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Identifying African countries' potential in the African automotive industry – A continental supply chain mapping approach

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Abstract

The automotive industry has received large attention in recent policy and academic discussion due to the large numbers of necessary parts and components to assemble a vehicle. This variety of inputs and materials provides an opportunity for a number of African countries and to promote resource-based industrialization. This paper provides an assessment of individual countries' export capacity and export potential to integrate in the continental automotive supply chain. It applies an input-output-product space method to 43 African countries with available recent (2018-2020) export data. It shows that while a range of products are already exported within the continent, current productive capacities are largely concentrated on South Africa and Morocco. In order to strengthen supply chain linkages and involve a larger number of African countries, strategic and coordinated diversification opportunities are necessary. Many African countries can build on the available natural resources to tap into the more complex and employment creating products. The paper provides policy recommendations to reduce African countries' dependence on imports on vehicles and automotive parts and components.

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1. Introduction

The automotive industry in Africa has received rising attention by international organizations and policy makers on the continent, driven by the establishment of the African Continental Free Trade Area (AfCFTA). At the African Union Summit in Niger in November 2022 African leaders committed to the acceleration of commodity-based industrialization through regional value chains, with priorities on five strategic industries – health and pharmaceutical, automotive, minerals beneficiation, food and nutrition and apparels of cotton.[1] The AfCFTA Secretariat has also incorporated the automotive industry as a key sector in its Private Sector Strategy and designed interventions to promote production and trade. In collaboration with the Afeximbank and the African Association of Automotive Manufactures (AAAM) it has developed a strategy to finalize Rules of Origin and committed to a $1 billion fund to support the continental development of the automotive value chain. Yet, there remains limited data-driven discussion on how all African countries could potentially integrate in the continental automotive supply chain.

The Economic Development in Africa Report (EDAR) 2023 assesses African countries' position and future opportunities in high-technology supply chains, with a focus on the automotive industry, mobile phone and solar panel supply chain, and pharmaceuticals and medical devices. This background paper to the EDAR 2023 examines the automotive supply chain between African countries. By using traditional trade data in combination with Input-Output tables, it maps the automotive supply chain into its Tier categories and products to identify each African country's individual export capacity and potential. It further combines supply chain analysis with the product space method to assess potential diversification opportunities of African countries. The paper shows that while intra-African trade of necessary inputs to the automotive industry is concentrated (in terms of volume) on raw materials, intra-African supply of processed parts and components to the vehicles sector is largely absent with the exception of a few countries. However, in order to promote a regional automotive supply chain and reap inclusive benefits (i.e., including African small and less developed countries) from the AfCFTA, it is necessary to fill recent gaps in the supply chain through targeted and coordinated diversification strategies among African countries.
To the best of our knowledge, this paper is the first study that produces a continental mapping of automotive parts and components across African countries. Despite its limitation due to the quality of trade data and limited availability of detailed production data, the paper can guide recent initiatives at the continental level such as those led by the AfCFTA Secretariat to implement a continental automotive sector strategy.

The remainder of the paper is as follows: Section 2 puts the African automotive industry in the context of the industry's global supply chain structure. Section 3 identifies African countries' position and future potential in the automotive supply chain. It first describes the methodology applied and data used, followed by the discussion of current intra-African export capabilities in the automotive supply chain (Section 3.2) and potential future

[1] https://au.int/en/pressreleases/20221201/africa-must-industrialize

diversification opportunities (Section 3.3.). Section 4 provides policy recommendations to strengthen the regional supply chain. Section 5 concludes.

2. The African automotive industry embedded in the industry's global dynamics

The global automotive supply chain is a technology- and capital-intensive industry that requires the realization of economies of scale to produce efficiently. Such cost advantages create market power and therefore, the governance is exercised by a small number of large multinational car producers (producer-driven supply chain). The top 10 Original Equipment Manufacturers (OEM)[2], accounting for 67 per cent of world's vehicle production value in 2017, are listed in Table 1. The concentration on a few players is largely explained by the need of economies of scale to amortize investments in this capital-intensive industry. It is estimated that an output-per-firm of at least five million vehicles is necessary to achieve the necessary economies of scale to finance high levels of R&D and technology advancements to remain competitive (Natsuda and Thoburn, 2021). The industry has become more concentrated in the last 20 years due to several mergers and acquisitions. The development of electric vehicles and increased capital requirements and R&D to meet rising demand for technology also further accelerated the formation of new alliances (e.g., Toyota's alliance with Mazda, Subaru and Suzuki in 2017; Audi joined BMW and Mercedes in a formal collaboration; and Volkswagen collaborates with Ford).

Table 1: World Ranking of manufactures, by production value 2017, in current $

Rang	GROUP		Year 2017	Year 2000	2000-2017 growth in %
	Total	**Origin/Headquarter**	**96'922'080**	**58'392'376**	**65.98**
1	TOYOTA	Japan	10'466'051	5954723.00	75.76
2	VOLKSWAGEN	Germany	10'382'334	5'106'749	103
3	HYUNDAI	South Korea	7'218'391	2'488'321	190
4	G.M.	USA	6'856'880	8'133'375	-16
5	FORD	USA	6'386'818	7'322'951	-13
6	NISSAN	Japan	5'769'277	2'628'783	119
7	HONDA	Japan	5'236'842	2'505'256	109
8	FIAT	Italy	4'600'847	2'641'444	74.18
9	RENAULT	France	4'153'589	2'514'897	65
10	PSA (Peugeot Société Anonyme)	France	3'649'742	2'879'422	27

Source: Natsuda and Thoburn (2021).

[2] In the automotive industry, OEM refers to the company that designs and manufactures the vehicles during their assembly. Tier 1 suppliers are the direct suppliers of auto-specific parts and components to OEMs. Tier 2 suppliers provide non-specific parts and components to Tier 1 suppliers as well as to OEMs. Tier 3 suppliers supply raw and semi-raw materials.

The OEMs have increasingly outsourced the production of parts and components and depend on numerous suppliers. In supply chain analysis, so-called Tier 1 suppliers usually provide specific parts and components such as engines, chassis, tires or seats. Tier 1 suppliers also have their sub-suppliers, so-called Tier 2 suppliers, to provide them with non-specific parts and components. Tier 2 suppliers can also supply OEMs directly, with, for instance, bearings or similar components necessary for the assembly of the vehicles. Finally, Tier 3 suppliers provide the necessary raw and semi-raw materials to the industry.

With regards to automotive suppliers, the main suppliers of automotive-specific modules and components remain highly concentrated in Germany, Japan and North America (see Table 2). Unlike in the assembly industry, emerging countries seem to rather play a limited role in providing parts and components. Technology changes in the industry have also called for stronger partnerships between automobile manufactures and tech companies. Some technologies key to digital transformation in the automotive industry include cloud computing, 5G, advanced automation, machine learning and mobility operator.

Table 2: Top 20 Automotive Parts Suppliers (Tier 1) in the world, 2017

Raking	Firm	Origin	Global automotive parts sales in $ million
1	Bosch	Germany	47'500
2	Denso	Japan	40'782
3	Magna	Canda	38'946
4	Continental	Germany	35'910
5	ZF	Germany	34'481
6	Aisin	Japan	33'837
7	Hyundai Mobis	Korea	24'984
8	Lear	USA	20'467
9	Valeo	France	19'360
10	Faurecia	France	19'170
11	Adient	USA	16'200
12	Yazaki	Japan	15'754
13	Panasonic Automotive	Japan	14'995
14	Sumitomo Electric	Japan	14'872
15	Mahle	Germany	14'441
16	Yanfeng	China	14'278
17	Toyota Boshoku	Japan	13'444
18	JTEKT	Japan	12'709
19	ThyssenKrupp	Germany	12'591
20	BASF	Germany	12'157

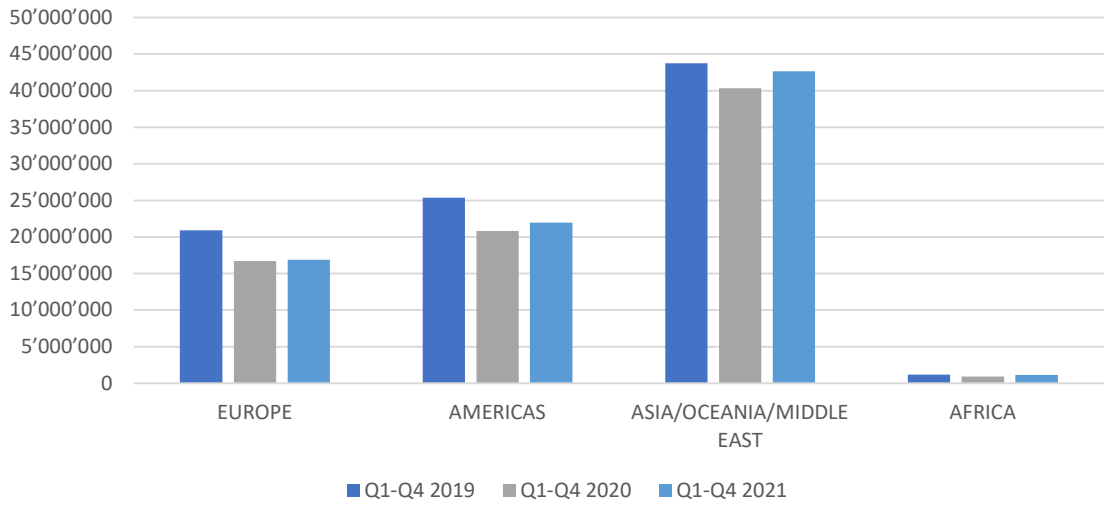
Source: Natsuda and Thoburn (2021).

OEMs usually have assembling subsidiaries in several countries in order to reduce transport and trade costs. In Africa, the largest subsidiaries are in South Africa (BMW, Ford, Isuzu, Mercedes-Benz, Nissan, Toyota, Volkswagen) and Morocco (Renault and PSA). However,

African subsidiaries of OEMs mainly undertake production activities with little participation in product design for its local markets. An exception is Morocco where more R&D functions of the supply chain are located to the subsidiary country. Such a relocation of R&D activities has, for instance, enabled local industries in subsidiary countries such as India and Thailand to develop low-cost vehicle models for the local market and it has played an important role in reducing the costs of these vehicle for emerging markets. A necessity for that is, however, to produce sufficiently high volumes of vehicles.

With a rate of 45 vehicles per 1,000 inhabitants, Africa is the continent with the lowest rate of motorization. This is far below the global average of 203 vehicles per 1,000 inhabitants, and lower than other developing regions such as Latin America (176) and Developing Asia, Oceania and the Middle East combined (79) (OECD, 2022).
As shown in Figure 1, the registration or sale of new vehicles in Africa is low at 1.15 million in 2021, especially compared to Asia, Oceania and Middle East (42.7 million), Europe (16.9 million) and Americas (22 million). However, projections show that vehicle demand in Africa could reach 10 million vehicles by 2030 thanks to rising middle class, the implementation of a larger market under the AfCFTA and related increased demand for transport vehicles, as well as new implementation of age requirements to limit purchase/import of used vehicles (see Section 4).

Figure 1: Registrations or sales of new vehicles (units), 2019-2021

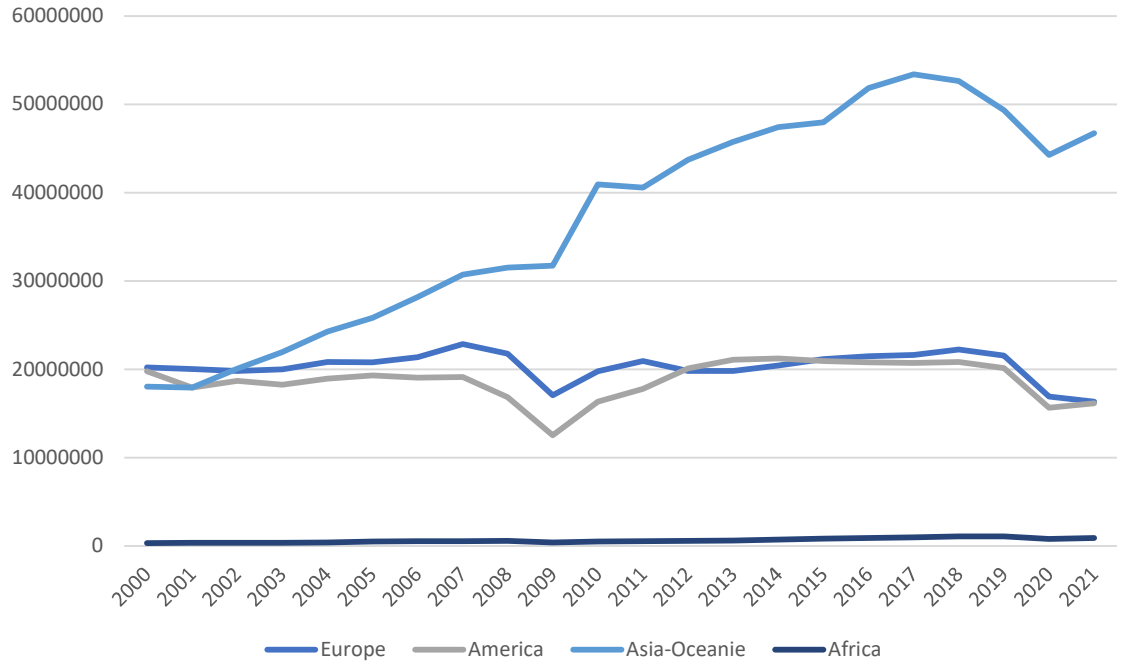


Source: Authors based on OICA.net (https://www.oica.net/category/sales-statistics/)
Note: Regional classification as reported by OICA.net

World vehicle production amounted to 80,145,988 in 2021.While production has decreased by 19 per cent and 18 per cent in Europe and Americas between 2000 and 2021, it has increased by 159 per cent in Asia and 183 per cent in Africa during the same period (see Figure 2). The large increase in Africa's production from 328,749 in 2000 to 1,113,651 in 2019 was largely driven by an expansion in Morocco. A few trends in South Africa and Morocco, the dominating African countries in the automotive industry, and Nigeria which also used to have substantive production of vehicles in the 1980s are shortly discussed below.

