Challenges and Opportunities of Logistics in African Countries

Technische Universität Berlin

AUTHORS

Prof. Dr. Frank Straube

Head of Chair of Logistics
Berlin University of Technology

straube@logistik.tu-berlin.de

Dr. Benjamin Nitsche

Manager ILNET
Berlin University of Technology

nitsche@logistik.tu-berlin.de

Angelica Coll, M.Sc.

Research Associate
Berlin University of Technology

coll@logistik.tu-berlin.de

IN COOPERATION WITH

Dr. Jonas Barayandema – College of Business and Economics, University of Rwanda

Dr. Gershome Abaho G. – Department of Civil Environment and Geomatic Engineering, University of Rwanda

Dr. Henry Kofi Mensah – Department of Human Resource and Organizational Development, Kwame Nkrumah University of Science and Technology

Dilnesahu Samuel – Department of Logistics and Supply Chain Management, Addis Ababa University

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1. INTRODUCTION

1.1 Importance of Logistics Performance Improvements in African Countries

International logistics networks are changing and are currently facing more challenges than ever before. The advancing globalization increases the complexity of international logistics networks. Disruptions in logistics networks have increased and solutions for dealing with them are being developed. Digitalization represents an enormous opportunity to respond quickly to rapid changes in increasingly complex logistics networks. Although the digitization of logistics networks and the associated changes require a great deal of attention from logistics managers, another core challenge of international logistics should not be neglected. Achieving sustainable international logistics networks is undoubtedly one of the most important goals of this decade. The focus of efforts concerning this issue is currently being placed at the reduction the CO2 emissions. This focus is understandable and correct. However, especially in sustainability, the integration of developing and emerging countries into international logistics networks. This process is one of the core challenges of our society, as responsible globalization that integrates African countries in a sustainable way holds enormous potential. Only in this way, the fight against poverty, hunger, gender inequalities and discrimination of minorities possible in the long term. Logistics has a decisive role to play here and, if properly designed, can contribute directly to improved trade and increased value creation in low-income countries and thereby contribute to a sustainable development of the continent, including economic growth and sustainable job creation.

The sustainable integration of the African continent plays a crucial role for the advancement of global value creation systems. Africa is the largest market of the future, and one that is still being tapped to a limited extent. It has enormous potential, which must be utilized both for economic and social purposes. A rapidly growing, very young population seeks to contribute as an equal part to this development. Therefore, solutions are needed that take into account the special characteristics of African countries, rather than simply transferring strategies from industrialized countries to exploit the economic development potential of these countries. To enable this development and a responsible globalization in cooperation with of Sub-Saharan Africa (SSA), efficient logistics is essential. However, part of the truth is that regarding logistics performance, many SSA countries are currently lagging far behind many industrialized countries. Currently, there are many logistics challenges in these countries that must be overcome if the potential of these countries is to be realized. These challenges include very high logistics costs, poor infrastructure, long transportation times, customs issues, and more. If their magnitude is reduced, investment barriers can be lowered, international inventors can be attracted, and SSA countries could be integrated more into international value networks. There is still a long way to go. However, if this path is taken in the right way and also the technological possibilities are exploited in a targeted manner, there is a chance that African countries will leapfrog in their logistics performance and take a major, decisive steps forward.

This study aims to provide insights into current logistics challenges in SSA countries and to characterize their manifestations. On the other hand, it provides insights into two important industries, i.e., food and automotive, their current state of development and their future development paths. Finally, fields of action for an efficient logistics of the future in SSA will be defined and described. This study is based on research projects conducted over the past years at the Chair of Logistics at the Berlin University of Technology which will be shortly described in the following section. The study is also the basis for a broader study to be published in the coming year, in which the topics addressed here will be explored in greater depth and further topics relating to the development of efficient logistics structures in SSA will be discussed.

1.2 Research and Training Activities of Chair of Logistics in African Countries

The Chair of Logistics at TU Berlin has been working on research topics as well as the further development of education and training in various African countries for several years. The Chair's activities with African countries go back a long way and are rooted in the great commitment of the founder of the Chair of Logistics, Prof. Dr. Helmut Baumgarten, who, with his team and the support of the Kuehne Foundation, has made an important contribution to research on humanitarian logistics. These activities have resulted in dissertations, cooperations (e.g. with the BVL working group “humanitarian logistics” head by Prof. Bernd Hellingrath) and a network for further activities. This important foundational work of former researchers of the Chair of Logistics who have been active in the field of humanitarian logistics (including Dr. Jennifer Schwarz, Dr. Martin Keßler and Dr. Hendrik Elsäßer, formerly Blome) is highly acknowledged and still serves as a basis today.

Currently, the Chair of Logistics closely works together with local universities (Addis Ababa University in Ethiopia, University of Rwanda, Kwame Nkrumah University of Science and Technology in Ghana) and an industry network. Part of the Chair of Logistics is the Competence Center for International Logistics Networks (ILNET), which has been endowed by the Kuehne Foundation for more than ten years. At ILNET, a team of researchers investigates trends and strategies in international logistics networks by involving industry partners into the research process. The focus is placed on logistics issues related to the integration of African countries into global value networks (e.g., the role of logistics in utilizing the potential of African free trade). But also, topics of risk and volatility management as well as technology-related topics of international logistics (e.g. the blockchain applications or the automation of informational processes) are discussed. Moreover, ILNET facilitates virtual research symposiums for cross-country research exchange between universities from several African countries which led to the build-up of the African Research Cluster on Logistics and Supply Chain (ARCLoS).

