Africa, creating a high-potential, booming market in view of the high growth rates observed and the emergence of middle social classes with substantial purchasing power (Lihoussou & Limbourg, 2022).

4.2. A complex and highly organized vehicle market

In addition to the market for used vehicle, there is a directly related market for spare parts. Importers/exporters of spare parts load them in used vehicle on board. In this way, they pay only for the car freight associated. They may also load them with other miscellaneous cargo, often containerized.

4.2.1. Complex used car maritime logistics

The highly competitive used car global market, is characterized by an oligopolistic structure of maritime actors and dominated by a few powerful forwarding agents. The most numerous actors in the market are the "middlemen", who collect the vehicles and sell them to garages or exporters. The latter then ships vehicles *via* freight forwarders, of which there are only a few. They use even fewer shipping companies. For the entire industry, concentration in the hands of Lebanese operators has long been the rule (Rosenfeld, 2013 a & b). They are omnipresent from the beginning to the final step, particularly in the management of used vehicle fleets at destination ports, and are organized in networks, most of which are family owned. This dominance is still evident in ports such as Cotonou and Lome. In contrast, local African actors are emerging, especially in Dakar, Abidjan, Accra, Douala and Libreville, and are gradually changing the way the industry is organized. The Fig.14 below summarizes the complex organization of this sector.