Other countries are marginally integrated into the automotive supply chain. Some African countries (Angola, Ethiopia, Ghana, Kenya, Lesotho, Mozambique, and Namibia) have relatively small-scale assembly operations, but these are mostly Semi-Knock down kits (SKD) with minimal value added. Parts and components are largely imported from outside the continent. The distribution, sales and aftersales market is characterized by high levels of informal activity (Japan International Cooperation Agency and Boston Consulting Group. 2022). For instance, in Ghana and Nigeria, 70-80 per cent of the sales and aftersales market is concentrated in informal SMEs, particularly in the segments of informal parts sellers and service centers and local garages. Informal businesses largely serve low-cost offerings for older used cars.

Figure 2: Vehicle unit production trend from 2000-2021



Source: Authors based on OICA.net (https://www.oica.net/category/sales-statistics/)

With regards to parts and components, African countries are also marginally integrated in the global supply chain. They supply 1 per cent of global exports in Tier 1 products, and 2 per cent in Tier 2 products (Table 3). Due to the abundance of critical minerals in African countries, the contribution of African countries in the provision of Tier 3 raw materials is much higher 6.8 per cent. Including the raw materials that are necessary for EV materials, the share of exports from Africa in world exports increases to 7 per cent. In contrast, as discussed in the EDAR 2023, the share of African countries' exports to Africa are higher, especially for Tier 2 components (11 per cent) and Tier 3 materials (38 per cent). The high concentration of global supply chains in Tier 1 makes it difficult for African countries to step into these parts of supply chain. Tier 1 suppliers provide components that are often targeted for a specific type and model of a car. Hence, Tier 1 suppliers work closely with OEMs which is why long-term business relationships are often necessary to ensure that components fit into the car. Supplying local assembly plants in Africa provides much more opportunities for African countries due to shorter distances and coordinated policies to favor local sourcing

(Section 4). Hence, the remainder of this paper is focused on the intra-African automotive supply chain and the position of individual African countries in the regional supply chain.

Table 3: Potential import supply by Africa to the world, based on reported exports 2018-2020, by Tier

	Tier 1		Tier 2		Tier 3		EV raw materials	
	value in $'000	share in %	value in $'000	Share in %	value in $'000	share in %	value in $'000	Share in %
Africa	5186090	1%	3916541	2%	32704588	6.75%	38798920	7%
Americas	167008901	20%	36735190	15%	133118378	27.47%	175237359	32%
Asia	286441544	34%	106416816	42%	133797311	27.61%	145302042	26%
Europe	394623176	46%	104850236	42%	108410793	22.37%	111534514	20%
Oceania	1307668	0%	595632	0%	76558411	15.80%	80829818	15%
Total	854567380		252514415		484589481		551702653	

Source: Authors based on UN COMTRADE.

In the following, the paper will discuss three countries – South Africa, Morocco and Nigeria – and the development of their automotive industry.

South Africa

Production of vehicles in South Africa increased from 271,872 in 2000, to 392,249 in 2010 and to 631,921 in 2019. Due to the economic recession and lockdown measures during Covid-19, production decreased to 499,087 in 2021. The export value of vehicles (HS 87) increased from $8 million in 2010 to $11.5 million in 2019 ($10.7 million in 2021), indicating a positive trade balance of $4 million in 2019.

Intra-African exports from South Africa accounted for 15 per cent of South Africa's total vehicle exports, but only 5.4 per cent in the category of passenger cars, highlighting a comparably larger potential for trucks, buses and tractors in the regional market. With regards to parts and components and materials for the production of vehicles, South Africa exported $ 3.1 billion (22 per cent of which went to Africa) of Tier 1 products to the world (average 2018-2020), $428.6 million (80 per cent to Africa) of Tier 2 and $ 11.4 billion (around 10 per cent to Africa) of Tier 3 products (raw and semi-raw materials). The bulk of exports of components, especially to SADC countries, are mainly for the aftersales market (i.e. repair and maintenance of cars) including for instance, tires, engine parts, transmission shafts (OECD, 2022). In 2019, there were 180 Tier 1 component manufacturers in South Africa, of which 75 per cent were foreign owned. In total there are 430 component suppliers. Tire manufacturing is controlled by four foreign companies (Bridgestone, Continental, Goodyear, Sumitomo). The largest components exports are of catalytic converters, largely due to the local availability of platinum as main input. However, this is also driven by export incentives, and OEMs trying to offset import duties instead of supplying components for the local assembly (Monaco et al., 2020).

Despite the advantage of availability of raw materials and government support in South Africa, domestic value additional is estimated at around 40 per cent, meaning that there is

still a significant part being imported. Research and development, mostly undertaken by OEMs, largely take place outside of South Africa. Key production challenges for the South African automotive industry are high labor and electricity costs, and obsolete technology. Supply chain localization is largely challenged by market scale, costs of production (labor, logistics, electricity), availability of quality input materials (e.g. steel is not available in all grades required) and availability of quality local suppliers.

Morocco

Morocco significantly increased production of vehicles from 19,432 in 2000 to 42,066 in 2010 and 403,218 in 2019. In terms of value, Morocco's total export of vehicles increased to $3.8 million in 2019, from 245,346 in 2010. The high increase was also due to the establishment of Morocco's first completely-built-up plant in 2012, which contributed to expanding the country's vehicle production capacity. While imports also increased, a negative trade balance remains at $-1.3 million (compared to $-2.5 million in 2010).

Morocco's vehicles exports are predominantly to the world (approximately 80 per cent of production is exported), especially Europe, and dominated by passenger cars with a very small share going to Africa (2.7 per cent). In terms of tier suppliers, Morocco's exports of Tier 1 parts and components amounted to US$ 990 million (1.8 per cent being intra-African exports). Its exports of Tier 2 products were valued at US$ 2.1 billion (1.1 per cent being intra-African) while its export of raw materials in the automotive industry (Tier 3) reached US$ 138.8 million (1.5 per cent of it being intra-African). Morocco's Acceleration Plan (2014-2020) to promote the automotive industry have led to the establishment of automotive clusters. The two largest clusters are the automotive cities of Tangier and Kenitra (see also EDAR 2023). Despite a decline in production during 2020 due to Covid-19 pandemic, the industry recovered quickly, partly thanks to sector relief funds of around 50 Million Euro from the European Investment Bank, EU and World Bank (Japan International Cooperation Agency and Boston Consulting Group, 2022).

Nigeria

While OICA.net reported 7384 produced vehicles in 2000, the reported number is 0 since 2009 due to the drastic decline in production as well as data limitations. Nigeria used to have a sizeable automotive industry which deteriorated since 1980s due to structural and macroeconomic challenges caused by the oil price shocks (Japan International Cooperation Agency and Boston Consulting Group, 2022). Recent policy efforts (such as the National Automotive Industry Development Plan (NAIDP), implemented in 2013) have failed to revive the sector due to several implementation challenges. For instance, the recent Finance Bill 2020 overruled the NAIDP by reducing imports duties and levies on passenger vehicles and commercial vehicles (Japan International Cooperation Agency and Boston Consulting Group, 2022). Consequently, OEM confidence is currently low following tariffs reversals. Nevertheless, a recent encouraging prospect of assembly of vehicle in Nigeria is the

investment in assembly facility of 10,000 units capacity through the joint venture between Dangote Industries Limited and Sinotruck of China[3].

3. Identifying African countries' position and future potential in the automotive supply chain

3.1. Methodology and data

Literature

This paper combines input-output analysis with the product space method to identify diversification opportunities through a supply chain mapping. Input-output tables to analyse the interaction between economic sector have been developed by Leontief (1936) and been widely applied to supply chains (e.g., Bam and de Bruyne, 2019; Bam, De Bruyne and Laing, 2021; Pachlot et al, 2021; Yu, 2018;). The product space is a network representation of how products are connected based on their product complexity (proposed by Hidalgo et al., 2007). The concept implies that the variety of exports is strongly path-dependent as a country's current production capabilities (i.e., technologies, production factors, institutions, resource endowments) influence what a country can produce in the future (e.g., Hidalgo et al., 2007).

We build on existing studies that measure local linkages of the automobile industry using Input-Output-Tables. For the example of Morocco, El Mataoui et al. (2019) use national resources and employment tables as the foundation for input-output data from 2002 to 2015, composed into 16 sectors. The authors find that the automotive sector ranks the first place on backward linkages with the Moroccan economy (followed by Other industries, Retail trade and repair, transport and construction), and that an increase in final demand in the automobile sector by 1 per cent, increases production in the other sectors by 0.94 per cent. With regards to forward linkages the automotive sector also ranks 7 indicating a similar, but smaller importance, for providing input into other industries (multiplier of 0.47) (e.g., tractors for farming). The largest increase from a one-per cent increase in value-addition in the automotive sectors was found in "Other non-financial services" (40 per cent), "Other industries" (39 per cent in total) and "Extractive industry" (36 per cent) (El Mataoui et al., 2019).
For the example of South Africa, Bam, De Bruyne and Laing (2021) combine input-output analysis with the product space method to identify current linkages and potential of the South African economy for upgrading.

[3] https://africa-businessinsider-com.cdn.ampproject.org/c/s/africa.businessinsider.com/local/markets/high-expectations-for-dangote-sinotruck-as-the-company-boasts-a-production-capacity/2f9jbjp.amp

Methodology

In order to position African countries in the continental automotive supply chain and to identify feasible opportunities for upgrading, the chapter applies the following approach using a variety of sources:

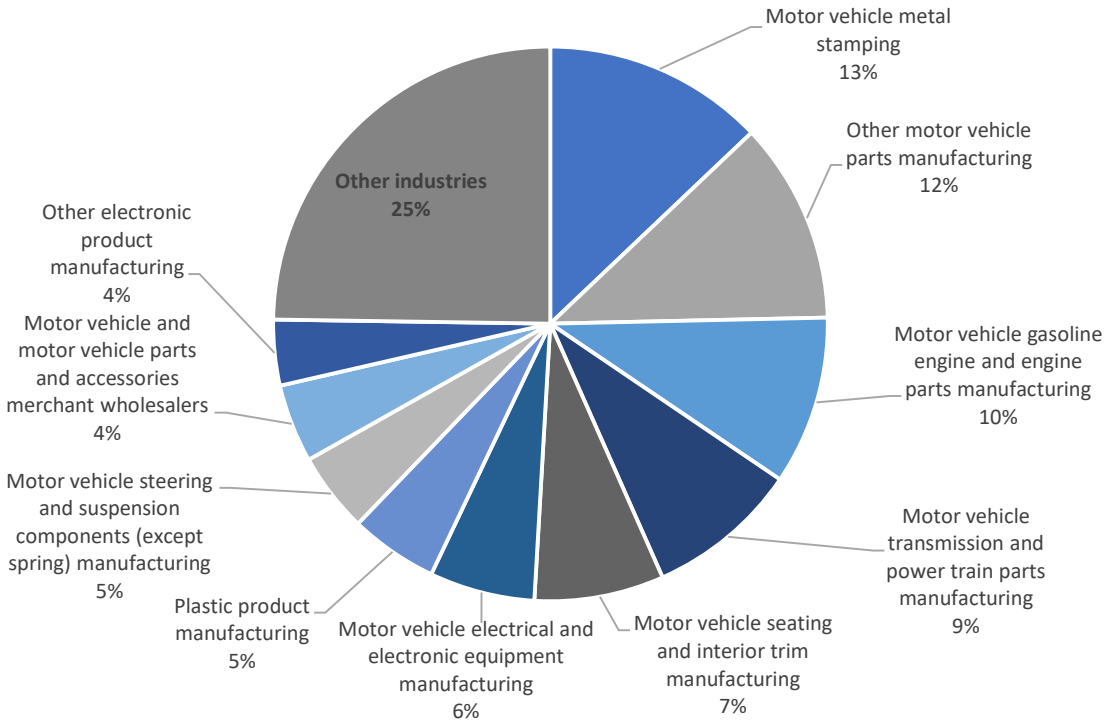
1) Input-output table for the year 2020 is used from Canada as its disaggregation into 234 subsectors allows a detailed identification of potential forward and backward linkages.[4] As input-output tables are not available for African countries at such detailed level, we need to assume that the assembly of a car requires similar inputs, irrespective where it is built. Therefore, we rely on Canadian input-output tables in the first step. After matching with International Standard Industrial Classification (ISIC) and with Harmonized System (HS) codes, relevant activities and products are identified along the supply chain. Important contributions to the literature of the paper at hand are the inclusion of services and industrial equipment in the supply chain mapping, the differentiation by supply chain categories to position all African countries and the inclusion of "new" raw materials to EV production. An overview of the key inputs to automobile manufacturing is shown in Figure 3. It suggests that vehicle metal stamping contributed the largest share of value added (13 per cent) to value-added in vehicle manufacturing output. This input-output analysis as done in Figure 3 is also conducted for the sub-sector to identify Tier 2 and tier 3 supplying industries.

(2) To bring identified activities into a Tier 1 to Tier 3 order, the chapter uses Bam et al.'s (2021) classification of HS products for Tier 1 and Tier 2 of the supply chain. However, in our assessment, Tier 1 products refer to automotive parts and system, Tier 2 to non-automotive parts and components, and Tier 3 to raw and semi-raw materials. The mapping of ISIC and HS codes by each Tier and by supporting services as well as industrial equipment is shown in Figure 4. It must be acknowledged that the matching is not perfect as not all identified products under a certain HS category are necessarily used in the automotive supply chain (especially in Tier 2 and Tier 3). For instance, with regards to iron and steel, although not all steel grades can be used by assemblers, we include all sub-groups as it is difficult to obtain more detailed information. Desktop research completes the identification of additional inputs and raw materials. In total, we identify 93 product groups at the HS 6-digit level and 28 product groups at the 4-digit level, 15 service categories at the ISIC 4-digit level, and 9 HS product groups as necessary

[4] Use of Canada input output tables as Canada is one of the world's top 12 producers of light vehicles. Five global OEMs assemble more than 1.4 million vehicles at their Canadian plants each year: Stellantis, Ford, GM, Honda and Toyota (https://ised-isde.canada.ca/site/canadian-automotive-industry/en)

industrial equipment/technology. Tables 6-11 in the appendix provide the breakdown of products.[5]

Figure 3 Value added (backward linkages) to automobile manufacturing, by industry



Source: Authors based on Canadian 2020 Input-Output Tables.
Note: Input-output table includes domestic and imported use and is reported at basic prices

(3) In order to identify potential product diversification opportunities in the automotive supply chain, we supplement the input-output approach with the product space method (see for an application of the South African automotive industry see (Bam et al., 2021) and for the steel industry (Bam and De Bruyne, 2019). Our analysis is the first applying the input-output-product-space method to the whole continent.