In addition to the work at ILNET, Chair of Logistics is conducting additional projects in SSA. E.g., the DAAD (German Academic Exchange Service) is currently funding three research projects together with local universities. In Ethiopia (project "IPLogE"), Rwanda (project "SUDLogER") and Ghana (project "ASONG"), the practice-orientation of local university teaching is being strengthened and new teaching formats are being developed by closely linking practice and university education. Students gain insights into real production and logistics structures through field trips, conferences are organized, and case studies are conducted at companies, which are then transferred to teaching. Among other things, co-working seminars are being developed in which Ethiopian, Rwandan and German students work together in mixed groups on current issues companies are facing, first online and then on site in the countries. Furthermore, the Chair of Logistics received funds by the German Federal Ministry for Economic Cooperation and Development (BMZ) to investigate the causes of food waste in East African countries in an application-oriented research project and to develop solutions. In the Log4Jobs project, case studies are carried out in companies in East African countries and recommendations for action for low-loss food logistics are developed. The project also shows how reducing food waste can help to create sustainable jobs in East African countries. In addition, the Chair of Logistics is a founding member of the Pan-African Mobility Alliance (PAMA) established by the BMZ. Through targeted methodical cooperation between politics, business, and research, the PAMA aims to develop supply chains, logistics solutions to support industrial value creation and new types of mobility services in emerging African countries, and to create sustainable local jobs.

The research content and teaching content generated by the projects is available on demand in the TUB Logistics Navigator free of charge. The TUB Logistics Navigator (https://navigator.logistik.tu-berlin.de/) is a co-creational planning tool through which companies can visualize and strategically plan logistics networks

together with their customers and suppliers. Content from several years of research on topics of international logistics is made available as well as teaching content digitally processed.

In the future, the Chair of Logistics will continue to support and develop research and education in African countries. If you are interested in content or potential cooperation, please contact us directly.

Finally, before moving on to the content of this study, we would like to point out that work in this field is only possible due to a large, constantly growing network of people and institutions with whom we are in close contact. We would like to thank these partners very much. First and foremost, the **Kuehne Foundation** and its network of universities and companies support research and training in SSA for many years. But also, the **BMZ** as well as the **DAAD** and the **GIZ** regularly provide platforms and opportunities to expand the network and support activities. In addition, the Global Knowledge Expert Network of the **World Bank** always provides a good exchange between experts in international logistics. Such industry-related work is also only possible thanks to excellent work done by various industry associations, which is why we greatly appreciate the close cooperation. These include the **Bundesvereinigung Logistik** (BVL), the **Afrika-Verein der deutschen Wirtschaft**, the **Verband der Automobilindustrie** (VDA), the **African Association of Automotive Manufacturers** (AAAM) and many more. Moreover, thanks to the **founding members of PAMA** (including BLG, DB Schenker, MOSOLF, Kühne + Nagel, Schaeffler, Volkswagen and more), as they were willing to get involved in the topic area at an early stage of discussions.

2. LOGISTICS CHALLENGES IN AFRICAN COUNTRIES

The African continent consists of 54 countries, all of which have different geographic, infrastructural and logistics characteristics. The majority of the countries have direct access to the sea, which facilitates self-determined participation in international trade, but 17 countries are landlocked, which further complicates their integration into international value creation systems. The logistical challenges faced by African countries are broad, diverse, and dependent on the country's particular framework conditions. Although all African countries face logistics challenges, South Africa occupies a special position due to its industrial importance, which has grown considerably over past decades, as do parts of North Africa (e.g., Morocco), which are already more integrated into international

logistics networks than it is the case for many countries in SSA. For this reason, the countries of SSA form the core of this studies analysis.

On a higher level, the logistics performance deficits of SSA countries become directly apparent when comparing their logistical performance with that of other countries in the world. The Logistics Performance Index (LPI) developed by the World Bank measures the logistics performance of 160 countries, using assessments by logistics industry experts around the world. For this purpose, assessments in six different evaluation dimensions are combined and subsumed into a single index, which can reach a maximum score of 5 points. The last assessment was made in 2018 and a new LPI is expected soon.

Figure 1 shows the assessment dimensions of the LPI and the comparison of average scores within the dimensions between Germany, South Africa and the countries of SSA. Even at this higher level, it is clear that there is a large gap in the logistics performance of SSA compared with both Germany (ranked first in the latest LPI) and South Africa (ranked 33rd out of 160 countries in the overall ranking) (Straube, 2021). To get a first impression of logistics deficits and differences the LPI is of importance. However, the question arises as to which specific logistics challenges prevail in SSA countries that lead to their low logistics performance.

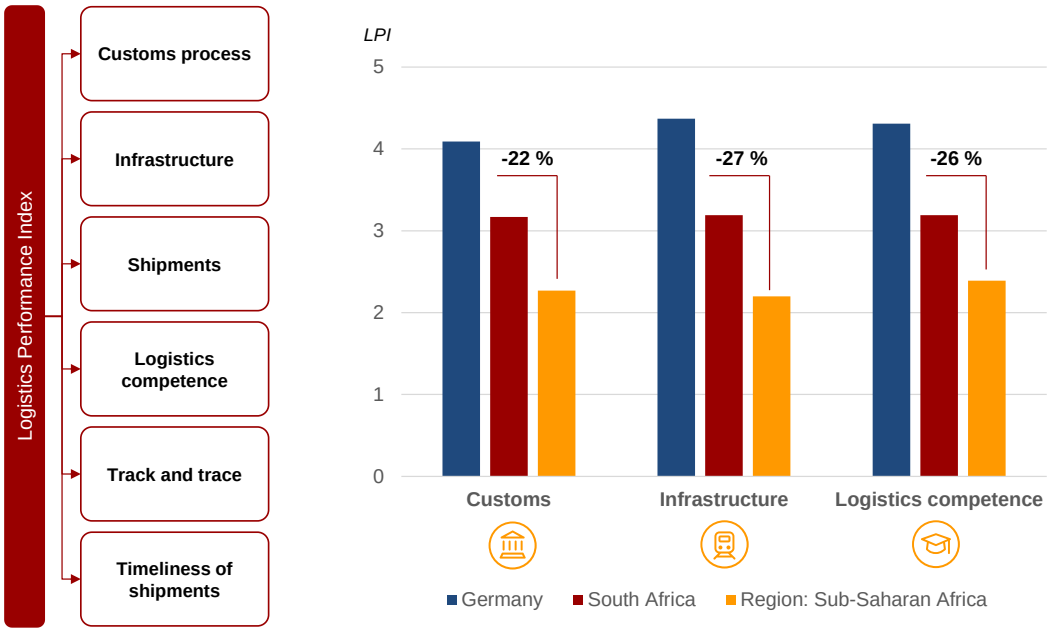

Figure 1 - Analysis of logistics performance of African countries compared to Germany via World Bank LPI

As mentioned above, the specific logistics challenges of individual countries, as well as of the various industries that dominate them, vary from country to country. Nevertheless, there are a number of challenges that are common to most of the countries of SSA. An excerpt of these challenges is shown in Figure 2.

