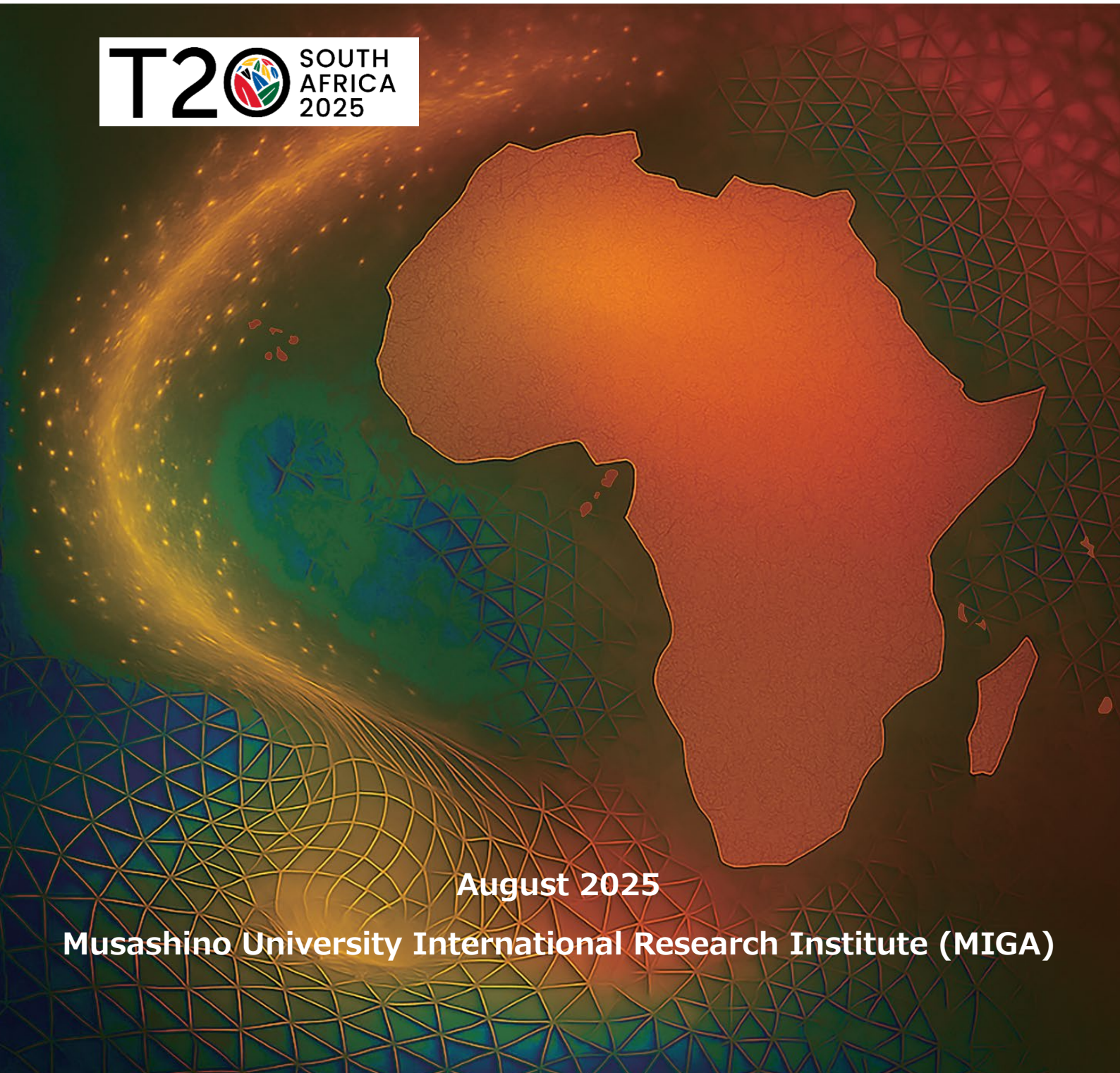
Sustainable Economic Development

A Pathway to Sustainable Economic Development



August 2025

Musashino University International Research Institute (MIGA)

About the illustration

: The haiku "The Milky Way stretching across the rough seas and Sado Island" by Basho symbolizes the immense power that Africa will harness to overcome challenges and thrive in a future filled with light.

INDEX

Chapter 1:

Overview

Overview for Digital Logistics/Circular Economy in the Global South

Hidetoshi Nishimura, Director, Musashino Institute for Global Affairs Specially Appointed Prof.
Mitsuhiro Maeda, Visiting Professor of Musashino University.
Akiyama Yu, Visiting Researcher of Musashino University.

1. Introduction

Musashino Institute for Global Affairs (MIGA) and NX Logistics Research Institute and Consulting, Inc. are collaborating on the "Master Plan Development Project for Strengthening Logistics Digital Connectivity in the African Region to Facilitate Resource Circulation." The primary theme of this project is to establish a circular economy system through enhanced logistics digital connectivity, with the following objectives:

【Objective 1】Present policy proposals to contribute to the construction of a circular economy within the Asia-Africa region and to enhance economic security in both regions.
【Objective 2】 To propose concrete policies from a logistics perspective to solidify the "circular supply chain" between Asia and Africa by leveraging digital technology to promote the entry of private-sector companies.

This research project aims to develop a master plan that incorporates resource circulation formation and the enhancement of logistics digital connectivity in the African region. The master plan consists of two major pillars representing different perspectives.

I. Circular Economy Policy

Achieve the construction of a circular economy in Africa and Asia and contribute to economic security.
Contribute to the formulation of policies that allow African countries to make autonomous decisions and implement measures in the context of international resource circulation.
Propose measures to enhance the efficient use of strategic resources through the establishment of a circular economy and to support the expansion of Japanese companies.

II. Strengthening the Supply Chains of Private Companies

Propose measures to promote the supply chain and logistics sector between Asia and Africa.
Trade is becoming more active from Japanese companies' manufacturing bases in India and

ASEAN countries to African markets or production bases within Africa. We will make proposals to further promote private-sector initiatives and investment.

2. Summary of each chapter

This final report was compiled based on the issues and background identified in the master plan. The following sections provide an overview of each chapter.

Chapter 2: Circular Economy

This chapter argues that the circular economy (CE) and digital connectivity (Industry 4.0) are key drivers of sustainable industrial development in the Global South, particularly in African countries. CE, which replaces the traditional "extract-manufacture-dispose" economy, aims to achieve both job creation and environmental conservation through efficient resource management and waste reduction. To achieve this, it is essential to integrate advanced sorting and recycling technologies with digital technologies (AI, IoT, sensors). In Africa, recycling of electronic waste, plastics, textiles, and other materials, as well as resource recovery from organic waste, are progressing, but there are fragmented policies and barriers to technology introduction. Regional initiatives such as the African Circular Economy Alliance (ACEA) and the African Development Bank's CE facilities are steadily expanding. Going forward, it will be necessary to develop digital infrastructure, introduce ESG indicators, and implement vein-artery integration development strategies that leverage regional resources.

Chapter 3: Overview of African Politics and Economics

The report argues that a shift in the industrial structure from agriculture to manufacturing and services is essential for sustainable economic growth in Sub-Saharan African countries, and that the key to this lies in industrial policy and the utilization of digital technology. Africa has seen economic activity revitalized in recent years due to infrastructure development and advancements in mobile communications, however, it still relies heavily on agriculture and the informal sector for labor, and poverty rates remain among the worst in the world. In the past, import substitution industrial policies were implemented, but they were rejected in the structural adjustment policies of the 1980s and are only now being reevaluated. Efforts are underway to establish economic zones, promote local content policies, and nurture domestic industries, but there are still challenges in terms of institutional development and government execution. Additionally, digital technologies such as mobile money have the potential to support business activities, but they are concentrated among small-scale businesses, and their

impact on productivity improvement and formal sector expansion remains limited. Sustainable growth requires policies targeting medium-sized and larger enterprises, dialogue between the government and the private sector, flexible industrial strategies tailored to the country's specific context, and coordination with aid agencies.

Chapter 4: Automotive Industry

Africa's automotive industry has low production volumes relative to its population size, with the used car market dominating and production capacity concentrated in South Africa and Morocco. However, in recent years, the introduction of electric vehicles by European and US manufacturers and the entry of Chinese and Indian manufacturers have led to the expansion of assembly operations to other countries. For the industry to develop in earnest in the future, it will be important to (1) nurture the new car market, (2) introduce safety and environmental regulations, (3) link supply chains with Asia, and (4) respond to electrification. In particular, regarding electrification, the establishment of battery recovery and recycling systems is essential, and Chinese manufacturers may consider ASEAN as an export hub for right-hand drive EVs. If ASEAN advances the localization of EV and battery production, improves end-of-life vehicle management systems, and participates in recycling systems for EVs targeting the African market, Asia and Africa could collaborate to foster the sustainable development of the automotive industry.

Chapter 5: Logistics

This study conducts a comprehensive investigation and analysis of the logistical challenges and prospects for achieving resource circulation between Africa and Asia, focusing on four countries: South Africa, Tanzania, Ethiopia, and Kenya. Focusing on three areas—international trade, the automotive industry, and the circular economy—this study identified current conditions and barriers through field research and literature reviews, covering investment environments, logistics infrastructure, customs clearance, transportation, waste management, and recycling. From the perspective of private companies, it presents recommendations for addressing challenges and future directions for promoting the African automotive industry and achieving sustainable resource circulation.

Chapter 6: Digital Leapfrog

This chapter proposes the establishment of a unique industrial paradigm called "Global South Industry 1.0 (GSI 1.0)" for the economic growth of Global South (GS) countries, which does not follow the traditional Global North-type industrial development model (Industry 4.0) but instead introduces digital technology and Cyber Physical Systems (CPS) from the

initial stages. In particular, it focuses on "connectivity," which generates economic value without relying on physical concentration, by leveraging cutting-edge technologies such as distributed infrastructure, drones, 3D printers, and sustainable materials. Furthermore, it demonstrates a method for strategically creating economic and social value through "Special Epistemic Zones (SEZ)," which are formed by combining data from different fields. SEZ can be formed beyond physical space, enabling the sharing and optimal utilization of industrial knowledge across regions. On CPS, by incorporating proven methodologies such as lean production through the use of System of Systems (SOS) architecture, industrial upgrading and human resource development can be achieved simultaneously. Furthermore, the digital sharing of specialized knowledge and human resource development are emphasized as key elements for the development of GS.

Chapter 7: Geographical Simulation Analysis

This chapter analyzes the development of economic corridors in Africa and their impacts using an economic geography simulation model (IDE-GSM). First, the development of economic corridors is a critical factor for the success of the African Continental Free Trade Area (AfCFTA). Here, we discuss the conditions for the success of a leapfrog-type economic corridor development strategy that introduces digital technology and renewable energy, rather than the traditional step-by-step economic corridor approach. The leapfrog approach prioritizes digital education, skill development, and the electronic reduction of non-tariff barriers over physical infrastructure development, demonstrating the potential to achieve high economic effects in a short period. Japan's cooperation could play a significant role in constructing efficient and reliable economic corridors.

Chapter 8: Development Strategy

To build a circular economy system through enhanced logistics digital connectivity, three major challenges must be addressed. The first challenge is to establish a comprehensive cyber-physical system in the target region. The second challenge is to develop methodologies to promote new value creation based on the new philosophy of circular economy systems that have emerged in modern civilization. Specifically, it will be necessary to develop new methodologies to promote value creation through interoperability platforms in cyber-physical systems, focusing on the development of artery-vein integrated development strategies. The third challenge is digital human resource development (d-HRD).

In order to address these challenges, it will be necessary to adopt a "leapfrog" development

strategy that differs from the conventional model of promoting labor-intensive manufacturing first, and instead promotes knowledge-intensive industries and DX before promoting any manufacturing. Universities and research institutions in the local areas of Global South countries are expected to play a particularly important role in addressing the many challenges we face. We propose a new concept, "Special Epistemic Zones (SEZ)," to capture the role of universities and research institutions in creating various forms of "knowledge."

Appendix: Glossary of Acronyms （Ch5）

Acronym/略語	Full name
AEO	Authorized Economic Operator
AfCFTA	African Continental Free Trade Area
AGOA	African Growth and Opportunity Act
ASYCUDA	Automated System for Customs Data
AWB	Air Waybill
C/O	Certificate of Origin
CIF	Cost Insurance and Freight
CIQ	Customs, Immigration, and Quarantine
CKD	Complete Knock down
COMESA	Common Market for Eastern and Southern Africa
DCTMC	Doraleh Container Terminal Management Company
DX	Digital Transformation
E&E	Electronics and Electrical Appliances
EAC	East African Community
EIC	Ethiopian Investment Commission
ELV	End of Life Vehicles
EOL	End of Life
EPA	Economic Partnership Agreement
EPR	Extended Producer Responsibility
EPZ	Export Processing Zone
ERIA	Economic Research Institute for ASEAN and East As
Ethiopia-Sudan FTA	Ethiopia-Sudan Free Trade Agreement

Ethiopia-Sudan FTA	Ethiopia-Sudan Free Trade Agreement
EU	European Union
EU-ACP	European Union - African, Caribbean and Pacific Gr
EU-EAC EPA	European Union - East African Community Economi
EU-SADC EPA	European Union - Southern African Development C
EV	Electric Vehicle
E-waste	Electronic and Electrical Wastes
FTA	Free Trade Agreement
FTZ	Free Trade Zone
HEV	Hybrid Electric Vehicle
I/V	Invoice
iCMS	Integrated Customs Management System
ICT	Information and Communication Technology
IDE-GSM	Institute of Developing Economies-Geographical Sir
IMMEX	Industria Manufacturera, Maquiladora y de Servicio
IoT	Internet of Things
IP	Industrial Parks Development Corporation
IPDC	Industrial Parks Development Corporation
ICD	Inland Container Depot
JICA	Japan International Cooperation Agency
MoTI	Ministry of Trade and Industry
MUB	Manufacturing Under Bond
NGV	Natural Gas Vehicle
NTB	Non-Tariff Barrier
NXRIX	NX Logistics Research Institute and Consulting Inc.
OSBP	One Stop Border Post
P/L	Packing List

PPP	Public-Private Partnerships
RFID	Radio Frequency Identification
SABS	South African Bureau of Standards
SACU	Southern African Customs Union
SACU-EFTA FTA	Southern African Customs Union - European Free T
SACU-MERCOSUR	Southern African Customs Union - Southern Comm
SADC	Southern African Development Community
SARS	South African Revenue Service
SEZ	Special Economic Zone
SKD	Semi Knock down
SW	Single Window
TANCIS	Tanzania Customs Integrated System
TEU	twenty-foot equivalent unit
TIC	Tanzania Investment Centre
TIDCA	Trade and Investment Development Cooperative Ag
TIFA	Trade and Investment Framework Agreement
TPT	Transnet Port Terminals
UK	United Kingdom
UK-Kenya FTA	United Kingdom - Kenya Free Trade Agreement
VAT	Value Added Tax
VC	Value Chain
WCO	World Customs Organization

Chapter 2:

Circular Economy

Circular Economy and Digital Connectivity as Drivers for Sustainable Economic Growth in the Global South

Venkatachalam Anbumozhi, Senior Research Fellow (Senior Researcher), East Asia and ASEAN Economic Research Center (ERIA)

1. Introduction

A circular economy (CE) is 'the economic system in which resources are kept at the highest possible level of functionality at all times'. A systemic approach to material management within this economy is critical to its success. The circular economy has the ambition to minimise material usage per unit of functionality and to manage materials in the system in such a way that losses are minimised. On a product level, CE strives to repair, re-use, and remanufacture before materials are recycled. Whereas Circular Economy is a central term in the EU and Chinese policy, Japan refers to the material cycle society. In many other countries e.g. in Asia, material policy is typically based on 3R: re-use, reduce, recycle. The circular economy adds upstream measures (e.g. in product design) to this 3R principle.

The introduction of the circular economy generates new technological and non-technological needs. The change in ownership and material management concepts, both at a consumer and at a business level, generates a need for the introduction of new business concepts, such as: products as a service, sharing platforms, peer-to-peer interactions, and industrial symbiosis. Many of these are based on the availability of efficient IT tools, such as apps, websites, consumer/user platforms, and databases.

Looking from an industrial perspective, the CE generates technological needs in the field of manufacturing, processing, identification and recycling of materials and products. The main needs are:

- advanced sorting and recycling technologies,
- efficient materials processing technologies and
- production technologies that support design for circularity.

These needs are covered by robotics, analytics and (artificial) intelligence, sensors and connectivity, machine learning, human-machine interfaces,…All these technologies are typically designated as 'digital technologies and or Industry 4.0'. Until now, the frameworks of digital technologies and the circular economy have not been connected in policy initiatives and R&D programs.

This paper try to clarify and explore the possible complementarity between both concepts. This

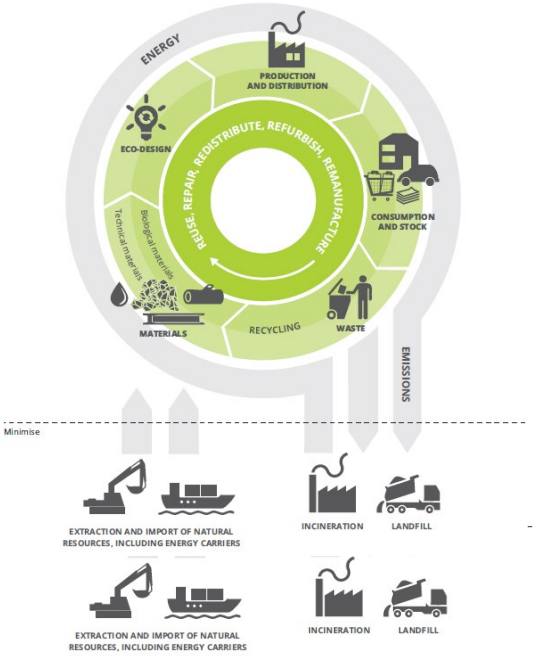
paper presents some basic insights from partner contributions, which will serve as a basis for the Africa circular economy master plan being discussed.

2. Circular Economy from an Industrial or Business Perspective

In essence, a circular economy represents a fundamental alternative to the linear take-make-consume-dispose economic model that currently predominates (ASEAN 2021). ERIA defines a circular economy as one that is restorative, and one which aims to maintain the utility of products, components and materials and retain their value (ERIA 2016). It thus minimises the need for new inputs of materials and energy, while reducing environmental pressures linked to resource extraction, emissions and waste. This goes beyond just waste, requiring that natural resources are managed efficiently and sustainably throughout their life cycles. A circular economy thus provides opportunities to create well-being, growth and jobs, while reducing environmental pressures. The concept can, in principle, be applied to all kinds of natural resources, including biotic and abiotic materials, water and land.

Eco-design, repair, reuse, refurbishment, remanufacture, product sharing, waste prevention and waste recycling are all important in a circular economy. At the same time, material losses through landfill and incineration will be reduced, although these may continue to play a much-reduced role in safely removing hazardous substances from the biosphere and recovering energy from non-recyclable waste. Several concepts and visualisations of a circular economy exist; Figure 1 shows a simplified model. The main idea is that waste generation and material inputs are minimised through eco-design, recycling and reusing of products. This will create economic and environmental co-benefits, as the dependency on extraction and imports declines in parallel with a reduction in the emissions to the environment caused, for example, by extraction and processing of materials, incineration and landfill.

[Figure 1]: A simplified model of the circular economy for materials and energy



(Source: ERIA (2016))

The circular economy generates new opportunities and needs for business. These can be grouped

according to 4 archetypes that each represents a specific business focus as the main entry point for developing a circular business model (EIT 2017):

- relationship with **customer**: providing a service instead of a product,
- **product or process**: circular product or process design,
- relationship with the **value network**: building circular value networks,
- sustainable **identity**: circularity as a unique selling proposition.

In most cases a company will combine elements of each archetype in its business approach.
An alternative categorisation of circular business approaches has been given by the Ellen McArthur Foundation, in their RESOLVE Framework: **RE**generate – **S**hare – **O**ptimise – **L**oop – **V**irtualise – **E**xchange (EMF 2015).

3. Digital Technology for Industry or Business EFFICIENCY

The term digital technologies that also often termed as Industry 4.0 is applied to a group of rapid transformations in the design manufacture, operation and service of manufacturing systems and products. The term originated in Germany but developments in other parts of the world have resulted in other labels, such as *Smart factories*, the *Industrial Internet of Things*, *Smart industry*, or *Advanced manufacturing*.
The ASEAN agreement on Digital Products and Services mentions "Digitalisation for productivity and growth" which Industry 4.0 builds upon a number of new technology developments. Similarly, Accenture has identified 10 digital, engineering and hybrid technologies that will enable the disruption of the current linear economy to bring in the circular economy (Accenture 2015) (see Table 1).

Digital Technological developments for Industry 4.0	Ten disruptive technologies for circular economy according to Accenture
•Information and communication technology •Cyber-physical systems •Network communications- Internet of Things (IoT) •Simulation •Advanced data analytics •Robots, augmented reality and intelligent tools for support of human workers	•Mobile technology •Machine-to-machine communication •Cloud computing •Social media for business •Big data analytics •Modular desing technology •Advanced recycling technology •Life and material science technology •Trace and return systems •3D Printing

Table 1: Classification of potential technological developments for Industry 4.0 and Circular Economy

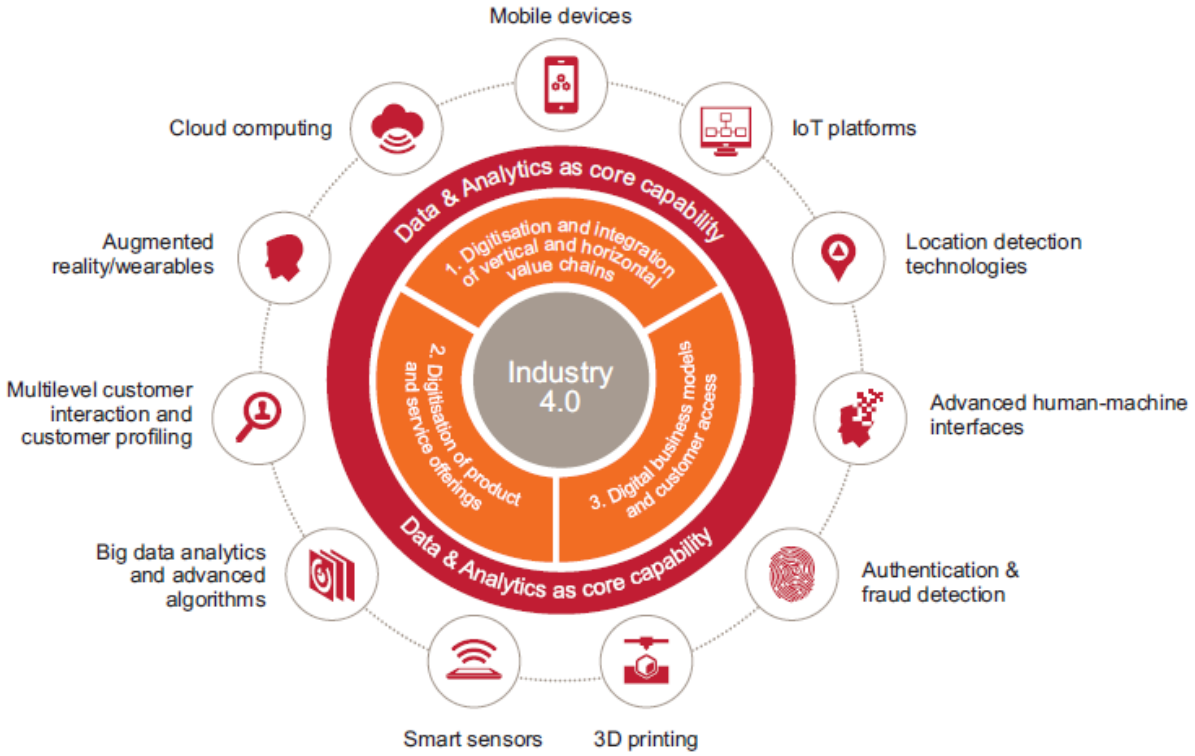
(Table and text based on input from FUTURING, H2020 project, D. Georgoulias co-ordinator)

PWC presents a framework for Digital technologies , based on 3 elements (PWC 2017):

- digital business models and **customer** access
- digitalisation **of product and service** offerings
- digitalisation and integration of vertical and horizontal **value chains**

Their approach is represented in Figure 2.