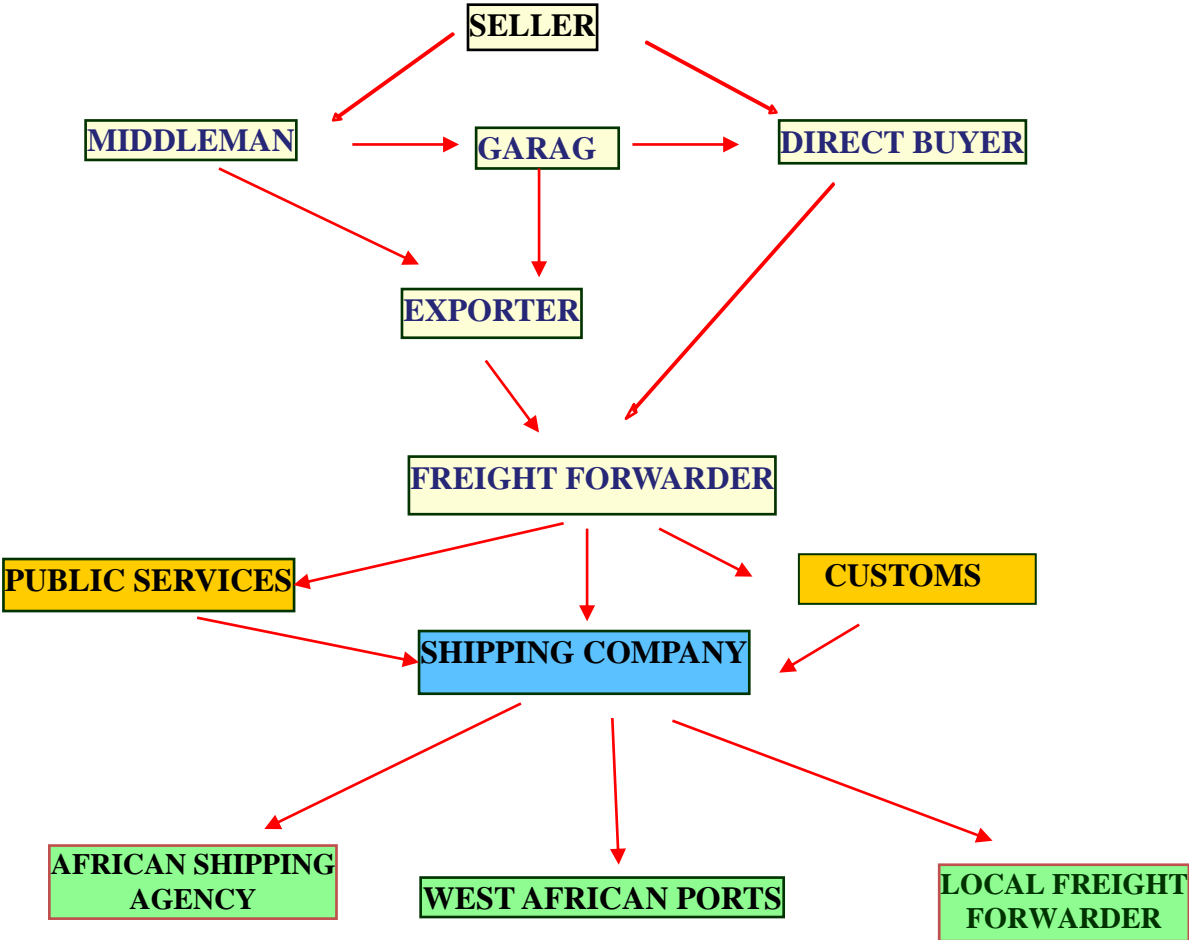


Fig. 14: Organization of the used car market from Europe to Atlantic Africa. Source: Field survey from July 2016 to May 2017.

There are two groups of actors. The upstream is the European link, and the downstream the African one to the final customer. However, there are many actors involved in the entire supply chain, both in Europe and in Africa.

4.2.2. Used car logistics actors in Europe

The main upstream actors are the direct marketer and seller, the garage or professional seller, the exporter, the forwarding agent, customs, the shipping line or shipping company. The downstream actors are port logistics operator, freight forwarder, seller or marketer, Lebanese sales park manager, middleman, local and foreign buyer, customs and other public services. This paper highlights only upstream logistics actors.

- Direct seller and middleman

The direct seller is an individual, household or trader who comes directly to sell his car to an exporter or garage. The direct seller is an intermediary between the individual seller and the exporter or garage. It starts with two coded words "for sale". If an agreement is reached, the vehicle is delivered by the direct seller to a partner who buys it by paying the vehicle owner and the direct seller a variable commission reaching 100 and 300 euros per vehicle, depending on the amount negotiated. This link in the chain is run almost exclusively by the African community of very diverse nationalities. Each group of canvassers tries to earn the loyalty of their counterparts through ethnic, sociocultural and family ties. They may stand at crossroads or wander around the Heyvaert district of Brussels all day, for example, in search of bargains. Although there are many similarities with the situation in Brussels, in the 'Ile-de-France' region and in Aubervilliers, for example, vehicle collection is carried out mainly via the internet, from garages or private individuals. One of the main reasons for this uniqueness is the number and regularity of police around up checking residence permits, which hampers street transactions. However, as in Brussels, middlemen are collecting vehicle force for garages. However, many of them indeed turn to exporters.

- Garage or Professional Seller

Garages are legally constituted businesses. They buy vehicles from all sources and resell them to a wide range of customers. They have showrooms, large storage areas and a solid financial base to support their business. At the customer's request, they can take care of all the formalities involved in shipping the vehicle to the forwarding agent. As they have to bear the costs of running their business (lease, staff, fluids, taxes, etc.), their selling price is often slightly higher than that obtained by direct purchase.

- Exporter

In reality, exporters stand as the main actors. They are original or legal persons who reside in Africa or Europe or who regularly commute between the two. He or she buys and exports vehicles from Europe to Africa. As such, he/she is in constant contact with one or all of the above stakeholders, as well as with his/her agent, the forwarder.