When industry experts are asked what the biggest logistics challenges in African countries are, they repeatedly mention very high logistics costs by international standards (including transport costs, but also handling costs at ports, etc.). There is no doubt that logistics costs in SSA are high. Figure 3 shows a benchmark of logistics costs carried out by the Chair of Logistics of the Berlin University of Technology using Ethiopia as an example. It shows that there are already large differences in logistics costs within Africa. For example, the port handling costs for an import via Djibouti to Ethiopia are 1.8 times higher than an import to Rwanda via Mombasa, Kenya. Road transport costs are also higher in Ethiopia than in Rwanda. More crucial and dramatic, however, are the differences to benchmark values from high-income countries in Europe. Both port handling costs and

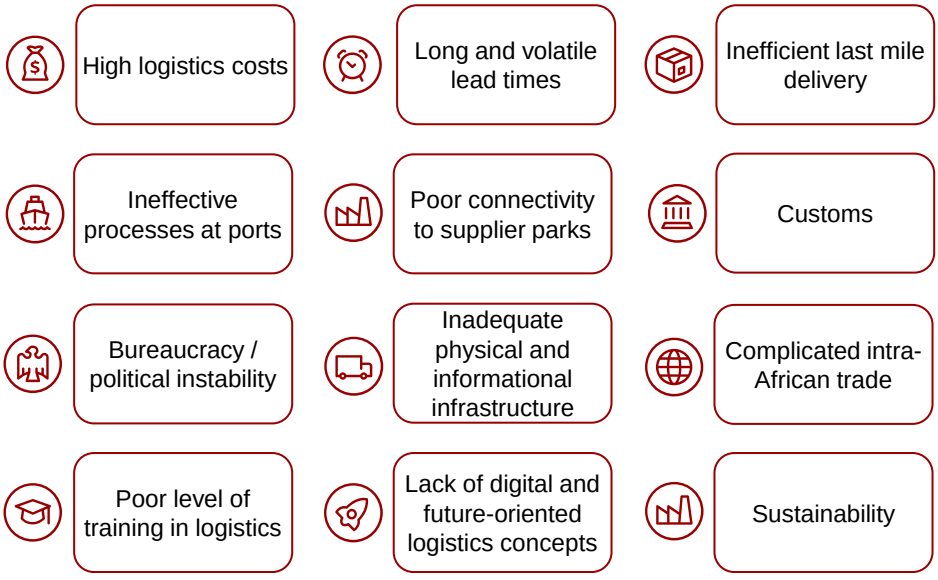

Figure 2 - Excerpt of logistics challenges in African countries

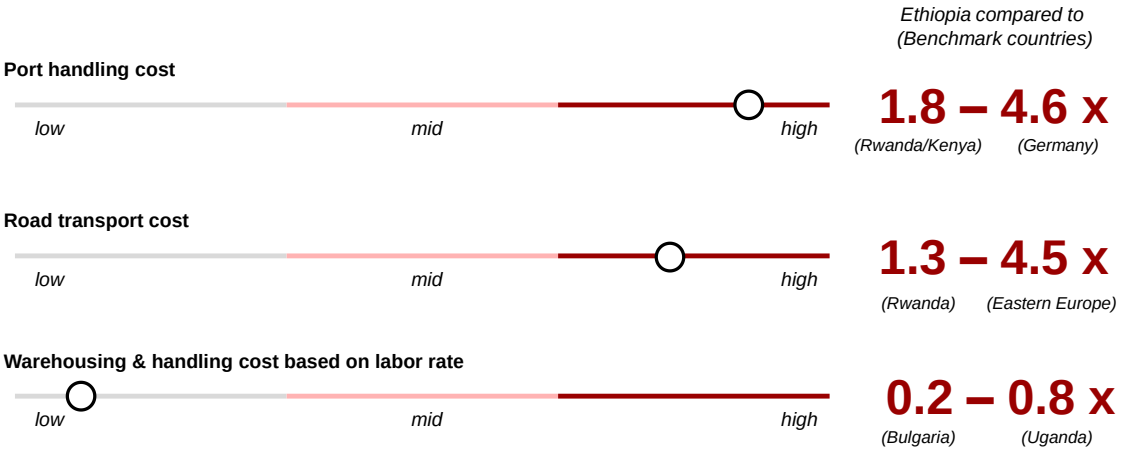

Figure 3 - Logistics cost in Ethiopia compared to other countries via cost benchmark

road transport costs in Ethiopia are more than four times higher than comparable values in European countries.

The following example should serve to illustrate this: The transport of a container from the port of Djibouti to Addis Ababa by truck costs between 3,000 and 4,000€ (around 800km). A comparable transport from the port of Hamburg to Munich would cost about 800 € (data from the end of 2019). This exemplary but fundamentally existing discrepancy in logistics costs leads to the fact that many business cases are no longer profitable and potential suppliers are not developed or production branches are not opened.