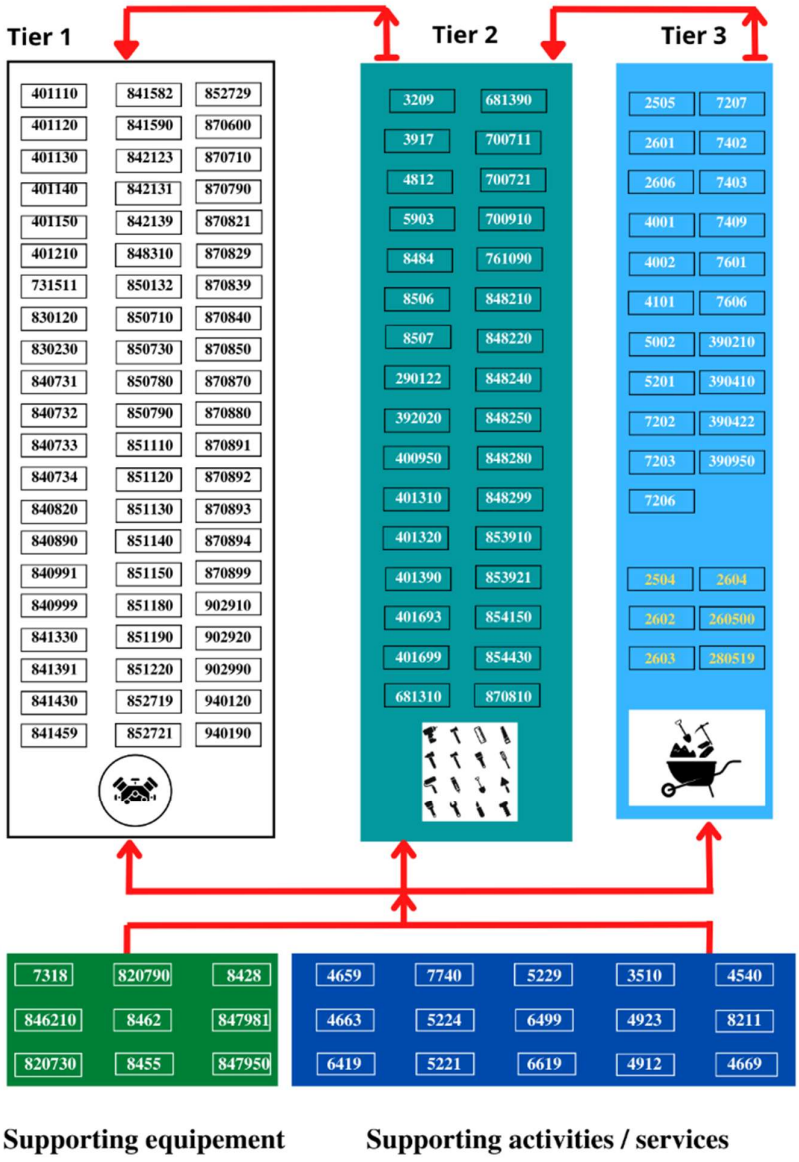
We use the product diversification results, obtained in UNCTAD (2022a). UNCTAD (2022a) applies the product space method (Hidalgo et al., 2007), which maps the distance between a country's current exports basket and a potential "new" product, to identify all African countries' feasible diversification opportunities. The proximity of two products in the product space is measured by the probability that two products are exported at the same time by a country. The proximity between two products, therefore, ranges from 0 per cent, in the case in which no country produces both products, to 100 per cent in the case in which all countries that produce one good also produces the other. In addition,

[5] For comparison, International Trade Centre (2022) identify 221 inputs to the automotive industries based on HS 6-digit product classification. The difference comes from the fact that we include product groups at the HS 4-digit level instead of 6-digit level, mainly to make the value chain mapping illustration simpler, and when differentiation within the 4-digit product group was not necessary or possible.

the method only considers products that have a higher-than-average complexity in order to ensure that diversification also benefits structural change over time. The product complexity index is calculated following Freire (2017) as a revised version of the method of reflections proposed by Hidalgo and Hausmann (2009).

For the mapping of diversification opportunities, we, hence, only consider those new products that can be considered as feasible to produce for a country (proximity to already exported products is at least 80 per cent), that have a higher-than-average product complexity, and favorable demand. In a first step, we look at all diversification opportunities for each country. In a robustness check we only consider a country's top 40 products which it faces the highest demand for.

Figure 4: Generic mapping of automotive supply chain, by HS (for Tier 1, Tier 2, Tier 3 and industrial equipment products) and ISIC Rev. 4 codes (for supporting services)



Source: Authors based on (Bam et al., 2021) and additional desktop research.
Note: The list of HS products, including product names is provided in Tables 6-11.

Data

To identify African countries' current position, we use export data (2018-2020 average) as reported in UN COMTRADE at the HS 1992 6-digit level. HS 1992 is used to align with the product codes as identified by Bam et al.'s (2021) and with the product space method in UNCTAD, (2022). To focus on a continental supply chain mapping, only exports to African countries are considered. We refrain from using mirror data in the first step of the analysis as the prevalence of re-exports might already cause some unreasonable export values (for instance, we exclude potential re-exports in the product category Engines (HS 840820 and HS 840890) for Angola, Botswana, Burkina Faso, Cameroon, the Democratic Republic of the Congo, Cote d'Ivoire, Ghana, Kenya, Lesotho, Mali, Mozambique, Namibia, Senegal, Zambia).[6] For product space method, we also consider import data to allow a more complete picture of potential diversification opportunities. Due to data limitations in most recent years, we were able to include only 43 African countries (no data in 2018-2020 for Algeria, Chad, Djibouti, Eritrea, Equatorial Guinea, Gabon, Guinea, Guinea-Bissau, Liberia, Somalia, South Sudan).
In addition, UNCTAD Trade in Services Data and the World Bank Enterprise Surveys (latest year for each country) are used to obtain additional information on potential supply chain linkages through services.

3.2. Current intra-African export capabilities

This section discusses the results from the supply chain mapping by supply chain category (Figure 4).

Tier 1

The mapping of Tier 1 exports by African countries is provided in Table 6 (see appendix). South Africa is the most integrated African country in the continental supply chain. It exports 95 per cent of the 63 Tier 1 products and components. It is noted that intra-African exports account for 16.8 per cent of South Africa's automotive exports. Morocco is the second most integrated country in Tier 1, it exports 37 per cent of Tier 1 products (23 products) to the continent. Both countries, as discussed in Section 2, have developed an automotive industry including parts and components, and export some components to the aftersales markets of neighboring countries.
Botswana is the third-largest exporter of Tier 1 products and components to the continent (21 of Tier 1 products). Botswana has been able to attract labor-intensive suppliers due to the availability of labor and the government's fiscal support and incentives. As a result, there

[6] We note that the growth of re-exports of intermediate goods is often associated with a strong involvement in global and regional supply chains. Countries with a large amount of re-exports (e.g. Hong Kong, United States, Netherlands, Singapore, United Arab Emirates, Canada) tend to be integrated in supply chains as a hub. A driving force behind re-exports is the superior logistics services provided by international shipping hubs of re-exporting economies (Jones et al., 2020). However, in the case of African countries, such linkages are still underdeveloped.

has been a relocation of labor-intensive suppliers to Botswana from South Africa. Also in the top 10 of Tier 1 product exporters are Kenya (32 per cent of the 63 tier 1 products), Tunisia (30 per cent), Zambia (29 per cent), Egypt (22 per cent), Tanzania (14 per cent), Ghana (11 per cent), Mozambique (11 per cent), and Uganda (11 per cent). The most exported products across countries are tyres, parts for engines, parts of pumps, and other motor vehicles parts (not classified elsewhere (nes)). Overall, only 31 of the 43 included African countries export at least one product. Countries that export no single Tier 1 product are Burundi, Cape Verde, Central African Republic, Ethiopia, the Gambia, Madagascar, Mauritania, Nigeria, Rwanda, Sao Tome and Principe, Seychelles and Sudan.
However, the findings must be treated with caution as not all countries actually produce these products which are often complex and require technological advancements. Therefore, while the mapping gives a first indication of the potential of creating stronger linkages in the automotive supply chain, country-specific analysis of production data remains necessary to obtain a complete picture.

Tier 2

Upstream the supply chain, regional trade also remains limited. In total, only 30 countries export at least one Tier 2 product to the continent. The countries with a considerable export capacity of Tier 2 products are South Africa (94 per cent of the 34 product groups), Tunisia (41 per cent), Morocco (38 per cent), Egypt (35 per cent), Kenya (32 per cent), Botswana (24 per cent) and Uganda (24 per cent) (see Table 8 in the appendix). The countries that do not export a single product in that category are: Burundi, Cape Verde, Central African Republic, Comoros, Democratic Republic of the Congo, Ethiopia, the Gambia, Madagascar, Mauritania, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone. It is surprising that more African countries export at least one Tier 1 than Tier 2 products although Tier 1 products are much more complex to produce. However, we relate this to the existence of re-exports. Overall, opportunities for African countries to export tier 2 products are much larger than tier 1 products.
Tier 2 products are the non-automotive products that link Tier 3 and Tier 1 products or can be used directly by vehicle assemblers. They play a critical role not just in the automotive industry, but are also used by a range of other industries. According to the mapping (see Table 8 in the appendix), paints and varnishes, tubes, pipes and hoses of plastics, primary cells and batteries, plastic parts, structures, and parts of aluminum are the most exported products by African countries, 10 exporters are identified for each product. Such variety poses an opportunity for producers of automotive parts and vehicles to diversify suppliers in order to increase resilience to potential shocks. Nevertheless, overall export capacity for Tier 2 products is still very limited. About 47 per cent of Tier 2 products are exported by only one or two countries on the continent. In most cases, this is South Africa and Morocco. This low participation could weaken the automotive value chain on the continent.

However, the production of Tier 2 products presents a chance for the industrialization process of African economies as these products are less complex and less technology-intensive, demanded by a range of industries and they often evolve from raw material processing, For instance, products and components of plastics (e.g. tubes, pipes and hoses

and fittings of plastics (HS3917) and Plastics; of polymers of propylene, plates, sheets (HS392020)) could be manufactured through oil processing by African leading producer countries (e.g., Nigeria, Libya, Angola, Egypt and the Republic of Congo). Products of rubber (e.g. Tubes, pipes and hoses, of vulcanized rubber (HS4009), inner tubes, of rubber (HS4013), articles of vulcanized rubber other than hard rubber (HS4016) as well as new pneumatic tires, of rubber (HS4011)) could be produced thanks to abundance of rubber production and export capacities of countries such as Côte d'Ivoire, Ghana, Cameroon, Nigeria, and the Democratic Republic of the Congo. However, as noted in the EDAR 2023, the local processing capacity would remain insufficient to serve the regional demand for processed rubber; thousands of tons of raw rubber are still exported without little value addition.[7]

The domestic and regional availability of Tier 2 inputs to the automotive industry can also provide incentives for Tier 1 companies to relocate some of its production closer to the car assembler. Manufacture of basic precious and non-ferrous metals, manufacture of basic iron and steel and manufacture of paints, varnishes and similar coatings are the three main activities where most African countries stand in Tier 2. For a completely knock-down (CKD) kit, it needs a body shop and a paint shop, and this is where African countries potentially face their largest short-term potential in integrating in global supply chains through their existing assemblers on the continent.

Export capacity in some of the Tier 2 products could also be leveraged to move up the supply chain in the future and produce Tier 1 products. For instance, car seats are less complex and less technology intensive than most other Tier 1 products, and the most common type of material used in seats of high-end class vehicles, is leather. Leather is already exported by at least 10 African countries, according to our mapping. In contrast, car seats are only exported by Egypt, Kenya, Morocco and South Africa.

Tier 3

Tier 3 products are raw materials processing exports capabilities and are strongly linked to mining activities and natural resource endowments.

The most common metals used in car manufacturing are steel (900 kg of steel in each car), and aluminum. Every light vehicle contains an average of $3,246 of chemistry (e.g. polypropylene that are used in the production of bumpers and exterior trim8), an average of 120 kg of rubber and 25 kg of manufactured fibres (almost entirely synthetic fibres) and 17 kg of coatings on a dry weight basis. For instance, as already noted above, a range of products such as tires and belts are made from rubber. Three quarters of the world's natural rubber ends up in tires; the industry in EU and America does not produce any of it and depends entirely on rubber from Southeast Asia and Africa.

There is a range of materials used where African countries have a comparative advantage to use available resources to produce some parts and components. Similarly, another key component to the production of vehicles, Glass, is made from natural and abundant raw

[7] https://www.reuters.com/article/rubber-ivorycoast-idAFL8N2M14AK

[8] https://www.bpf.co.uk/plastipedia/polymers/PP.aspx

materials (sand, soda ash and limestone). For instance, natural sands (HS 2505) is already exported by 8 African countries (see Table 10 in the appendix).
The countries that export the largest variety of Tier 3 materials are South Africa (77 per cent of the 26 identified product groups), Egypt (54 per cent), Zambia (42 per cent), Tanzania (35 per cent) and Kenya (31 per cent).