[Figure 2]: Circular economy framework that contributing digital technologies



(PWC 2017)

4. Starting Point for Circular Economy Transition aided by Digital Technologies

If we compare the elements of this framework to the archetypes for circular businesses, it is striking that similar concepts emerge. Both circular economy and digital economy are based on:

- a change in the approach of customers,
- new product and process offerings, and

- an integration of value chains.

From this perspective, it becomes clear that digital economy and circular economy at least share a similar vocabulary. In the sustainable development paradigm of the Global South, particularly countries in Asia, Africa and Latin America, we could explore to which extent they also share a common future vision, a common goal for the industry towards 2030. A goal that is in line with the SDGs 9 and 12.

Circular economy is considered a driver for envisioning the industrial framework in 2030 that meets the Net Zero emission tragets in 2050 , while digital economy provides the driver for technological innovation. Thus there are several interlinkages we can discuss the interaction between both and consider how the development can be diversified over different regions of global south in the world.

The discussions and policy debates could be on 3 thematic issues

- business potential and investment needs for circular economy
- envisioning a circular economy based industry in 2030
- the future of the waste industry in view of CE and digital connectivity

SDG 12 calls to *ensure sustainable consumption and production patterns*. Progress is indicated by e.g. *material footprint and domestic materials consumption, food loss, recycling rates and hazardous waste production, sustainable public procurement actions*. All these indicators are directly affected by the implementation of circular economy or 3R policies. CE and 3R go beyond the efficient collection and recycling of waste. They aim at the introduction of a sustainable lifestyle, in which producers and consumers move away from the linear make-use-dispose model and introduce sharing, leasing, repair and remanufacturing concepts.

SDG9 aims to *build resilient infrastructure, promote sustainable industrialization and foster innovation. Sub-target 9.4 aims to upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities*. This calls for a smart introduction of technologies and a deliberate choice of industrial development.

5. Value pools and investment potential for Circular Economy in Global South

Circular Economy is a driver for new business creation. In a first analysis in Asia, Africa and Latin Amrica, there is huge the business potential for resource efficiency in the raw materials sector, which

can be considered the sector of prime interest for the transition to circular economy in the global south , as it covers the value chain from mining over processing (including recycling) to production and consumption.

The global raw material market is challenged by a huge potential for operational improvement on the one hand, calling for a much better inclusion of key enabling technologies and cross-sectional impulses. The raw material or mining sector in south, south east and central asian countries as well as African contintent and Latin American countries like Brazil, Chile and Peru , appears yet to be hardly stable, with significant variances in material demand and constantly changing patterns of trade, and with disruption and market failure being present for particular raw materials.

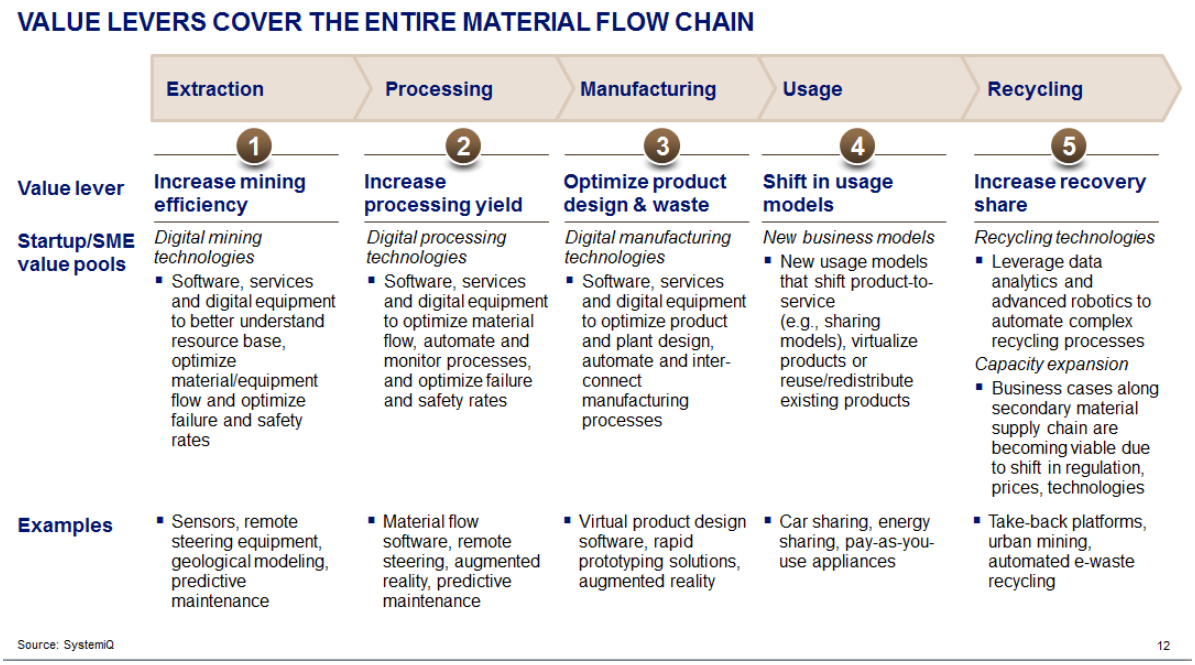
Traditionally, the mining sector is driven and dominated by large corporations. This is mostly linked to the high CAPEX intensity, long payback periods of investment and rather low fungibility of assets in operation. However, new disruptive technologies, business model innovations and regulatory changes are transforming the competitive landscape of the mining sector. An adjacent raw material sector is emerging , with value pools around technologies increasing the efficiency of material supply and reducing waste and material usage, such as those related to:

- Digital or Industry 4.0 type technologies for mining and processing companies
- Advanced sorting, dismantling and recycling technologies
- Waste management for e-waste, precious and specialty metals
- New usage models that shift products to services, virtualize or redistribute products

Naturally, incumbent players would be rather slow in exploiting such newly arising opportunities. Start-ups, not having the need to defend legacy business, are generally more agile in this field. The relatively limited number of viable new ventures in the raw material sector compared to the economic potential however indicates market barriers that impede entry or scale-up of new technologies and ventures. Such barriers include as explained earlier high upfront capital and specialised knowledge requirements, market-specific trading patterns and market reflexivity. Altogether this results in high underlying volatility and risk with regards to new venture activity.

Figure 3 presents the contributing value levers and technologies for business creation in the different steps of the material value chain. It is shows that digitalization technologies are central in this.

[Figure 2]: Value Levers for busines creation across the material value chain



(Source: SystemiQ)

As a second viewpoint, we can look for the future of global supply chain development from developing countries of global south perspective. Since 2012, UNEP's Eco-Innovation project supports entrepreneurs for business creation in developing and emerging economies of Global South . It presents methods and tools for the implementation of eco-innovation in small and medium sized companies. The business cases that have been generated through this programme have been evaluated concerning the on the role of technology in the implementation, including its connection with the circular economy approach.

6. Envisioning a circular economy based industry in the Global South towards 2030/2050

Circular economy has the ambition to produce a resource efficient society, in which consumption and production systems operate within the boundaries of our eco-system's resilience. This will have an effect on all actors in society. It will not only produce new business opportunities, as identified above, but will also affect the roles of policy makers, financers, consumers, suppliers, designers,… From this perspective it is important to look ahead and envision what this future will look like. Industrial sectors need to redefine their role and approach, need to identify business opportunities and research and innovation needs. Countries and regions need to assess their strengths and evaluate their possible pathways.

At European level, projects like Vision and Roadmap for European Raw Materials) brings together industrial actors and researchers. It aims to produce a common long term vision and roadmap to 2050 for the most relevant raw materials, including metals, industrial minerals, aggregates and wood. At ASEAN level the circular economy framework states that the South East Asia's industry sector need to foster a sustainable supply and use of Raw Materials to feed existing and new value chains, while ensuring base loads from ASEAN resources, decreasing import dependencies and ensuring resilience of the ASEAB and East Asua industrial base through resource diversification. The future vision is based on the idea that the right materials needs to be made available for the right product and the right place. Coupling this diversification idea to the principles of circular economy leads to a different approach for sourcing and management of materials.

The Regional 3R Forum for Asia and the Pacific gathers 35 countries, that have signed the Jaipur declaration towards the promotion of circular economy in achieving resource efficient societies in Asia and the Pacific under the 2030 Agenda for sustainable development. The coordination is done by UNCRD. In this declaration, the signing parties express their willingness to strengthen the coordination to adopt and implement circular economy plans, a whole-of-value chain approach, strategies and tools to reduce, reuse, and recycle natural resources in production, consumption and other life cycle stages (7th Regional 3R Forum in Asia and the Pacific, 2025, Jaipur 3R Declaration, India).

Several studies recognise the need for more efficient management of resources in view of increasing consumption patterns, but also the inherent strengths of Asian societies concerning recovery and recycling as well as digital technologies. The combination of both must allow a direct move towards effective (circular) systems, avoiding linear system lock-ins (EMF 2017). The Economic Research Institute for ASEAN and East Asia (ERIA) has generated insights in the international perceptions towards Industry 4.0 and Circular Economy, and can provide input on progress and problems in its implementation.

The UNEP International Resource Panel performed groundbreaking work on responsible resource management and resource efficiency in Africa. They identified priority products and materials, provided advice on decoupling between economic activity, resource use and environmental impact and identified the critical role of recycling of metal stocks and flows (UNEP 2012). The African Union (AU)recently launched the Continental Circular Economy Action Plan (CEAP), a ten-year strategy to foster sustainable industrialization and climate-resilient growth in Africa by incorporating circularity into key economic sectors (Käsner et al. 2024).

7. The future of the Circular Economy and the Digital Economy in the Global South

The circular economy industry has its basis in the make-use-dispose logic of the linear economy. They have made a business from taking ownership and responsibility for the materials that industry and society want(ed) to dispose. They have taken up a central role in managing hazardous materials and reducing exposure to toxic substances. With the introduction of the circular economy, the material ownership and risk allocation will change (Velis and Vrancken 2015). Material recycling industries in sectors like the automobile need to re-evaluate its business concept and make the transition to material management in a changed industrial and consumption context. A system where materials are exchanged, pooled, and shared, where value is maximised, and therefore safe sinks are still necessary.

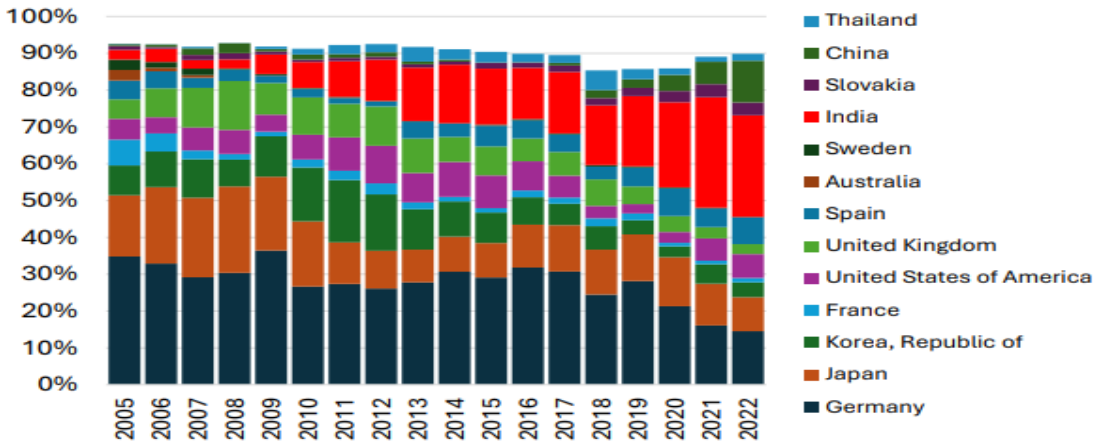
The Global Waste Management Outlook (GWMO) report was presented by UNEP IETC in 2015 (UNEP 2015). ne of its actions called to move the focus of 'waste management' upstream, to become 'resource management' as an integral part of a circular economy.

For the future of the waste sector, the introduction of ddigital economy will be a determining factor. Material management will no longer be a merely logistic concept. In current practice, waste collection services are already optimised using digital technology. The introduction of sensoring, identification and tracing allows data collection on the flow and destination of goods and components. Data analysis and intelligence, together with the interner of things, will enable the mapping of materials and initiate a new range of material management services.

In waste sorting and material processing, the introduction of advanced characterisation techniques by digital technologies and robots may revolutionise the current practice. The introduction of large-scale sorting installations will enable the production of higher value recovery materials and the production of new higher-grade secondary products. It will impact waste collection and recycling schemes, may allow strong progress in material recycling and impact current landfilling practice.

The automobile sector poses a vast source of investment for Africa. In 2024, the African automotive market was valued at $20.5 billion, expected to grow by $6 billion by 2029 (CII, 2024), however, this market is dominated by used vehicle imports from Europe, the United States, and Japan (EMF, 2024). International car manufacturers are increasingly establishing manufacturing plants across Africa to bolster the presence of supply chains on the continent.

[Figure 4]. Used Vehicle Imports to South Africa by Country %



(Source: Tardemap.org)

Figure 4 shows the sources of import of vehicles to South Africa. East Africa predominantly imports used vehicles from Japan, while West Africa imports from North America, with Nigeria leading as the main market for these imports accounting for 16% of total African used vehicle imports, followed by Libya (11%), Tanzania (9%), Guinea (6%), and Ghana (5%). Among African countries, only South Africa, Egypt, Tunisia, Algeria, and Morocco have legislated bans on the import of second-hand vehicles, while some countries impose no restrictions, and others have age limits for imported used vehicles. The affordability of used cars, due to lower disposable incomes, limited credit and vehicle finance access, and the higher cost of new vehicles, makes them a favorable option for African consumers.

The circular economy in the automotive sector is characterized by sharing, electrification, automation, materials evolution, and a system-level integration of transport modes. Adopting the circular economy aided by digital platforms in the Global South aids in the minimization of e-waste, the repurposing and harvesting of raw materials, and the electrification materials. (T20 2025).

8. The State of the Circular Economy Transition in Africa

The African Circular Economy Alliance (ACEA) founded in 2016 by the governments of Rwanda, South Africa, and Nigeria with UNEP and WEF for best practices regarding circular economy policy development. The current members are: Nigeria, South Africa, Rwanda, Ghana, Burkina Faso, Benin, Sudan, and the Ivory Coast.

The following thematic areas are identified for implementation

- Converting food waste to organic fertilizer

- Recycling plastic packaging
- Promoting e-waste collection and recycling
- Promoting the use of mass timber
- Recycling clothing and textiles waste

The financial backing of the intra-national circular economy transition is the Africa Circular Economy Facility (ACEF), established by the African Development Bank in 2022. ACEF outlined a three-point approach for forwarding the circular economy transformation at all levels in Africa: capacity building and policy development, circular business development, and advocacy and knowledge sharing.

There are some converging efforts in the application of circular economy policies in Africa and ASEAN. Fig. 5 below shows the types of existing policies in Africa as per country in 2020

[Source]: GRID-Arendal, ACEN, Footprints Africa and ICLEI, 2021.

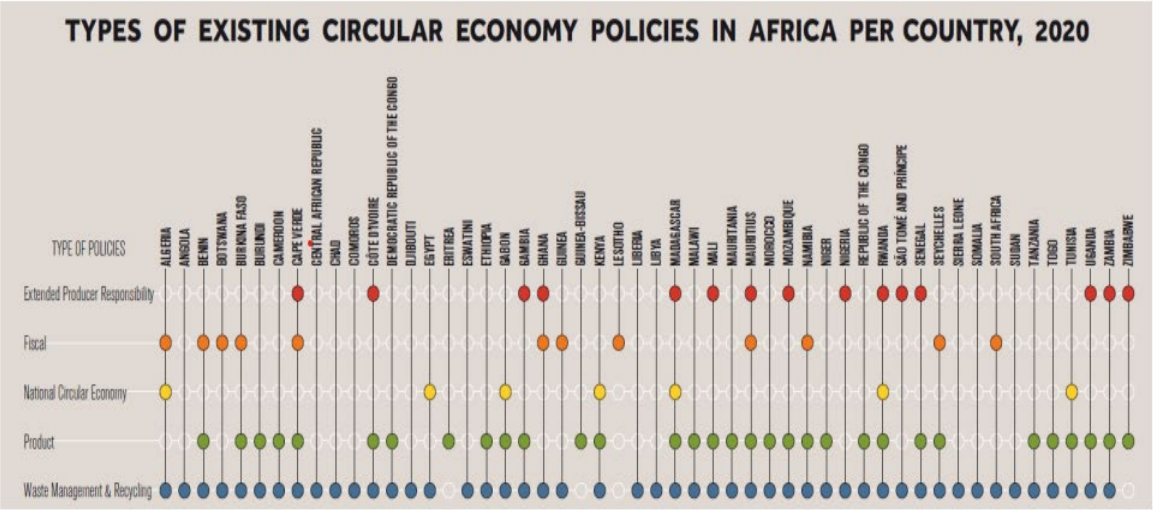


Figure 21.1 CE-related policies, regulations and initiatives in a selection of African countries (Source: GRID-Arendal, ACEN, Footprints Africa and ICLEI, 2021

As could be seen in the figure and the table 2 below across the continent of Africa, countries are in the different stages of adopting circular economies.

Table 2: Current level of Circular Economy initiatives in the African continent

Sub-Region	Key Features
Intra-Regional	The African Circular Economy Alliance (ACEA) founded in 2016 by the governments of Rwanda, South Africa, and Nigeria with UNEP and WEF

	for best practices regarding circular economy policy development. The current members are: Nigeria, South Africa, Rwanda, Ghana, Burkina Faso, Benin, Sudan, and the Ivory Coast. Five thematic areas: - Converting food waste to organic fertilizer - Recycling plastic packaging - Promoting e-waste collection and recycling - Promoting the use of mass timber - Recycling clothing and textiles waste
Eastern Africa	- Rwanda: 2019, revised its Environment and Climate Change Policy called for the establishment of a legal and institutional framework on the circular economy. - 2017, the East African Community (EAC) adopted a resolution named Polythene Materials Control Bill aimed at regulating the use of polythene in the region. - In Kenya, the National Environment Management Authority (NEMA) drafted the 'Environmental Management and Co-ordination (E-waste management). Kenya has emerged as a leader of digitalization in Sub-Saharan Africa. - Nairobi city government launched campaigns to become a zero-waste city. - Multiple governments are members of key working groups to develop policy implementation strategies.
Western Africa	- Cameroon and Ivory Coast, Nationally Determined Contributions (NDCs) include the circular economy in their adaptation commitments. - Senegal in the process of developing such plans - Ghana: Ghana established the Ghana National Plastic Action Partnership, a country-wide platform for multi-stakeholder engagement tasked with establishing a regional model for the circular economy transition and managing plastics.

	- Lagos State, Nigeria organized the Lagos State Roundtable on Circular Economy in 2020 and presented plans for incorporating the circular economy in the 30-year development plan.
Northern Africa	- Morocco is in the process of developing such plans for circular economy action plan - Demco, a clothing manufacturer in Tunisia incorporates the recycling of water, energy, and textile waste to recycling partners.
Southern Africa	- In 2020, South African stakeholders, government, and NGOs created the South African Plastics pact chaired by GreenCape. - South Africa, aims to bolster its policies regarding Extended Producer Responsibilities (EPR)—policies related to packaging and recycling of electrical and electronic equipment. In addition to industry regulation, these policies aim to fund a salary scheme for workers in the informal sector. - South Africa: Digital Society South Africa (2017) - Cape Town South Africa, launched Africa's first circular economy action plan on a city level

Early adoption entails a fractured approach anchored on integrated waste management and a limited understanding of the benefits and components of the circular economy. East Africa sub-region's readiness remains at the moderate transitioning phase, marked by a few articulated policies and/or strategies establishing the circular economy and national initiatives supported by donors and governmental funds. The Southern African sub-region represents an integration phase of the circular economy with industrial policies. This advanced integration is aided by emerging EPR laws and policies, clearly identified sector-specific circular opportunities, and potential for increased investment from commercial investors. On the national level, multiple African countries, including Rwanda, Cameroon, Ivory Coast, Senegal, Morocco, South Africa, and Ghana have either established a component of circular economy transitions in their climate change and national adaptation policy commitments. In 2019, Ghana joined the international Global Plastic Action Partnership, brought together by the World Economic Forum (WEF) and established the Ghana National Plastic Action Partnership—a national platform that fosters cooperation between government, business, and civil society. African governments on a local, national, and international level are increasingly recognizing the circular economy as a strategic framework for sustainable development—integrating it

into policy, fostering public-private partnerships, and advocating for equity in global sustainability.

The vast opportunities in Africa lie in the informal economy. This sector forms the backbone of activities such as textile reuse, metal and e-waste recycling, and repair-based entrepreneurship. According to the ILO (2023), circularity in the Global South, particularly in Africa, could create 7–8 million new jobs by formalizing and scaling these practices. Yet the lack of research and implementation in African countries emphasizes a stark knowledge gap.

Africa can leverage its material resources—such as copper, cobalt, and rare earth elements—and its maritime access, to further it's position on the global stage. The east coast of Africa, part of the Indo-Pacific region, is poised to harness the blue economy, which the United Nations Economic Commission for Africa has dubbed the "new frontier of African renaissance." With 90% of Africa's trade passing through maritime routes, the Bab-el-Mandeb Strait and the Indian Ocean trade corridors position African countries as indispensable to the global supply chains (Nkala, 2021). However, only 1.2% of the world's ships are African-ownedunderscoring Africa's invisibility in maritime trade.

9. Summary and Recommendations

Global South could become a critical driver in shaping the global circular economy transition grounded in resilient and sustainable industrial development. With some of the world's fastest-growing urban centers, the largest informal workforce, and an abundance of natural resources, developing countries of Asia, Africa and Latin Amrica can define how circularity can address the specific socioeconomic development challenges. However, gaps remain. Many countries in the global south are in the early adoption phase of integrated circular economy and digital strategies, with fragmented policy environments and limited capacity for Industry 4.0 technologies. The circular economy transition relies on sufficient digital technological knowledge and infrastructure to formalize waste regeneration. Currently, in several countries of Africa, this knowledge is limited, and implementation plans must be tailored to the national context.

The following serve as recommendations for such a partnership and contribute to building Africa's Circular Economy Master Plan

- Establish circular material transition targets and key performance indicators (KPIs) that drive the circular design of products and associated services.
- Identify actions and foster collaboration for making trade and investment policy supportive of circular supply chains.
- Enhance circular economy financing and establish dedicated funding mechanisms.
- Develop ESG metrics that evaluate company performance on circularity principles, which are used by financing institutions to deploy capital per their institutional mandates.
- Nurture a localized circular economy transition, harnessing regional resources to shorten value chains, reduce emissions, bolster local economies, and create long-term value, maximizing the long-term value creation by allowing Path Diversity towards the transition and the value creation across local communities.
- Develop an open digital platform to ensure national, regional, and trans-continental digital connectivity along circular value chains that make the transition to a circular economy just, inclusive, and entirely optimal for the Global South with the support of the above-proposed global EPR standards and other economic incentive mechanisms.

This Master plan, built upon an Asia–Japan- Africa intercontinental partnership, presents a shared opportunity for sustainable, equitable development across the Global South. Japan and Africa's expanded connectivity on co-propseity through circular supply chains and digitalare poised to lead the sustainability transition. While challenges persist in financing, policy, and infrastructure, the potential for mutual growth through innovation, regional integration, and private sector investment persists. By advancing coordinated policy frameworks, financing mechanisms, and digital infrastructure, global forums like G20 and TICAD can catalyze this transformation, making circularity both an environmental goal and a driver of economic resilience and South-South prosperity.

＜References＞

Accenture (2015). Waste to Wealth. Accenture Strategy.