The high logistics costs, however, are directly visible to logistics planners, but they are caused by various other reasons, the solution for which remains challenging. In many parts of SSA lead times are very long and volatile. This is the case for transport times, but also for various other process times, such as port handling times, customs clearance times and others. Often, high costs and long transport times are also caused by poor infrastructure. Both the condition of roads is poor in many places and access to paved roads is often non-existent, which is especially problematic in rural areas. For example, in many SSA countries, often less than 30-40% of the rural population has access to paved all-weather roads within a 2km radius (World Bank, 2019). The fact that these unpaved roads are then sometimes exposed to extreme weather conditions often cause accidents as well as damage to vehicles and goods, resulting in high transportation costs in the region, and leads to inefficient last mile delivery. But even beyond the roads, the transport infrastructure, including ports and rail networks, is often not adequately developed and, above all, not interconnected and integrated to enable efficient logistics. For example, supplier parks are often built and connected by asphalt roads to dry ports and then by rail to ports long after the supplier park is operational.

The inefficiency of port processes also becomes clear when the latest Container Port Performance Index of the World Bank is analyzed (World Bank, 2021). Even though the African continent accounts for a considerable share of the world's population, which will continue to grow strongly, ports in SSA have only a marginal share of global container throughput. One of the reasons for this is the inefficient processes in the ports which have insufficient capacity and are often poorly equipped, which in turn leads to high port handling costs by international standards. In the current Container Port Performance Index, the ports of SSA are therefore mostly ranked at the bottom. Important ports such as Abidjan, Dar Es Salaam, Mombasa, Lagos, Cape Town and also Durban and Port Elizabeth are ranked in the bottom quarter of the 370 ports evaluated worldwide.

In addition to the challenges described, international trade with African countries is often complicated because import and export, including customs clearance, are challenging. This also materializes in concrete KPIs, which make the planning of logistics networks involving African countries very difficult. Figure 4 shows a selection of logistics KPIs in Africa, compared to values in the EU. It shows how big the differences are, but more importantly how much this ultimately complicates the import and export of goods and thus international trade. Waiting times at borders are very high, import processes often take a disproportionately long time, coupled with bureaucratic processes and high costs.

These issues do not only complicate international trade with countries outside Africa. Especially within Africa, the import and export of goods is very challenging and always associated with high customs and logistics costs. Complicated intra-African trade is certainly one of the continent's core challenges. Intra-African trade still accounts for far less than 20% of total trade, while Europe conducts almost two-thirds of its trade within Europe. Although there are already countless trade agreements between different African countries, a large and ambitious agreement for an African Continental Free Trade Area (AfCFTA) is supposed to-connect all countries in Africa and promote trade within the region. While the AfCFTA is already sealed on paper, it has not yet been implemented and thus, its potential remains unexploited.

The aforementioned traditional logistical challenges, which are of particular significance in SSA countries, are burdensome enough on their own, and overcoming them can take years to decades if they are not addressed in a targeted manner. In addition, there are other challenges that need to be overcome. Among others, poor level of training in logistics is often seen by local practitioners as one of the core challenges to address the logistics problems of the future. Potential workforce is often not trained for the demands of the labor market and skilled workers are scarce, which is why education and training is certainly an important future field in addition to all the directly visible logistics problems. It is this generation of young professionals that will have to develop solutions for the global megatrend of sustainability. Digital and future-oriented logistics concepts are needed both for CO2 neutrality and for solving various other logistics challenges, which do not yet exist in many places. However, there is an enormous drive among the young African population to develop these solutions and innovative start-ups are developing at a rapid pace. The field of future mobility in Africa is also playing a driving role here and will bring many more innovations.

Logistics KPI	Africa	EU
Average waiting time at the border in hours	97	8
Number of days required for import (*SSA)	37*	10
Cost in US dollars for the export of one TEU	2037	1042
Cost in US dollars for the import of one TEU	2702	1079
Average number of processed documents	7,5	4,1
Average time spent in hours with import documents	104	1

Figure 4 - Comparison of logistics KPI from Africa compared to Europe (GIZ, 2019)

3. INDUSTRY INSIGHTS: OPPORTUNITIES AND FUTURE DIRECTIONS OF SELECTED INDUSTRIES

3.1 Automotive Industry

The automotive industry is certainly one of the future industries in Africa. Already today, South Africa is an important production location, also Morocco and Egypt in North Africa have important locations for CKD and SKD assemblies. If the potential of the automotive industry in Africa were to be derived solely from the size of the population, its growth and the current rate of motorization, the potential would be considered immense. This becomes particularly clear when analyzing Africa's current volumes and comparing them with those of industrialized countries in which the automotive industry is already strongly rooted. Germany has a population of almost 80 million and a motorization rate (the number of vehicles per 1000 inhabitants) of 580 (ACEA, 2022). Over three and a half million vehicles are produced annually in Germany, not only for the local market. Africa, on the other hand, has well over a billion inhabitants, coupled with immense population growth and a currently very low motorization rate of 42 in Africa (AIEC, 2020) which is also significantly lower when only considering developing-countries of SSA. Almost 1.2 million vehicles are produced in the whole of Africa, almost half of which are manufactured in South Africa and a large proportion is exported to the rest of the world. However, it is also clear that a German motorization rate will not and maybe should not be achieved in Africa in the near or even distant future. For one thing, purchasing power is much lower; the average per capita GDP in SSA is just around US$ 1600 (World Bank, 2022). On the other hand, many old used cars are still imported to Africa from many parts of the world, which has an additional impact on the local market. However, there are already countries that are counteracting this development through used-car policies. Taking into account local purchasing power, developments in the used car market and other conditions, the African Association of Automotive Manufacturers (AAAM) estimates that local demand for new vehicles could rise to 3,5 to 5 million per year by 2035 depending on several influencing factors. Embracing this development and creating local value chains is a key task for the African continent, as increasing local production by several million vehicles also means hundreds of thousands of well-paid local jobs.

However, it is also important to mention that the developments of the automotive industry in Africa should not be considered solely on the basis of potential automotive production. It can be assumed that even in the distant future, many people will still not be able to afford a vehicle and may not have to. In parallel to the developments described above, countless mobility applications are currently being developed at a rapid pace and start-ups are innovating the market. Therefore, the development of the mobility industry must always be considered in addition, which is also a major lever for sustainable job growth and a sustainable future for Africa.