Supporting industrial equipment

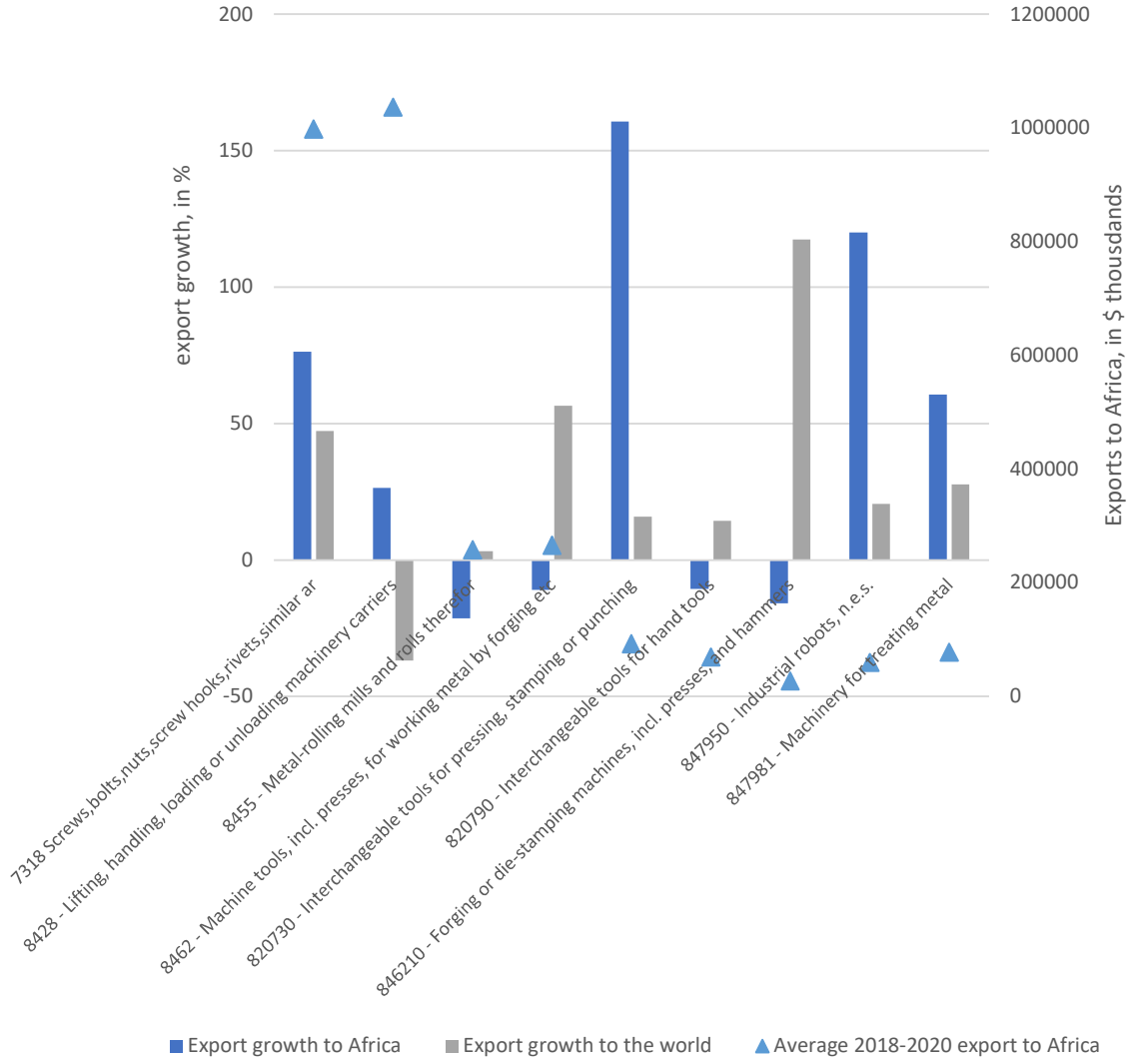
The identified equipment is not only used in the automotive industry but across manufacturing, especially those industries that require metal working. The largest import demand to the continent is observed for Lifting, handling machinery (HS 8428: $1,03 billion) and screws and bolts (HS 7318: $998 million) (see figure 5). Between 2008/2010 and 2018/2020, imports to Africa of Interchangeable tools for pressing, stamping or punching (HS 820730) have grown the strongest (161 per cent), followed by Industrial robots (HS 847950) (120 per cent). In 2019, African countries imported a total of 7,176 industrial robots, a paltry 0.19 per cent of total global industrial robot imports.

Only few African countries have productive capacities in the industrial equipment and strongly depend on imports. Exports to the continent in each of the 9 industrial equipment products groups are recorded by South Africa (see Table 11 in the appendix). Tunisia, Senegal and Kenya also record regional exports in 4 product groups. Other countries that export at least one product are Angola (3), Botswana (3), Burkina Faso (1), Democratic Republic of the Congo (1), Republic of the Congo (3), Cote d'Ivoire (3), Egypt (1), Eswatini (1), Ghana (1), Lesotho (1), Madagascar (1), Mauritius (2), Morocco (3), Mozambique (2), Namibia (1), Tanzania (2), Uganda (3), Zambia (3) and Zimbabwe (1). Screws and bolts ((HS 7318) and Lifting, handling machinery (HS 8428) are the products where most African countries report some exports.

Supporting services

Across the supply chain, a range of services are identified. Those include Sale of motor vehicle (ISIC Rev. 4 4510), Maintenance and repair of motor vehicles (ISIC 4520), Sale of motor vehicles parts and accessories (ISIC 4530); Wholesale and repair services (e.g., Wholesale of other machinery and equipment (ISIC 4659); Sale, maintenance and repair (ISIC 4540); Wholesale of construction materials (ISIC 4663)); Financial services (e.g. Other financial services (ISIC 6499); Other monetary intermediation (ISIC 6419)); Transportation services (e.g. Cargo handling (ISIC 5224), Service activities incidental to land transportation (ISIC 5221); Freight transport by road (ISIC 4923), Freight rail transport (ISIC 4912); Electric power generation (ISIC 3510); Leasing of intellectual property (ISIC 77401); and Office administration service.

Figure 5: World exports of industrial equipment to the world and Africa (at 4-digit or 6 digit level), 2018-2020 average and growth rate between 2018-2020 and 2008-2010



Source: Authors based on UN COMTRADE.

It must be noted that due to the limitation of services data for the automotive supply chain, the following analysis only provides a first indication of African countries involvement in the automotive supply chain through services. In a first step, we use trade in services data as reported by UNCTAD Trade in Services data to have an overview of the relative importance of relevant services. However, the estimated data is not detailed enough to observe more disaggregated automotive services activities such as sale in motor vehicles or maintenance and repair services. Therefore, we use the World Bank Enterprise Surveys to assess the relative importance of these services as compared to other regions. As the sector of activity is reported at ISIC Rev. 3.1 in the Enterprise Surveys, we convert ISIC Rev. 4 to ISIC Rev. 3.1 (Table 12 in the appendix).

As seen in Table 4, the value of trade in services is low for Africa, compared to other regions. While, for instance, Asia exports $1,669 billion, Africa only exports $110 billion (average 2018-2020). In addition, transport and travel services account for more than two thirds of services exports, indicating a larger concentration of these traditional services than for instance in Asia (less than 45 per cent). Other business services which include most automotive related services only represent 16 per cent of all services (compared to 22 per cent in Asia). We also note the relatively smaller share of exports of Charges for the use of intellectual property. Such charges allow for the use proprietary rights through licensing agreements and related rights. It is an important component of services to access knowledge and technology. Charges for the authorized use of rights (e.g. patents, trademarks), for instance through licensing agreements have increased from US$ 76 billion in 2000 to US$ 509 billion in 2021 (World Bank Indicators). African countries have a low level a registered patents and innovations, which explains the low share of exports (0.33 per cent of total services, compared to 11 per cent in the Americas).

Table 4: Services exports to the world, in % of total (if not stated otherwise), average 2018-2020

	Africa	Americas	Asia	Europe	Oceania
Total services (in $ millions)	110'409	1'108'533	1'668'625	2'887'577	83'143
Manufacturing services on physical inputs	2.10	0.32	2.17	2.49	0.02
Maintenance and repair services n.i.e.	0.51	2.40	1.39	1.66	0.37
Transport	26.21	10.89	19.85	16.95	9.16
Travel	36.79	23.02	22.99	14.73	60.35
Construction	1.93	0.29	3.50	1.46	0.76
Insurance and pension services	1.42	2.37	2.09	2.94	0.71
Financial services	3.38	14.27	5.44	9.83	4.90
Charges for the use of intellectual property	0.33	11.34	4.63	7.42	2.06
Telecommunications, computer, and information	5.71	6.87	12.36	13.86	5.35
Other business services	15.57	22.81	22.38	25.98	11.76
Personal, cultural, and recreational services	0.85	2.99	0.68	1.36	2.77
Government goods and services n.i.e.	5.19	2.39	1.17	0.79	1.79

Source: Authors based on UNCTAD Trade in Services data.

It must be noted, however, that African countries are not all the same. For instance, in Eswatini, Transport and Travel plays a minor role, the largest service areas are Other business services (78 per cent) and Charges of IPRs (12 per cent). In the manufacturing services on physical inputs, Guinea, Namibia and Morocco seems to have a relative comparative advantage where this category contributes more than 35 per cent, 18 per cent and 8 per cent to total services. 83 per cent and 53 per cent of manufacturing services exports from Morocco and Namibia go to Europe while it the main trading partner of Guinea is Asia (38 per cent).

According to the enterprise surveys conducted by the World Bank in African countries (various years), the share of enterprises in the services relevant for the automotive supply chain is on average 8.2 per cent of total 22'645 surveyed enterprises which is comparably more than in other regions (6.5 per cent in East Asia, 7.4 per cent in Europe, 6.5 per cent in Latin America, 4.9 per cent in South Asia), where the manufacturing sector is much stronger represented. Firms in "Maintenance and repair of motor vehicles" account for the largest share of firms in the automotive services surveyed (20 per cent) and 1.9 per cent of all enterprises surveyed. This share is larger than in other regions (see Table 12 in the appendix). The biggest obstacle for the surveyed services companies in Africa is access to finance (21 per cent), followed by political instability (11 per cent) and tax rates (11 per cent).

3.3. New opportunities through targeted diversification

African countries have the opportunity to participate in a more substantial way in the automotive value chain. UNCTAD (2022a) has identified export diversification opportunities for 54 African countries. Based on these export diversification opportunities, all 43 African countries included in our sample can diversify their exports toward automotive products and components in Tier 1 and Tier 2.

At Tier 1, 12 countries could enter the intra-African supply chain considering the all exports diversification opportunities (Burundi, Cabo Verde, Central African Republic, Ethiopia, Gambia, Madagascar, Mauritania, Nigeria, Rwanda, Sao Tome and Principe, Seychelles, and Sudan) (see appendix, Table 7). For instance, Nigeria, Africa's largest economy but without any exports in Tier 1 products and only one Tier 2 product (plates, sheets of plastics (HS 392020), shows feasible diversification opportunities in 29 products. It is unlikely that a country could target all these products, but should rather opt for a strategic choice. Of its top 40 diversification opportunities, as identified in UNCTAD (2022), only Chassis (HS 870600) seem to provide the most lucrative opportunity. The remaining countries (31) which already have export capacities would also further diversify and strengthen their exports.

In category Tier 2, the 13 countries that do not have export capacity for any product (those are: Burundi, Cape Verde, Central African Republic, Comoros, Democratic Republic of the Congo, Ethiopia, Gambia, Madagascar, Mauritania, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone) all show regional export diversification opportunities (see appendix, Table 9). Interestingly, we find diversification opportunities for all African countries. For Tier 2 products, targeted and coordinated diversification efforts by African countries could fil recent regional supply chain gaps in the automotive industry. A range of countries could diversify into paints and varnishes (HS 3209), tubes and pipes of plastics (HS 3917), textile fabrics (HS 5903) and screws and bolts (HS 7318). These product groups are relatively less complex and have a higher proximity to existing products than Tier 1 products. For instance, the Democratic Republic of the Congo does not have current export capacity for tubes, pipes and hoses, of vulcanized rubber (HS400950) at tier 2 level.

However, based on its export capacity of natural rubber - a Tier 3 product –the Democratic Republic of the Congo could export these products of vulcanized rubber.
In a robustness check, we only consider the top 40 export opportunities of each African country. In that scenario, only seven additional countries (Madagascar, Mauritania, Nigeria, Rwanda, Sao Tome and Principe, Seychelles and Sudan) could enter the supply chain at Tier 1 with one or two products and the supply chain gaps would remain considerable.

Regarding the top 40 export diversification opportunities of Tier 2 products, only 5 countries on the continent (Burundi, Cape Verde, Central African Republic, Comoros, Gambia) have opportunities to diversify their exports. For the other countries, their most favorable export diversification opportunities, in terms of demand, are outside the Tier 2 products.
We do not look into Tier 3 export diversification opportunities as the exported products are conditioned to the availability of natural resources of the country.

4. Discussion and policy recommendations

The following section puts the results from the value chain mapping and the potential diversification opportunities in the context of current constraints and policies in the automotive supply chain. It discusses the instruments and policies that need to be put in place in order to realize a greater participation in the continental supply chain.

Achieving scale through promoting national demand

It is estimated that an output-per-firm of at least five million vehicles is necessary to achieve the necessary economies of scope to finance high levels of R&D and technology advancements to remain competitive (Natsuda and Thoburn, 2021). The minimum size of an automotive assembly plant is estimated at around 80,000 vehicles produced per year, with a necessary investment of $200 million. Hence, it is important for reach scale before local supply chain can be development. Both, supply in parts and components as well as distribution and aftersales require sufficient demand to be efficient and also to encourage investment in skill development.
UNCTAD (2021) estimated that through GDP and population growth, an additional intra-African export potential of vehicles valued at $820 million could emerge by 2026. In order to translate this potential into reality and promote regional demand for vehicles even further, there must be a combination of approaches: First, new vehicle financing mechanism must be developed. In Nigeria, for instance, the African country with the largest car park due to its sizeable population and motorization rate, 90 per cent of vehicles that enter the market every year are used car imports. Current financing options in African countries often have high interest rates (e.g., around 15 per cent in Kenya, up to 20 per cent in Nigeria and Ghana, according to Japan International Cooperation Agency and Boston Consulting Group, 2022) with strict repayment terms (e.g., 1-4 years repayment in Nigeria). Initiatives such as the recently introduced Ghanian Vehicle Financing Scheme are welcoming to allow more

African to purchase locally manufactured new cars. It is understood as an important requirement for the survival of Ghana's budding automotive industry.[9]

Second, regulation of used car imports as well as minimum standard requirements on imported parts and components should also be reviewed and harmonized in order to promote the aftersales market. About 25 African countries have implemented age requirements on used imports, 3 countries completely banned the import of used cars, except for electric vehicles such as in Algeria. Various countries such as Algeria, Botswana, Egypt, Ghana, Morocco, Nigeria, Rwanda and South Africa also require that imported cars comply with certain emission standards. With Euro 4 standard, Morocco currently imposes the most restrictive requirement (UNECE, 2022). With an increasing awareness of the environmental and security threats that import of used cars can pose on the economy, African countries are increasingly implementing higher restrictions. For instance, Ethiopia introduced a new tariff structure in 2020 to incentivize purchase of new vehicles. The tax rate on new vehicles decreased while it was heavily increased on used car imports. For used vehicles, depending on the age and engine size, the tax rate ranges from 55 per cent to 500 per cent. For example, a used 2-4 years old Toyota Yaris, with an engine size of 1500cc, is subject to a tariff rate of 160 per cent. In Nigeria, until 2021, tariff on used cars was 35 per cent which is significantly lower than on new vehicles (75 per cent). The 2020 finance bill provides a reduction of tariffs to 20 per cent, for both used and new vehicles. Auto car assembling companies that import Completely Knocked Down (CKD) and Semi-Knocked Down (SKD) vehicles enjoy between 0 and 10 per cent of tariff.[10]

At the regional level, ECOWAS countries have decided on new regulations for import of vehicles. By 2021, import requirement for used vehicles is a maximum age of 5 for Light Duty Vehicles (LDV), The ECOWAS region has now also adopted a Vehicles Directive for Euro 4/IV equivalent emission standards, which was implemented from January 2021. The EAC is also in the process of setting minimum standards for the import of used vehicles, after which each country will work towards passing these standards into legislation (UNECE, 2022).