- Freight Forwarder

As a key actor in the logistics chain, the freight forwarder is an intermediary or agent for the exporter. He takes charge of the cargo from the exporter and handles the precarriage from Brussels to Antwerp, Paris to Antwerp or Paris to Le Havre, using car transporter trucks with a 4x2 axle configuration and a capacity of up to 8 or 9 vehicles. He or she acts as an intermediary between the export customer and the shipping line. It draws up the consignment note, assists the customer in securing the goods loaded on board the vehicle, and handles all the administrative and customs formalities required for shipping. They have a fleet of vehicles at their disposal and organize more or less regular shipping to the port, depending on the capacity of their fleet and, above all, on ship departures to West Africa. Some forwarders collect all freight in Europe to avoid the risk of nonpayment, while others collect it at destinations in a variety of ways. The latter option is designed to enable the customer to

export more used vehicles without having to advance funds, which can be very high for large shipping. Freight is then paid according to sales on the destination market, all these actions in limited time, which can sometimes lead to seizures and judicial sales if the debtor defaults. This relies on the trust gained from years of working together. Some forwarding agents finance and control the links in the course of the chain. This is generally motivated in the sense of the sake of vertical integration through showrooms, the hosting of garages and the financing of certain customers.

- **Shipping companies**

Shipping companies assure sea transport with cargo by making ships available to freight forwarders, who pay freight charges. The shipping company owns a charging quay to receive bulk storage and loading cargos. It also owns a branch within the port of destination or appoints a representative managing the transit. The most important shipping company for this type of traffic is the Grimaldi Group. However, they face competitive companies chartering mixed ships.

- **Customs and administrative facilities (public services)**

The customs administration addresses the regulatory aspects of shipping and tax collection. It works mainly with freight forwarders who declare goods and pay customs duties but also with shipping lines for various controls. Its contribution to trade facilitation is a real asset in the choice of destination port.

4.3. The oligopolistic organization of the maritime vehicle market

4.3.1. Oligopolistic maritime logistics actors

Two companies (Grimaldi and Sallaum) currently dominate the shipping market, with total annual traffic estimated at 400,000 and 450,000 vehicles in Antwerp, of which approximately 50% come from Brussels. ERL, which operated at the beginning of the study, no longer existed. The remainder of the market (approximately 3%) is contested by III King, IMS, Abou Merhi, and others. Similarly, with the exception of a few rare cases, each group of forwarder ships vehicles under exclusive agreements with a single shipping line is as follows:

- Grimaldi : Belgo-Malienne, Socar, Facar, IMS, Nord-Sud Transit, *Zeiter*, *III King*.
- Sallaum: Abou-Zeid, Sallaum Export Center, IMS, *Zeiter*.

Agreements are negotiated between shipping lines to allocate space on one line's vessels for the benefit of another, especially in delicate phases of reduced traffic, as was the case in 2016. As far as transit companies are concerned, although statistics are truly inaccessible, the actors involved and interviewed establish a subjective and variable ranking of the main operators. Our surveys enable us to organize this market around the powerful forwarding agents Abou-Zeid, Nord-Sud Transit, Karim Export, Belgo-Malienne, IMS, SOCAR, Zeiter and Sallaum Export. It is important to note that the same forwarding companies control the market in Brussels, Antwerp and Ile-de-France. They are run predominantly by Lebanese managers, who operate in family networks. In Africa, they are strongly involved in the allocation of used vehicle fleet management and control local market. However, local African actors are emerging, especially in Nigeria, Côte d'Ivoire, Cameroon, Ghana and Senegal.

4.3.2. Used car transportation costs from Europe to Africa

The rates charged and displayed by the forwarder include the cost of road pre-carriage (Brussels to Antwerp, Ile-de-France to Antwerp or Ile-de-France to Le Havre), customs duties, other administrative formalities (e.g., insurance), sea freight and the forwarder's

margin. Rates vary according to whether the vehicle is lightweight, a classic van or minivan (category 1, less than 2 meters high), a large van (minibus) or a truck (category 2), expressed in linear meters (lm).