ASEAN (2021) Framework for Circular Economy for the ASEAN Economic Community. ASEAN Secretariat.
https://asean.org/wp-content/uploads/2021/10/Brochure-Circular-Economy-Final.pdf

CII (2024). Pathway for Shared Proposerity: India-Africa Economic coopeation, https://www.cii.in/International_ResearchPDF/Pathways%20for%20Shared%20Progress%20India_Africa%20Economic%20Cooperation.pdf

EIT RawMaterials. (2017). Circulator (http://www.circulator.eu).

EMF. (2015). Delivering the Circular Economy: A toolkit for policy-makers. Ellen MacArthur Foundation.

EMF. (2017). Circular Economy in India: rethinking growth for long-term prosperity, Ellen Mc Arthur Foundation, UK.

EMF (2024). Global Commitment. Ellen Mc Arthur Foundation, UK. https://www.ellenmacarthurfoundation.org/global-commitment-2024/overview

ERIA (2016). 'Twoards Circular Economy : Cirporate Manangement and Policy Pathways Circular economy. ERIA Project Report. https://www.eria.org/research/towards-a-circular-economy-corporate-management-and-policy-pathways/

Käsner, S., K. Gihring, P. Desmond and C. Schenck (2024). Chapter 21. Circular Economy Transitions in Africa: a policy perspective. in Passaro, R., P. Ghisellini, M. Pansera, S. Barca. M. Calisto Friant. (ed.) (2024) Circular Economy for Social Transformation: Multiple Paths to Achieve Circularity.

Nkala, S. (2021). 'Africa and the Indo-Pacific Dynamics: China, India, and Japan's Strategic Competition in Africa's Indian Ocean States', https://www.jstor.org/stable/27159669

PWC (2017). Industry 4.0: hype or reality?, PWC and Flanders Make.

Systemiq (2024) . Transition materla Chalalnges https://www.systemiq.earth/wp-content/uploads/2024/04/240405-OSF-Transition-Materials-Study-1.pdf

T20. (forthcoming). Embedding Circularity in Global Trade: A G20 Road Map for Catalysing Circular Value Chains：T20 South Africa Policy brief

UNEP. (2012). Responsible Resource Management for a Sustainable World: Findingd from the International Resource Panel.

UNEP. (2015). Global Waste Management Outlook, http://web.unep.org/ietc/what-we-do/global-waste-management-outlook-gwmo.

A Just Transition To ciruclar Economy in AU https://just2ce.eu/wp-

content/uploads/2024/06/2024-JUST2CE-eBook-Final_Version_19.4.24-ch21.pdf

Velis C., and K.C. Vrancken. (2015). Which Material Ownership and responsibility in a circular economy?, editorial, *Waste Management & Research*, 33. 773-774.

ILO. (2023). Global South circular economy could generate millions of job opportunities', 9 May 2023. International Labor Organization. https://www.ilo.org/resource/news/global-south-circular-economy-could-generate-millions-job-opportunities

Chapter 3:

Overview of African Politics and Economy

For Sustaining Growth in Sub-Saharan Africa: In search of structural transformation

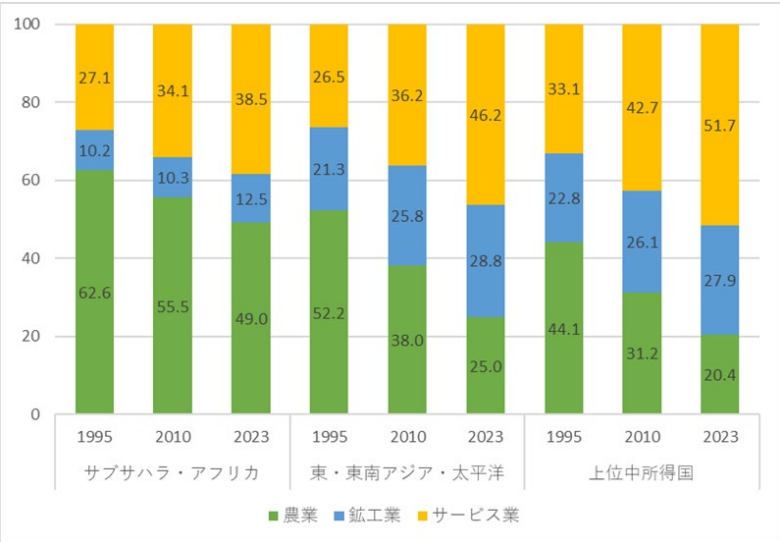
Takahiro Fukunishi Ph. D, Seinior Reseach Fellow, IDE-JETRO

Recently, many stakeholders expect transformation of African economies through application of digital technology removing constraints on firm activities. While digital technology has delivered productivity gain in African firms, it is not clear if they lead to structural transformation from agriculture to industries, and from informal-based to formal-based economy, which is necessary to realize sustained economic growth. Based on a brief history of industrial policies in sub-Saharan Africa, this chapter argues that potential and challenges of the recent industrial policies.

1. Need for Structural Transformation

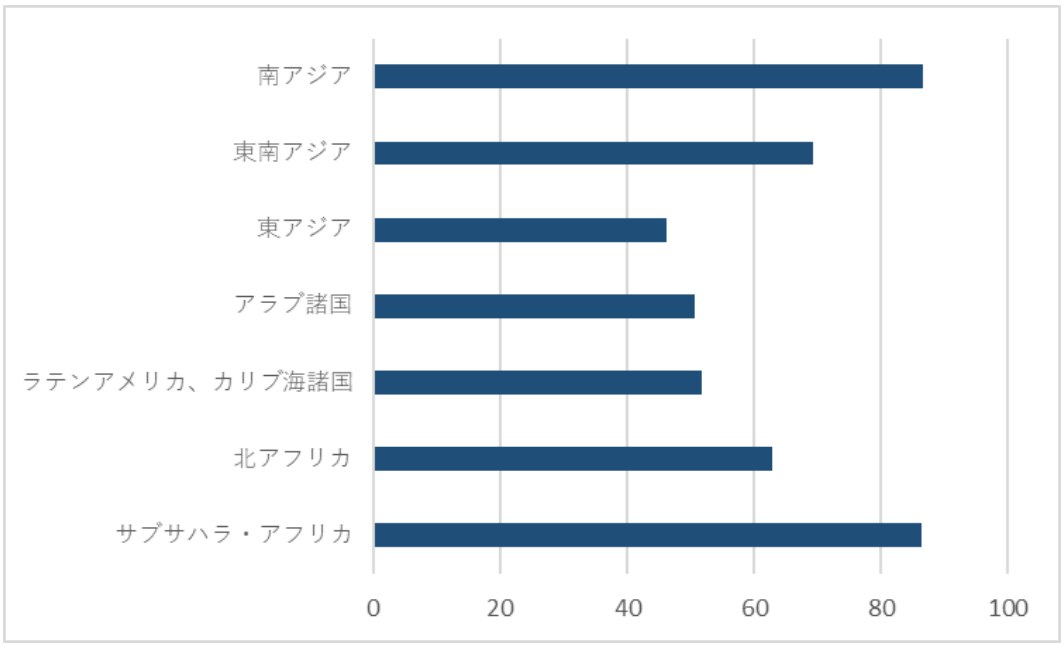
The economies of sub-Saharan African countries (hereafter referred to as "Africa") have experienced major changes in recent years. Since the mid-2000s, direct investment from developed and emerging countries has increased in transportation infrastructure such as roads, railroads, and ports, as well as residential and commercial facilities. More recently, as Internet access becomes widely available with the development of mobile communication networks, mobile money is spreading rapidly, and online shopping is becoming common, especially in urban areas. These are positive changes for growth and poverty reduction, however, African countries still suffer from the highest poverty rate, headcount ratio under the international poverty line, in the world.

[Figure 1] Employment Share by Sector



(Source: World Development Indicators

[Figure 2] Informal Employment (%, 2024)



NOTE: Informal employment includes employment and informal sector and employment in formal sector without a contract complying with labor law.

(Source: ILO STA)

Persistent poverty is related to the two features of the African economies. First, employment is concentrated in agriculture with small fraction in the manufacturing sector. In sub-Saharan Africa as a whole, employment in agriculture is the largest, while employment in industry is the smallest (Figure 1). Although there has been a gradual shift of labor from agriculture to services, structural changes from agriculture to manufacturing has not yet realized in African countries except for a few countries such as South Africa and Mauritius. And the two largest sectors, agriculture and service are composed of small farmers and self-employed, with low labor productivity. These micro-scale producers form the informal sector, which are not registered with the government and evade the obligation to comply with various regulations. Another characteristic of African economies is that the informal sector employs more workers than the formal sector, in which employment is better paid and protected by labor regulations (Figure 2).

Africa has one of the highest population growth rates in the world (2.5%, 2023 WDI). The number of young workers will continue to grow, with the ILO estimating that young workers in the sub-Saharan Africa region will increase by approximately 72.6 million between 2023 and 2050 (ILO, 2024). For this growing number of young people to get out of poverty, they need to move to cities and find employment in the manufacturing and service industries in formal sector. In other words, the poverty rate will not decline unless the number of decent jobs in non-agricultural sectors increases,

and at a faster rate than the growth rate of the labor force (Bandiera et al. 2022). This means that Africa needs high growth in both the number and quality of jobs.

2. Industrial Policies in Africa

The structural transformation of the economies has been the most important challenge for African countries since independence. Given an economic structure specializing in primary commodities such as agricultural products and natural resources, created in the colonial era, the new African governments pursued import-substitution industrialization through the active industrial policies. Modest growth shown in the 1960s did not sustain and turned stagnated after the Oil Shocks in the 1970s, leaving large government debt. In the 1980s, the World Bank and the International Monetary Fund introduced the structural adjustment programs focusing on economic and trade liberalization as a condition of loan. Many state-owned enterprises were abolished or privatized, support for local industries including protective tariffs on imports, subsidies and low-interest loans were largely eliminated. The government's role was limited to stabilizing the macroeconomic conditions. Subsequently, establishing effective institutions for smooth functioning of markets was emphasized as a part of good governance in developing countries, while active intervention in private sectors was not allowed. During the 1980s and 1990s, however, African economies experienced serious stagnation and poverty deepened.

Given the persistent poverty in Africa, Jeffrey Sachs, who initiated the UN Millennium Development Goals, argued that these countries had been captured in a poverty trap and needed large scale of aid to escape the trap (Sachs et al. 2004). He argued that poverty reduction cannot be achieved by simply liberalizing the economies. While his argument induced controversy with those skeptical of aid, it triggered discussions on development strategies, and the need for structural transformation. At the same time, witnessing China's industrial growth and the resulting stagnation of the manufacturing sector, some African governments began to set industrialization as a policy target. In the mid-2000s, African countries experienced resource-led economic growth for a decade, but resulting in quite limited employment generation. This encouraged African governments, donors, and development agencies to emphasize the diversification of economic structures and African governments began to pursue industrialization as a key channel to economic growth.

From the late 2000s onward, African countries started active industrial policies. Special Economic Zones (SEZs) have been established to attract foreign direct investment. Some countries have also begun to explicitly support industries through expanding supply in the domestic market. Rwanda, for example, has started a policy to increase share of local products in the domestic market. It designates construction materials (especially cement), light industry (textiles, etc.), and processing of agricultural products as target industry, providing financing in leading domestic companies and giving priority in government procurement. Oil-producing countries have implemented local content policies that

require foreign mining companies to procure materials, parts, and related services from local firms. These are import-substitution industrial policies that were strongly rejected in the structural adjustment programs.

Currently, mainly two types of policies are implemented for industrialization. The first is to facilitate efficient business environment to remove constraints on business activities. It includes stable macroeconomic policies, effective contract enforcement and property rights, public services related to business such as licensing and customs clearance, access to finance, and infrastructure such as electricity and transportation. These have been imposed by aid agencies on African countries since the 1990s, and some progress has been made, but the business environment in African countries remains ineffective in the world (World Bank 2024). The other is to support for industries to achieve economies of scale. Given increasing-return-to-scale technology in the manufacturing sector, large-scale investment is required to achieve productivity comparable with industries in foreign countries. Policies inducing large investment are considered effective for industrialization, which include provision of public finance and protecting the domestic market from imports to ensure market share of domestic firms. These approaches were actively adopted in many countries after independence, but had been rejected under the structural adjustment program. Only recently, have they been reintroduced in the menu of industrial policies.

3. Toward Structural Transformation

There has been high expectation for digital technology to bring about economic growth in Africa. With poor wired communication networks, mobile communication technology has had a major impact, rapidly spreading among urban and rural populations. In particular, it facilities penetration of mobile money as financial infrastructure. The spread of mobile money has led to the proliferation of online transactions in urban areas, combined with SNS, e-commerce platforms, and motorcycle delivery services. Online services have greatly increased opportunities for informal micro-businesses to search for and exchange information with consumers and suppliers, improving the efficiency of marketing and procurement. In addition, microfinance through mobile money has become available to many micro-businesses. Digital technology including mobile networks has the potential to eliminate constraints on economic activity in Africa (e.g., Goh 2025).

The development of digital technology may induce growth driven by the service sector rather than the manufacturing sector that has been stagnating in Africa. However, rather than growth potential of ICT sector, the most promising impact of digital technology on economic growth is transformation of business environment that has been improved only slowly for some decades. Since sustained growth necessitates steady productivity gain in the whole economy, for which effective business environment is required. Given the present structure, it should entail the reduction of the informal sector and the

expansion of the formal sector through the growth of firm size. Therefore, digital technology must lead to productivity improvements for medium and large-sized enterprises, while currently we see significant changes rather among the informal micro-businesses. It needs to streamline business licensing, improved access to finance, stabilization of power supply, and acceleration of cross-border logistics procedures, so that firms in formal sector are benefitted.

The realization of these goals requires strong initiative of public sectors, while based on past performance, the African governments are not likely to promote necessary actions in the digital field. For example, M-Pesa, the most popular mobile money service launched in Kenya, was a technology led by a private company with little involvement by Kenyan government. While the private-sector-led approach has been successful for the spread of mobile money (Tyce 2020), users have suffered from serious problems. So frequent online frauds have discouraged consumers from contacting unknown shops and people online (Fukunishi and Inoue 2024). Furthermore, since interest rates for mobile finance were not regulated until recently, extremely high interest rates were set, leaving many users unable to repay their loans. It has been argued that the government does not prioritize consumer protection over the interests of mobile communication operators (Upadyaya et al. forthcoming). Those cases raise questions about the effectiveness of African governments in changing the business environment.

Industrial policies in Africa are still in their infancy. With the exception of Ethiopia, South Africa, and Mauritius, many African countries have lost their experience and knowledge during the period of the structural adjustment policies. Since the tasks of government were limited in internal governance, policy makers did not develop an understanding of constraints and potential of local industries. Therefore, communication between private sectors and governments has remain sparce, and many countries have not even conducted census surveys of firms for many years. With rapid advances in digital technology, industrial technology is experiencing major changes, and labor-intensive manufacturing may no longer be the only entry point of industrialization. Considering these factors, African governments need to start by understanding private sector through frequent dialogue and undergo a process of trial and error to develop unique industrial policies tailored to country's socioeconomic conditions. To this end, it is also important for aid agencies and donor countries to gain a detailed understanding of the societies and economies of African countries and to collaborate each other in the formulation of unique industrial policies.

A part of this manuscript is based on Takahiro Fukunishi, “Industrial Policy in Africa,” in Takahashi, Fukunishi, Yamazaki, Ideue, and Matsubara eds., *Economic Development in Africa*, Kyoto: Minerva Publishing, 2025 (in Japanese).

＜References>

Bandiera, O., A. Elsayed, A. Smurra and C. Zipfel, (2022). “Young Adults and Labor Market in Africa,” *Journal of Economic Perspective*, 36(1) pp.81-100.

ILO (2024). *Global Employment Trends for Youth 2024*, Geneva: ILO.

Goh, C. ed. 2025. *21st-Century Africa: Governance and Growth*, Washington D.C: World Bank.

Fukunishi, T. and N. Inoue (2024). “Online Marketing in Urban Informal Sector: A Case in Nairobi,” in Hamada ed., *Digitalization in developing countries: cases from Africa, Southeast Asia, and Latin America*, Chiba: Institute of Developing Economies, pp.45-74 (in Japanese).

Sachs, J., J. W. McCarthur, G. Schmidt-Traub, M. Kruk, C. Bahadur, M. Faye, and G. McCord (2004). “Ending Africa’s Poverty Trap,” *Brookings Papers on Economic Activity*, 1, pp.117-240.

Tyce, M. (2020). “The politics of central banking in Kenya: Balancing political and developmental interests?” ESDI Working Paper No. 130.

Upadhyaya, R., K. Weitzberg, and L. Bonyo (forthcoming). “Digital credit providers, regulatory frameworks, and structural power: A case study of digital microcredit regulation in Kenya,” *Finance and Society*.

World Bank (2024). *Business Ready 2024*, Washington D.C.: World Bank.

Chapter 4:

Automotive Industry

Automotive Industry

Yasushi Ueki, President of Bangkok Research Center and Senior Research Fellow, IDE-JETRO
Fusanori Iwasaki, Consulting Fellow, Research Institute of Economy, Trade and Industry (RIETI)

1. Introduction

This chapter aims to provide an overview of the current state of the automotive industry in Africa, its development to date, and future prospects. The key characteristics of the automotive industry in Africa can be summarised as the low number of vehicles productions relative to the population size and the uneven distribution of production facilities. A significant portion of new vehicles sales within Africa are imported vehicles, and while South Africa and Morocco have established production bases with a certain level, production in other countries remains extremely limited. On the other hand, imports of used vehicles remain strong, in particular in countries with rapidly growing economies such as Kenya. However, there are signs of change from the status quo. In recent years, there has been a significant increase the number of news about European and the United States automakers starting sales and production of battery electric vehicles (BEVs), as well as Chinese manufacturers entering the market with local sales and production. These trends are spreading to countries other than South Africa and Morocco, and the extent to which such movements will expand, backed by robust economic growth, could become a key focus for the future development of the automotive industry.

The following section provides an overview of the current state of the African automotive industry based on various figures, with a focus on information obtained from media reports, and discusses the latest trends and outlook.

2. Trends in Automobile Production and Sales in Africa

According to information released by the OICA (International Organisation of Motor Vehicle Manufacturers), new vehicle sales in Africa have been fluctuating at around 1 million units per year, although there are some deviations. This scale is roughly equivalent to domestic sales in Thailand and Indonesia (however, it should be noted that sales in these two countries have recently declined significantly). New car sales in Africa have not expanded significantly relative to the population size. South Africa accounts for approximately half of all new car sales in Africa. The three countries of South Africa, Egypt, and Morocco together account for approximately 70–80% of total sales in Africa, while the remaining 50 or more countries share the remaining 20% of sales, reflecting the geographical

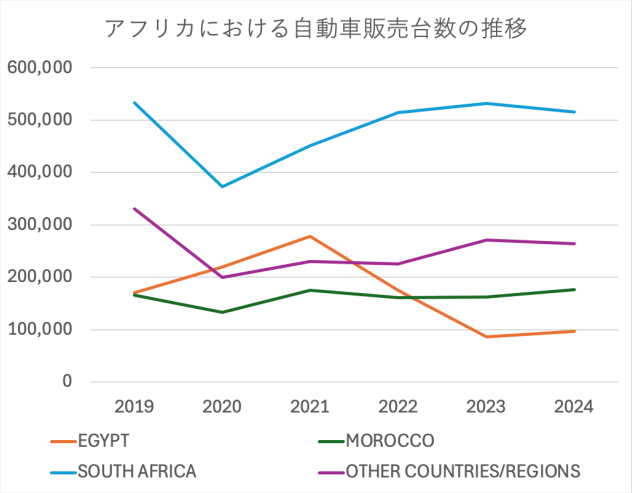
concentration of the African automotive market (Table 1). However, some estimates show that Algeria's 2021 new vehicle demand at 400,000 units and view Algeria as Africa's second-largest automotive market (JETRO, 30 January 2023). In Nigeria, 10,000 units were produced in 2021, but imports exceeded 30 times that figure (NADDC, 2023). Additionally, Kenya's new vehicle registrations in 2024 are projected to reach 69,000 units (JETRO 2025, March 11), representing a market size that cannot be ignored even when compared to Egypt.

[Figure 1] New vehicle sales in Africa

	2019	20	20	20	2023	2024
AFRICA	**1,200,291**	**925,708**	**1,133,520**	**1,075,740**	**1,050,105**	**1,053,611**
Egypt	170,568	219,732	277,805	175,125	86,044	96,862
MOROCCO	165,916	133,308	175,435	161,409	161,504	176,401
SOUTH AFRICA	532,898	372,633	450,674	514,178	531,557	515,853
OTHER COUNTRIES/REGIONS	330,909	200,035	229,606	225,028	271,000	264,495

(Source: OICA)

[Figure 1] Trends in automobile sales in Africa



(Source: Compiled by the author based on OICA data)

Next, we focus on production volume. According to OICA statistics, automotive production in Africa in 2024 is estimated to be approximately 1.177 million units. South Africa and Morocco each produce over 500,000 units annually, accounting for 98% of Africa's automotive production (Table 2). South Africa, the largest automotive producer in Africa, ranks 21st globally in terms of production volume in 2024. However, this is nearly 200,000 units less than Malaysia, which ranks 20th with 790,000 units production, and only about half of Indonesia, which ranks 15th with 1,197,000 units production. Note that Egypt's production figures in Table 2 have been zero since 2021, as these were

not captured in OICA data. According to JETRO (2025, June 9), out of Egypt's 2024 new vehicle sales, 63,666 were locally assembled vehicles. Even if there were exports of locally produced vehicles, Egypt's local production volume is likely to be lower than that of Morocco or South Africa. It should also be noted that 94,413 locally assembled vehicles were sold in Egypt in 2020 (JETRO 2025), which exceeds the OICA statistics. In addition to Egypt, 11,555 vehicles will be assembled in Kenya in 2024 (JETRO 2025). There are also reports that 10,000 vehicles will be produced in Nigeria in 2021 (NADDC 2023). As such, it appears that automotives are being assembled in countries other than those reported in the OICA statistics. Although there are limitations to the statistics, these data suggest that the African automotive industry is geographically uneven in terms of production.