Despite the restrictions in place, these requirements have had little impact on new vehicles import and local production without additional financial incentives to buy a new car. In fact, in some cases the requirement lead a reduction of cars on the road due to the price difference between used and new cars is too high. Hence, in order to encourage the sales of new vehicles, African governments should focus on reducing the price, including through tariffs. Intra-African tariff reduction through the AfCFTA can help access cheaper vehicles within the continent.

[9] https://www.modernghana.com/news/1205547/government-to-roll-out-vehicle-financing-scheme.html; https://www.ghanabusinessnews.com/2023/01/13/government-to-roll-out-vehicle-financing-scheme-for-ordinary-ghanaians-kyerematen/

[10] https://nairametrics.com/2022/04/12/customs-reduces-import-duty-for-used-and-new-vehicles-to-20/

Leveraging AfCFTA reduction of tariffs and non-tariff barriers

UNCTAD (2021) finds a currently untapped intra-African export potential in vehicles of $573 million due to various non-tariff barriers, including costly non-tariff measures, mismatches in quality of standards, and inadequate market information. Tariff liberalization under the AfCFTA could unlock an additional of US$ 1.9 billion of intra-African exports. The simple average tariff applied on vehicles (HS 8701-8705) imported from Africa was 4 per cent (2018-2020 average) as compared to 8 per cent on imports from the world (see EDAR 2023).

Within the supply chain, tariff advantages from regional sourcing also strongly vary. For instance, intra-African tariff advantages as compared to tariffs applied on imports from the world, are highest for Electric accumulators of nickel-iron (intra-African average tariff is 3 per cent and average tariff applied on imports from world is 13.3 per cent), of rubber tires, especially retreaded rubber tires (tariff difference of 10 percentage points), as well as vehicle bodies (9 percentage points) and seats (7.5 percentage points difference). Hence, the African market would be more attractive for firms procuring these parts and component on the continent, especially for Tier 1 products as shown in EDAR 2023 where the average tariff advantage for sourcing inputs form Africa amounts to almost 4 percent-points. In tier 2, it is around 3 percentage-points and in Tier 3 only 0.8 percentage-points. In Tier 2, rubber products – here, the inner tubes used in the production of tires - enjoy highest preferential treatment in the intra-African market. With the implementation of the AfCFTA, the tariff advantage of sourcing inputs from Africa will increase further.

However, in order to benefit from tariff advantages on vehicles trade, non-tariff barriers, including cumbersome non-tariff measures (NTMs) must be reduced. One of the most burdensome NTM includes complex rules of origin and its certification. The requirement for detailed documentation of origin criteria causes that only few companies can trade under preferential schemes. Rules of Origin (RoO) are an important instrument to promote regional value addition and to limit the importation of close to fully manufactured (SKD) vehicles, at least if vehicles are intended for regional export. The AfCFTA RoO are being negotiated on a sector-by-sector level, resulting in product-specific origin rules (Agarwal et al., 2022). As of January 2023, RoO in 88 per cent of tariff lines were concluded. However, the automotive sector is still not concluded. In order to allow more grant preferential market access even for SKD producers, extended and differential RoO should be adopted, allowing them higher imported content. However, such differential treatment will create high complexity. Currently, existing RECs apply RoO of 25-35 per cent. The African Association of Automotive Manufacturers (AAAM) is in favour of plurilateral agreements that go beyond simple RoO.

Following the example of other developing-country Preferential Trade Agreements such as Mercad Comun del Sur (MERCOSUR), the Andean Community and the Latin American Integration Association (LAIA), lesser developed countries could be allowed more leniency in terms of a lower level of originating content and the allowance of incentives such as duty drawbacks. Regional blocs such as the EU have successfully used such differential regime (Agarwal et al., 2022). The discussed dynamics in the automotive industry with regards to

supply shortages, increasing demand for electric vehicles requires more flexible RoO in order to allow companies to respond efficiently to any supply chain disruptions. In fact, considering the increasing amount of diverse metals needed for the production of an electric vehicle, a relaxation of RoO would promote investments.

Regional integration plays a crucial role in establishing a larger market and for the provision of parts and components at scale. For the example of the Southern African supply chain, Botswana for example has attracted FDI from two wiring harness component manufacturers that are producing for the nearby South African automotive OEMs. Similarly, Lesotho whose competitive advantage lays in labor-intensive automotive components attracted investment from a leather seat manufacturer due to lower wages in Lesotho. However, the regionalization of the supply chain remains limited due to remaining high transport and logistics costs, demanding quality assurance by OEMs, as well as regulatory disincentives. Even for the potential hub in Southern Africa, Angola, Botswana, Lesotho, and Zambia collectively supply less than USD 100 million component exports annually to South Africa which represents only 1.1 per cent of South Africa's imports of equipment and aftermarket parts (OECD, 2022).

Promoting supply chain linkages and financing

Tariff liberalization of sourcing inputs as discussed above is only one of the many factors making intra-African sourcing more attractive. In order to ensure "just-in-time" production, firms prefer to have their key suppliers in close proximity and at low transport costs. This is clearly a challenge in African countries with large distances between markets, OEMs and suppliers. Logistical costs are one reason why for instance, South Africa was not able to attract multinational component manufacturers to undertake more export from the continent. In the case of South Africa's export of fully assembled vehicles, the policy incentives have been strong enough to offset the logistical disadvantages (Wuttke, 2022).

Supply chain infrastructure involves transportation, communication, utilities and technology. Additional basic elements include security, risk, legal, contracts, insurance, customs and payment.[11] Technologies play an increasingly important role to connect suppliers and customers. Electronic data interchange technology is widely used between OEMs and their large suppliers for instance in the automotive industry. Better data and information sharing would attract more African countries to international investors as multinational companies also require supply chain information in order to be agile[12]; and to comply with Environmental, Social and Governance (ESG) regulation. However, according to World Bank Enterprise Surveys, only 77 per cent of surveyed African firms that are active in Tier 1 report communicating via email with their clients and suppliers. In contrast, the percentage is 87 per cent in East Asia, 98 per cent in Latin America and 92 per cent in South Asia. At Tier 2, only 49 per cent of firms in Africa used such mode of communication,

[11] https://www.supplychainbrain.com/blogs/1-think-tank/post/35583-the-african-supply-chain-and-its-new-trade-agreement

[12] https://www2.deloitte.com/us/en/insights/focus/supply-chain/supply-chain-agility-efficiency.html

compared to 80 per cent in East Asia, 95 per cent in Latin America and 84 per cent in South Asia. Although other communication channels are not captured in the surveys, such relatively poor communication and connection to suppliers and clients can be a key obstacle to find potential suppliers or customers and increase regional supplier linkages. Digital platforms allow to reach a larger customer base and realization of scale. For instance, the Nigerian-based e-commerce company, Jumia, established in 2012, has reached into 23 African countries (World Bank, 2019). In September 2022, Jumia announced collaboration with Zipline (one of the world's largest autonomous delivery system) to deploy automated delivery for e-commerce in Africa.[13] Although the warehousing sector has been growing by 24 per cent between 2006 and 2016[14], e-commerce sales, and industrial parks require greater logistics and robust warehousing which still remain a challenge in most African countries. The overall primary warehousing markets are in Nairobi and Johannesburg with increasing activity in Addis Ababa and Lagos.

In addition, the network of suppliers and distributors of vehicles and automotive parts and components is largely informal in most African countries (e.g., 70 per cent in Kenya, 70-80 per cent in Ghana). High informality is associated with limited regulation and standards, limited availability of skilled labour, and a high prevalence of low-quality of parts and components.

The supply chain can also be leveraged to improve access to finance through financing from suppliers/customers. According to World Bank Enterprises responses, enterprises report to have purchased working capital from their suppliers only in few African countries. With regards to Tier 1 companies, the values range from 1 per cent in Ethiopia to 40 per cent in Mauritius. The EDAR 2023 emphasizes the role of supply chain finance to improve enterprises' access to finance and bridge the payment gap through, for instance obtain financing by using its receivable as collateral or selling its receivable at a discount to a finance provider (UNCTAD, 2023).

In order to support financing of industrial players in the automotive supply chain, Afreximbank and the African Association of Automotive Manufacturers (AAAM) have entered into a memorandum where Afreximbank has committed to US$ 1 billion. The potential interventions include direct financing, project financing, guarantees and equity financing, amongst others. An example of private sector collaboration to improve financing along the supply chain is the Automotive Industry Transformation Fund (AITF), launched by the seven South Africa's OEMs, targeting funding of upstream and downstream businesses (Japan International Cooperation Agency and Boston Consulting Group, 2022).
Moreover, the lack of harmonization of standards and quality as well as the limited quality infrastructure makes it also difficult for parts and components suppliers to produce at sufficiently large scale. Quality infrastructure to certify standards is an important element

[13] https://group.jumia.com/news/zipline-and-jumia-join-forces-to-pioneer-drone-delivery-of-thousands-of-products-to-homes-across-africa

[14] https://www.turnerandtownsend.com/en/perspectives/warehouse-cost-index-2021/warehousing-across-africa/

in the supply chain, not only to secure safety but also to improve trust in locally produced products. Based on World Bank Enterprise Surveys (only latest year), covering the identified Tier 1 economic activities, only 26 per cent of African enterprises responded to have an internationally recognized quality certificate, compared to 60 per cent in East Asia and the Pacific, 64 per cent in Europe and Central Asia, 43 per cent in Latin America and 68 per cent in South Asia. At Tier 2, it is even less: only 20 per cent of African establishment have a recognized quality certificate (versus 48 per cent in East Asia and the Pacific, 52 per cent in Europe, 37 per cent in Latin America, and 50 per cent in South Asia). There are around 1432 international automotive standards worldwide. The African Organization for Standardization (ARSO) anticipated that on the continent, some 250 standards will need to be harmonized based on basic components and replacement parts to keep the vehicle safe and operational.[15]

Industrial policy and attracting investments

A firm's decision to invest in a certain country depends on various factors, most importantly the type of investment made. For horizontal investment (establishment of local production plant to target domestic market), the costs of establishing a new plant would need to be lower than transportation costs including tariffs. Vertical investment in contrast refers to outsourcing production processes and activities and the local establishment would export the product back to the lead firm. Therefore, trade costs could increase horizontal FDI but reduce vertical FDI, and horizontal FDI is more attractive to larger markets. With the exception of Morocco and to some extent South Africa, vertical investment in the automotive industry have been largely absent in Africa. The majority of investment was made by OEMs in the establishment of local SKDs to serve the local market. Fully assembled cars are more costly to transport than disassembled production kits or parts and components, which provides a strong incentive for horizontal investment. Although empirical evidence confirms that horizontal FDI are more interesting to protected markets, none of African markets is technically large enough to amortize a full assembly plant only through its domestic demand. The addressable market for an CKD assembly plant investment must be at least 50,000 sales of new passenger vehicles a year, and at least 750,000 for Completely-Built-Up (CBU) production (Japan International Cooperation Agency and Boston Consulting Group, 2022). In 2020, total new vehicle sales in Africa amounted to only 1.14 million units in 2021, of which around 383,000 were in South Africa, 240,000 in Egypt, and 133,000 in Morocco. Therefore, in order to attract investment in CKD and CBU plants which would create more value added and employment opportunities, total new vehicle sales in Africa must increase.

With regards to industrial policies used by developing countries, including African countries, tax policy remains one of the most widely used instruments to promote

[15] https://www.afreximbank.com/afreximbank-supports-arso-in-the-harmonisation-of-african-automotive-standards/

investment, although it is far from being the most important one (UNCTAD, 2022b).[16] Based on UNCTAD (2022b), investors are more concerned about improvements in transport and logistics, access to skilled workers and technicians, and favorable business climate rather than tax breaks and subsidies as the first are determinants whether the investment will amortize in the long-run (Freund and Moran, 2017)[17]. For the example of Morocco which has increasingly attracted investments especially from Europe, improvements in infrastructure have complemented the geographical advantages. The Tangier Med ports is now the biggest container port in Africa.[18] Port infrastructure is crucial to link to global and regional supply chains. Of the top 10 container ports (by volume) seven are in China, underlining its dominant role in supply chains.

In order to acquire the technological capabilities needed to manufacture more sophisticated automotive components, the attraction of component manufacturing FDI is needed. The experiences from Thailand, Morocco (see EDAR 2023) and South Africa (Box 1) have shown that without the participation of OEMs and component manufacturers through FDI the local industry can hardly evolve. Strong domestic demand, favorable location, infrastructure investment and supportive trade and industrial policy such as local content requirements, tax incentives and creation of special economic zones were among the key factors that attracted FDI in these countries.

Box 1: South Africa's automotive industrial policy plans

South Africa's Motor Industry Development Programme (MIDP), implemented in 1995, liberalised the industry. Key features of the MIDP were: (a) Reduced tariffs on light vehicles and components, with tariffs being phased down even faster than required by WTO obligations; (b) Removal of local content requirements; (c) Duty-free import of components up to 27 per cent of the wholesale value of the vehicle; (d) Duty rebate credits to be earned on exports of vehicles and components and used for duty-free import of vehicles and components (Wuttke, 2022).