The frequency of ship departures is in fact the most decisive variable in the choice of port of departure and forwarder. Once the transit-time issue has been settled, the attention is turned to pricing. Price differences for the same destination are not very decisive, as they are cheap even if they do exist. However, some forwarding agents, who are leaders at given destinations, generate larger volumes than others in these ways. This enables them to obtain highly preferential rates from the shipping line to which they are linked at these destinations. Being able to obtain more competitive fares in their preferred way, operators are able to retain their customers and win new ones. The shipping line with which it has agreements gains by securing economies of scale through a reduction in its unit margin. This is the case, for example, for Zeaiter from Brussels/Antwerp and Nord-Sud Transit from Ile-de-France/Antwerp to Abidjan, Dakar and Conakry; Belgo-Malienne to Cotonou, Lagos and Lome; and III King to Douala and Sallaum Export Center to Pointe-Noire. The surveys enabled us to specify the average cost chain for transporting a vehicle via Brussels and Antwerp (Table 2).

Table 2: Average supply chain costs *via* Brussels/Antwerp (in euros)

Actors	Average cost
Middleman	100 – 300 €
Garage	300 – 500 €
Customs and taxes	25 € (10 €+15 €)
Road Carrier Fees	35 - 40 €
Freight Forwarder charges	40 – 100 €
Shipping line margining	25 -100 €
Average cost	525 € - 1065 €

source: Investigation data, from July 2016 to May 2017

With regard to maritime freight, average prices observed from September 2016 to August 2017 reveal wide disparities between destinations, not only in terms of distance but also by considering many other parameters, such as the size of flows, the frequency of services, the geopolitical situation and sometimes the erratic evolution of freight rates (Tables 3 & 4).

Table 3: Maritime freight Brussels *via* Anvers (in euros)

Destination Ports	Cars	Buses	Heavy Buses	Trucks (ml)
Dakar	336	443	940	295
Conakry	428	565	1350	405
Freetown	603	813	1635	530
Abidjan	289	398	990	270
Tema	398	498	1265	370
Lomé	289	379	860	350
Cotonou	294	383	860	280
Lagos	401	496	980	370
Douala	318	413	1030	235
Pointe Noire	476	569	1467	410
Libreville	695	815	1750	560

Luanda	750	850	2000	
Bata	715	815	1600	575
Malabo	765	865	1600	600

Source: Investigation data from July 2016 to May 2017.

Table 4: Maritime freight from Ile-de-France (Paris) to West Africa (in euros)

Destination Ports	Africap	Nord Sud Transit	Louise Transport	Afrique Transit Express	Average cost
Abidjan	550	400	450	480	470
Cotonou	500	400	450	450	450
Conakry	620	550	530	550	563
Dakar	500	400	450	450	450
Douala	550	450	520	460	495
Lagos	620	650	700	530	625
Libreville	940		790		865
Lomé	540	500	480	470	498
Tema	650		700	530	627

source: Investigation data, from July 2016 to May 2017

The field surveys from June to October 2023 show that several shipping lines have reduced their Ro-Ro services to West Africa in favor of Asia-Europe flows of new electric vehicles and that, paradoxically, European households are increasingly keeping their old vehicles for fear of the risks inherent to new technology. The result is freight rate and used car price growth. The resumption of maritime traffic in the wake of socioeconomic disruptions caused by the COVID-19 pandemic and the Ukraine-Russia war could also explain these new rates, as shown in Table 5 below.

Table 5: Actual maritime freight from Ile-de-France (Paris) to West Africa (in euros)

Destination Ports	Transit Time	Cars	4 X 4	Buses (Small Van)	Heavy Buses (Big Van)
Abidjan	12	750	910	990	1690
Conakry	13	740	860	950	1750
Cotonou	12	715	840	900	1640
Dakar	14	670/740	770/840	870/990	1500
Douala	25	690/800	790/900	930/990	1900
Lagos	14	750	1030	1140	1800
Lome	15	690	790	890	1650
Nouakchott	14	1020	1135	1240	see cotation
Pointe-Noire	26	1000	1110	1210	2320
Tema	18	930	980	1120	see cotation

Source: Data collected on Nord-Sud Transit Website (May 2023)

The ever-increasing demand for vehicles in good or new condition from Africa's emerging middle classes is increasingly putting car-makers from developed countries in competition, with sources of supply (Europe, America and Asia) and with the forms of settlement of car sellers (for example: launch in 2023 of the new Iveco vehicle assembly line by Sotra

Industries in Côte d'Ivoire). The main challenge will be to reconcile environmental requirements facing the negative externalities associated with the used-vehicle sector and West African population varied expectations. Maybe through the development of a new vehicle market, on the one hand, and of the used cars sector, on the other hand, which is less old (as opposed to wrecked) and in better condition regarding an efficient logistics management process.