[Figure 2] Trends in automobile production in Africa

	2019	20	20	20	2023	2024
AFRICA	**1,095,151**	**776,247**	**907,302**	**1,022,783**	**1,170,447**	**1,177,400**
ALGERIA	60,012	754	5,208	2,773	2,456	30,108
Egypt, annual only	18,500	23,754	0	0	0	0
Egypt (AMIC)	90,295	94,413	116,650	93,578	48,831	60,366
MOROCCO	403,218	328,280	403,007	464,864	535,825	559,645
SOUTH AFRICA	631,921	447,213	499,087	555,889	632,362	599,755

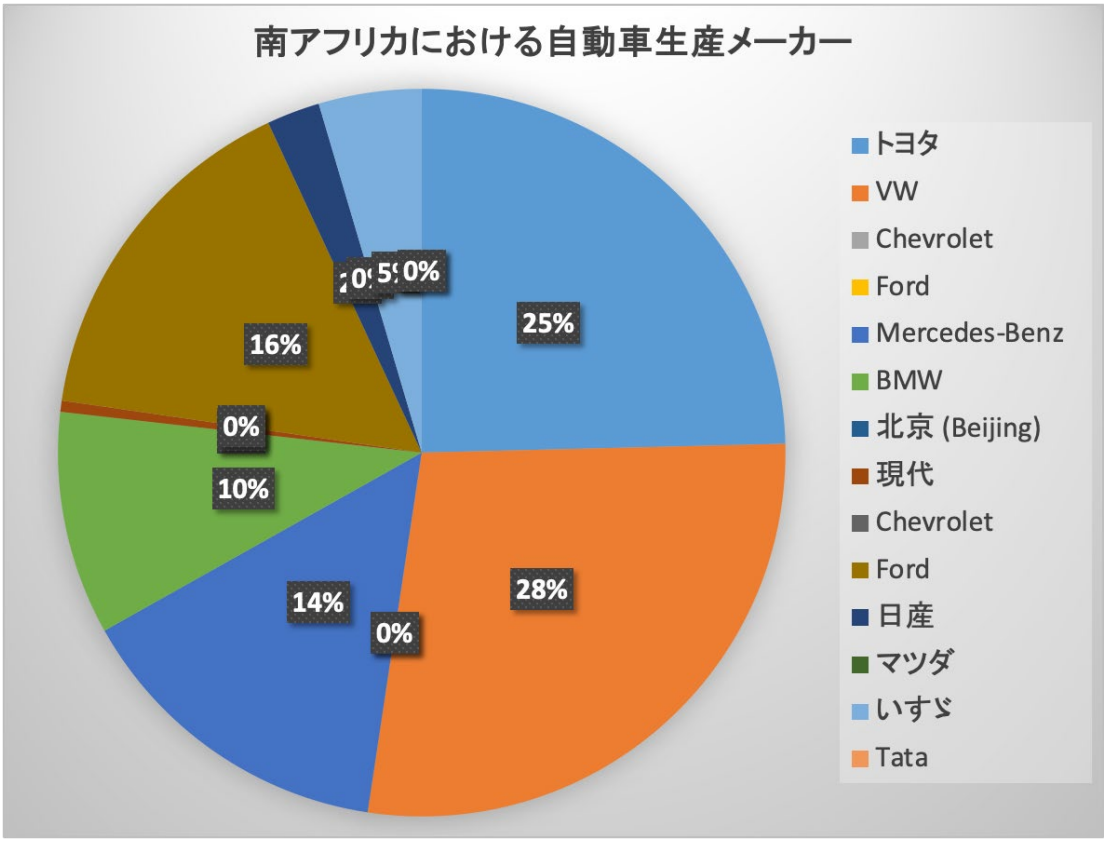
(Source: OICA. Note that the production figures for Egypt are not zero from 2021 onwards; rather, they were not captured in OICA's data. For reference, the data on local assembly of new vehicle sales from the Automobile Market Information Committee (AMIC) included in JETRO (2024; 2025) has also been included.)

There are significant differences between Morocco and South Africa in terms of the companies that have entered the market and their target markets. In Morocco, production has expanded due to the establishment and expansion of production bases by mainly European automakers, including Renault and Stellantis. As shown in Tables 1 and 2, Morocco is characterised by a situation in which production significantly exceeds domestic sales. While Morocco serves as a production hub for European manufacturers, its role is more as an export hub targeting the European market across the Mediterranean Sea rather than for local production and sales.

In contrast to Morocco, South Africa has a well-balanced mix of Japanese, European, and American automotive manufacturers with production bases. Historically, thanks to government export promotion policies, German manufacturers expanded production in South Africa as an export base for right-hand drive vehicles, while Japanese and American manufacturers expanded production as a supply base for small commercial vehicles for African countries (FOURIN 2016). Unlike Morocco, South Africa has

a domestic market of 500,000 vehicles, so production is carried out for both the domestic market and export markets, including within Africa. In 2024, 391,000 units (65% of total production) out of 599,000 units produced were exported to 155 countries. The largest export destination is Europe (75.7% of exports), followed by Asia (7.5%), Africa (6.6%), and North America (6.5%). Another difference from Morocco is that production and sales figures are roughly equal in South Africa (Tables 1 and 2). This means that South Africa imports approximately the same number of completed vehicles as it exports. In 2024, South Africa imported 304,000 small vehicles (passenger cars and light commercial vehicles) from 24 countries worldwide. This accounts for 62.8% of small vehicle sales (485,000 units). The largest source of small vehicle imports is India (57.1% of total imports), followed by China (17.1%), Germany (5.6%), and Japan (4.2%). In recent years, imports from India and China have increased significantly (NAACAM 2025).

[Figure 2] Automobile Production by Manufacturer in South Africa



(Source: Compiled by the author based on MarkLines data)

[Figure 3] Breakdown of automobile production by manufacturer in South Africa

メーカー・ブランド	モデル	2017	2018	2019	2020	2021	2022	2023	2024
トヨタ	Corolla	17987	18861	15603	7292	7414	5071	4995	N/A
トヨタ	Corolla Cross	-	-	-	-	3683	16203	21001	26210
トヨタ	Fortuner	14820	14869	14051	10614	9798	8688	10750	9862
トヨタ	Hilux Revo	76305	87843	90257	70783	78662	72564	97844	84737
トヨタ	Dyna	-	2768	2229	1187	1213	1067	1219	1022
トヨタ	Hiace	14272	16198	11152	11801	13875	12374	16891	14378
VW	Polo	84233	101675	125197	103355	113009	116264	117941	115741
VW	Polo Vivo	26043	25452	28042	19607	19816	20370	27344	22678
VW	Amarok	-	-	-	-	-	-	13121	15270
現代	Porter	3016	3225	2905	2226	2580	2267	2565	2735
Ford	Everest	5062	4876	3834	1709	2263	1132	-	-
Ford	Ford Ranger	82086	93420	91968	64542	75327	73375	78114	87314
日産	NP200	15047	18819	18510	10356	13150	13297	13266	2413
日産	Nissan Frontier (Navara)	-	-	-	-	6803	7832	9440	10683
日産	不詳	7531	15191	14326	8937	5484	-	-	-
Mercedes-Benz (2022-)	C-Class	118216	101904	86414	55768	54027	77302	N/A	80170
BMW	BMW 3 Series	52867	8051	-	-	-	-	-	-
BMW	BMW X3	-	43719	69524	50963	58456	61329	67437	54976
いすゞ	D-Max	18394	-17645	-18746	-15884	20712	22161	25572	25291

(Source: Compiled by the author based on MarkLines data)

Next, let's look at the market share by manufacturer in South Africa. According to Figure 2, which shows the percentage of production volume, Toyota and Volkswagen (VW) each account for about a quarter of the market share, followed by Ford, Beijing Automotive, and BMW. Although their market share is not that large, Japanese manufacturers such as Nissan, Mazda, and Isuzu also follow closely behind. Referring to Table 3, which shows production volumes by brand, the production trends in South Africa become clearer. A notable feature is that the Toyota Hilux, Ford Ranger, and Isuzu D-Max account for a large share of production, all of which are classified as pickup trucks. In terms of passenger vehicles (including SUVs), the Volkswagen Polo holds a significant share. Considering the condition of unpaved roads in Africa, it can be inferred that pickups maintain a certain level of popularity. In 2024, the export ratio for light commercial vehicles was approximately 53%, significantly lower than the 78% for passenger vehicles, with statistics also indicating this trend (NAACAM 2025).

3. Trends in African automotive manufacturers

Next, we will examine trends among automotive manufacturers in Africa based on web information regarding local production. As with sales and production statistics, data on production bases in Africa varies depending on the data source. Some brands have established their own factories, but in many countries, knock-down (KD) production is carried out at assembly plants operated by local companies. Automotive manufacturers are outsourcing KD production to local companies with sales networks and

assembly facilities, while reorganising their production systems in response to changes in local policies and demand. Furthermore, there is a lack of information on withdrawals and production suspensions. For these reasons, it is difficult to make a reliable assessment of the current state of automotive production in Africa based solely on web information. Table 4 is an attempt to organise the vehicles assembled in Africa by brand based on web information, given these limitations.

According to Table 4 and information from the web survey, automotive production bases (including SKD and CKD) in Africa are mainly located in Algeria, Egypt, Ghana, Kenya, Morocco, Nigeria, and South Africa (JAMA 2024), where Japanese automakers have expanded their operations, as well as in Tunisia, Rwanda, and other countries. However, as of 1999, production in Botswana, Libya, and Zimbabwe was reported by the OICA. In Rwanda, Volkswagen reported the opening of an automobile assembly plant in 2018 (Reuters 2018, June 27), but the current status of operations is unknown. In addition, information on production by local companies that are difficult to understand without on-site investigation, such as CNG vehicle manufacturing by Lanre Shittu Motors based on an initiative by the Nigerian government, an EV project by Kiira Motors in Uganda, and GIAD Motor and GIAD Truck in Sudan, can be found on the web based information. As mentioned earlier, the OICA statistics referenced in this paper have coverage issues, such as the failure to capture production and sales figures for Egypt and the inaccurate counting of assembly by local companies. It should be noted that more detailed information gathering and field research are necessary to gain a comprehensive understanding of the African automotive industry. Despite these data limitations, not only European and American car brands, but also brands from developing countries such as China, India, and Russia, as well as local brands such as Nord, are being produced locally in Africa (Table 4).

Under these circumstances, as shown in Table 4, major Japanese brands are also assembling passenger cars and commercial vehicles locally, suggesting that they have established a certain presence in the local new car market. According to JAMA (2024), Japanese automakers are producing four-wheeled vehicles at 176 overseas plants (as of the end of March 2024). Of these, seven countries in Africa—Algeria (1), Egypt (5), Ghana (3), Kenya (4), Morocco (1), Nigeria (2), and South Africa (5)—house 21 factories (12% of the total), surpassing Europe (14), Latin America (19), and North America (United States and Canada) (20) in terms of the number of factories. In 2023, overseas production accounted for only 2.1% of total production, but it still reached 231,000 units.

[Figure 4] Brand-specific automobile assembly facilities in Africa

Country	Car brands (including contract manufacturing)
Algeria	Mercedes-Benz, Renault, Stellantis
Egypt	BMW, BYD, Changan Automobile, Chery, GM, King Long, Hyundai, Isuzu, LADA, Mercedes-Benz, Mitsubishi Fuso, Nissan, Proton, Stellantis, Suzuki, Toyota, Volvo

Ethiopia	Hyundai, Isuzu
Ghana	Honda, Kia, Nissan, Suzuki, Toyota, Volkswagen
Kenya	Beiben Heavy Duty Truck, Hyundai, Hino, Isuzu, Mahindra, Mitsubishi Fuso, Proton, Scania, Stellantis, Tata Daewoo, Toyota, UD Trucks, Volvo, Volkswagen
Morocco	Dongfeng Motor, Irizar, Mitsubishi Fuso, Renault, Shaanxi Automobile, Stellantis
Nigeria	Ashok Leyland, Honda, Nissan, Nord, Stellantis
South Africa	Beijing Automotive Industry Corporation (BAIC), BMW, First Automobile Works (FAW), Ford, Hino, Hyundai, Irizar, Isuzu, Iveco, Mahindra, Mercedes-Benz, Mitsubishi Fuso, Nissan, Tata, Toyota, Renault, Stellantis (scheduled to begin operations in 2025), UD Trucks, Volvo, Volkswagen

(Source: JETRO (July 1, 2024), MarkLines, Africa Business Partners (2023), compiled by the author based on internet information)

Non-Japanese companies are also increasingly establishing production bases and expanding production capacity in Africa. Among European automakers, Stellantis has set a target of increasing sales in Africa and the Middle East to 1 million units by 2030, with 90% of those units manufactured within the region. The company plans to open a new factory in Algeria in 2023 (JETRO, December 21, 2023) and another factory in South Africa by the end of 2025. It also plans to develop local suppliers in Africa (JETRO, June 16, 2025). In addition, Volkswagen announced plans to resume vehicle production in Kenya in December 2024. Among Asian automakers, Hyundai Motor is expanding exports to Africa from India while preparing to start production in Algeria. Mahindra has signed a memorandum of understanding with the Industrial Development Corporation (IDC), South Africa's investment promotion agency, in February 2025 to begin feasibility studies for the commercialization of a CKD plant in South Africa.

In terms of automotive electrification, Ford began production of the Ranger PHEV at its Silverton plant in South Africa in March 2025. Among European companies, Stellantis is doubling its production capacity in Morocco and expanding local production of EVs. The company has increased its production capacity for small EVs such as the Citroën “Ami,” Opel “Rocks-e,” and Fiat “Topolino” from 20,000 units to 70,000 units by January 2025. Starting in July 2025, it will begin producing an electric three-wheeler developed by Moroccan engineers at an annual scale of 65,000 units.

However, the automakers actively expanding into overseas markets through market development and local production are Chinese car manufacturers responding to economic tensions with the United States by advancing overseas market expansion. Neta Automobile (NETA) opened its first store in Africa in Kenya in June 2024, marking its full-scale entry into the African market. In November 2024, the company also began supplying its small electric SUV, the NETA V, to taxi drivers in Nairobi for

use in a ride-hailing service provided by Kenya's MojaEV. In October 2024, BAIC Motor agreed to establish an electric vehicle (EV) production plant in Egypt with Alkan Auto, a subsidiary of Egyptian International Automotive Motors (EIM). The company aims to begin production by the second half of 2025, targeting both the Egyptian market and exports to the Middle East and Africa, with an initial annual production of 20,000 units, expanding to 50,000 units by the fifth year. Geely's EV brand Zeekr also entered into a partnership with EIM in October 2024 to build a sales and service network, and launched two models in the Egyptian market in February 2025. In April 2025, Geely launched the RD6 bakkie in South Africa under its electric pickup truck brand Riddara. In February 2025, Rox Motor signed a memorandum of understanding with Ronor Motors Ghana, an automotive dealer based in Ghana and West Africa, for the sale of the ROX 01, a mid- to large-sized PHEV SUV. In February 2025, emerging EV manufacturer U POWER Tech partnered with Ghana's Majesty Group to develop a minibus based on its skateboard chassis, produce vehicles in Ghana via KD assembly, and create a new energy vehicle (NEV) brand exclusive to Ghana.

Additionally, in June 2024, four EV manufacturers—Naza, Wuling, Chery, and Seres—reached an agreement with the Indonesian government to utilize Indonesia as a production hub for right-hand drive vehicles destined for 54 countries worldwide. Considering that Thailand, where BYD and others have started local production, is also a major automotive manufacturer in ASEAN where right-hand drive vehicles are widespread, the agreement with Indonesia suggests the possibility that Chinese EV manufacturers will utilize Thailand as an export base for right-hand drive countries in Africa.

[Figure 5] News related to the automotive industry in Africa

date	news report
26 June 2024	Four Chinese OEMs, including NIO, plan to utilise Indonesia as an export hub for right-hand drive EVs
2 July 2024	NIO opens its first store in Africa, a flagship store in Kenya
30 October 2024	Beijing Automotive plans to establish an EV production plant in Egypt
31 October 2024	Geely-owned Zeekr enters Egypt to expand into the African market
12 November 2024	Neta Automobile to supply electric SUV ‘NETA V’ for taxis in Kenya
5 December 2024	Volkswagen to resume vehicle production in Kenya
6 December 2024	Zimbabwe government reduces import tariffs on EVs from 40% to 25%
12 December 2024	Congo, Morocco, and Zambia partner to develop electric mobility value chain
16 December 2024	Toyota introduces new MT option for Land Cruiser 70 series in South Africa
17 December 2024	Morocco's Al Mada partners with China's CNGR for domestic production of EV battery components

29 January 2025	Hyundai Motor and Saud Bahwan Group to produce vehicles in Algeria
5 February 2025	Hyundai Motor expands exports to Africa from India, considers exporting electric SUVs
26 February 2025	Chinese emerging EV manufacturer U POWER Tech plans NEV assembly in Ghana
28 February 2025	Mahindra signs memorandum of understanding with South African investment promotion agency to begin feasibility study for CKD plant
3 March 2025	China's Luoqi Automobile to launch plug-in hybrid SUV 'ROX 01' in Ghana
4 March 2025	Great Wall Motor to launch pickup truck 'P300' in South Africa
17 March 2025	Stellantis to accelerate expansion of Tafraoui plant in Algeria
31 March 2025	Ford to begin production of "Ranger" PHEV at Silverton plant in South Africa
4 April 2025	BYD to enter Nigerian market
9 April 2025	Riddara, a subsidiary of Geely, to launch electric pickup truck 'RD6 bakkie' in South Africa
18 April 2025	VW to carry out major renovations at its Kariega plant in South Africa for the production of a third model
18 July 2025	Stellantis to expand production capacity for engines and EVs at its Kenitra plant in Morocco

(Source: Compiled by the author based on MarkLines data)

4. Automobile Exports to Africa

Although automotive assembly capabilities are being developed in Africa, local assembly plants are relatively small in scale and are thought to rely heavily on imported KD kits. In addition, more than half of the finished vehicles produced in major producing countries such as South Africa and Morocco are manufactured and exported for foreign markets, and a significant portion of the demand for automotives in Africa is met by imports from outside the continent. This includes a considerable number of imported used cars. According to Deloitte Africa (2016), 80% of imported vehicles in Ethiopia (which has since banned imports of internal combustion engine vehicles), Kenya, and Nigeria were used vehicles. Some reports indicate that used vehicles account for 85% of all vehicles in Africa (Mordor Intelligence, n.d.).

Trade statistics also confirm that new and used cars are exported from major automotive-producing and consuming countries to Africa, making Africa a global importer of used cars. According to UNEP (2024), 33% of used small vehicles exported by Japan, the EU, the United States, and South Korea—

the major exporters of used small vehicles—were imported by Africa between 2015 and 2022. In 2022 alone, 46% of Africa's imports of used small vehicles were from the EU, and 31% were exported from Japan.

The UAE is considered to be a transit point for used cars bound for Africa. A special economic zone specialising in used cars has been established in Dubai, where used cars collected from around the world are traded among dealers who have entered the special economic zone. In the industrial area of the Emirate of Sharjah, vehicles are dismantled, and used car parts are traded. Used cars and parts exported from Japan also flow into Africa via the UAE (JETRO, 22 February 2024).

With these circumstances in mind, the authors examine trade data below. This paper uses export data from UN Comtrade. UN Comtrade's product classification is limited to six-digit HS codes, even for subcategories, so it is not possible to distinguish between new and used cars when compiling data, but it is sufficient to confirm the overall trend in exports of automobiles (HS 8702-8705) to Africa.

Table 6 shows the value of automotive exports to Africa in 2019 and 2023. In both 2019 and 2023, the Asia-Pacific region is the largest exporter of automotives to Africa. Europe is the second largest exporter, followed by the Asia-Pacific region. The Asia-Pacific region's share of global exports to Africa rose from 47.6% in 2019 to 52.1% in 2023. During the same period, Europe's share declined from 37.2% to 31.7%. However, in exports to North Africa, Europe's global share remained above 50%, at 54.5% in 2019 and 57.7% in 2023, with a slight increase in share over the same period. On the other hand, in exports to the Sub-Saharan region, the Asia-Pacific region's global share increased from 51.7% in 2019 to 59.7% in 2023, securing more than half of the market share during the same period.

Within the Asia-Pacific region, the region that exports the most to Africa is East Asia. In 2023, it accounted for 27.6% of global exports to Africa. This was followed by West Asia at 13.0% and South Asia at 8.2%. The high share of West Asia may be influenced by exports of used vehicles. Although Southeast Asia's share is only 3.1%, its growth rate from 2019 to 2023 was 40.1%, exceeding the overall growth rate of 30.4% for the Asia-Pacific region.

Table 7 shows the top 15 countries exporting automobiles to Africa in terms of export value in 2023. The top three countries are China, Japan and Germany, followed by the UAE in fourth place and India in fifth place. The UAE's high ranking is likely due to the inclusion of used car exports in its export value. Thailand, a global supply base for pickup trucks, ranks 12th among Southeast Asian countries. This shows the importance of the pickup truck market in Africa.

[Figure 6] Automobile Exports to Africa (HS 8702-8705) (in thousands of dollars)

2019	Africa	Northern Africa	Sub-Saharan Africa
Asia & Oceania	**11,850,852,339**	**3,865,392,857**	**7,985,459,482**
Eastern Asia	6,189,886,303	2,027,007,653	4,162,878,650
Southeast Asia	666,532,148	151,434,968	515,097,180
Southern Asia	1,809,660,807	354,681,688	1,454,979,119
Western Asia	3,158,735,326	1,328,037,419	1,830,697,908
Oceania	26,037,755	4,231,129	21,806,626
Europe	**9,247,357,271**	**5,142,887,878**	**4,104,469,393**
Americas	**1,999,116,323**	**331,392,335**	**1,667,723,988**
Northern America	1,921,578,440	324,304,370	1,597,274,069
Latin America and the Caribbean	77,537,883	7,087,965	70,449,918
Africa	**1,781,800,527**	**93,835,274**	**1,687,965,253**
Northern Africa	120,502,494	85,120,970	35,381,523
Sub-Saharan Africa	1,661,298,033	8,714,304	1,652,583,730
Grand Total	**24,879,126,461**	**9,433,508,345**	**15,445,618,116**

2023	Africa	Northern Africa	Sub-Saharan Africa
Asia & Oceania	**15,449,906,357**	**4,022,875,686**	**11,427,030,671**
Eastern Asia	8,177,465,675	2,022,923,743	6,154,541,932
Southeast Asia	933,637,600	214,087,190	719,550,410
Southern Asia	2,417,676,412	304,231,232	2,113,445,180
Western Asia	3,858,194,990	1,481,580,026	2,376,614,964
Oceania	62,931,681	53,495	62,878,186
Europe	**9,394,081,871**	**6,056,475,619**	**3,337,606,252**
Americas	**2,201,698,951**	**338,863,146**	**1,862,835,805**
North America	2,110,491,792	321,975,812	1,788,515,980
Latin America and the Caribbean	91,207,159	16,887,334	74,319,825
Africa	**2,597,818,972**	**71,278,193**	**2,526,540,779**
Northern Africa	105,737,084	61,382,712	44,354,372

Sub-Saharan Africa	2,492,081,888	9,895,481	2,482,186,407
Grand Total	**29,643,506,152**	**10,489,492,644**	**19,154,013,507**

(Source: UN Comtrade, compiled by the author)

[Figure 7] Top 15 Exporters of Automobiles (HS 8702-8705) to Africa in 2023 (in thousands of dollars)

	Country	Region	Sub-region	Africa Total
1	China	Asia & Oceania	Eastern Asia	3,854,182,124
2	Japan	Asia & Oceania	Eastern Asia	3,015,494,596
3	Germany	Europe	Western Europe	2,918,289,081
4	United Arab Emirates	Asia & Oceania	Western Asia	2,735,718,760
5	India	Asia & Oceania	Southern Asia	2,413,486,576
6	USA	Americas	Northern America	1,747,373,254
7	South Africa	Africa	Sub-Saharan Africa	1,590,039,378
8	France	Europe	Western Europe	1,315,409,360
9	Rep. of Korea	Asia & Oceania	Eastern Asia	1,303,029,140
10	Spain	Europe	Southern Europe	975,390,195
11	United Kingdom	Europe	Northern Europe	787,269,439
12	Thailand	Asia & Oceania	South-eastern Asia	763,318,359
13	Turkey	Asia & Oceania	Western Asia	751,226,897
14	Italy	Europe	Southern Europe	606,666,578
15	Czech	Europe	Eastern Europe	547,568,053

(Source: Compiled by the author based on UN Comtrade data)

5. Future Prospect

The African automotive industry has been shaped by the influx of used cars from automotive manufacturing countries such as Japan, other Asian countries, Europe, and the United States, as well as by automotive manufacturing in North African countries such as Morocco and Egypt and in South Africa. In recent years, in addition to the start and expansion of local production by European companies that have traditionally used Africa as a production base, there has been an increase in new entrants and local production by Chinese and Indian companies. With population growth and economic growth, automotive production and sales are expected to expand in Africa. In the development process, the following industrial structure is expected to form, and policy responses are needed accordingly.

First is the expansion of local production. Currently, local production is mainly carried out by some car brands at their own factories and by local companies through KD assembly. As many developing countries that produce automotives have shifted from KD production to full-scale automobile production, if new car sales expand in Africa, it will be possible to form a full-set automotive industry covering everything from parts production to assembly locally in the future. The electrification of automotives will require production systems that pursue economies of scale more than ever before, and policies for the formation and development of local new car markets will be necessary.

Second, safety and environmental regulations related to automobiles will have a growing impact on the automotive industry. The African automotive market has been dominated by used cars. The influx of inexpensive used cars makes it possible for a wide range of income groups to purchase automotives, but it not only limits the development of the local new car market, it also has a negative impact on traffic safety and the environment. Safety and environmental regulations on the import of used cars and registered vehicles are expected to become increasingly important, as they will affect not only the pace of development of the new car market and the automotive industry in Africa, but also the healthy development of the transport society.