In 2013, the Automotive Production and Development Programme (APDP) replaced the MIPD to restrict imports and incentivize local manufacturing. Import tariffs on CBU vehicles increased to 25 per cent and 20 per cent for Completely-Knock-Down kits, and import of used vehicles was banned (with a few exceptions). In addition, duty-free imports credits are offered based on local value added in the production process and for manufacturers that assemble more than 10.000 vehicle annually (Japan International Cooperation Agency and Boston Consulting Group, 2022). Despite the industrial policy, local parts content on vehicles made in South Africa declined from an average 40.9 per cent in 2013 to 38.7 per cent in 2015, according to South Africa's Automotive Industry Master

[16] UNCTAD's World Investment Report finds that the introduction of the minimum tax rate of 15% is expected to discourage MNEs from shifting profits to low-tax countries and increase tax revenues paid by MNEs. A potential downside is that global FDI could decrease by around 2%, according to UNCTAD estimates.

[17] https://www.piie.com/sites/default/files/documents/wp17-1.pdf

[18] https://african.business/2022/04/agribusiness-manufacturing/morocco-turns-to-hi-tech-manufacturing/

Plan to 2035 (2018). The decline happened to some extent because of how the secondary duty rebate mechanism – the volume assembly allowance (VAA) – is structure. The VAA provides OEMs with another duty rebate, as long as they assemble a minimum volume of vehicles in South Africa. However, due to this incentive, volume production has become more important than local value addition and sourcing.

The key objectives of the Automotive Industry Master Plan 2035, produced by the Department of Trade and Industry (DTI) to replace the APDP in 2021, are to increase local content of assembled cars up to 60 per cent by 2035, to double employment, upskilling black employees, and substantially increasing contribution of black-owned automotive component manufactures.

Important amendments to the APDP include, for instance, the replacement of the VAA by a Volume Assembly Localisation Allowance (VALA). While the 2020 VAA was based on the wholesale selling price of the vehicle produced in South Africa, irrespective of content source, with the new legislation adopted in 2021, incentives are no longer based solely on the wholesale selling price.19 OEMs must deduct the value of imported content from the vehicle's wholesale selling price.

While SACU members benefit from the South African industrial support, SADC member states fear that increased local content requirements in South Africa and tariff reduction will harm their respective national industries (OECD 2022).

Source: Various sources

There must be a regionally harmonized policy to attract large scale investment in both, assembly and parts and components. Regional industrialization initiatives are numerous on the continent. Yet, major challenges in implementation (e.g. inadequate business and regulatory environment; no concrete projects formulated; no involvement from donor community; lack of political will; lack of human, institutional and financial capacity) have limited the expected results (OECD, 2022). At the national level, implementation of government incentives is also often delayed[20]. In order to make industrialization plans successful there must be stronger incorporation of the private sector, including lead firms in the respective supply chains, industry association and other stakeholder, as well enhanced capacity building of national implementation authorities.

Skills development, Research and Development (R&D) and technology transfer

In order to increase local benefits for the economy, apart from local content requirements which are officially prohibited under WTO law and could also cause inefficiencies in sourcing inputs, other performance requirements include local training requirements, joint-venture requirements, technology transfer requirements and export requirements. Such requirements, for instance to transfer technology or R&D, must however be coupled with

[19] https://www.gov.za/speeches/minister-rob-davies-media-statement-south-african-automotive-masterplan-2035-and-extension

[20] An example of how delayed tax refunds have caused uncertainties and potential losses for the copper fabricator ZAMEFA is provided in (Makgetla et al., 2019).

national efforts to build national systems of innovation, including education and training. Technical education institutions should work with firms in the sector and ensure that the curriculum has an appropriate mix of apprentice training and classroom learning. In order to promote research and development that also meets demand, collaboration between universities and domestic as well as multinational firms should be encouraged. Investment Promotion Agencies (IPA) can play an important role in in providing a platform for establishing such networks and in attracting FDI in targeted sectors and. Research shows that targeted sectors can attract twice as much as non-targeted sectors and that each dollar spent on investment promotion can accumulate $189 FDI inflows (Freund and Moran, 2017). Greater digital transformation of IPAs would allow easier access to investors to accurate and up-to-date information. However, 2020, while 68 per cent of IPAs in developed countries provided comprehensive business- related information to investors through their various digital channels, only 21 per cent of agencies in developing countries and 2 per cent in least developed countries did so. IPAs from the poorest countries require support from international partners. UNCTAD provides technical assistance to governments and IPAs. [21]

R&D is in most cases exercised in the headquarters of the lead firms. For instance, none of the car assemblers in South Africa are engaged in local R&D due to absence of local brands. However, even without the presence of a local brand, Thailand has been successful to localize R&D activities of MNEs domestically. An important factor to attract R&D activities is regulatory framework and Intellectual Property policy that encourages investment and protects innovation, which is especially relevant in the fast-moving medium- and high-technology industries.

According to World Bank Enterprise Survey, only 16 per cent of the African companies supplying parts and components to the automotive industry invested in R&D, compared to double that share in the other regions (East Asia and Pacific 23 per cent, Europe: 30 per cent; Latin America: 30 per cent; South Asia 30 per cent). Many firms on the continent do not have the financial resources to engage in in-house R&D. Other alternatives are public R&D and/or partnerships with universities. The involvement of universities in supporting productive capacities is shown in the example of Africa's first semiconductor enterprise in Kenya. Semiconductor Technologies Limited was created through a public-private partnership between the Dedan Kimathi University of Technology, 4Wav Inc (a nanotechnology firm based in the US). However, the company still depends on annual funding due to the lack of local tech hardware companies what limits production at scale. Africa's first electric vehicle produced in Uganda was also born through a collaboration with the university, but the vehicle has not been commercialized yet.

Recently in January 2023, the Centre of Excellence in E-Vehicle and Industrial Welding Technologies at the Sunyani Technical University in Ghana is supported by the Ghana National Gas company seeking to build capacity in the niche area of electrical engineering for the production of electric vehicles.

[21] https://unctad.org/system/files/official-document/diaepcbinf2022d9_en.pdf

It shows that R&D is of course an important element, but without the sufficient productive capacity and/or collaboration with producers that would be able to put innovation into practice, investment in R&D might be ineffective.

Achieving scale and competitiveness through clustering production and identifying niche areas

Regarding the supply of materials, different vehicle models require different standards and specific requirements of metal products, and therefore, the suppliers would not be able to achieve sufficient economies of scale when meeting the demand in each single product (Wuttke, 2022). Even in South Africa for instance, aluminum production companies do not find the demand of vehicle production sufficient to expand, with only 10.9 per cent of their production going to the automotive industry in 2019. Hence, large scale assembly is important to facilitate investment in the supplier base, where in major components such as engines, economies of scale are even greater than in assembly. In order to achieve sufficient economies of scale and to save costs, the possibility of attracting multi-brand production plants with common components and systems could be a viable option.

The dominance of SKD plants on the continent is also cumbersome to leverage regional integration. For instance, within the East African Community (EAC), a 25 per cent Rules of Origin requirement applies on SKD vehicles but not on CKD vehicles. Similarly, RoO requirements within ECOWAS of 30 per cent cannot be met by SKD production plants. Hence, countries should aim to attract at least CKD assembly plants to enhance localization (between 10 and 40 per cent) and supplier development. However, the minimum requirement to make an investment in CKD plant, is 10-15 thousand units produced per plant (Agarwal et al., 2022). By increasing its assembly capacity and producing 50,000 units per year, a CKU plant would be able to attract domestically produced parts and components. Industrial policies should take the criteria of achieving minimum scale into account.

Due to the sheer variety of automobiles and international competition, African producers are unlikely to rely on the regional market to achieve sufficient scale, at least in the near future. For instance, even in Morocco which has a large production capacity, 75 per cent of total sales are imported from the EU and Turkey because imports provide wider range of models with preferential access under existing FTAs. Therefore, other African countries (such as Tunisia and Egypt) could benefit from nearshoring trends by European assemblers and attract especially assemblers in niche markets that are currently imported.

In addition, attracting multi-brand production plants could also allow to achieve higher scale of production plants and attract parts and components suppliers to the region. Based on World Bank Enterprise Surveys conducted in African countries, it is interesting to see that among the category of Manufacturing of motor vehicles (ISIC Rev. 4 34), on average (African average) 17 per cent are in Manufacturing of motor vehicles, while 45 per cent are in Manufacture of parts and accessories, and 38% in Manufacture of bodies. In contrast, the share of vehicle manufacturing as compared to parts and components is only 10 per cent in East Asia, 12 per cent in Europe, 4 per cent in Latin America and 4 per cent in South Asia.

Clustering production, for instance through industrial parks would also reduce high costs of production which make African companies less competitive compared to, for instance, Asian firms. In a highly competitive environment, African countries will not be able to compete with imported parts and components suppliers without tackling high operation costs. Using World Enterprise Survey, we find that at Tier 1, the biggest obstacles affecting the business is Electricity (18 per cent of respondents identified as main obstacle, followed by access to finance (14 per cent), and corruption (13 per cent). At Tier 2, 23 per cent of respondents reported electricity as being the biggest obstacle. Similarly, the majority of firms in East Asia and South Asia also report Access to finance, tax rates and electricity as main obstacles. The reported loss of annual sales due to power shortages is 6 per cent for African Tier 1 firms, compared to 0 per cent in Europe and East Asia and the Pacific, 2 per cent in Latin America and 5 per cent in South Asia. Tier 2 companies even reported an annual loss of 8 per cent due to power shortages. These circumstances, coupled with infrastructure inefficiencies explain that Africa's Tier 1 enterprises report the lowest capacity utilization rate: only 68 per cent on average is utilized. Tier 2 companies even report that only 60 per cent of the establishment's capacity was utilized (for comparison: East Africa and the Pacific 75 per cent; Europe 70 per cent; Latin America: 68 per cent and South Asia 77 per cent).

5. Conclusion

This paper produces a continental supply chain mapping of the automotive industry to identify African countries' potential to increase participation in this strategic industry. The complexity of the supply chain and the variety of input needed to assemble a car can provide various opportunities for developing and least developed countries in Africa.

The most significant parts lie in Tier 2 – the non-specific parts and components of the supply chain as these products are less complex and less technology-intensive to produce, they are also demanded by other industries. Therefore, they would more likely create jobs, local content and transfer of skills. In addition, some of these products require raw materials that are abundant on the continent and African countries could leverage the resource wealth to step up investments and production.

However, as the automotive industry is governed by OEMs on the continent and their key suppliers, it is essential to build strategic partnerships with leading firms to favor local sourcing and value addition of inputs from the continent. The findings of this paper confirm that not all African countries have the same opportunities and that there must be a strategic approach to coordinate continental production networks. The AfCFTA Secretariat is expected to play a key role in promoting the dialogue between African countries and could promote a regionally coordinated industrial policy. Trade policies and industrial policies are closely interlinked. If countries in a regional integration system promote the same products, neighbouring countries will end up with an exclusion list against each other in the same product, undermining national industrial policies (Odijie, 2019). The recent difficulties in finalizing the negotiations on RoO for the automotive industry are a symbol of national interests that may conflict with the aim of regional integration.

Despite the challenging implementation of a regional industrial policy strategy, sector negotiations taking the form of a division of labour to build a regional value chain should still be promoted more actively by regional institutions. UNCTAD can support African countries and the AfCFTA Secretariat to find their niches and most lucrative opportunities in the continental automotive supply chain.

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Appendix

Table 5: Top 10 destinations of Africa's exports of vehicles, 2018-2020 average, in thousands USD

8701 - Tractors (other than tractors of heading 8709)		8702 - Motor vehicles for the transport of >= 10 persons, incl. driver		8703 - Motor cars and other motor vehicles principally designed for the transport of persons		8704 - Motor vehicles for the transport of goods		8705 - Special purpose motor vehicles	
ZWE	44113.67	NGA	21689.416	DEU	3498878.67	BEL	586255	ZMB	8577.89
NAM	32394.48	HKG	20587.897	FRA	1663552.33	DEU	278784	MOZ	6162.92
MOZ	30940.43	BWA	11115.362	ESP	497450.967	FRA	218119	ARE	5377.97
ZMB	30174.73	GBR	9830.6147	USA	459613.533	ESP	205339	ZWE	4855.74
TZA	16011.82	NAM	9462.3807	JPN	456004.667	GBR	202589	SWZ	4723.55
BWA	11147.84	CMR	9385.779	ITA	374202.867	NAM	156010	NAM	3815.09
SUD	7060.572	UGA	7414.836	GBR	314208.44	BWA	122926	BWA	3620.1
SWZ	4937.697	ZWE	7299.5997	AUS	240758.667	MOZ	96671	LSO	2860.12
MWI	3747.915	SAU	6790.079	TUR	210347.45	GHA	92118	EGY	2531.83

Source: UNCTAD based on UN COMTRADE.