Although mobility is essential to the deployment of all economic and social activities and is a fundamental lever for development, it is also true that used vehicles is not without consequences for the environment and society. These include water and air pollution, noise and climate change.

5. Conclusion

Field surveys revealed that the port of Antwerp is fully attractive to every stakeholder. Any other port could compete with it with regard to statistics. This is confirmed by the comments of all categories of actors, regardless of the national origin of the European vehicle imported. The arguments developed by those involved in the used-vehicle logistics chain are the frequency and regularity of ship departures, the total cost of transport, the facilitation of customs and port formalities, clearance times, and so on. In fact, the prevailing feeling in all the interviews was one of satisfaction when passing through Antwerp, a familiar port, with landmarks, practices, and relationships - in other words, comfort. Passing through another port is an upset habit. The stakeholders directly questioned on this point state the complexity: they are not against it, but they say it would be a change they are not prepared to accept the risks.

The growing potential of the used car market has been confirmed in Africa. Wealthy minority households are able to afford new vehicles, or at the very least recent, top-of-the-range used vehicles, and they are doing so increasingly. However, they are also waiting for a second or third vehicle, and in this case, their demand is for second-hand vehicles of lesser quality. This is often the case in Nigeria, where every middle-class household has at least two or three vehicles. High-ranking religious and political personalities are said by some to have fleets of approximately 50 vehicles. Moreover, this market is characterized by the circumvention of legislation on vehicle age limits, as well as by the payment of fines that are not very challenging and by corruption, which is denounced but widespread.

Alongside this market aims at the very wealthy classes, a market is emerging to satisfy demand from an emerging middle classes with growing incomes. Their expectations are increasingly focused on used vehicles that are in good condition and therefore relatively recent. Their demands are growing. There is also a growing demand from the more underprivileged social categories for a means of transportation that is safer than two-wheeled vehicles and more flexible than the often-failing public means of transport. It can also be a productive investment. The vehicle purchased is used for commercial purposes, mainly as a cab. Therefore, HAROPA could get opportunity in creating and developing a French export platform for non-new vehicles and thus capture part of the flows from Ile-de-France to West African countries *via* Belgium.

From a perspective point, however, we need to consider the sensitivity of these flows to the economic climate, the socioeconomic upheavals linked to the COVID-19 pandemic and the Ukraine-Russia war, and the resistance of European households to electric vehicles. Indeed, field surveys from September to October 2023 show that several shipping lines have reduced their Ro-Ro services to West Africa in favor of Asia-Europe flows of new electric vehicles. In

contrast, European households are increasingly keeping their fossil fuel vehicles. The result is a rise in freight and in the purchase costs of imported vehicles. The market trend toward new vehicles, particularly in Senegal, Ghana, Gabon and Côte d'Ivoire, could eventually limit the flow of used vehicles, which have been the most numerous on the market in recent years. However, the strong demand for original spare parts will continue to fuel the market of used vehicle. Lagos (Nigeria) and Kumasi (Ghana), for example, are the main supply sites for parts of the West Africa. In other words, the import of used vehicle clearly has very bright prospects for the future. Therefore, logistical management to restore the plants to good condition before the export procedure guarantees compliance with environmental standards.

Data availability statement

Materials and data are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and informed consent to participate All authors agree to publish the article in the journal.

Research involving human participants and/or animals Not applicable.

The authors would like to confirm that the research design was examined and validated for ethics manner. So for field surveys (by questionnaire and interview), there was a prior access negotiation to obtain the informed consent even if oral of the actors concerned. As a result, the data collected received their first validation for publication.

Conflicts of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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