Third, as North Africa strengthens its position as a production base for exports to Europe, it is likely to take the lead over the Sub-Saharan region in forming supply chains that comply with EU environmental regulations. The global automotive industry is required to respond to environmental concerns. The Sub-Saharan region, which is strengthening its links with the highly cost-competitive Asian supply chain, is no exception. The African automotive industry needs to aim for the development of a low-environmental-impact automotive industry in cooperation with Asia, while also keeping an eye on competition and cooperation with Europe.

Fourth, the advancement of electrification. Electrification is also expected to advance in Africa. According to UNEP (2024), 105,273 small battery electric vehicles (BEVs) were traded worldwide between 2017 and 2022, but imports by Africa accounted for only 1% of that, or 1,432 vehicles. However, in Ethiopia, the spread of electric vehicles (EVs) is progressing due to a ban on imports of petrol and diesel vehicles in 2024. The Zimbabwean government reduced import tariffs on EVs from 40% to 25% in 2025. Chinese companies are also increasing their investment in the African EV market. As the market for two-wheeled electric vehicles, which offer lower fuel costs than gasoline vehicles, expands in African countries, the electrification of four-wheeled vehicles is also expected to progress. The widespread adoption of electric vehicles requires not only the development of maintenance personnel and the establishment of power generation and charging infrastructure, but also the long-term development of battery collection and recycling systems in Africa. Chinese EV manufacturers are leading the way in introducing EVs to Africa ahead of Japanese, American, and European manufacturers. This could be seen as a strategic move toward localising EV production in Africa. At the same time, Chinese EV manufacturers are also establishing EV production facilities in Thailand

and Indonesia. Both countries could serve as export hubs for right-hand drive EVs from Chinese companies, and it is also anticipated that EVs will be exported from these countries to the African right-hand drive vehicle market, including South Africa. The potential use of Thailand and Indonesia in China's EV recycling process could be influenced not only by the localisation of EV and battery production in these countries but also by the establishment of systems for dismantling and disposing of end-of-life vehicles (Iwasaki et al., 2025).

＜ Reference websites＞

Various production and sales figures from MarkLines (www.marklines.com)

＜References

Africa Business Partners. (2023). Trends in African Automobile Production Countries and Japanese Manufacturers. https://abp.co.jp/contents/insights/insights-2381/ (accessed 24 July 2025). (in Japanese)

JETRO. (2023, 30 January). Trends and Outlook for the Automotive Industry (Algeria). https://www.jetro.go.jp/biz/areareports/2023/113aca5a6ad36e1a.html (Accessed on 24 July 2025). (in Japanese)

JETRO. (2023, 21 December). Fiat Opens New Plant in Algeria. https://www.jetro.go.jp/biznews/2023/12/d4aa86937562c334.html (accessed on 1 August 2025). (in Japanese)

JETRO. (2024). Automotive Production and Sales Trends in Major Countries and Regions. https://www.jetro.go.jp/ext_images/_Reports/01/b8108a3ebf32792b/20240012rev2.pdf (Accessed on 31 July 2025). (in Japanese)

JETRO. (2024, February 22), ‘Secondhand Market (Used Cars and Clothing) in the United Arab Emirates (from Dubai),’ https://www.jetro.go.jp/biz/trendreports/2023/5a6aef322f810204.html (accessed on 31 July 2025). (in Japanese)

JETRO. (2024, 1 July). Automotive Sales and Production, Export Trends from Japan (Africa)’. https://www.jetro.go.jp/biz/areareports/2024/626de60521ed58f6.html (accessed on 24 July 2025). (in Japanese)

JETRO. (2025, 11 March). New car registrations in 2024 down 8.5% year-on-year (Kenya).’ https://www.jetro.go.jp/biznews/2025/03/0778a82d3138f5df.html (accessed 27 July 2025). (in Japanese)

JETRO. (2025, 9 June). New vehicle sales in 2024 up 13% year-on-year, import value also increases

(Egypt). https://www.jetro.go.jp/biz/areareports/2025/28c7a7b5a8f692fc.html (Accessed on 21 July 2025). (in Japanese)

JETRO. (2025, June 16). Stellantis Expands Supplier Network in Algeria. https://www.jetro.go.jp/biznews/2025/06/50b0431c3c6e0e86.html (Accessed on 1 August 2025). (in Japanese)

JETRO. (2025). Automotive Production and Sales Trends in Major Countries and Regions. https://www.jetro.go.jp/ext_images/_Reports/01/6f831adb699b3451/20250016.pdf (accessed on 31 July 2025). (in Japanese)

Deloitte Africa (2016). Deloitte Africa automotive Insights Navigating the African automotive sector: Ethiopia, Kenya and Nigeria. https://digitaldealership.com/wp-content/uploads/2021/03/ZA_Deloitte-Africa-automotive-insights-Ethiopia-Kenya-Nigeria-Apr16-2017.pdf. (Accessed on 1 August 2025)

FOURIN (2016) African Automotive Industry and 54 Country Market Trends. Nagoya: FOURIN. https://www.fourin.jp/info/multi-client_AfricanAutomotiveIndustryandMarketTrendsof54Countries.html (accessed 21 July 2025) (in Japanese)

Iwasaki, F., Kawamura, R., Kojima. M., Yang, C., Kaneko, H., Okumura, S., Yoshinaga, Y. (2025) Vehicle dismantling/recycling survey in response to the transformation of the automobile industry in ASEAN. Jakarta: Economic Research Institute for ASEAN and East Asia.

JAMA (2024) 'Japanese Automotive Industry 2004,' Japan Automobile Manufacturers Association (JAMA), August 2024. https://www.jama.or.jp/library/publish/mioj/ebook/2024/MIoJ2024_j.pdf (accessed 24 July 2025) (in Japanese)

Mordor Intelligence (n.d.) Africa used car market size & share analysis - growth trends & forecasts (2025 - 2030). https://www.mordorintelligence.com/ja/industry-reports/africa-used-car-market (Accessed on 24 July 2025)

NAACAM (2025) The Automotive Trade Manual 2025. Sandton: National Association of Automotive Component and Allied Manufacturers (NAACAM). https://naacam.org.za/wp-content/uploads/2025/05/Automotive-Trade-Manual-2025.pdf. (Accessed on 21 July 2025)

NADDC (2023) Nigerian Automotive Industry Development Plan 2023. National Automotive Design and Development Council (NADDC). May 2023. https://naddc.gov.ng/wp-content/uploads/2023/06/Nigerian-Automotive-Industry-Development-Plan-2023.pdf. (accessed on 27 July 2025)

UNEP (2024). Used vehicles and the environment: Update and progress 2024. https://www.unep.org/resources/report/used-vehicles-and-environment-global-overview-used-light-duty-vehicles-flow-scale. (Accessed on 1 August 2025)

Chapter 5:

Logistics

Development of digital trade and logistics for strengthening supply chain

Maika Watanuki, NX Logistics Research Institute and Consulting, Inc.（NXLIX）
Yutaka Hosoyamada, NX Logistics Research Institute and Consulting, Inc. Senior Consultant
TASAKA Mikio, Research Fellow

This chapter examines the potential obstacles and ideal approaches to develop a resource circulation system between Africa and Asia from a logistics perspective. Trade from manufacturing bases of Japanese companies in India and various ASEAN countries to the African market or to production bases in African continent is becoming more active. In order to further promote private sector activities and investment, strengthening the resilience of supply chains is essential. Additionally, it is important to establish a global system for circulating resources contained in products supplied from Asia from the economic security perspective.

Although Africa consists of a diverse range of countries, this study focused on four countries (South Africa, Tanzania, Ethiopia, and Kenya) for detailed investigation, aiming to form an overall picture of Africa while examining the situation in these countries.

With the aim of expanding industrial development in Africa through improvements in logistics, we focused on three themes: (1) logistics and international trade, (2) the automotive industry, and (3) the circular economy. This study started with the desktop review of existing domestic and international literature and information. In addition, interviews (22 cases) with private companies and industry associations in the target countries were conducted to understand and summarize the current situation in each country. The content of this study is current as of March 2025.

Based on the study results, issues were identified in each target country, and measures to improve logistics efficiency to promote investment from Japan were derived. As a result, this chapter proposes recommendations on logistics, particularly from the perspective that both Africa and Japan should benefit from the future development of resource circulation in the automotive-related industry.

1. Logistics and Trade (Import/Export)

(1) Current status of logistics and trade systems in target countries

An initial overview of investment promotion frameworks in each target country was conducted. Subsequently, the current logistics and trade environments were analyzed based on the following elements: import regulations, required documentation, infrastructure, customs clearance procedures, tariffs, and transportation systems.

We also assessed the implementation status of trade-related systems such as customs broker licensing, advance filing, advance rulings, deferred tariff payments, and trade facilitation mechanisms like Authorized Economic Operator (AEO) programs.

Regarding digitalization, we reviewed the development of electronic customs systems and the status of single-window platform implementation.

Based on this analysis, we identified key logistical challenges in each country and examined potential improvement measures to enhance efficiency. Additionally, we emphasized the importance of capacity building to support these improvements.

(2) Analysis of collected information

① Investment Promotion Systems

The investment incentives offered in each country are summarized in the table below. A comparison of the investment environments in the target countries—South Africa, Tanzania, Ethiopia, and Kenya—shows that most incentives are closely tied to the characteristics of Special Economic Zones (SEZs) and Export Processing Zones (EPZs), which are typically located in urban centers or near ports.

Preferential treatment is generally granted to products with a high export ratio from Africa. Consequently, foreign companies aiming to serve local markets may find these incentives less beneficial, diminishing the overall appeal of these countries as investment destinations.

Moreover, the relatively short duration of incentive programs has been identified as a factor that may discourage long-term business commitments by Japanese enterprises in the region.

Table 1: Key investment incentives

	South Africa	Tanzania	Ethiopia	Kenya
Foreign Investment Law	Investment Act 100% foreign ownership in principle	TIC Investment Act 100% foreign ownership possible; foreign firms protected upon TIC registration	Investment Proclamation Some sectors have ownership limits; restrictions in telecom, finance, aviation (49% for logistics)	Investment Promotion Act 100% foreign investment allowed
Investment Incentives	SEZ Program 15% corporate tax in SEZ; exemptions for manufacturing goods; specific bonded manufacturing permitted	EPZ Act, SEZ Act, TIC Certificate Tax and duty exemptions in EPZ/SEZ; incentives available via TIC registration; multiple zones under public development	Industrial Parks Proclamation, EIC Incentives Tax incentives through national industrial parks or EIC certification; parks fully equipped with infrastructure	EPZ Act, SEZ Act, MUB Program Tax incentives available in EPZ/SEZ; corporate tax and duty exemptions within industrial parks

Key Locations	Near cities and ports	Major cities and coastal areas (e.g., Bagamoyo, Kigombe)	Bole-Lemi, Adama, etc. Developed by IPDC	Concentrated in Nairobi and Mombasa
Export Requirements	No explicit export obligation, but incentives favor export orientation	Generally requires 80% or more export ratio	Minimum 80% export ratio; businesses with high domestic sales not eligible	80–100% export ratio; domestic sales not eligible for incentives
Tax Incentives Outside SEZ/EPZ	-	SEP Standalone allows bonded manufacturing (requires 80% export ratio)	Tax/duty exemptions possible outside parks with Investment Board certification, but parks preferred	-

（Source: Compiled by NXRIX based on various materials.）

② Trade agreements

The trade agreements currently in effect in the target countries are summarized in the following table. A comparison of Free Trade Agreements (FTAs) indicates that none of the countries have established FTAs with Asian nations.

In contrast, several FTAs have been signed with European countries, giving European products a competitive edge over those from Asia. This imbalance creates challenges for sourcing materials from Asia and for promoting local production by Asian companies.

Table 2: Existing trade agreements in force

Agreement	South Africa	Tanzania	Ethiopia	Kenya	EU	USA	Asia	Japan
SACU	✓							
SADC	✓	✓						
AfCFTA	✓	✓	✓	✓				
AGOA	✓	✓	✓	✓		✓		
TIDCA	✓					✓		
EU-SADC EPA	✓				✓			
SACU-EFTA FTA	✓				✓			
SACU-MERCOSUR	✓							
TFTA	✓	✓	✓	✓				
EAC		✓		✓				
COMESA			✓	✓				
TIFA				✓		✓		

EU-ACP		✓	✓	✓	✓			
EU-EAC EPA		✓		✓	✓			
Ethiopia-Sudan FTA			✓					
UK-Kenya FTA				✓	✓			

（Source: Compiled by NXRIX based on JETRO and other official sources）

③ Port infrastructure

The status of major port infrastructure in the target countries is summarized in the following table. Overall, port facilities in these regions are aging, and inefficiencies in port operations have emerged as a major concern.

In particular, at Durban Port and Mombasa Port, public-sector-led operations have resulted in delays in cargo handling and rising logistics costs.

Table 3: Port profiles

Port	Durban	Dar es Salaam	Djibouti	Mombasa
Terminal Operator	TPT (public)	CT1: DP World / CT2: ADANI (AIPH)	DCTMC (semipublic)	Kenya Ports Authority (public)
Container Handling Capacity	3.6 million TEU	1,000,000 TEU	350,000 TEU	2.3 million TEU
Container Throughput	2.65 million TEU	820,000 TEU	635,000 TEU (2022)	1.62 million TEU
Number of Berths	10	7 (Berths No. 5–11)	2	6
Total Berth Length	914 m	1,288 m	400 m	1,399.6 m
Number of Gantry Cranes	16	8	4	16
Maximum Draft	12.2–12.5 m	13.5 m	9.5-12 m	12.5–14 m
CPPI Performance Rank (World Bank, 2023)	399/405	373/405	337/405	335/405
Automation	None	None	None	Plan to expand automation
Rail Link	Available (16% rail share)	Available	Available (approx. once a week)	Available
Operating Hours	7/24	7/24	7/24	7/24

Road Access	Good highway connections	Major roads available but poor traffic control near the port	Main road to Addis Ababa developed	Port access roads frequently congested; truck terminals underdeveloped
Current Situation	Centrally managed by state; strikes and chronic delays	Centralized at Dar es Salaam; chronic congestion and traffic	Heavy reliance on Djibouti Port (landlocked country); limited political stability	Centralized at Mombasa Port; infrastructure development ongoing under LAPSSET plan

（Source: Compiled by NXRIX from official sources and local interviews）

④ Customs procedures

The current state of customs procedures and related systems in the target countries is outlined in the table below. Each country has its own documentation requirements, and the complexity of these requirements presents a significant challenge. Notably, the need to submit original Certificates of Origin (C/O) often causes delays and increases operational costs.

While some countries have introduced deferred payment schemes, advance ruling systems, and Authorized Economic Operator (AEO) programs, these mechanisms are mostly limited to domestic application and have not substantially improved intra-regional customs procedures. Furthermore, none of the countries have implemented a non-resident inventory system, limiting operational flexibility for Japanese businesses.

Although single-window (SW) systems are under development or partially operational, in many countries, multiple government agencies still operate independently. This results in redundant data entry and inefficient procedures, collectively lowering logistics efficiency.

Table 4: Overview of customs procedures

Category	South Africa	Tanzania	Ethiopia	Kenya
Customs Declaration	Via SARS eFiling	Via TANCIS	Submit through ASYCUDA	Submit via iCMS

Required Documents	I/V, P/L, B/L, AWB (surrendered B/L acceptable), Importer Tax ID, Import License (for regulated items), C/O, Quarantine Cert., SDS, Product Certifications, Import Contract & Order	I/V, P/L, B/L, AWB, Import License, Duty Exemption Cert., Packing List, Certificate of Origin, Compliance Certificates, Originals required for port customs clearance (matched with TANCIS)	I/V, P/L, Import License (MoTI), TIN, B/L, AWB, C/O, Compliance Cert., Customs POA, Insurance, Proforma Invoice (for foreign exchange approval), Originals required	I/V, P/L, B/L, AWB, C/O, Freight Invoice, Translated vehicle logbook, Import License, PIN Certificate, Exemption Certificate (if applicable), Purchase Order/Contract, Vehicle Maintenance Certificate, Letter of Credit
Deferred Customs Payment System	Implemented *Deferral of up to 30 days is permitted	Not implemented	Not implemented	Not implemented
Advance Ruling	Available (domestic use only), 4–6 weeks for official rulings (fee-based)	Available (domestic only), valid for 12 months	Available (domestic only), rulings are binding on customs	Available (domestic only), valid for 12 months
Customs Broker Qualification	At least one certified representative required; CSK exam open to non-citizens	No national license system like Japan's; at least one staff must hold EACFFPC	Only Ethiopian nationals or companies allowed; brokers must hold customs license; 1,086 licensed brokers exist	Must complete customs training and obtain certification
AEO Program	Available; SARS launched expanded AEO in 2023; ~80 companies certified; no mutual recognition	Available (EAC Regional AEO); 9 companies certified as of Apr 2022	Available; ~46 companies certified as of 2023; no mutual recognition	Available (EAC Regional AEO)
Single Window System	Not yet implemented (under development); no transport data sharing	Partially implemented; 30 out of 60 gov. agencies connected; full ops by FY2024/2025; no transport data sharing	16+ gov. agencies connected, but multiple separate interactions still required; no transport data sharing	Implemented (KenTrade); over 35 gov. agencies & 42 stakeholders integrated; data input duplication still occurs; no transport data sharing

Tariff Rates	CIF basis; General goods: 0–30%, Apparel: 40%, Yarns: 15%, Fabrics: 22%, Vehicles: 25%, Auto Parts: 20% (until 2035); Raw materials/capital goods may be duty-free if unavailable locally; VAT: 15%	CIF basis; Finished goods: 25%, Dairy/Meat/Textiles/Leather: up to 35%; Intermediate goods not produced in EAC: 10%, produced: 25%; Capital goods: 0%; VAT: 18%	CIF basis (valuation not based on declared I/V, but customs-assessed); 6 brackets: 0%, 5%, 10%, 20%, 30%, 35%; Raw materials/capital goods: 0–10%; Semi-finished goods: 20%; Consumer goods: 35%; Excise tax: 5–500%; VAT: 15%	CIF basis; Finished goods: 25%; Intermediate: 10–15%; Selected raw materials: 0%; VAT: 16%
Non-resident Inventory Scheme	Not available	Not available	Not available	Not available

（Source: Compiled by NXRIX based on official sources and local interviews）

⑤ Transportation (road and rail)

In the target countries, there is a heavy reliance on road transport, with minimal progress in shifting to alternative transportation modes. Although the benefits of rail transport are increasingly recognized, the lack of supporting infrastructure continues to hinder its broader adoption. In particular, the development of container rail transport remains insufficient, limiting the potential for cost savings and high-capacity freight movement compared to road transport.

Due to the underdevelopment of logistics hubs for rail usage and overall inefficiencies, the performance of logistics networks has been negatively affected. Additionally, cross-border transportation procedures remain inefficient, marked by limited data sharing and incomplete implementation of one-stop border processing systems. These issues result in repeated documentation, redundant data entry, and the physical submission of paperwork, all contributing to delays and higher transaction costs at borders.

Moreover, the absence of integrated cargo information systems across countries further exacerbates delays in cross-border logistics coordination.

Table 5: Overview of transport (road and rail)

(Road)

Item	South Africa	Tanzania	Ethiopia	Kenya

Road Infrastructure	Highways and trunk roads are relatively well-developed and paved	Main roads are being developed; rural roads are poorly paved and difficult to access during rainy seasons	Trunk roads under construction; rural areas mostly unpaved; port and hub access remains a challenge	Some well-developed areas, but rural/remote areas lack infrastructure; frequent congestion on major roads
Major International Routes	N3 (Durban–Johannesburg), N1/N12 (Cape Town–Johannesburg), Maputo Corridor, Trans-Kalahari Corridor	Central Corridor (Dar es Salaam–Dodoma–Mwanza–Rwanda/Burundi), Southern Corridor (Mtwara–Southern Mines–Zambia), Namanga Corridor (to Nairobi), TAZARA route	Addis Ababa–Djibouti Port (handles 95% of impoty/export cargo), Mojo–Kaliti/Gelan, Walaita/Samara corridor	Northern Corridor (Mombasa–Nairobi–Malaba border), LAPSSET (Lamu–Lodwar–Ethiopia/South Sudan), Namanga Corridor (to Tanzania), Southern Corridor (bypass to Tanzania)
Truck Transport Features	Container transport predominant; road conditions relatively good	90% reliance on road; higher risk of damage and delays	Mainly connected via dry ports; Djibouti connection is a bottleneck	SGR used partially; heavy reliance on trucks
Distance to Major Cities (Est. Time)	Durban–Johannesburg: 600 km (~10h), Cape Town–Johannesburg: 1,400 km (~18–22h)	Dar es Salaam–Dodoma: 450 km (~10–12h), Mwanza: 1,100 km (~20h)	Addis Ababa–Mojo: 75 km (~2h), Addis Ababa–Djibouti Port: 900 km (2–3 days)	Mombasa–Nairobi: 500 km (~10h), Nairobi–Malaba: 400 km (~8–10h)
Cross-Border Transport Issues	Some paper documents still required; congestion and theft risk at borders	Poor rural road conditions, rainy season access issues; road widths and signs not standardized	Long distances between ports and inland areas raise logistics costs; chronic delays	Congestion, customs delays; non-standard road design and aging infrastructure

(Rail)

Item	South Africa	Tanzania	Ethiopia	Kenya
Railway Operator	Transnet Freight Rail (TFR)	Tanzania Railways (TRC), TAZARA	Ethiopian Railways Corporation (ERC)	Kenya Railways Corporation (SGR operated by Africa Star)
Network Overview	Approx. 22,000 km	~3,000 km including Central Corridor and TAZARA	SGR line from Addis Ababa to Djibouti built with Chinese support	SGR (Mombasa–Nairobi–Naivasha) and legacy MGR lines
Track Gauge	1,067 mm	Mostly 1,000 mm	Partially upgraded to 1,435 mm	1,435 mm (SGR), 1,000 mm (legacy MGR)

Port Connectivity	Connected to multiple ports (e.g., Durban, Cape Town)	Connected to Dar es Salaam Port	Connected to Djibouti Port	Connected to Mombasa Port
Main Container Routes	Durban–Johannesburg: 688 km (Rail: 5 days, Road: 3 days)	Dar es Salaam–Dodoma	Addis Ababa–Djibouti: Rail: 12h, Road: 3 days	Mombasa–Nairobi
Inland Hubs / ICDs	Around Johannesburg	Isaka ICD, Morogoro	Addis Ababa, Mojo ICD	Nairobi ICD, Naivasha ICD
Regional Connectivity	Connected to Zimbabwe, Botswana, Namibia, etc.	Planned connections to Zambia, Rwanda, Burundi (via TAZARA)	Direct connection only to Djibouti; no other links	MGR links to Uganda, Rwanda; SGR extension plans
Utilization Status	Low utilization rate; competition from road transport	Below 10% utilization; network undergoing renovation	Operates only 1 service per week; still low usage	Limited usage due to truck competition

（Source: Compiled by NXRIX from official sources and field interviews）

(3) Logistics challenges and future policy recommendations

Logistics serves as a fundamental driver of economic growth. However, a range of logistical issues in the target countries is impeding trade facilitation and broader economic development. These challenges can be broadly categorized as follows:

1. Limitations of investment incentive schemes

Existing incentives are often constrained by geographic and export-oriented conditions, limiting the scope of operations for Japanese enterprises. This reduces investment motivation and increases entry barriers.

2. Absence of FTAs with Asian countries

The lack of Free Trade Agreements with Asian countries, including Japan, makes Asian products less competitive in African markets compared to those from Europe or the U.S.

3. Inadequate infrastructure

Underdeveloped road and rail systems, along with aging and inefficient government-operated port infrastructure, result in shipment delays and higher logistics costs.

4. Complicated and inefficient customs procedures

Customs processes involve complex documentation requirements—especially the frequent need to

submit original Certificates of Origin. Deferred payment and AEO systems are inflexible and lack cross-border functionality. Single-window systems remain incomplete, and insufficient transport data sharing further reduces customs efficiency.