Table 6: Intra-African export capacity by Tier 1 products, average 2018-2020

product code	Contry/ description	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central African R.	Comoros	DR of the Congo	Rep. of the Congo	Cote d'Ivoire	Egypt	Eswatini	Ethiopia	Gambia, The	Ghana	Kenya	Lesotho	Libya	Madagascar	Malawi	Mali	Mauritania	Mauritius	Morocco	Mozambique	Namibia	Niger	Nigeria	Rwanda	São Tomé and Principe	Senegal	Seychelles	Sierra Leone	South Africa	Sudan	Tanzania	Togo	Tunisia	Uganda	Zambia	Zimbabwe
401110	New pneumatic tyres, of rubber of a kind used o	x	x	x										x					x														x		x	x				x	x	x	
401120	New pneumatic tyres, of rubber of a kind used o	x												x					x					x			x	x						x			x			x	x	x	
401130	New pneumatic tyres, of rubber for aircraft													x																							x							
401140	New pneumatic tyres, of rubber of a kind used o																																				x					x		
401150	New pneumatic tyres, of rubber of a kind used o																																				x					x		
401210	Retreaded tyres of rubber																																				x							
731511	Chain, roller, iron or steel																																				x		x					x
830120	Locks of a kind used for motor vehicles of base																																				x						x	
830230	Mountings,fittings and similar art. of base mtl											x																									x							
840731	Engines, spark-ignition reciprocating, displaci																																				x							
840732	Engines, spark-ignition reciprocating, displaci																																											
840733	Engines, spark-ignition reciprocating displacin																																											
840734	Engines, spark-ignition reciprocating displacin																																				x							
840820	Engines, diesel, for the vehicles of Chapter 87																										x										x							
840890	Engines, diesel nes																										x										x							
840991	Parts for spark-ignition type engines nes			x										x					x								x										x				x			
840999	Parts for diesel and semi-diesel engines	x		x	x						x		x					x	x							x	x	x						x			x				x		x	
841330	Fuel, lubricating or cooling medium pumps			x							x							x									x										x				x		x	
841391	Parts of pumps for liquid whether or not fitted	x		x			x				x	x						x	x								x										x		x		x	x	x	
841430	Compressors of a kind used in refrigerating equ			x										x													x										x				x			
841459	Fans nes																		x								x										x		x					
841582	Air cond mach nes, inc a refrigerating unit													x													x										x						x	
841590	Parts of air conditioning machines				x									x												x	x							x										
842123	Oil or petrol-filters for inten. combustion eng.													x				x	x							x	x							x			x				x		x	
842131	Intake air filters for internal combustion engi			x															x								x										x				x			x
842139	Filtering or purifying machinery and apparatus			x																							x										x							
848310	Transmission shafts and cranks			x	x														x	x				x					x								x				x		x	
850132	DC motors,DC generators																																				x							
850710	Lead-acid electric accumulators of a kind used	x		x										x					x				x			x	x										x				x			x
850730	Nickel-cadmium electric accumulators																				x																x							
850780	Electric accumulators, nes			x															x								x			x				x			x				x	x		x
850790	Parts of electric accumulators, including separ													x																							x					x			
851110	Spark plugs			x																																	x							
851120	Ignition magnetos																																											
851130	Distributors and ignition coils																																				x							
851140	Starter motors				x																							x									x							
851150	Generators and alternators									x		x						x																				x					x		
851180	Glow plugs and other ignition or starting equip																																				x							
851190	Parts of electrical ignition or starting equipm			x																																	x					x		
851220	Lighting or visual signalling equipment nes											x																									x				x			
852719	Radio broad rece capable of op w/o an external											x																									x		x					
852721	Radio rece not capable of op w/o ext source of																																				x							
852729	Radio rece not capable of op w/o ext source of																																				x		x					
870600	Chassis fitted with engines for the vehicles of														x				x																		x			x				
870710	Bodies for passenger carrying vehicles																																				x		x					
870790	Bodies for tractors, buses, trucks and special			x										x					x								x										x							
870821	Safety seat belts for motor vehicles																																				x							
870829	Parts and accessories of bodies nes for motor v			x										x					x								x										x				x		x	
870839	Brake system parts nes for motor vehicles			x															x								x										x		x		x		x	
870840	Tansmissions for motor vehicles	x		x																								x	x								x						x	
870850	Drive axles with differential for motor vehicle			x														x	x								x	x	x					x			x						x	
870870	Wheels including parts and accessories																											x									x							
870880	Shock absorbers for motor vehicles			x															x										x								x				x		x	
870891	Radiators for motor vehicles			x																									x								x						x	
870892	Mufflers and exhaust pipes for motor vehicles													x																							x							
870893	Clutches and parts for motor vehicles																																				x							
870894	Steering wheels, steering columns and steering																		x																		x					x		
870899	Motor vehicle parts nes			x							x		x	x	x			x	x	x					x	x	x	x						x			x		x		x	x	x	x
902910	Revolution counters																																				x							
902920	Speed indicators and tachometers																																				x							
902990	Parts and access of revolution counters																																				x							
940120	Seats, motor vehicles													x					x								x										x							
940190	Parts of seats other than those of heading No 9																			x							x										x							
Total product by country		6	1	21	4	0	1	0	0	1	4	5	2	14	2	0	0	7	20	3	1	0	1	2	0	5	23	7	6	2	0	0	0	8	0	1	60	0	9	1	19	7	18	5

Source: Authors based on UN COMTRADE. Note: "x" indicates current exports to African countries (at least $100,000).

Table 7. Export diversification opportunities (all) by Tier 1 products, average 2018-2020

product code	Contry/ description	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central African Rep.	Comoros	DR of the Congo	Rep. of the Congo	Cote d'Ivoire	Egypt	Eswatini	Ethiopia	Gambia, The	Ghana	Kenya	Lesotho	Libya	Madagascar	Malawi	Mali	Mauritania	Mauritius	Morocco	Mozambique	Namibia	Niger	Nigeria	Rwanda	São Tomé and Príncipe	Senegal	Seychelles	Sierra Leone	South Africa	Sudan	Tanzania	Togo	Tunisia	Uganda	Zambia	Zimbabwe
401110	New pneumatic tyres, of rubber of a kind used o	x	x	x			1			1		1	1	x				1	x		1						1				1	1	x		x	x		x				x	
401120	New pneumatic tyres, of rubber of a kind used o	x	1	1							1	1		x					x				x	1		x	x	1	1					x	1		x		1	x	x	x		
401130	New pneumatic tyres, of rubber for aircraft		1	1				1				1		x	1			1	1			1			1	1	1	1	1					1	1	x			1	1	1		
401140	New pneumatic tyres, of rubber of a kind used o	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1		1	1	1		1		x		1	1	1		1
401150	New pneumatic tyres, of rubber of a kind used o	1		1	1			1	1			1		1	1		1	1	1	1		1	1	1				1	1	1	1	1			1	1	x	1		1		1	1
401210	Retreaded tyres of rubber			1										1	1	1			1							1	1				1				1	x	1		1	1	1		
731511	Chain, roller, iron or steel	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	x	1	1	1	x	1	x
830120	Locks of a kind used for motor vehicles of base	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	x		1
830230	Mountings,fittings and similar art. of base mtl	1	1		1	1	1	1			x		1		1				1			1	1	1	1					1		1			1	1	x		1				1
840731	Engines, spark-ignition reciprocating, displaci																																			x								
840732	Engines, spark-ignition reciprocating, displaci																																											
840733	Engines, spark-ignition reciprocating displacin	1	1	1			1	1				1		1	1	1		1	1	1				1		1		1	1	1			1	1			1		1	1	1		1	
840734	Engines, spark-ignition reciprocating displacin	1	1	1	1	1	1	1		1	1	1	1	1	1	1		1		1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1	1	1		1	1
840820	Engines, diesel, for the vehicles of Chapter 87	1	1		1	1	1	1			1	1	1			1	1				1		1	1	1		x		1		1		1		1	1	x	1	1	1		1	
840890	Engines, diesel nes		1		1			1	1	1	1	1	1			1	1			1	1	1	1	1	1		x		1		1		1			1	x	1	1				
840991	Parts for spark-ignition type engines nes			x			1		1				1					1	x								x						1				x			x		1		
840999	Parts for diesel and semi-diesel engines	x		x	x							x	x					x	x						x		x	x					x			x			x		x		
841330	Fuel, lubricating or cooling medium pumps			x									x					x									x									x			x		x		
841391	Parts of pumps for liquid whether or not fitted	x		x			1	x			x		x	1				x	x						1	x		1		1				1		1	x			x	x	x	x	
841430	Compressors of a kind used in refrigerating equ	1	1	x	1	1	1		1	1	1	1	1	x		1				1	1	1	1	1	1		x	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
841459	Fans nes	1			1														x								x					1		1	1	1					1	x		1
841582	Air cond mach nes, inc a refrigerating unit	1	1	1	1			1					1	x	1	1		1	1	1	1	1	1	1	1		x		1	1		1			1	1	1	x			1	1	1	x	
841590	Parts of air conditioning machines		1		x			1	1	1		1	1	1	x		1	1				1		1	1	1	x	x		1		1		1	1	x			x		1	1			1
842123	Oil or petrol-filters for intern. combustion eng													x					x	x						x	x									x						x		
842131	Intake air filters for internal combustion eng			x		1				1		1							x					1			x					1					x							x
842139	Filtering or purifying machinery and apparatus		1	x			1	1	1				1		1			1	1			1			1		x		1	1	1			1	1	1	x	1	1	1	1	1	1	1
848310	Transmission shafts and cranks	1		x	x			1		1	1	1	1	1	1	1		1	x	x		1		x	1			x	1	1	1	1	1	1		1	x	1	1	x	1	1	x	1
850132	DC motors,DC generators,of an output exceeding		1	1		1	1	1				1	1	1	1				1		1	1			1	1	1	1	1	1	1				1		x		1	1	1			
850710	Lead-acid electric accumulators of a kind used	x	1	x		1		1				1	1		x	1	1		1	x			1	x	1		x	x			1	x	1		1	1	1	x	1		1	x	1	1	x
850730	Nickel-cadmium electric accumulators	1	1	1	1			1	1	1	1	1	1	x	1	1	1	1	1	1	x	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
850780	Electric accumulators, nes			x						1		1		1		1		1	x	1			1				x	1		x	1			x			x	1		x	x	1		x
850790	Parts of electric accumulators, including separ	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	x	1	1	1	1
851110	Spark plugs			x										1												1	1										x						1	1
851120	Ignition magnetos													1															1												1			
851130	Distributors and ignition coils	1	1	1			1	1				1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1			x	1		1	1	1	1	1
851140	Starter motors	1			x				1					1							1							x								1	x							
851150	Generators and alternators	1	1				1			x	x			1				x	1														1		1		x				1	1	x	
851180	Glow plugs and other ignition or starting equip	1	1	1			1	1			1	1	1		1	1	1	1	1	1		1		1		1		1	1	1		1			1	x					1	1	1
851190	Parts of electrical ignition or starting equipm	1	1	x		1		1	1	1	1	1	1	1		1	1	1		1		1	1	1	1			1	1	1	1	1	1	1	1		x	1	1		1		x	1
851220	Lighting or visual signalling equipment nes	1	1		1			1			x	1	1	1		1			1				1		1		1			1		1	1	1	1	x		1	1	x		1	1
852719	Radio broad rece capable of op w/o an external							1			x		1		1	1		1	1	1	1	1					1	1	1	1	1	1				x		1	1	1		1	1	1
852721	Radio rece not capable of op w/o ext source of	1	1	1	1		1	1	1		1	1	1	1	1	1	1		1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
852729	Radio rece not capable of op w/o ext source of	1			1	1					1	1		1	1	1			1	1	1	1									1				1	1	x				x		1	1
870600	Chassis fitted with engines for the vehicles of	1		1	1		1	1	1		1	1		1	x	1		1	x			1		1		1	1	1		1		1			1	1	1	x		1	1	1	1	1
870710	Bodies for passenger carrying vehicles	1		1	1		1	1	1		1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	x	1	1	1	x	1	1
870790	Bodies for tractors, buses, trucks and special	1		1	x		1	1	1		1	1	1	x	1	1	1	1	x	1	1	1					1	x		1	1	1	1	1		1	1	1	1	1	1	1	1	1
870821	Safety seat belts for motor vehicles	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
870829	Parts and accessories of bodies nes			x						1				x					x								x									x			x			x	
870839	Brake system parts nes for motor vehicles			x															x								x									x			x		x	x	
870840	Tansmissions for motor vehicles	x	1	x	1	1	1	1	1	1	1	1	1		1	1	1	1					1	1	1	1		x	x	1	1	1	1	1	1	1	x	1	1			x		1
870850	Drive axles with differential for motor vehicle	1		x				1				1			1			x	x								x	x	x	1				x			x			1		x		
870870	Wheels including parts and accessories	1		1	1						1	1	1	1	1	1	1	1			1		1	1	1			x		1	1			1		1	1	x	1	1		1	1
870880	Shock absorbers for motor vehicles			x											x														x											x			
870891	Radiators for motor vehicles			x				1																				x														1	x	
870892	Mufflers and exhaust pipes for motor vehicles	1	1	1	1		1	1	1	1	1	1	1	x	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	x	1	1	1	1	1	1	1
870893	Clutches and parts for motor vehicles							1		1					1	1			1									1	1								x							1
870894	Steering wheels, steering columns and steering		1	1	1		1	1	1		1		1		1			1	x		1		1	1	1				1	1	1	1		1	1	1	x	1	1	x		1	1	
870899	Motor vehicle parts nes			x								x	x	x	x			x	x	x						x	x	x	x					x			x		x	x	x	x	x	
902910	Revolution counters,production counters taximet	1	1	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1			1	1	1	1	1	1	1	1			1	1	1	x	1	1	1	1	1	1	1
902920	Speed indicators and tachometers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
902990	Parts and access of revolution counters	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
940120	Seats, motor vehicles	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1	1
940190	Parts of seats other than those of heading No 9		1			1		1	1		1									x			1				x						1				x		1					
Total current capacity		6	1	21	4	0	0	1	0	1	5	2	4	14	2	0	0	7	20	3	1	0	1	2	0	5	23	7	6	2	0	0	0	8	0	1	60	0	1	19	7	9	18	5
Total diversification opportunities		32	33	27	30	17	30	39	28	18	33	40	31	26	33	36	22	31	27	26	26	30	28	30	28	26	18	32	30	35	29	31	29	28	35	31	1	33	34	21	29	29	25	30

Source: Authors based on UN COMTRADE.