However, to leverage the potential, various challenges need to be addressed in the future. Figure 5 shows an overview of the challenges facing the automotive industry, which was developed through an industry workshop held as part of the PAMA. These are divided into policy, infrastructure and market-related challenges. It can be seen that the automotive industry also has to deal with challenges that were already mentioned in chapter two. However, there are also industry-specific challenges. One of these is the creation of adequate automotive policies to support the build-up of local value chains. Moreover, used car policies that enable automotive manufacturers to create value-adding structures for local consumption are needed. There are still over 40 million used cars on the market, and the share of used cars in the total number of vehicles is particularly high in SSA countries by international standards. Even though countries such as Morocco and South Africa have already

Action level	Contribution politics/industry	Challenges	
Policy (macro)	**The role of politics "Compact with Africa“**	• Political instability • Compliance • Lack of monetary stability • Lack of African Trade Agreements • Crime / Security	• Lack of automotive policies (incl. proper used car policies)
Infrastructure (meso)		• High transport costs • Inadequate physical infrastructure • Unstable supply (energy / water) • Level of education	• Inadequate social framework • Inadequate information infrastructure • Fuel quality
Market (makro)	**The role of industry "concrete business cases”**	• Lack of alliances between companies • Creation of "African" business models" • Insufficient local market / purchasing power	• Defective raw material refinement • Lack of supply base

Figure 5 - Challenges for automotive companies in the African market (PAMA, 2019)

banned used car imports, in Kenya and Ethiopia and other countries, up to 90% of imported vehicles are used cars. Even though many SSA countries regulate the age of imported used cars (e.g., in Nigeria, no vehicles older than 12 years may be imported), mainly for environmental reasons, these imports influence local market developments and slow down job creation.

Market-related challenges are the ones where overcoming them is more in the hands of the companies that are active in the market. Firstly, there is a lack of “African” business models in many places, which means that companies often take their old approaches from other countries and try to apply them to the African market, which often fails because local characteristics are not taken into account properly. Companies also need to find solutions to account for the lower local purchasing power, be it through low-cost vehicles adapted to the market or mobility solutions without car-ownership. Furthermore, representatives of the automotive industry confirm that they would like to source components locally from African countries, but in most countries of SSA there is no suitable supplier base and building this is also challenging besides the still existing customs issues between African countries.

In order to show a development path on how to a strengthened automotive industry in Africa with greater involvement of the countries of SSA, which also creates a large number of local jobs, a vision of the sustainable development of value-adding structures was developed with the help of industry working groups during PAMA meetings as shown in Figure 6.

Although many African countries strive to locate OEM production in their countries, this should not be the aspiration for every country. Although a manufacturing plant may create jobs and attract other industries, the vast majority of jobs are at the lower supply tiers. Rather, the goal should be to strengthen the core competencies of individual African countries and based on these core competencies, strengthen local industry so that it can become part of the automotive industry. This means that often already existing local industry structures in automotive-related industries can be further developed to enable them to contribute to the automotive industry. Therefore, a technology cluster competence analysis of African countries was carried out, to show clear development potentials of individual countries in terms of their contribution to the automotive industry (ITCL, 2020). Taking Ethiopia as an example, it would be conceivable that the textile

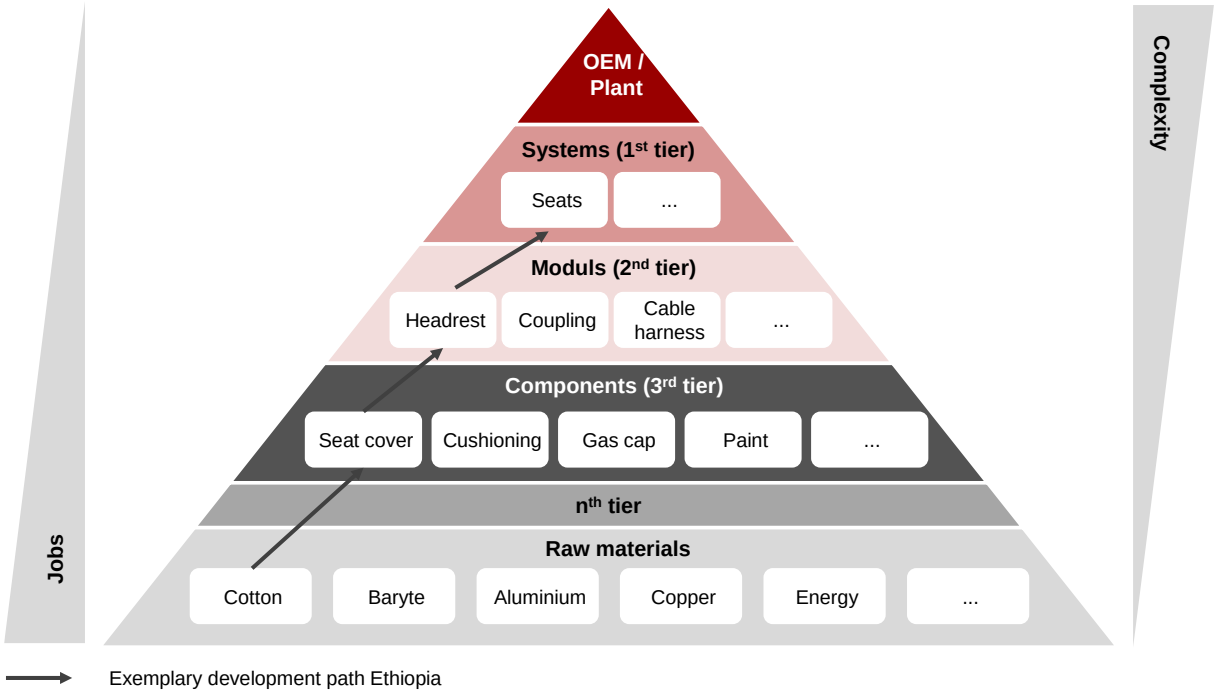

Figure 6 – PAMA approach for value chains from raw material to OEM for sustainable job creation (PAMA, 2019)

industry, which already exists today, could be enabled through the development of competencies and capacities to also produce the fabrics and covers for seats or the headrests in the medium term, which would then be integrated into global automotive value chains. But the long-term, the development of manufacturing structures for entire seats in Ethiopia is also conceivable on this basis. While the complexity of setting up an automotive production facility is very high and requires an enormous amount of expertise, for many components this complexity decreases with and requires an enormous amount of expertise, for many components this complexity decreases with subsequent delivery tiers, but the potential for job creation in later tiers is extremely high. In a long-term vision, it is therefore quite conceivable that individual countries will focus on their core competencies, develop them further, and then contribute a significant part to global automotive value creation systems.