To address these challenges, the following policy proposals are proposed:

Proposal 1: Redesign of investment incentive system

The current investment incentive system, centered around Special Economic Zones (SEZs), lacks flexibility and long-term stability. This creates challenges for companies aiming to enter the AfCFTA market. To address this, we propose introducing a more flexible system that does not geographically fix SEZs, allowing manufacturers to designate their production facilities as SEZs (similar to India's Private Bonded Facility (PBF) or the U.S. Foreign Trade Zone system). Additionally, to encourage long-term investment, we suggest extending the preferential period up to 15 years based on performance. This approach aims to improve logistics efficiency, boost regional economies, and enhance market responsiveness. The system will be gradually implemented following pilot testing in selected countries, with Japan providing support through system design and collaboration with relevant agencies.

Proposal 2: Promote Asian investment in Africa through strategic new FTAs

Currently, there are no trade agreements between Asia and Africa. This results in high tariffs and a lack of competitiveness for Asian products due to the non-application of EPA rules of origin. We propose forming FTAs to gradually reduce tariffs and unify rules of origin, including cumulative systems, to enhance Asian companies' competitiveness and promote local production. Implementation will include phased liberalization of key items and consideration for local industries. Japan will assist by supporting the design of rules of origin, cumulative systems, and local capacity building.

Proposal 3: Enhance port operations with PPP (Public-Private Partnerships) models

Ports in South Africa and Kenya, managed mainly by the government, face issues like long berthing times and unclear fees. To improve efficiency, we recommend adopting a PPP model where the government retains ownership but outsources management to private companies through competitive bidding. This model aims to cut costs and boost transparency. Japan will leverage its PPP experience to support modernization, including technical assistance and training.

Proposal 4: Implement a fully digital application system

Export and import processes often require original documents and physical signatures, making procedures slow and costly. We recommend digitalizing import permits and quarantine certificates,

implementing one-stop EDI applications, and enabling data sharing among relevant agencies. This will reduce costs and speed up cross-border procedures. Japan will support implementation by helping with system design and local training.

Proposal 5: Establish a post-customs payment system

In some countries, customs duties and VAT must be paid before goods are released, causing cash flow issues. We propose a 'post-customs payment system' for certified importers, allowing payment within 30 to 90 days after cargo release. This would reduce lead times and encourage trade. Implementation will include secure payment systems and digital infrastructure, with Japan providing system design support.

Proposal 6: Improve advance ruling systems for better tariff clarity

While some countries have advance ruling systems, tariff code determination can be slow, and mutual recognition within regions is lacking. We suggest creating a unified system for advance tariff determination and mutual recognition, ensuring transparency and smoother customs procedures. Japan will offer expertise in designing internationally standardized systems and operational guidance.

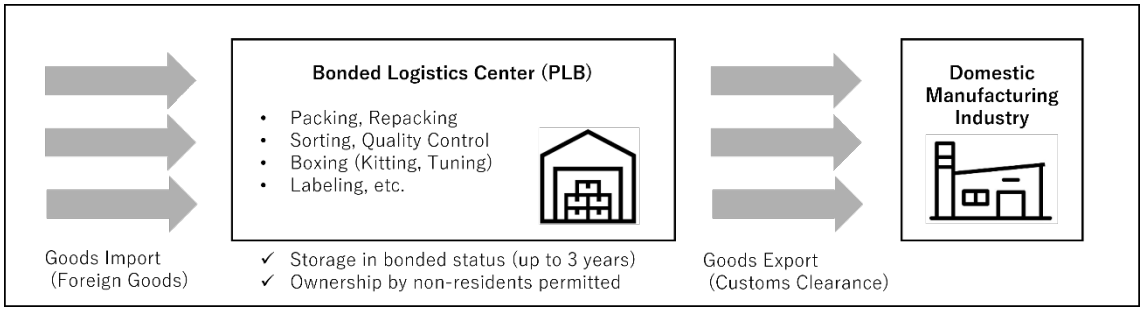
Proposal 7: Mutual recognition of accredited importers and exporters

Existing systems for recognizing reputable businesses are often not mutually recognized between countries, limiting their effectiveness. We propose establishing a system for mutual recognition between import and export countries to simplify or waive cargo inspections, reducing customs time and increasing logistics efficiency. Japan will provide guidance based on WCO standards and operational expertise.

Proposal 8: Introduce a non-resident inventory system

Currently, non-residents cannot store inventory without establishing a local corporation, hindering flexible supply systems. We propose a system allowing non-residents to use bonded warehouses and pay customs duties and VAT upon sale. This would make market entry easier for Japanese companies. Japan will support trial implementation, legal structuring, and rule creation.

Table 6: Reference case: Indonesia's bonded logistics center (PLB)

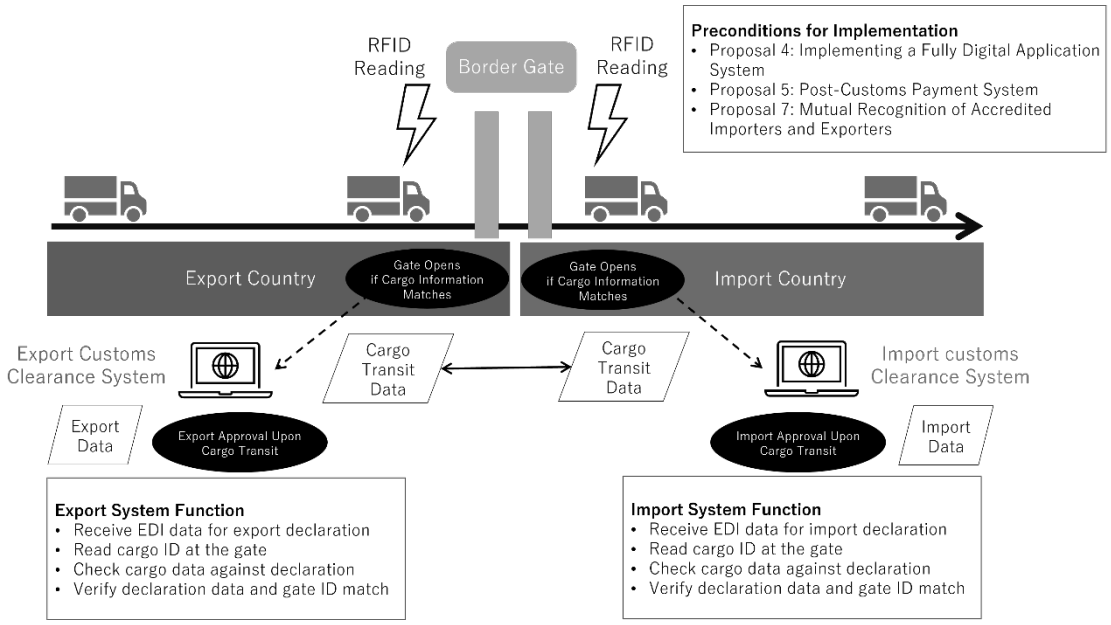


(Source: JETRO (https://www.jetro.go.jp/biznews/2017/04/d3ec8d9caa5a8904.html))

Proposal 9: Enable seamless cross border transport with RFID technology

Despite some progress, many cross-border transport procedures still involve paperwork. We propose using RFID tags on cargo vehicles to share data electronically among agencies, enabling seamless transport. This would reduce waiting times and improve logistics. Japan will support technology introduction and system design.

Table 7: Seamless cross border transport with RFID technology concept image



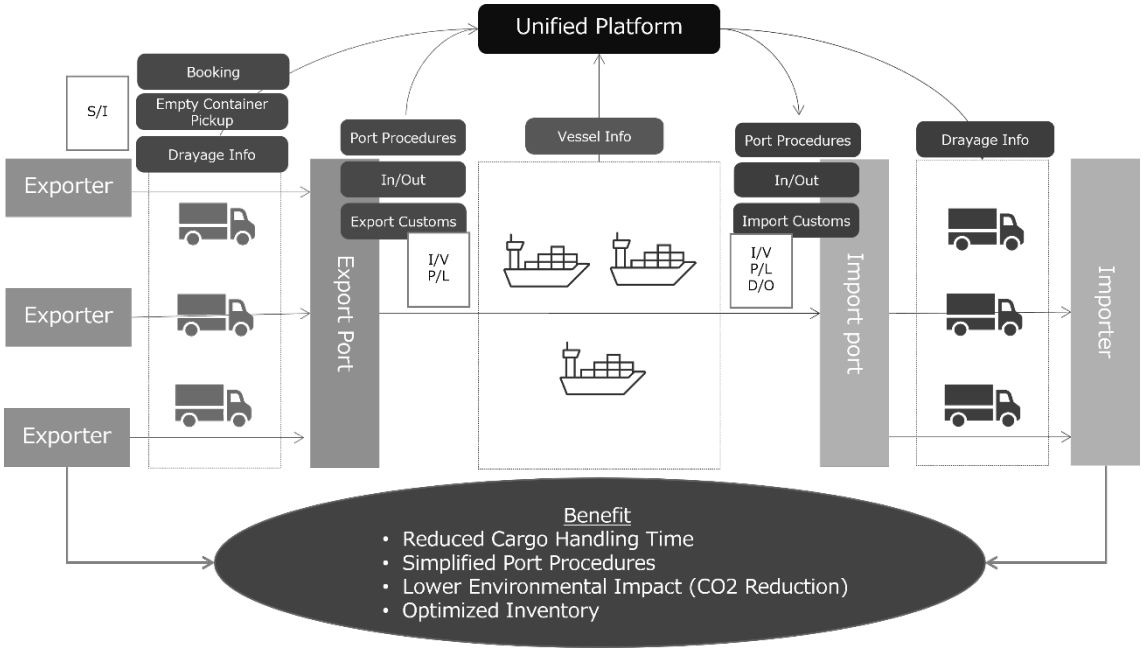
(Source: NXRIX)

Proposal 10: Build a unified transport information platform

Transport data in the region is fragmented, causing delays and inefficiency. We propose creating a common platform that consolidates data and connects customs and port systems through data

integration. This will reduce cargo handling times and simplify processes. Japan will support the platform's development by proposing data integration plans and providing capacity building for local stakeholders.

Table 8: Unified Transport Information Platform Concept Image



(Source: NXRIX)

Proposal 11: Strengthen rail transport through intermodal connectivity

Rail-to-road connections in Africa are underdeveloped, leading to low logistics efficiency. We suggest promoting intermodal transport by prioritizing rail as the core and enhancing road connectivity. Developing hubs and digital coordination will lower logistics costs and environmental impact. Japan will support infrastructure development and digital integration using its railway expertise.

2. Automotive Industry

(1) Current status of the automotive industry in target countries

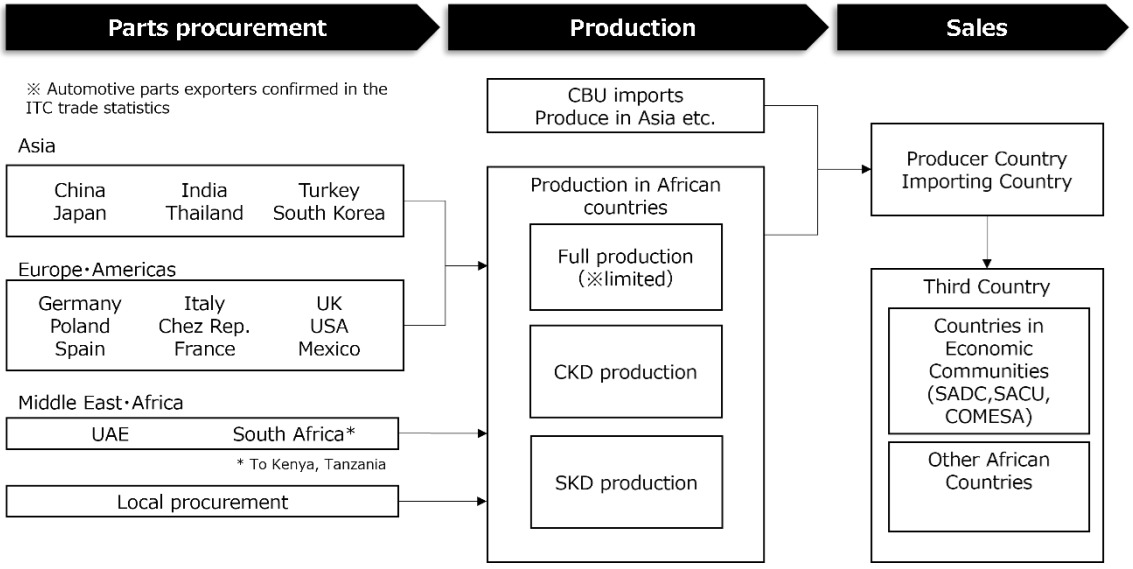
This research examined the supply chain of the automotive industry and the life cycle of vehicles after sales to understand the surrounding circumstances of the industry. The research also studied automotive industry policies, local production trends, and the spread of EVs, including not only four-wheelers but also two- and three-wheelers. Furthermore, we identified issues related to the industry and the handling of EVs and lithium-ion batteries from a logistics perspective. In addition, this reviewed the promotion of the automotive industry as well as the supply chain and life cycle of

vehicles and parts.

(2) Analysis of collected information

In the supply chain for new vehicles and two-wheelers, production parts are imported from Asia and Europe, and the exporting countries are also those with thriving automotive production. In the target countries, except for South Africa, CKD/SKD production methods are adopted, and local procurement of parts remains limited. Some car makers export vehicles to neighboring countries, but production is mainly for the domestic market.

Figure 8: Supply chain of four-wheel vehicles



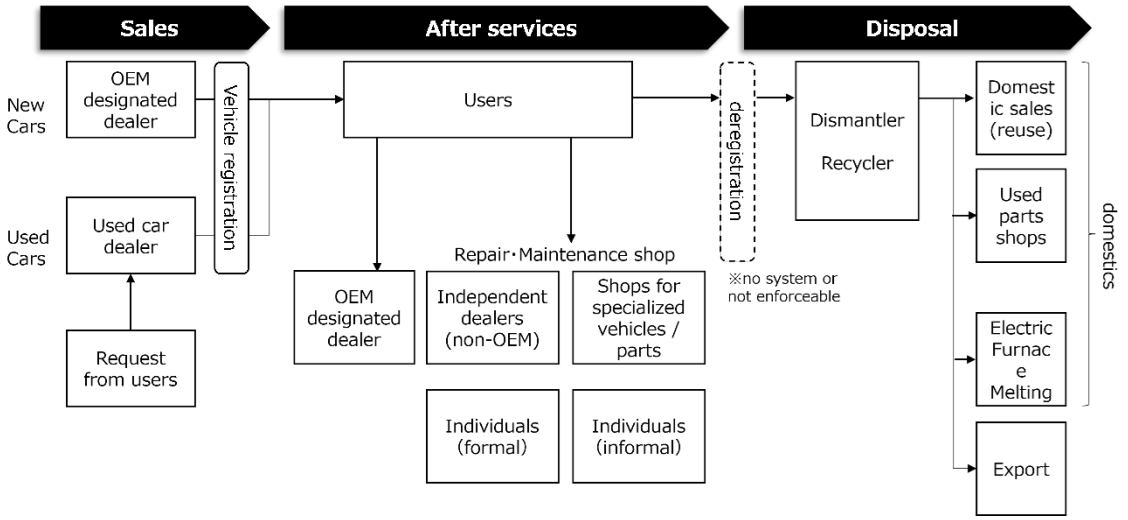
(Source: International Trade Center, NXRIX study)

Regarding the vehicle life cycle from after-sales care to disposal, it is difficult to understand the situation from after-sales maintenance to disposal in the target countries. Since the supplier of new vehicles is clear, after-sales service is often provided by car maker-designated dealers during the warranty period, but after the warranty expires, users choose cheaper after-sales services. Because there is no vehicle inspection system, there is no enforcement for vehicle maintenance. Used cars are not related to car maker dealers, thus after-sales service is provided by large independent repair shops, small private repair shops, or even informal operators working under trees.

Whether to scrap a vehicle is left to the user's decision, and the government's vehicle deregistration system is not thoroughly enforced, such situation makes it difficult to grasp the actual number of vehicles on the road. For scrapping, users bring vehicles to repairers, dismantlers, or recyclers. In addition to certified recyclers, many informal businesses and individuals are involved in the end-of-

life vehicle industry, and the sources of parts and scrap collected by recyclers are diverse. Along with scrap from products other than automobiles, the final destination of resources is determined domestically or internationally.

Figure 9: Vehicle life cycle



(Source: JICA (2022), NXRIX study)

Automotive-related policies and regulations shape the structure of the automotive industry in each country. All countries have policies or guidelines related to EVs, but the speed and degree of implementation vary greatly. The spread of EVs is closely related to electricity prices and its supply conditions.

Reflecting various regulations, the automotive market in each country is divided into new and used car markets, affecting the supply of finished vehicles and the supply chain for production and replacement parts. Four-wheel EVs are not produced locally and, except for Ethiopia, are not widespread in the target countries. On the other hand, two- and three-wheel EVs are spreading ahead. Two-wheel EVs are used for short-distance delivery and taxis in urban areas where charging is less of a concern, but the lack of charging infrastructure for four-wheel EVs is pointed out in all target countries and is hindering their spread. Two-wheel EVs also use lithium-ion batteries, and an increase in battery imports is expected. If a battery circulation system for two- and three-wheel EVs can be established, it may be applicable to battery management and recycling systems when four-wheel EVs become widespread.

Figure 10: Summary of automotive/EV trends in target countries

Country	South Africa	Tanzania	Kenya	Ethiopia

Automotive Industry Policy	Policy exists → Aiming to be Africa's auto manufacturing hub	No policy: Framework for EV policy being developed	Policy exists → Strengthening auto manufacturing	No policy: EV policy in draft
Automotive Market	New cars (Used commercial vehicle imports banned)	Used cars	Used cars	Used cars → New cars (Ban on fuel vehicle imports)
EV Status	4wheel: × 2wheel: × Hybrid possible	4wheel: × 2wheel: ○ 3wheel: ○ Gasoline vehicles dominant, some shift to NGV	4wheel: × 2wheel: ◎ Hybrid possible	4wheel: ◎ 2wheel: ◎ EVs rapidly spreading as national policy
Electricity Price (per kWh, Mar 2024, TICG)	USD 0.182	USD 0.087	USD 0.255	USD 0.003

(Source: NXRIX Study, Tanzania Investment and Consultant Group: TICG)

(3) Issues and policy recommendations for the automotive industry

Considering the promotion of the automotive industry and the progress of EV adoption in the target countries, there are issues that may hinder its development. The following issues and recommendations are identified:

① Lack of high-level policy

Some countries (Ethiopia, Tanzania) lack clear automotive industry policies although there are policies focusing on specific aspects such as EVs. Even where EV incentives exist, frequent policy changes prevent reliable implementation, making it difficult for private businesses to consider long-term investment.

② Small local new car market

In countries where used cars dominate, the new car market is small, and CKD/SKD production is mainstream, making it difficult for related industries such as parts suppliers to enter.

③ Inability to track end-of-life (EOL) for vehicles and parts

Due to incomplete or non-existent deregistration systems at scrapping, the number of vehicles currently on the road cannot be tracked. Furthermore, it is unclear whether user or disposal operator is responsible for reporting at the time of disposal. The lack of clear control points at vehicle/parts disposal prevents reliable resource recovery.

Aiming to improve issues mentioned above, here are some policy recommendations.

Proposal 12: Formulate automotive policies including EOL regulations for vehicles and batteries

When developing mid- to long-term automotive policies including EV policies, also establish policies for handling lithium-ion batteries. Cover not only four-wheelers but also two- and three-wheelers and formulate automotive policies in conjunction with EPR regulations, considering the EOL of vehicles and batteries, to create an environment where manufacturers can invest with confidence.

Proposal 13: Develop systems to facilitate entry of auto parts suppliers

Establish a temporary import or bonded system (equivalent to Mexico's IMMEX) that allows auto parts suppliers (from Tier 1 to Tier 3) to store, process, assemble, and transport parts with deferred tariff payment until final assembly, and build a digital system to track/manage progress.

3. Circular Economy

(1) Current status of efforts toward circular economy transition in target countries

This research studied the status and recent trends of waste management laws and regulations, and summarized recycling trends. Focusing on lithium-ion batteries, we particularly examined trends related to E-waste. Through case studies in the target countries, general trends and issues in Africa are summarized.

(2) Analysis of collected information

① Legal basis for waste management

Waste management policies have existed for some time, but since the 2020s, policies have become more detailed, targeting specific wastes such as plastics and e-waste. Recently, EPR regulations have begun to be strengthened, requiring manufacturers, importers, wholesalers, and retailers to take responsibility throughout the product life cycle, including collection and reverse logistics.

Although EPR regulations specify "post-sale management responsibility," the process from post-sale to disposal is not yet traceable. As the regulations have just started, the extent of rule enforcement is unclear.

Transboundary movement of waste is managed under two international treaties: the Basel Convention (global) and the Bamako Convention (Africa-specific).

Figure 11: Legal basis for waste management

	Domestic Waste Management Policy	Domestic EPR	International Law (Basel)	International Law (Bamako)
Overview	Regulates the process up to disposal for all or specific products	Requires manufacturers/importers to take responsibility throughout the product life cycle (collection, recycling, recovery, etc.), and to hand over waste to certified recyclers	Basel Convention: Regulation of transboundary movement of hazardous waste (global framework)	Bamako Convention: Regulation of import and transboundary movement of hazardous waste within Africa (Africa-specific)
Countries Adopting	All 4 target countries (with different details)	South Africa, Tanzania, Kenya (enacted); Ethiopia (draft as of Apr 2025)	All 4 target countries	All 4 target countries
Scope of regulations				
New products	N/A	✓	N/A	N/A
Lifecycle after sales	N/A	✓	N/A	N/A
used/second-hand products (as waste)	✓（waste）	✓（include reuse, recycle）	✓	✓
Control point	At disposal	At import/post-sale	At export	At import

(Source: NXRIX study)

② E-waste policy

Regulations on E-waste are progressing in each country, especially for the ICT industry, which uses and disposes of large amounts of cables and electronic devices. For certain ICT-related companies, authorities impose collection responsibilities.

For general consumer electronics, EPR laws are being developed for manufacturers, importers, and sellers. While electronic devices are managed at the time of manufacture/import, tracking up to disposal by general users is impossible, and there is no enforcement by businesses.

Reverse logistics (collection/transport) is not established for all electronic devices. The value chain from post-use to disposal is heavily dependent on informal sector operators and individuals, making it difficult to understand the actual flow to disposal. Therefore, various batteries are also subject to EPR management, but the actual status of reuse, recycling, and disposal is not accurately known.

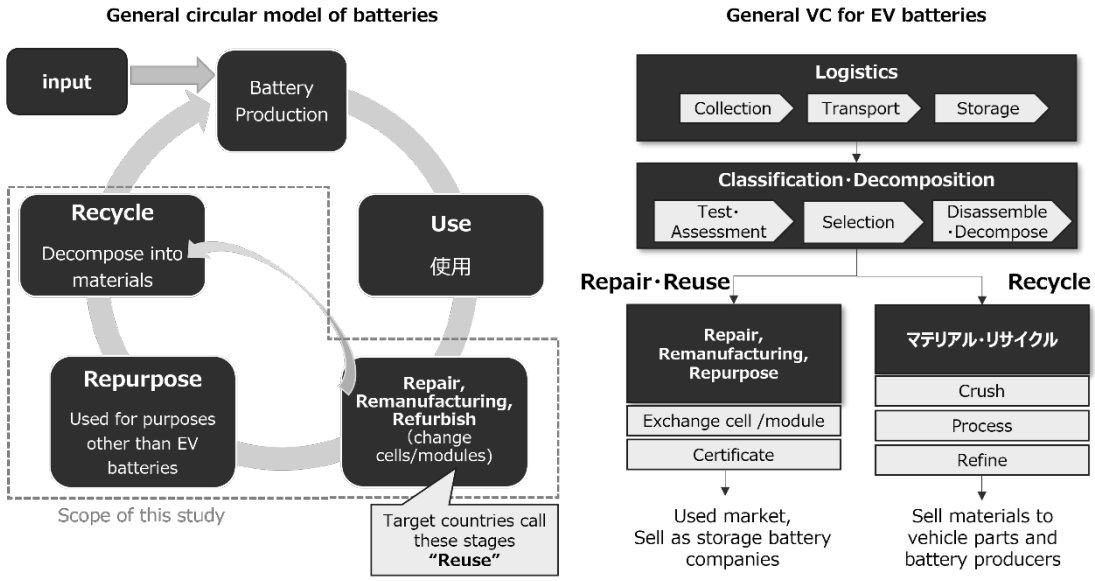
Furthermore, there are currently no clear domestic regulations for the disposal of end-of-life vehicles or batteries.