Table 8: Intra-African export capacity by Tier 2 products, average 2018-2020

product code	Contry/ description	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central African Republic	Comoros	Democratic Republic of the Congo	Republic of the Congo	Cote d'Ivoire	Egypt	Eswatini	Ethiopia	Gambia, The	Ghana	Kenya	Lesotho	Libya	Madagascar	Malawi	Mali	Mauritania	Mauritius	Morocco	Mozambique	Namibia	Niger	Nigeria	Rwanda	São Tomé and Príncipe	Senegal	Seychelles	Sierra Leone	South Africa	Sudan	Tanzania	Togo	Tunisia	Uganda	Zambia	Zimbabwe
3209	Paints and varnishes		x		x								x	x				x	x							x										x				x	x		
3917	Tubes, pipes and hoses and fittings thereof			x									x	x				x	x							x										x		x		x	x		
4104	Leather of bovine or equine animals													x					x								x		x	x						x	x	x		x	x		
4812	Filter blocks, slabs and plates of paper pulp																																			x							
5903	Textile fabrics impregnated			x									x	x	x				x							x	x										x							
7318	Screws, bolts, nuts, coach screws, etc												x	x					x							x	x							x			x		x		x		x	
8484	Gaskets and similar joints of metal sheeting																																x			x				x			
8506	Cells and batteries; primary	x		x										x					x					x		x										x		x			x	x	
8507	Electric accumulators, including separators therefor			x										x					x		x					x	x										x				x	x		x
290122	Acyclic hydrocarbons; unsaturated, propene (propylene)																				x																						
392020	Plastics; of polymers of propylene, plates, sheets												x	x					x				x							x				x			x			x	x	x		
400950	Tubes, pipes and hoses, of vulcanized rubber wi				x							x	x	x	x																						x		x		x			
401310	Rubber; inner tubes, of a kind used on motorcars																																			x							
401320	Rubber; inner tubes, of a kind used on bicycles				x																																				x		
401390	Rubber; inner tubes, n.e.c. in heading no. 4013																																			x					x		
401693	Gaskets, washers and other seals, of vulcanized			x															x							x	x									x				x		x	
401699	Articles of vulcanized rubber, nes			x															x							x		x								x		x		x		x	
681310	Asbestos brake linings and pads																			x						x										x							
681390	Asbestos friction material and articles nes																									x										x							
700711	Safety gls toughened (tempered) for vehicles,ai													x																						x							
700721	Safety glass laminated for vehicles, aircraft,													x					x																	x							
700910	Rear-view mirrors for vehicles																																			x							
761090	Structures&parts,alum,eg plate,rods etc,for str				x		x						x	x						x						x	x									x				x		x	
848210	Bearings, ball			x								x																									x				x			
848220	Bearings, tapered roller, including cone and ta																																			x							
848240	Bearings, needle roller																																			x							
848250	Bearings, cylindrical roller, nes																	x																		x				x			
848280	Bearings, ball or roller, nes, including combin																																			x						x	
848299	Bearing parts, nes																																			x						x	
853910	Sealed beam lamp units																																			x							
853921	Filament lamps, tungsten halogen																									x										x							
854150	Semiconductor devices, nes																																			x							
854430	Ignition wiring sets&oth wiring sets of a kind			x																						x										x				x			
870810	Bumpers and parts for motor vehicles																											x								x		x					
Total product by country		1	1	8	4	0	1	0	0	0	0	2	7	12	2	0	0	3	11	2	2	0	1	1	0	5	13	1	3	1	1	0	0	3	0	0	32	1	7	1	14	8	7	1

Source: Authors based on UN COMTRADE. Note: "x" indicates current exports to African countries (at least $100,000).

Table 9: Export diversification opportunities (all) by Tier 2 products, average 2018-2020

product code	Contry/ description	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central African Republic	Comoros	Democratic Republic of the Congo	Republic of the Congo	Cote d'Ivoire	Egypt	Eswatini	Ethiopia	Gambia, The	Ghana	Kenya	Lesotho	Libya	Madagascar	Malawi	Mali	Mauritania	Mauritius	Morocco	Mozambique	Namibia	Niger	Nigeria	Rwanda	São Tomé and Príncipe	Senegal	Seychelles	Sierra Leone	South Africa	Sudan	Tanzania	Togo	Tunisia	Uganda	Zambia	Zimbabwe
3209	Paints and varnishes	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
3917	Tubes, pipes and hoses and fittings thereof	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
4104	Leather of bovine or equine animals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	x	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
4812	Filter blocks, slabs and plates of paper pulp	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5903	Textile fabrics impregnated	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
7318	Screws, bolts, nuts, coach screws, etc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8484	Gaskets and similar joints of metal sheeting		1	1	1	1	1	1	1	1	1		1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1		1	1	1	1
8506	Cells and batteries; primary	1	1	x	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
8507	Electric accumulators, including separators therefor	1	1	1	1		1					1	1	1	1	1			1		1	1	1	1	1	1	1	1	1		1		1	1	1	1	x		1	1	x	1	1	1
290122	Acyclic hydrocarbons; unsaturated, propene (propylene)													1	1			1	1	1	x					1	1	1										1	1		1			
392020	Plastics; of polymers of propylene, plates, sheets	1	1	1	1			1	1	1	1	1	1	x	1	1		1	x	1	1	1	1	1	1			1	1	1	x	1	1	1	1	1	x	1		1	x	1	1	1
400950	Tubes, pipes and hoses, of vulcanized rubber wi				x						1	x	x	x	x								1		1								1				x	1	x	1	x			
401310	Rubber; inner tubes, of a kind used on motorcars	1	1	1	1		1			1	1	1	1	1	1	1			1		1	1	1		1	1	1	1	1	1	1	1	1	1	1	x	1		1		1	1	1
401320	Rubber; inner tubes, of a kind used on bicycles	1		1	1					1	1		1	1	1				1			1				1	1			1		1			1	1					x		
401390	Rubber; inner tubes, n.e.c. in heading no. 4013		1	1		1		1	1	1			1	1			1		1		1				1	1	1				1	1			1	1	1				1	x		
401693	Gaskets, washers and other seals, of vulcanized			x															x								x	x									x				x		x	
401699	Articles of vulcanized rubber, nes			x															x								x		x								x		x		x		x	
681310	Asbestos brake linings and pads	1	1	1	1	1		1	1		1	1	1	1	1	1		1	1	1	1	1	1	1				1		1	1		1		1	1	1			1		1	1
681390	Asbestos friction material and articles nes	1	1	1	1				1		1	1	1	1	1	1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1
700711	Safety gls toughened (tempered) for vehicles,ai	1	1		1	1	1	1	1	1	1	1	1	x		1		1	1	1	1	1	1	1	1				1		1	1	1	1		1	1	x	1		1	1	1	1
700721	Safety glass laminated for vehicles, aircraft,	1	1	1	1	1			1	1	1		1	x	1	1	1		1	1	1	1	1		1				1		1		1	1		1	1	x	1		1	1	1	1
700910	Rear-view mirrors for vehicles	1	1		1	1	1		1		1	1	1	1		1	1	1	1	1	1		1	1	1				1		1		1	1			x	1	1			1		1
761090	Structures&parts,alum,eg plate,rods etc,for str	1	1	1	1		1	1			1	1	1	x	1	1	1		1	1	1	1	1	1		x	x		1	1	1		1	1	1	1	x			1	x	1	1	1
848210	Bearings, ball			x								x							1												1						x			1	x				
848220	Bearings, tapered roller, including cone and ta	1	1	1	1		1		1		1	1		1	1			1	1	1				1			1	1	1	1				1	1		x	1			1	1	1	1
848240	Bearings, needle roller	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	x	1	1	1	1	1	1	1
848250	Bearings, cylindrical roller, nes	1		1	1		1	1	1				1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		1	1	1	1	x	1	1	1	1		1	1
848280	Bearings, ball or roller, nes, including combin	1	1				1	1	1		1	1	1	1		1	1			1	1	1	1	1	1				1		1	1		1	1		x	1		1	1	1	x	1
848299	Bearing parts, nes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1		1	1	1	1	1	1	1		1		x	1	1	1		1	1	1
853910	Sealed beam lamp units		1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1			1	1	1	x	1	1	1	1	1	1	1
853921	Filament lamps, tungsten halogen	1			1		1	1	1	1		1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1			1	1	1	x	1	1	1	1	1	1	1
854150	Semiconductor devices, nes		1										1	1	1	1									1	1			1					1			x		1				1	
854430	Ignition wiring sets&oth wiring sets of a kind	1	1	1	1		1	1	1	1	1	1			1	1	1	1		1	1	1	1	1	1		x			1		1	1	1	1	1	x	1	1	1	x	1	1	1
870810	Bumpers and parts for motor vehicles	1	1	1		1	1	1	1	1	1	1				1	1	1	1	1	1		1	1					1			1		1	1	1	x		1	1		1	1	1
Total product by country		25	26	27	26	15	23	20	24	20	25	25	27	29	25	25	21	21	30	25	25	22	25	24	25	21	24	24	24	24	19	22	23	21	26	22	33	24	22	25	28	27	27	26

Source: Authors based on UN COMTRADE.

Table 10. Intra-African export capacity by Tier 3 products, average 2018-2020

product code	Contry/ description	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central African Republic	Comoros	Democratic Republic of the Congo	Republic of the Congo	Cote d'Ivoire	Egypt	Eswatini	Ethiopia	Gambia, The	Ghana	Kenya	Lesotho	Libya	Madagascar	Malawi	Mali	Mauritania	Mauritius	Morocco	Mozambique	Namibia	Niger	Nigeria	Rwanda	São Tomé and Principe	Senegal	Seychelles	Sierra Leone	South Africa	Sudan	Tanzania	Togo	Tunisia	Uganda	Zambia	Zimbabwe
2504	Natural graphite													x																									x					
2505	Natural sands of all kinds																	x	x								x		x								x		x		x		x	
2601	Iron ores and concentrates																	x														x				x					x	x	x
2602	Manganese ores and concentrates										x																x										x					x		
2603	Copper ores and concentrates			x							x																										x					x		
2604	Nickel ores and concentrates																																											x
2606	Aluminium ores and concentrates																	x										x			x							x						
4001	Natural rubber, balata, gutta-percha						x				x		x	x									x								x						x							
4002	Synthetic rubber and factice derived from oils																		x								x							x										
4101	Raw hides and skins of bovine															x					x											x												
5002	5002 - "Raw silk ""non-thrown"""																																												
5201	Cotton, neither carded nor combed		x		x		x						x	x	x	x				x		x	x					x			x			x			x	x	x	x		x	x	x
7202	Ferro-alloys													x					x																		x		x				x	x
7203	Ferrous products												x	x							x																x							x
7206	Iron and non-alloy steel in ingots or other primary forms	x												x							x																	x		x	x			
7207	Semi-finished products of iron or non-alloy steel	x				x						x		x					x		x			x							x			x			x						
7402	Copper anodes (unrefinded) for electrolytic refining										x								x												x						x						x	
7403	Copper, refined, and copper alloys, unwrought			x							x																		x								x				x		x	x
7409	Plates, sheets and strip, of copper													x															x								x						x	
7601	Unwrought aluminium													x												x					x						x		x		x			
7606	Plates, sheets and strip, of aluminium						x						x	x				x	x								x							x			x		x		x	x		
260500	Cobalt ores and concentrates										x																																x		
390210	Polypropylene, in primary forms				x								x	x	x				x				x	x			x			x	x			x			x		x			x	x	
390410	Polyvinyl chloride, not mixed with other substa													x					x																		x							
390422	Plasticised polyvinyl chloride mixed, in primar												x	x																							x							
390950	Polyurethanes, in primary forms													x					x							x	x										x							
Total product by country		2	1	2	2	1	3	0	0	0	6	1	6	14	2	2	0	4	8	1	4	1	3	2	0	2	6	3	3	1	7	2	0	5	0	1	20	1	9	1	6	5	11	6

Source: Authors based on UN COMTRADE. Note: "x" indicates current exports to African countries (at least $100,000).

Table 11: Intra-African export capacity by industrial equipment , average 2018-2020

product code	product description	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central African Republic	Comoros	Democratic Republic of the Congo	Republic of the Congo	Cote d'Ivoire	Egypt	Eswatini	Ethiopia	Gambia, The	Ghana	Kenya	Lesotho	Libya	Madagascar	Malawi	Mali	Mauritania	Mauritius	Morocco	Mozambique	Namibia	Niger	Nigeria	Rwanda	São Tomé and Príncipe	Senegal	Seychelles	Sierra Leone	South Africa	Sudan	Tanzania	Togo	Tunisia	Uganda	Zambia	Zimbabwe
7318	Screws,bolts,nuts,screw hooks,rivets,similar ar	x		x								x	x	x				x	x							x	x	x	x				x			x		x		x	x	x	
8428	Lifting, handling, loading or unloading machinery	x		x							x	x	x		x				x			x				x	x	x					x			x		x		x	x	x	x
8455	Metal-rolling mills and rolls therefor																		x														x			x				x			
8462	Machine tools for working metal																		x	x							x										x					x		
820730	Interchangeable tools for pressing, stamping or punching																																				x							
820790	Interchangeable tools for hand tools			x	x								x																				x			x						x	
846210	Forging or die-stamping machines																																				x							
847950	Industrial robots, n.e.s.											x																									x				x			
847981	Machinery for treating metal, incl. electric wire coil-winders	x																																			x							
Total product by country		3	0	3	1	0	0	0	0	0	1	3	3	1	1	0	0	1	4	1	0	1	0	0	0	2	3	2	1	0	0	0	0	4	0	0	9	0	2	0	4	3	3	1

Table 12: Automotive supporting services, as surveyed in World Bank Enterprise Surveys, in % of total enterprises (if not stated otherwise)

	ISIC Rev. 4	ISIC Rev. 3.1	Sub-Saharan Africa	East Asia and Pacific	Europe and Central Asia	Latin America	Middle East and North Africa	South Asia
Electric power generation	3510	4101						
Sale of motor vehicles	4510	5010	0.9	1.0	0.6	0.8	0.7	2.1
Maintenance and repair of motor vehicles	4520	5020	1.9	1.2	1.3	0.9	1.2	0.6
Sale of motor vehicle parts and accessories	4530	5030	1.3	0.7	0.5	1.1	1.1	0.4
Sale, maintenance and repair of motorcycles	4540	5040	0.4	0.4	0.1	0.2	0.2	0.3
Wholesale of construction materials	4663	5143	1.2	0.8	1.2	0.9	1.6	0.1
Wholesale of waste and scrap	4669	5149	0.2	0.2	0.2	0.2	0.2	0.1
Wholesale of other machinery and equipment	4659	5159	0.5	0.6	1.2	0.8	1.0	0.1
Freight rail transport	4912	6010	0.1	0.1	0.1	0.0	0.1	0.0
Freight transport by road	4923	6023	1.0	1.2	1.7	0.9	0.6	0.2
Cargo handling	5224	6301	0.5	0.2	0.1	0.2	0.1	0.1
Storage and warehousing	5210	6302	0.1	0.1	0.2	0.2	0.1	0.8
Service activities incidental to land transportation	5221	6303	0.2	0.2	0.2	0.3	0.3	0.1
Other transportation support activities	5229	6303						
Other monetary intermediation	6419	6591						
Other financial service activities	6499	6599						
Other activities auxiliary to financial service activities	6619	6599						
Leasing of intellectual property	7740	7111, 7122, 7129						
Combined office administrative service activities	8211	NA						
Total number in automotive related services			1'855	740	2'261	951	282	677
Total number of surveyed enterprises			22'645	11'300	30'609	14'522	3'945	13'725
Automotive related services (% of total)			8.2	6.5	7.4	6.5	7.1	4.9

Source: Author's calculations based on World Bank Enterprise Survey, various year.

Note: Only latest year of survey is included for each country. The country classification as reported in the surveys.