Leather and fabric covered seats from Ethiopia, tires produced in Ivory Coast, and interior and electric motors produced in Rwanda then transported to Morocco where the final assembly takes place before the vehicles are sold to the world is a scenario with a huge potential. There is still a long way to go to realize this vision, but the potential is there and can be realized through intelligent interaction between industry, policy, and support from academia.

3.2 Food Industry

The food industry in the African continent is as varied as the countries conforming it. At a domestic level, the most produced agricultural products range from coffee beans, maize, beans, cashew nuts, and cassava in East Africa, to olive oil, dates, and tangerines in North Africa, and cacao beans, palm oil, and groundnut oil in West Africa (FAOSTAT, 2021). Although recent economic activities in the African countries have experience a significant diversification, with the industrial and service sectors seeing an increase of their contribution to the GDP, the food and agricultural sector remains the backbone of the economy in the continent (PETIT, 2007). Agriculture, fish, and forestry account for about 17% of GDP of Sub-Saharan African countries. Although the contribution to the GDP is expected to decline to 15% by 2031, the rural population in the region is projected to make up 52% of its population, representing an absolute increase of the size of rural population by 2031 (OECD and Food and Agriculture Organization of the United Nations, 2022). Thus, this industry is still characterized across the continent by a deep dependency on agricultural production, both for export and commercial activities as well as for the sustenance of its own inhabitants. On the other hand, the processing of food products has only recently begun to gain traction in some countries, especially as a response to the changed demand patterns of the African population (Reardon et al., 2021). For example, a data analysis for Eastern and Southern Africa conducted by Reardon et al. (2021) concluded that, in value terms, processed foods in urban areas were 70% of all food purchases, from which 40% was minimally processed, such as flour, and 60% was highly or ultra-processed. Furthermore, in value terms, food purchases in rural areas were 43% of the food consumed and processed and ultra-processed foods were 70% of all food purchases, from which 53% was minimally processed, and 47% was highly or ultra-processed.

Even though many countries in Africa are self-sufficient at the national food production level, localized food deficit can occur due to poor storage management, lack of access to proper technologies and heavy dependence on rain-fed agricultural practices (Benjamin Nitsche et al., 2018). Considering the central role of food for the sustenance of human beings, creating systems and procedures to provide the populations with food products is of unmeasurable importance. Performing this task is part of the logistic activities as it comprises "planning, management and control of the value-added network of food from the source of raw materials to the customer." (Figiel & Nitsche, 2016, p. 6). Many of the activities involved in the harvesting, processing, transporting, handling, and distributing of food products are performed in an inefficient manner in the continent, leading to several amounts of avoidable food losses. To understand the main causes and possible solution approaches to these inefficiencies, a preliminary literature review and interviews with different stakeholders in the sector were conducted. This resulted in an analysis of the main differences in the framework conditions for the food logistics networks in East Africa. As it can be seen in figure 7, different actors involved in the network have different characteristics and are surrounded by different framework conditions that either support or hinder their individual ability of improving their own processes and operations. Input suppliers and producers mainly deal with lack of financial means, inefficient harvesting techniques, and outdated technology. The main challenge for rural and urban trader is lack of transparency and dependency on price knowledge. Processors, retailers, and customers, however, must fight with trust issues and a small market for processed products. Furthermore, the logistics network overall presents a missing standardization regarding the valuation of the quality and the price of products, the production processes as well as the investment strategies. Each actor is therefore highly dependent on the negotiation skill and the respectability of the upstream and downstream actors. This leads to a high price volatility and high storage of teff to use it as savings (Minten et al., 2018).