③ Lithium-ion battery recycling

General circular economy model consists of stages before recycling, such as "repair," "remanufacturing/refurbishing," and "repurposing." In Africa, battery reuse (equivalent to repair/refurbish) is carried out mainly by small businesses, and repurposing is also emerging.

In Japan and the West, there are the general circular model and the value chains for EV batteries, but in the target countries, "battery" refers to lead-acid batteries, hybrid vehicle nickel-metal hydride batteries, two-wheeler EV and portable lithium-ion batteries, and does not include large lithium-ion batteries for four-wheel EVs. This report summarizes the current status of these battery cycles.

Figure 12: General Battery Circulation Model



(Source: NXRIX)

(a) Repair

In the target countries, due to the lack of periodic vehicle inspection systems, users bring vehicles for repair at their own discretion, choosing repairers based on the vehicle's age and repair budget. Bringing vehicles to car maker dealers is mostly limited to those within the new car warranty period.

The repair flow is similar in the West and Africa, but the informal sector plays a larger role in Africa. Especially for used vehicles, car maker dealers rarely get involved in repairs.

The destination of replaced old batteries or defective cells is unclear and left to the discretion of repairers. For example, in Kenya, lead-acid battery collection by battery manufacturers is conducted, but there is no such system for lithium-ion battery collection.

(b) Reuse/Repurpose

In the target countries, battery reuse is carried out mainly by small businesses. Only defective cells

are replaced and refurbished batteries are sold as used batteries, allowing users to purchase used batteries during repairs. Battery reuse in the target countries combines repair and refurbishing.

In the West and Japan, logistics and qualified recycling operators are involved in reverse logistics, requiring safe collection, transport, and storage, but in the target countries, responsibility, and rules for collecting old batteries are unclear.

To replace defective cells during reuse, good cells from used batteries are needed; therefore, reuse/repurpose operators procure used batteries in various ways. These operators are small-scale businesses, and major logistics companies are not involved in domestic transport of batteries; logistics are arranged in-house or procured from individuals. There is no systematic rule or system for collecting lithium-ion batteries. Since domestic procurement of used batteries is insufficient, used batteries are imported from overseas in compliance with import regulations.

Reuse operators are also starting to develop repurposing businesses. Batteries unsuitable for reuse are sometimes sold as small home storage batteries, but the business scale is still very small. Since storage batteries may be useful in rural areas, both the government and private sector are highly interested in repurposing.

(c) Recycling

Currently, lithium-ion battery recycling is not conducted in the target countries. Certified recyclers exist, and waste from businesses is legally required to be handed over to certified recyclers. Recyclable resources (iron, plastic, etc.) are crushed to scrap level and then purchased by specialized resource companies for material recycling. However, handling lithium-ion batteries is dangerous, and there is no processing technology in the target countries. Items that cannot be processed domestically are exported overseas for recycling.

(3) Issues and policy recommendations for circular economy development

Although there are many efforts toward a circular economy, the process up to battery recycling and management of disposal is still being developed. The following issues have been identified:

① Lack of awareness and technology for battery recycling

Although legal changes toward a circular society have occurred in recent years, governments have not yet considered actual battery recycling. Battery reuse and repurposing are emerging on a small business basis.

② Lack of legal regulations for two-wheeler EV battery recycling

With the rapid spread of two-wheeler EVs, a large number of small lithium-ion batteries are expected to reach end-of-life in a few years, but there are no clear legal regulations for their disposal.

③ Involvement of informal operators and individuals

Informal operators and individuals are the main players in resource collection, making the sources and procurement methods of resources unclear and legally opaque. The amount and method of collecting reusable lithium-ion batteries cannot be tracked.

④ Technical barriers

Lithium-ion batteries require advanced technology for dismantling, making domestic recycling impossible at present. As a result, valuable resources are being exported overseas.

⑤ Overlapping e-waste regulatory authorities

E-waste, including batteries, spans multiple sectors such as ICT and automotive industries, each with its own regulatory authority. Coordination with the Ministry of Environment, which comprehensively regulates all waste, is insufficient.

Aiming to address these issues, the following policy recommendations are to be proposed.

Proposal 14: Establishment of a reliable lithium-ion battery collection scheme

Build a safe and efficient lithium-ion battery collection network utilizing digital technologies. In doing so, design incentives to encourage cooperation from lithium-ion battery users and aim for a symbiotic model that also involves informal sector operators.

Proposal 15: Government-led promotion of battery reuse and repurposing

Expand reuse and repurposing (such as battery storage businesses) under government leadership, involving local businesses, Japanese companies, and partner country enterprises.

Proposal 16: Construction of a lithium-ion battery recycling value chain

In the process from collection to recycling, collaborate with locally certified recyclers to establish standards for state of health and safe handling methods. Implement technical cooperation on lithium-ion battery recycling from Japan and India.

These policy recommendations aim not only to facilitate the physical flow of goods, but also to enhance the visibility of the movement of goods and resources. For this purpose, digitalization should be maximally utilized, and barriers to information sharing between government and private sector operators should be eliminated. If logistics between Africa and Asia are streamlined, connectivity will be strengthened, which would contribute to the promotion of global resource circulation.

References:

１．Trade and Logistics

（投資関係/Investment）

South Africa

- Government of South Africa. (2015). Protection of Investment Act 22 of 2015. Retrieved from https://www.gov.za/documents/protection-investment-act-22-2015-15-dec-2015-0000
- JETRO. (n.d.). Investment Environment (South Africa). Retrieved from https://www.jetro.go.jp/world/africa/za/invest_02.html
- JETRO. (n.d.). Investment Regulations and Incentives (South Africa). Retrieved from https://www.jetro.go.jp/world/africa/za/invest_03.html

Tanzania

- Tanzania Investment Centre. (n.d.). Publications/Acts. Retrieved from https://www.tic.go.tz/publications/acts
- JETRO. (2020). Tanzania Investment Environment Report (September 2020). Retrieved from https://www.jetro.go.jp/ext_images/_Reports/02/2020/66b6863998765962/202009.pdf
- Tanzania Investment Centre. (n.d.). Homepage. Retrieved from https://www.tic.go.tz/
- FAO. (n.d.). National Investment Promotion Act No. 6 of 1997. Retrieved from https://www.fao.org/faolex/results/details/fr/c/LEX-FAOC220972/
- Export Processing Zones Authority. (n.d.). EPZ Act. Retrieved from https://www.epza.go.tz/uploads/documents/en-1631959649-EPZ%20%20ACT.pdf
- Export Processing Zones Authority. (n.d.). Pwani EPZ. Retrieved from https://www.epza.go.tz/pages/pwani

Ethiopia

- UNCTAD. (2020). Investment Proclamation No. 1180/2020. Retrieved from https://investmentpolicy.unctad.org/investment-laws/laws/318/ethiopia-investment-proclamation-no1180-2020
- JETRO. (n.d.). Investment Regulations and Incentives (Ethiopia). Retrieved from https://www.jetro.go.jp/world/africa/et/invest_03.html
- JETRO. (n.d.). Investment Environment (Ethiopia). Retrieved from https://www.jetro.go.jp/world/africa/et/invest_02.html
- Ethiopian Investment Commission. (n.d.). Industrial Parks. Retrieved from https://www.ipdc.gov.et/service/parks/

Kenya

- Invest Kenya. (2004). Investment Promotion Act No. 6 of 2004. Retrieved from https://eprocedures.investkenya.go.ke/media/InvestmentPromotionAct6of2004.pdf
- JETRO. (n.d.). Investment Environment (Kenya). Retrieved from

https://www.jetro.go.jp/world/africa/ke/invest_02.html
・ JETRO. (n.d.). Investment Regulations and Incentives (Kenya). Retrieved from https://www.jetro.go.jp/world/africa/ke/invest_03.html
（貿易協定/Trade Agreement）
South Africa
・ JETRO. (n.d.). Trade Agreements (South Africa). Retrieved from https://www.jetro.go.jp/world/africa/za/trade_01.html
・ Tanzania
・ Southern African Development Community (SADC). (n.d.). Homepage. Retrieved from http://www.sadc.int
・ East African Community (EAC). (n.d.). Homepage. Retrieved from https://www.eac.int/
・ African Union (AU). (n.d.). Homepage. Retrieved from https://au.int/
Ethiopia
・ JETRO. (n.d.). Trade Agreements (Ethiopia). Retrieved from https://www.jetro.go.jp/world/africa/et/trade_01.html
Kenya
・ JETRO. (n.d.). Trade Agreements (Kenya). Retrieved from https://www.jetro.go.jp/world/africa/ke/trade_01.html
（輸入規制/Import Restriction）
South Africa
・ JETRO. (n.d.). Import Regulations (South Africa). Retrieved from https://www.jetro.go.jp/world/africa/za/trade_02.html
Tanzania
・ East African Community (EAC). (n.d.). EAC Customs Management Act. Retrieved from https://www.eac.int/documents/category/eac-customs-management-act
Ethiopia
・ JETRO. (n.d.). Import Regulations (Ethiopia). Retrieved from https://www.jetro.go.jp/world/africa/et/trade_02.html#block2
・ JETRO. (2024). Ethiopia's Economy and Trade Outlook (February 2024). Retrieved from https://www.jetro.go.jp/biz/areareports/2024/a6ee8e980665ed4d.html
Kenya
・ JETRO. (n.d.). Import Regulations (Kenya). Retrieved from https://www.jetro.go.jp/world/africa/ke/trade_02.html#block2

(認証制度/Certification System)
South Africa

・ JQA. (n.d.). Global Certification: South Africa. Retrieved from https://www.jqa.jp/service_list/safety/service/global/south-africa/
・ JETRO. (n.d.). Standards and Certification Systems (South Africa). Retrieved from https://www.jetro.go.jp/world/africa/za/trade_05.html
・ ExplosionSafe.net. (n.d.). South Africa SABS Certification. Retrieved from https://explosionsafe.net/ksc/%E5%8D%97%E3%82%A2sabs%E8%AA%8D%E8%A8%BC/

Tanzania

・ Ministry of Internal Affairs and Communications (Japan). (n.d.). Information on Certification Systems in Tanzania. Retrieved from https://www.soumu.go.jp/main_content/000621029.pdf
・ Tanzania Bureau of Standards (TBS). (n.d.). Homepage. Retrieved from https://www.tbs.go.tz/
・ Tanzania Bureau of Standards (TBS). (n.d.). Certification Procedure. Retrieved from https://www.tbs.go.tz/pages/certification-procedure
・ Tanzania Bureau of Standards (TBS). (n.d.). Inspection. Retrieved from https://www.tbs.go.tz/pages/inspection
・ Tanzania Bureau of Standards (TBS). (2023). PVoC HS CODES VERSION 2023. Retrieved from https://www.tbs.go.tz/uploads/files/PVoC%20HS%20CODES%20VERSION%202023.pdf
・ Tanzania Bureau of Standards (TBS). (2023). DI HS CODES VERSION 2023. Retrieved from https://www.tbs.go.tz/uploads/files/DI%20HS%20CODES%20VERSION%202023.pdf

Ethiopia

・ JETRO. (2019). Ethiopia: Report on Standards and Certification Systems (March 2019). Retrieved from https://www.jetro.go.jp/ext_images/_Reports/02/2019/3d98c4290d4dc8e8/201903.pdf

Kenya

・ JETRO. (n.d.). Import Regulations (Kenya) - Standards and Certification. Retrieved from https://www.jetro.go.jp/world/africa/ke/trade_02.html#block4

（港湾/Ports）

South Africa

・ Logistics Cluster. (n.d.). South Africa - Port Durban. Retrieved from https://lca.logcluster.org/211-south-africa-port-durban
・ Prodafrica. (n.d.). Port of Durban. Retrieved from https://maps.prodafrica.com/places/south-africa-1/kwazulu-natal/durban/port/597/
・ Ocean Commerce. (2023, November 21). News Digest. Retrieved from https://www.ocean-commerce.co.jp/news/news_digest.php?CreatedOn=11/21/2023&sortorder=ascend
・ SDI Logistics. (n.d.). Global Port Congestion Data: Durban is the Most Congested Port. Retrieved from http://ja.sdilogistics-shippingfr.com/info/global-port-congestion-data-durban-is-the-mos-99663125.html
・ FreshPlaza. (n.d.). Durban Port Equipment Failure is a Worry. Retrieved from

https://www.freshplaza.com/north-america/article/9627356/durban-port-equipment-failure-is-a-worry/
・ Port and Harbor Association of Japan. (n.d.). Top 100 Ports. Retrieved from https://www.phaj.or.jp/distribution/earth/top100.html
・ Transnet Port Terminals. (n.d.). Durban Container Terminal. Retrieved from https://www.transnetportterminals.net/ports/pages/durban_container.aspx
・ Transnet National Ports Authority. (n.d.). Port Statistics. Retrieved from https://www.transnetnationalportsauthority.net/Commercial%20and%20Marketing/Pages/Port-Statistics.aspx
・ Parliamentary Monitoring Group. (2021). Revised Transnet Presentation (June 2, 2021). Retrieved from https://static.pmg.org.za/210602Revised_Transnet_Presentation.pdf

Tanzania

・ Logistics Cluster. (n.d.). Tanzania, United Republic - Port Dar es Salaam. Retrieved from https://lca.logcluster.org/tanzania-united-republic-211-port-dar-es-salaam
・ Tanzania Ports Authority. (n.d.). Dar es Salaam Ports. Retrieved from https://www.ports.go.tz/index.php/en/ports/dar-es-salaam-ports
・ World Bank Open Knowledge Repository. (n.d.). Port Dar es Salaam Assessment. Retrieved from https://openknowledge.worldbank.org/server/api/core/bitstreams/6cebb847-6f46-44e7-9533-12ac893b3693/content

Ethiopia

・ Port de Djibouti. (n.d.). Services: Container Terminal. Retrieved from https://www.portdedjibouti.com/services/container-terminal/
・ CEIC Data. (n.d.). Djibouti Container Port Throughput. Retrieved from https://www.ceicdata.com/en/indicator/djibouti/container-port-throughput

Kenya

・ The Business Year. (n.d.). Port Series: Mombasa, Kenya. Retrieved from https://thebusinessyear.com/article/port-series-mombasa-kenya/#:~:text=It%20All%20Adds%20Up,are%20targeting%202%20million%20TEUs.%E2%80%9D
・ Kenya Ports Authority. (n.d.). Mombasa Container Terminal. Retrieved from https://www.kpa.co.ke/OurBusiness/pages/mombasa-container-terminal.aspx
・ Kenya Ports Authority. (n.d.). Kipevu Container Terminal. Retrieved from https://www.kpa.co.ke/OurBusiness/pages/kipevu-container-terminal.aspx
・ The Reporter Ethiopia. (n.d.). Kenya and Ethiopia on Port Development. Retrieved from https://www.thereporterethiopia.com/32220/

（輸入通関/Import Customs Clearance）

・ South African Revenue Service (SARS). (n.d.). Customs and Excise: Imports. Retrieved from

https://www.sars.gov.za/customs-and-excise/import-export-and-transit/imports/

- JETRO. (n.d.). Customs Procedures (South Africa). Retrieved from https://www.jetro.go.jp/world/africa/za/trade_05.html
- South African Revenue Service (SARS). (n.d.). Clearance Declaration. Retrieved from https://www.sars.gov.za/customs-and-excise/clearance-declaration/
- Logistics Cluster. (n.d.). South Africa - Customs Information. Retrieved from https://lca.logcluster.org/13-south-africa-customs-information
- Baker McKenzie. (n.d.). South Africa: Customs Registered Deferment Account Holders Must Pay 13th Deferment Payment by 28 March 2024. Retrieved from https://insightplus.bakermckenzie.com/bm/tax/south-africa-customs-registered-deferment-account-holders-must-pay-13th-deferment-payment-by-28-march-2024
- South African Revenue Service (SARS). (n.d.). Advance Tax Rulings (ATR). Retrieved from https://www.sars.gov.za/legal-counsel/interpretation-rulings/advance-tax-rulings-atr/
- South African Revenue Service (SARS). (n.d.). Customs Sufficient Knowledge. Retrieved from https://www.sars.gov.za/customs-and-excise/about-customs/customs-sufficient-knowledge/
- South African Revenue Service (SARS). (n.d.). Registration, Licensing and Accreditation: Accreditation. Retrieved from https://www.sars.gov.za/customs-and-excise/registration-licensing-and-accreditation/accreditation/
- South African Revenue Service (SARS). (n.d.). Customs Single Window Solution. Retrieved from https://www.sars.gov.za/customs-and-excise/customs-single-window-solution/
- JASTPRO. (2022). South Africa Customs Procedures (April 2022). Retrieved from https://www.jastpro.org/files/libs/1417/202204081657196248.pdf
- JETRO. (n.d.). Import Procedures (South Africa). Retrieved from https://www.jetro.go.jp/world/africa/za/trade_03.html

Tanzania

- SRA Tanzania. (n.d.). Business Formation. Retrieved from https://sra.co.tz/business-formation/
- Logistics Cluster. (n.d.). Tanzania, United Republic - Customs Information. Retrieved from https://lca.logcluster.org/tanzania-united-republic-13-customs-information
- Tanzania Investment Centre. (n.d.). Dar es Salaam Port Manual. Retrieved from https://procedures.tic.go.tz/Media/Editor_Repo/dar%20es%20port%20manual.pdf
- Tanzania Revenue Authority (TRA). (n.d.). Import Procedures. Retrieved from https://www.tra.go.tz/page/import-procedures
- IJRPR. (n.d.). Analysis of Import Clearance Procedures in Tanzania. Retrieved from https://ijrpr.com/uploads/V5ISSUE10/IJRPR34206.pdf
- Tanzania Trade Portal. (n.d.). Procedure: Import of Goods. Retrieved from https://trade.tanzania.go.tz/procedure/131?l=en

- TAFFA. (n.d.). EACFFPC Training. Retrieved from https://taffa.or.tz/eacffpc-training/
- Tanzania Revenue Authority (TRA). (n.d.). Authorized Economic Operators (AEOs). Retrieved from https://www.tra.go.tz/page/authorized-economic-operators-aeos
- East African Community (EAC). (n.d.). EAC AEO Program. Retrieved from https://www.eac.int/customs/eacaeo
- Ministry of Works (Tanzania). (2022). e-Government Capability Maturity Framework. Retrieved from https://www.utumishi.go.tz/uploads/documents/e_strategy2022.pdf
- e-Government Agency (Tanzania). (2023). e-Government Capability Maturity Framework. Retrieved from https://www.ega.go.tz/uploads/standarddocuments/sw-1692042035-e-GOVERNMENT%20CAPABILITY%20MATURITY%20FRAMEWORK%20(1).pdf
- Ministry of Land, Infrastructure, Transport and Tourism (Japan). (n.d.). Port of Dar es Salaam Study. Retrieved from https://www.mlit.go.jp/common/001027224.pdf
- Ethiopia
- theiguides.org. (n.d.). Ethiopia Customs Guide. Retrieved from https://admin.theiguides.org/media/documents/ethiopia_customs_guide.pdf
- 2merkato.com. (n.d.). Customs Procedures in Ethiopia. Retrieved from https://www.2merkato.com/articles/customs/35-customs-procedures-in-ethiopia
- Ermias Tizazu Law Office. (n.d.). Import Export Procedures in Ethiopia in Case of Customs. Retrieved from https://ermiastizazu.com/wp-content/uploads/2013/02/import-export-procedures-in-ethiopia-in-case-of-custom.pdf
- Trade.gov. (n.d.). Ethiopia: Customs Regulations. Retrieved from https://www.trade.gov/country-commercial-guides/ethiopia-customs-regulations
- Jimma University Repository. (n.d.). Study on Import and Export Procedures in Ethiopia. Retrieved from https://repository.ju.edu.et/bitstream/handle/123456789/3821/Bedsatisse%20edited.pdf?sequence=1&isAllowed=y
- Ethiopian Single Window. (n.d.). Homepage. Retrieved from https://esw.et/esw-trd/

Kenya

- Aeromarine. (n.d.). Custom Clearance: Kenya Clearing and Forwarding Procedures. Retrieved from https://aeromarine.co.ke/clearing-forwarding/custom-clearance/kenya-clearing-forwarding-proceedures/
- Logistics Cluster. (n.d.). Kenya - Customs Information. Retrieved from https://www.lca.logcluster.org/13-kenya-customs-information
- FreightAmigo. (n.d.). Understanding Import Taxes and Customs Duties for Kenya: A Comprehensive Guide. Retrieved from https://www.freightamigo.com/blog/understanding-import-taxes-and-customs-duties-for-kenya-a-comprehensive-guide/

・ Kenya Revenue Authority (KRA). (n.d.). Advance Ruling. Retrieved from https://www.kra.go.ke/helping-tax-payers/faqs/advance-ruling
・ Kenya Revenue Authority (KRA). (n.d.). Authorized Economic Operators (AEO): Eligibility & Getting Certified. Retrieved from https://www.kra.go.ke/business/authorized-economic-operators-aeo/learn-about-aeo/eligibility-getting-certified
・ Kentrade. (n.d.). Single Window System. Retrieved from https://kentrade.go.ke/single-window-system

(道路&越境輸送 / Roads &Cross-Border Transport)

South Africa

・ Logistics Cluster. (n.d.). South Africa - Road Network. Retrieved from https://lca.logcluster.org/23-south-africa-road-network
・ Focus On Transport. (n.d.). Cross-Border Trucking Procedures for Compliant Operators. Retrieved from https://focusontransport.co.za/cross-border-trucking-procedures-for-compliant-operators/

Tanzania

・ Ministry of Works (Tanzania). (2022). Basic Statistics 2022. Retrieved from https://www.mow.go.tz/uploads/documents/sw-1688644679-Basic%20Statistics%202022%20FINAL.pdf
・ Logistics Cluster. (n.d.). Tanzania, United Republic - Road Network. Retrieved from https://lca.logcluster.org/tanzania-united-republic-23-road-network

Ethiopia

・ Logistics Cluster. (n.d.). Ethiopia - Road Network. Retrieved from https://www.lca.logcluster.org/23-ethiopia-road-network

Kenya

・ Logistics Cluster. (n.d.). Kenya - Road Network. Retrieved from https://lca.logcluster.org/kenya-23-road-network

Africa

・ AUDA-NEPAD. (2024). One-Stop Border Post (OSBP) STATUS REPORT. https://nepad.org/publication/one-stop-border-post-osbp-status-report
・ African Development Bank. (2023). CROSS-BORDER ROAD CORRIDORS

Expanding Market Access in Africa and Nurturing Continental Integration (October 2023).

https://www.afdb.org/sites/default/files/documents/publications/cross-border_road_corridors_web.pdf

（鉄道/Railways）

South Africa

・ Transnet Freight Rail. (n.d.). Overview. Retrieved from https://www.transnetfreightrail-tfr.net/BU/CAB/Pages/Overview.aspx
・ Transnet. (n.d.). Rail Infrastructure. Retrieved from https://www.transnet.net/SubsiteRender.aspx?id=4492347

・ Maersk. (n.d.). Local Information: South Africa Import. Retrieved from https://www.maersk.com/local-information/imea/south-africa/import
・ Hapag-Lloyd. (2020). South Africa Import Detention MHD 2020. Retrieved from https://www.hapag-lloyd.com/content/dam/website/downloads/detention_demurrage/South_Africa_Import_Detention_MHD_2020.pdf