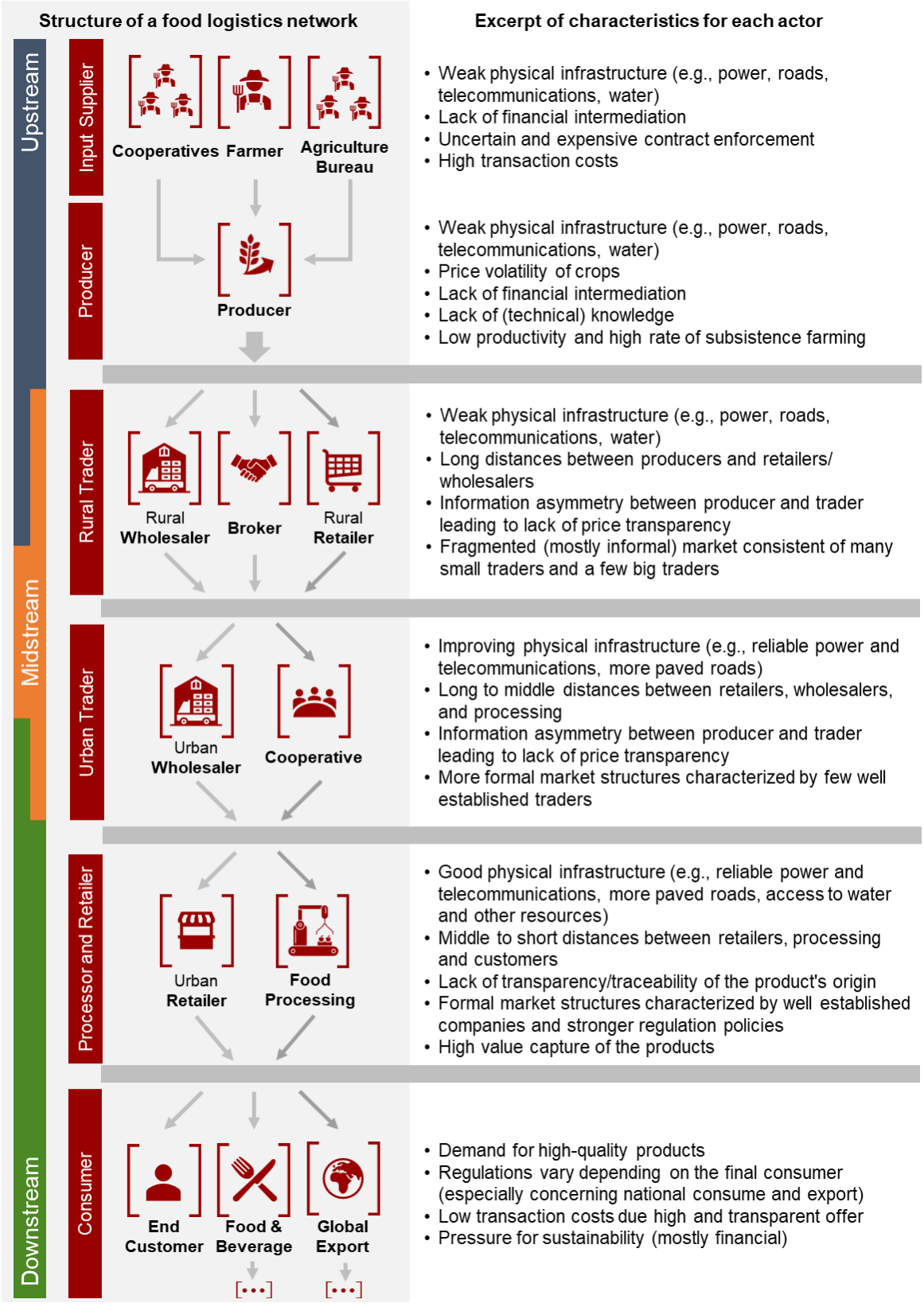

Figure 7 – Exemplary food logistics network with a selection of characteristics for each actor

Tackling food losses in Africa does not only require the implementation of appropriate technologies and methods, more financial resources, and increased collaboration among the logistics networks actors, but also involves the creation jobs and the improvement of the quality of already existing ones. African countries have several of the fastest growing populations in the world (World Bank, 2022). As cities grow,

consumer demand will shift away from staple foods and relatively unprocessed agricultural goods. Urban consumers in the region are beginning to demand new foods and other attributes of the foods they consume, such as: convenient preparation and easy cooking, dietary diversity, food safety, food and nutritional quality, and standardization of food types (Cheru et al., 2019). For this reason, agricultural policy needs to be rethought and start from the demand side. The goal is no longer to supply raw staple foods to urban centers, but to meet the growing urban demand for increasingly higher quality products while developing a healthy food processing industry (Cheru et al., 2019). With the establishment of new food processing plants more jobs can be created, current jobs can be enhanced through the upgrading of their scope and/or scale, and food loss can be prevented through chemical and physical processing (e.g., drying, heating, freezing, etc.).

4. MAIN FIELDS OF ACTION TO GUIDE FUTURE LOGISTICS DEVELOPMENTS IN AFRICA

The key to nurture sustainable development in SSA, in a way that does not only favor the economic growth but also protects the environment and societies within, lies ultimately in enabling and expanding the logistics sector in the region. As previously described, the logistics challenges in SSA involve many areas of the commercial and governmental activities and require the collaboration of all the stakeholders in the international logistics networks to be overcome. As a result from a series of studies performed at the Chair of Logistics, different cross-cutting main fields of action were identified and are being presented in this section in an effort to draw a path for the future development of the logistics sector in the region.

The *development of trade and transport related infrastructure* remains the core of any substantial improvement of the logistics networks in SSA. Tackling infrastructure deficiencies such as the dearth of logistics zones and roads connecting seaports to the main economic centers are mentioned consistently in the development plans of every nation in the region. Nevertheless, several hard and soft infrastructure issues persist. Wiederer (2021) showed in her investigation that enhancing, and in some cases creating, transshipments facilities, bettering intermodal transportation, and implementing supporting regulatory actions will improve the state of the formal logistics sector in SSA. This is specially the case for landlocked countries such as Rwanda, Uganda, and Ethiopia, which are highly dependent on proper infrastructure to maintain logistics costs low. Additionally, regulations, such as the prohibition of asset ownership of logistics service providers in Ethiopia, prove detrimental to the establishment of efficient and reliable logistics networks in the countries.

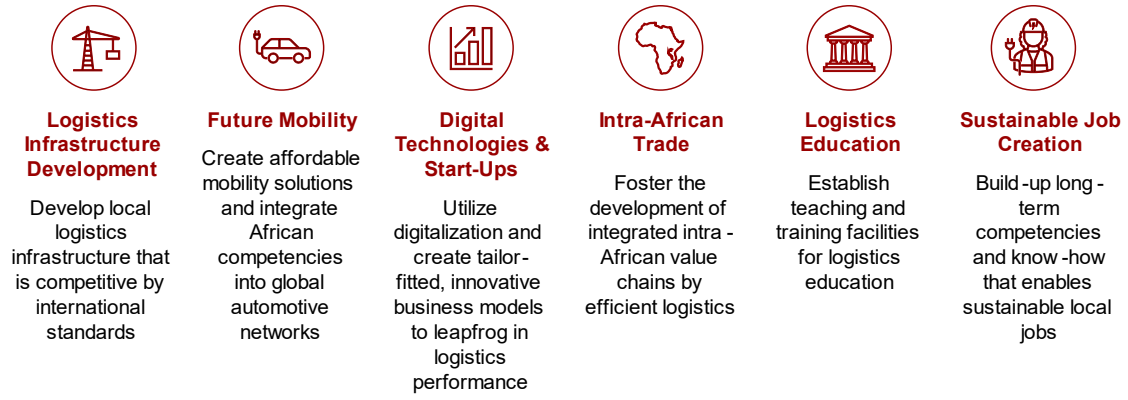

Figure 8 - Main fields of action for logistics development in SSA

On a specific level, cold chains are essential to minimize spoilage in the food and agricultural industry and must be developed in SSA. This includes the availability of temperature-controlled storage and transport (e.g., in reefer containers, refrigerated trucks, and railroad cars), as well as pre-cooling right after picking to maximize post-harvest life. The facilitation of intermodal transport and reliable air transport are important for the advancement of both the food and automotive industry. Success in the automotive industry depends on flexible and reliable logistics processes and networks due to their own complex processes and high number of parts, production lines, and individualization options. In order to generate logistics structures necessary to meet these requirements, not only intermodal transportation needs to be set-up and road quality and connectivity improved, but also ports need to be able to handle high container volumes for parts and components as well as allow for roll-on roll-off traffic for shipping and finished cars. Additionally, air freight must be promoted and enhance for ensuring the timely delivery of products with high value density or to enable the realization of common production practices in automotive production such as just-in-time (Wiederer, 2021).

Furthermore, *future mobility solutions* will play a pivotal role in the development of the economic and societal activities in SSA. It has been already determined that the current industrial environment in the continent offers great opportunities for the automotive production and the integration of both African suppliers, producers, and market will guide the growth of this industry in the upcoming years. Nevertheless, the progress does not end there. New ways of transportation, such as pay per service, and technological improvements of existing transportation devices such as e-cars and e-bikes, are already transforming the way millions of Africans go through their everyday lives, care for the environment, and design their businesses. There are currently over 60 identifiable ride hailing services in Africa offering cargo as well as passenger (specially for taxi and bike) transportation services and the most successful players are present across the continent, e.g., Kobo360 and Sendy (Nono, 2020). In light of the expected demographic changes and challenges in SSA, this field of action is expected to have immense repercussions on the design and controllability of last-mile logistics as well as the integration of remote rural areas in the main trade activities at a national level. These developments have been only possible with the support of *digital technologies and start-ups*, which emergence has been favored by maturing markets and helpful regulatory frameworks. Africa is home to an estimated 650 start-up hubs in more than 50 countries (Afrilabs & Briter Bridges, 2019). Both in terms of the number of innovation hubs and start-ups and in terms of the volume of financing, the big three in particular (Kenya, Nigeria and South Africa) clearly stand out from the other African states. For example, in Kenya, Nairobi is known as Silicon Savannah as it counted with a financing volume for entrepreneurial activities of approx. 350 million dollars in 2018. In its different technology centers, digital start-ups are just sprouting from the ground. Nairobi has grown into a start-up oasis over the past few years, but investments are coming in particular from China and the USA and often support the old familiar. There is a danger that local founders will not receive sufficient support in the future. Nevertheless, many of them have so far made it their goal to improve people's lives in their area and are developing apps and services to strengthen agriculture, education, health, nutrition, or mobility, in other words to solve the problems of the African continent.

In addition to the currently mentioned fields of action, *Intra-African trade* must be enabled to leverage the complete potential of better infrastructure, innovative mobility solutions, digitalization, and a thriving start-up landscape. The ratification and implementation of the AfCFTA offers the opportunity for the region to become the world's largest free trade area consistent of a market with 1.2 billion people and having a combined economic output of around US$2.5 trillion. Having a duty-free access to this zone will encourage manufacturers and service providers to venture into new markets and profit from economies of scale resulting from higher sales. Moreover, the same manufacturers and service providers will foster innovative

practices as they will be forced to improve their processes towards more efficiency and cost effectiveness since market competition will increase, resulting in better quality of products and services. Additionally, this unified economic front will prove more attractive for investors as the ease of doing business in the region will potentially decline.

At the base of any developmental progress both for industries as well as nations lie the improvement and promotion of education and job-creation, more so in a sector that has been neglected for many decades like the logistics sector in SSA has. While most of the countries in the region struggle with high unemployment rates, practitioners point the lack of qualified workforce and missing work ethics as the main challenge for integrating their businesses to the international markets. Differences between the understanding of business ethics in European and sub-Saharan Africa lead to inefficiencies and missing of opportunities for improvement of intermodal transportation and, thus, the export ability of companies (Nitsche, 2021). Additionally, Wiederer (2021) exposes the inadequate training of logistics specialists and underinvestment on human capital in African countries. *Logistics education* is, thus, imperative for empowering the young generation in the region to develop solutions adapted to the needs of their own countries. Students need to be enabled to develop practice-oriented solutions and thereby develop a practice- and problem-oriented mindset that prepares them for the requirements of the job-market.

Furthermore, to ensure that students are equipped with the skills they need for future employments, and to consequently reduce unemployment, more practice-oriented teaching approaches are necessary. In the same way, *sustainable job creation* must be taken into account by governments and corporations alike to enhance the human capital in the region and nudge its development. This field of action does not only concern the absolute increase of job offerings but also involves the generation of jobs with personal development perspectives for the employees, such as increased scope of responsibilities, diversification of tasks, consistent training offerings, implementation of incentives, and fair payment policies.

The potential of the African continent is immense, not only economically and politically, but also socially. However, in sub-Saharan Africa in particular, this potential has not yet been fully exploited. Efficient logistics can make a decisive contribution to the development of sustainable value-creation systems and jobs. It would be negligent not to exploit the existing potential and would have far-reaching consequences beyond the African continent. For this reason, an integrative approach involving politics, business and academia must be used to develop and implement solutions that will drive sub-Saharan Africa's logistics development forward in leaps and bounds.

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