Tanzania

・ Wikipedia. (n.d.). Rail transport in Tanzania. Retrieved from https://en.wikipedia.org/wiki/Rail_transport_in_Tanzania
・ ISCOS Africa Shipping. (2018). TPA Workshop Dar es Salaam (September 2018). Retrieved from https://iscosafricashipping.org/wp-content/uploads/2018/09/TPA-19-20TH%20SEPTEMBER-2018-WORKSHOP-DAR-ES-SALAAM.pdf
・ Daily News. (n.d.). Isaka Cargo Volume Surges 30% in Four Months. Retrieved from https://dailynews.co.tz/isaka-cargo-volume-surges-30pc-in-four-months/
・ Tanzania Embassy in Israel. (n.d.). Kwala Dry Port Set for Full Swing. Retrieved from https://www.il.tzembassy.go.tz/resources/view/kwala-dry-port-set-for-full-swing
・ Easy Track Africa. (n.d.). Ensuring Smooth Operations at Tanzanian Borders with ECTs. Retrieved from https://easytrackafrica.com/ensuring-smooth-operations-at-tanzanian-borders-with-ects/
・ JICA. (n.d.). Tanzania Railway Development Study. Retrieved from https://openjicareport.jica.go.jp/pdf/11936689_02.pdf
・ East African Community (EAC). (n.d.). Cross-Border Road Transport Laws, Regulations, Standards and Systems Harmonized from Cape to Cairo. Retrieved from https://www.eac.int/press-releases/150-infrastructure/1859-cross-border-road-transport-laws,-regulations,-standards-and-systems-harmonized-from-cape-to-cairo

Ethiopia

・ Ethiopian Railways Corporation. (n.d.). Our Service: Freight Service. Retrieved from https://edr.gov.et/our-service/freight-service/

Kenya

・ Logistics Cluster. (n.d.). Kenya - Railway Assessment. Retrieved from https://www.lca.logcluster.org/kenya-24-railway-assessment
・ Non-Resident Inventory
・ JETRO. (2017, April). Non-Resident Inventory Regulations in Japan (April 2017). Retrieved from https://www.jetro.go.jp/biznews/2017/04/d3ec8d9caa5a8904.html

２．自動車産業/Automotive Industry

Africa in general

・ 独立行政法人国際協力機構（JICA）・ボストン・コンサルティング・グループ合同会社(2022). 「アフリカ地域自動車産業振興（ポストコロナのサプライチェーン・ モビリティ改革）に

係る情報収集・確認調査　ファイナルレポート」. 2022 年 2 月 https://openjicareport.jica.go.jp/pdf/12336814.pdf

- 綿貫麻衣香・NX 総合研究所 (2022)「サーキュラーエコノミーを物流視点で考えてみよう」『NX 総合研究所　物流ブログ』https://www.nx-soken.co.jp/topics/logistics-2206-01.（2025-6-20 Access）
- アフリカビジネスパートナーズアフリカの電気自動車（EV）市場のトレンドと国別動向」2024.12.13.「 https://abp.co.jp/contents/insights/insights-4731/（2025-４-20 Access）
- アフリカビジネスパートナーズ「アフリカの自動車生産国と日本メーカーの動」2023.08.06. https://abp.co.jp/contents/insights/insights-2381/　（2025-４-20 Access）
- 自動車リサイクル促進センター（2021）.「国内外における自動車リサイクル・資源循環に関連する基礎調査　報告書」(令和 3 年 10 月 29 日). https://www.jarc.or.jp/renewal/wp-content/themes/jarc/assets/pdf/Basic_working_papers_in_conjunction_with_car_recycling.pdf（2025-6-20 Access）
- Energy for Growth Hub （2024）. “Who in Africa Is Ready for EVs?” Oct 23, 2024. https://energyforgrowth.org/article/who-in-africa-is-ready-for-evs/　(2025-2-20 Access）

Kenya

- AA Autonews. “Kenya’s national automotive policy attracts investors in new vehicle dealerships” November 11, 2023. https://aakenyaautonews.co.ke/kenyas-national-automotive-policy-attracts-investors-in-new-vehicle-dealerships/（2025-6-20 Access）
- Africa e-mobility Alliance (2023). Kenya E-Mobility Tariff Review. https://africaema.org/resources/AfEMA_technical_brief_2023_Kenya.pdf （2025-２-２５ Access）
- Africa e-mobility Alliance (2023). EAC 2023/4 Finance Acts and E-Mobility. https://africaema.org/resources/AfEMA_technical_brief_2023_EAC.pdf （2025-２-２５ Access）
- Xinhua. “Kenya sees steady increase in EV registrations, infrastructure development”. 2024-4-9.（2025-２-25 Access）https://english.news.cn/20240409/4bdbbfa80acb4faf9256dab0f0e5872f/c.html
- Energy and Petroleum Regulatory Authority of Kenya(2023). “ELECTRIC VEHICLE CHARGING AND BATTERY SWAPPING INFRASTRUCTURE GUIDELINE” https://energy.go.ke/sites/default/files/KAWI/Other%20Downloads/EPRA-E-Mobility-Guidelines.pdf （2025-２-25 Access）
- Kenya Revenue Authority. “HIGHLIGHTS OF THE FINANCE ACT 2023”. https://www.kra.go.ke/popular-links/key-highlights-of-the-finance-act-2023 （2025-２-25 Access）
- Ministry of Roads and Transport of Kenya. “Dawn Of New Era as Ministry Launches Draft Electric Mobility Policy”. 03/27/2024. https://www.transport.go.ke/dawn-new-era-ministry-launches-draft-electric-mobility-policy （2025-２-25 Access）

- Nairobi Wire. “KEBS Prohibits Importation Of Secondhand EVs with Battery Life Below 80%”. February 21, 2024. https://nairobiwire.com/2024/02/kebs-prohibits-importation-of-secondhand-evs-with-battery-life-below-80.html#google_vignette （2025-２-25 Access）
- EY. “Kenya proposes tax changes under the Finance Bill, 2024”. 21 May 2024 https://www.ey.com/en_gl/technical/tax-alerts/kenya-proposes-tax-changes-under-the-finance-bill--2024 （2025-２-27 Access）

Ethiopia

- International Trade Administration of the USA. “Ethiopia Automotive EV Market”. 2024.12.13. https://www.trade.gov/market-intelligence/ethiopia-automotive-ev-market （2025-4-20 Access）
- BBC. “Ethiopian currency falls sharply after big policy change”. https://www.bbc.com/news/articles/cxr2k24z29xo （2025-２-２５ Access）
- Addis Standard. “News: Gov’t mandates EV importers, assemblers to install charging stations before resuming operations”. January 16, 2025. https://addisstandard.com/govt-mandates-ev-importers-assemblers-to-install-charging-stations-before-resuming-operations/ （2025-２-２５ Access）
- The reporter. “Gov’t scraps automobile policy, doubles down on EV strategy”. January 11, 2025. https://www.thereporterethiopia.com/43302/
- CleanTechnica (2024). “Ethiopia Shows Us Just How Fast The Transition To Electric Mobility Can Happen In Africa”. https://cleantechnica.com/2024/05/13/ethiopia-shows-us-just-how-fast-the-transition-to-electric-mobility-can-happen-in-africa/
- University of Gothenburg. “E-vehicles exempted from tax in Ethiopia – IGE fellow wrote proposal”. 29 November 2022. https://www.gu.se/en/news/e-vehicles-exempted-from-tax-in-ethiopia-ige-fellow-wrote-proposal

Tanzania

- Africa e-mobility Alliance (2023). “Barrier to E-Mobility March 2023”. https://www.africaema.org/resources/AfEMA_country_report_2023_Tanzania.pdf （2025-２-２５ Access）
- Tanzania Investment and Consultant Group. “Tanzania’s Competitive Electricity Pricing”. November 28, 2024. https://ticgl.com/tanzanias-competitive-electricity-pricing/ （2025-6-20-Access）
- Tanzania Revenue Authority. “TAXES AND DUTIES AT A GLANCE 2023/202”. July 2023. https://www.tra.go.tz/images/uploads/public_notice/swahili/TAXES_AND_DUTIES_2023_-_2024.pdf (2025-2-25Access）
- BBC News (5 January 2025). “Tanzania's fuel revolution slowed down by lack of filling stations”. https://www.bbc.com/news/articles/cx2pggj3g3po （2025-6-20 Access）
- International Energy Agency. “Energy Mix- Tanzania – Energy Supply”. https://www.iea.org/countries/tanzania/energy-mix (2025-6-20 Access）
- Deloitte Tanzania (2024). Finance Bill 2024 Insights.

https://www.deloitte.com/content/dam/assets-zone1/tz/en/docs/services/tax/2024/deloitte-tanzania-insights-finance-bill-2024.pdf?icid=mosaic-grid_2024-25-finance-bill-highlights?icid=mosaic-grid_2024-25-finance-bill-highlights (2025-3-25 Access)

- The Citizen. "Tanzania launches initiative to develop national EV policy". h December 18, 2024. ttps://www.thecitizen.co.tz/tanzania/news/national/tanzania-launches-initiative-to-develop-national-ev-policy-4861208 (2025-3-25 Access)
- EY. "Tanzanian Finance Act, 2023 analysis". 13 Jul 2023. https://www.ey.com/en_gl/technical/tax-alerts/tanzanian-finance-act--2023-analysis https://ticgl.com/tanzanias-vision-2050-with-ambitions-and-challenges-ahead/
- Tanzania Investment and Consultant Group. "Tanzania's Vision 2050 With Ambitions and Challenges Ahead". December 12, 2024. https://ticgl.com/tanzanias-vision-2050-with-ambitions-and-challenges-ahead/ (2025-3-25 Access)

South Africa

- Trade, Industry and Competition Republic of South Africa (2018). "Geared for Growth South Africa's Automotive Industry Master Plan to 2035". December 2018. https://www.thedtic.gov.za/wp-content/uploads/Masterplan-Automotive_Industry.pdf (2025-2-25Access)
- International Trade Administration Commission of South Africa. "IMPORT CONTROL GUIDELINES PERTAINING TO THE IMPORTATION OF USED OR SECOND-HAND VEHICLES, TRUCKS, BUSES, TAXIS, COACHES, MOTORCYCLES, ENGINES, GEARBOXES, DIFFERENTIALS AND USED OR SECOND-HAND SPARES FOR HEAVY DUTY TRUCKS. https://www.itac.org.za/upload/amended%20guidelines%20for%20importation%20of%20used%20or%20second%20hand%20vehicles_.pdf (2025-2-25Access)
- Department of Trade, Industry and Competition Republic of South Africa. "EV White Paper November 2023". https://www.thedtic.gov.za/wp-content/uploads/EV-White-Paper.pdf (2025- 4 -20 Access)
- Ministry of Road and Transport of Kenya. "DRAFT NATIONAL E-MOBILITY POLICY, KENYA". March 2024. https://transport.go.ke/sites/default/files/Draft%20National%20e-Mobility%20Policy_For%20Circulation%2027.03.2024.pdf (2025- 4 -20 Access)
- South African Government (2025). "Deregister a motor vehicle" https://www.gov.za/services/services-residents/driving/register-motor-vehicle/deregister-motor-vehicle (2025-6-20 Access)
- ロイター通信.「南ア初のＥＶは 2026 年に生産される見通し＝貿易産業相」(2023 年 12 月 5 日. https://jp.reuters.com/business/autos/JNSEJEPEHNPDVPAOW35VMOJL3U-2023-12-05/ (2025-6-20 Access)
- JETRO.「電気自動車などに関するロードマップ案を発表

・ （南アフリカ共和国）」．（2021 年 05 月 25 日）https://www.jetro.go.jp/biznews/2021/05/e1ccd861d14ff716.html （2025-2-20 Access）

Global

・ International Energy Agency (2024). “Global EV Outlook 2024 Policy Explorer”. https://iea.blob.core.windows.net/assets/8ba25b88-1931-418a-8d97-e3d1c22d7298/PolicyExplorer2024.pdf （2025-２-2５ Access）
・ Marklines 情報プラットフォーム記事各種

３．循環経済/Circular Economy

Africa in general

・ African Development Bank. “Africa Circular Economy Facility (ACEF)”. https://www.afdb.org/en/topics-and-sectors/topics/circular-economy/africa-circular-economy-facility-acef （2025-２-2５ Access）
・ Africa Circular Economy Network (ACEN). https://acenfoundation.org/about-us/
・ Chatham House. “Circular Economy. Earth”. https://circulareconomy.earth/ （2025-２-2５ Access）
・ Jack Barrie・Chatham House（2024）. “ Trade and the circular economy- Presentation for TESSD Informal Working Group on Circular Economy – 16th April 2024” https://www.wto.org/english/tratop_e/tessd_e/15042024_e/08_CircEconomy-ChathamHouse.pdf （2025-２-2５ Access）
・ Manufacturing Africa（October 2024）.“Africa’s Competitiveness in Global Battery Supply Chains Final Report-Core Section”. https://manufacturingafrica.org/wp-content/uploads/2024/10/from-minerals-to-manufacturing_africa-competitiveness-in-global-battery-supply-chains_core-report-updated.pdf （2025-2-25 Access）
・ GIZ (2024). “Exploration of Market Potentials in Battery Recycling and Refurbishment in Africa”. https://transformative-mobility.org/wp-content/uploads/2024/07/Battery_Recycling-Opportunities-in-Africa.pdf （2025-2-25 Access）
・ Pivnenko (2021). “Towards a Circular Economy for the Electronics Sector in Africa:Overview, Actions and Recommendations”. UNEP. https://wedocs.unep.org/bitstream/handle/20.500.11822/40108/circular_economy_africa.pdf?sequence=3&isAllowed=y （2025-2-27 Access）
・ European Commission. “Global Gateway: EU announces new EU Circular Economy Resource Centre and SWITCH to Circular Economy in East and Southern Africa programme to accelerate global transition” News Announcement. 16 April 2024. https://international-partnerships.ec.europa.eu/news-and-events/news/global-gateway-eu-announces-new-eu-circular-economy-resource-centre-and-switch-circular-economy-east-2024-04-16_en （2025-2-27 Access）

Kenya

- Kenya Government (2022). “Sustainable Waste Management Act”. https://new.kenyalaw.org/akn/ke/act/2022/31/eng@2022-12-31. Kenya Gazette Vol. CXXIV—No. 158 on 12 August 2022. （2025-6-20 Access）
- National Environment Management Authority of Kenya（2013）.”Draft E-waste Regulations”. https://www.nema.go.ke/images/Docs/Regulations/Draft%20E-waste%20Regulations-1.pdf.（2025-6-20 Access）
- Kenya Government. “THE SUSTAINABLE WASTE MANAGEMENT (EXTENDED PRODUCER RESPONSIBILITY) REGULATIONS, 2024. ARRANGEMENT OF REGULATIONS”. （2025-6-20 Access） https://kenyalaw.org/kl/fileadmin/pdfdownloads/LegalNotices/2024/LN176_2024.pdf
- Netherlands Enterprise Agency (2021). “Kenyan Circular Economy trends opportunities”. https://www.rvo.nl/sites/default/files/2021/06/Kenyan-Circular-Economy-trends-opportunities.pdf （2025-6-20 Access）

Ethiopia

- Ethiopian Government (2018). “Hazardous Waste Management and Disposal Control Proclamation”. Federal Negarit Gazette No. 58 7th September, 2018. https://faolex.fao.org/docs/pdf/eth195394.pdf （2025-6-20 Access）
- GIZ (2023). “SECTOR BRIEF ETHIOPIA: Waste management and recycling”. https://www.giz.de/en/downloads/giz2023-en-sector-brief-ethiopia-waste-management-and-recycling.pdf （2025-6-20 Access）
- FAOLEX Database. “Electrical and Electronic Waste Management and Disposal Council of Ministers Regulation No. 425 /2018”. https://www.fao.org/faolex/results/details/en/c/LEX-FAOC216623/ （2025-3-20 Access）

Tanzania

- Tanzania Government (2021). “THE ENVIRONMENTAL MANAGEMENT (HAZARDOUS WASTE CONTROL AND MANAGEMENT) REGULATIONS, 2021”. https://www.nemc.or.tz/uploads/publications/sw-1645446901-HAZARDOUS%20WASTES_REGULATIONS%202021.pdf. GOVERNMENT NOTICE No. 389 Published On 14/5/2021. （2025-6-20 Access）
- Tanzania Government(2021). “THE ENVIRONMENTAL MANAGEMENT (CONTROL AND MANAGEMENT OF ELECTRICAL AND ELECTRONIC EQUIPMENT WASTE) REGULATIONS, 2021 ARRANGEMENT OF REGULATIONS”. https://www.nemc.or.tz/uploads/publications/sw-1645446706-e_WASTES%20REGULATIONS_2021.pdf. GOVERNMENT NOTICE No. 388 Published On 14/5/2021. （2025-6-20 Access）
- Logistics Cluster. “Tanzania, United Republic of - 3.7 Waste Management and Recycling

Infrastructure“. https://lca.logcluster.org/tanzania-united-republic-37-waste-management-and-recycling-infrastructure-assessment （2025-2-20 Access）

- Climate Change Laws of the World. “The Environmental Management Act (EMA)” https://climate-laws.org/documents/the-environmental-management-act-ema_4a18?id=the-environmental-management-act-ema_025b （2025-2-20 Access）
- Tanzania Government (2020). “THE ELECTRONIC AND POSTAL COMMUNICATIONS (ELECTRONIC COMMUNICATIONS EQUIPMENT STANDARDS AND E-WASTE MANAGEMENT) REGULATIONS, 2020” . GOVERNMENT NOTICE No. 919 Published On. 23/10/2020. https://media.tanzlii.org/media/legislation/331955/source_file/96537d783d3bed4e/tz-act-gn-2020-919-publication-document.pdf （2025-3-20 Access）

South Africa

- DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT of South Africa（2023）. “National Environmental Management: Waste Act, 2008”. https://www.gov.za/sites/default/files/gcis_document/202303/48283gon3179.pdf （2025-6-20 Access）
- DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT of South Africa （2020）.”National Waste Management Strategy 2020” . https://faolex.fao.org/docs/pdf/saf198615.pdf （2025-6-20 Access）
- Käsner・ Gihring (2024). “South Africa's Policy Framework Does it support a just Circular Economy transition?”. September 2024. African Circular Economy Network(ACEN). https://acen.africa/wp-content/uploads/2024/10/ACEN-South-Africas-Policy-Framework.pdf （2025-3-3 Access）
- Engineering News. “Batteries, pesticides and lubricants added to Extended Producer Responsibility Schemes”. 24th May 2023. https://www.engineeringnews.co.za/article/batteries-pesticides-and-lubricants-added-to-extended-producer-responsibility-schemes-2023-05-24 （2025-3-3 Access）
- Netherlands Enterprise Agency (2023). “2023 Market Study of the Circular (& Waste) Economy of South Africa”. August 2023. https://www.rvo.nl/sites/default/files/2023-10/SA-Circular-Economy-Opportunities.pdf （2025-3-21 Access）

Batteries

- IATA. “航空危険物規則書第 66 版（2025 年 1 月 1 日発効）への訂正、追加” https://www.iata.org/contentassets/b08040a138dc4442a4f066e6fb99fe2a/dgr-66-addendum-1---jp.pdf （2025-6-15 Access）
- NCA Japan. “IATA Dangerous Goods Regulations 第 66 版（2025 年）主な変更点”. 2024 年 9 月 17 日 . https://www.ncajapan.co.jp/webtool/wp-content/uploads/2024/09/e61fda483986dfe371c5717968b13699.pdf （2025-6-15 Access）
- IMO. “The International Maritime Dangerous Goods (IMDG) Code

https://www.imo.org/en/OurWork/Safety/Pages/DangerousGoods-default.aspx". (2025-2-25 Access)
・ セイノーホールディングス株式会社. “オートモーティブ・バッテリー物流事業部のご紹介”. https://www.seino.co.jp/seino/mail2/branch/287_24041313042468.pdf (2025-2-25 Access)

＊最終頁に略語集記載

Chapter 6:

Digital Leapflog

Promoting the digitalization of the GS industry development paradigm

Prof., Dr., Masahiro Nakamura, CEO of Lexer Research Inc., Chairman of Green CPS Council, Professor at Tokyo City University

1. A new paradigm for industrial development in the Global South

The future direction of the Global South's evolution does not need to be positioned as an extension of the Global North's industrial development paradigm. By leveraging the latest digital technologies in light of the current situation in the Global South, it is possible to realize an industrial development paradigm specific to the Global South.

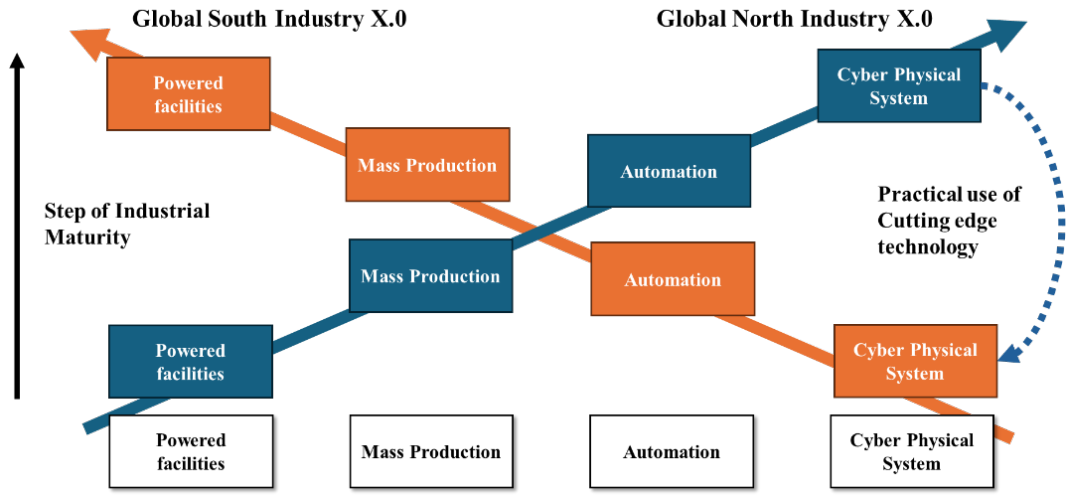
Until now, the industrial development paradigm of the world has been the Global North-type Industry 4.0, which originated in Europe. Industrial policies based on this maturity model have been promoted in countries of the Global South, but they strongly reflect the Global North's perspective on economic value creation. While contributing to the global expansion of business scope and trade flows, they do not generate leading economic value for the Global South.

(1) Global South Industry Strategy

Considering the existing Global North-type industrial development paradigm, namely the framework of Global North Industry X.0, the following developments are being advanced: (1) the introduction of concepts such as the development and shared use of power infrastructure and the aggregation of physical resources, (2) the introduction of process concepts and the efficient utilization of resources through role division, (3) the transition away from labor dependency through automation and robotization, and (4) the optimal utilization of resources and dynamic connection with the market through digital technology and Cyber-Physical Systems (CPS). This constitutes a maturity model for development. Today, with the ability to leverage cutting-edge technologies such as digital technology from the early stages, it is possible to design a new industrial development paradigm distinct from traditional industrial policies to promote economic value creation in the Global South.

In today's global business environment, connectivity enabled by digital technology can achieve “penetration in the industrial space” and dynamically connect demand and supply to generate economic value. In other words, even in the early stages of industrial development where industrial clusters are insufficiently developed, it is a realistic approach to invest in cutting-edge technology

[Figure 1]: Design of the industrial development paradigm in the Global South



(Source: Author)

while considering the current level of industrial clustering and advance digital networking to create an economic value generation model. In other words, we propose considering the approach of generating value by starting with industries that utilize digital technology and CPS for dynamic connectivity, referred to as Global South Industry 1.0 (GSI 1.0). We propose exploring the concept of positioning this approach—which involves prioritizing digitalization and enhancing industrial infrastructure by reversing the steps of Global North Industry X.0—as a Global South-type industrial development paradigm (Figure 1).

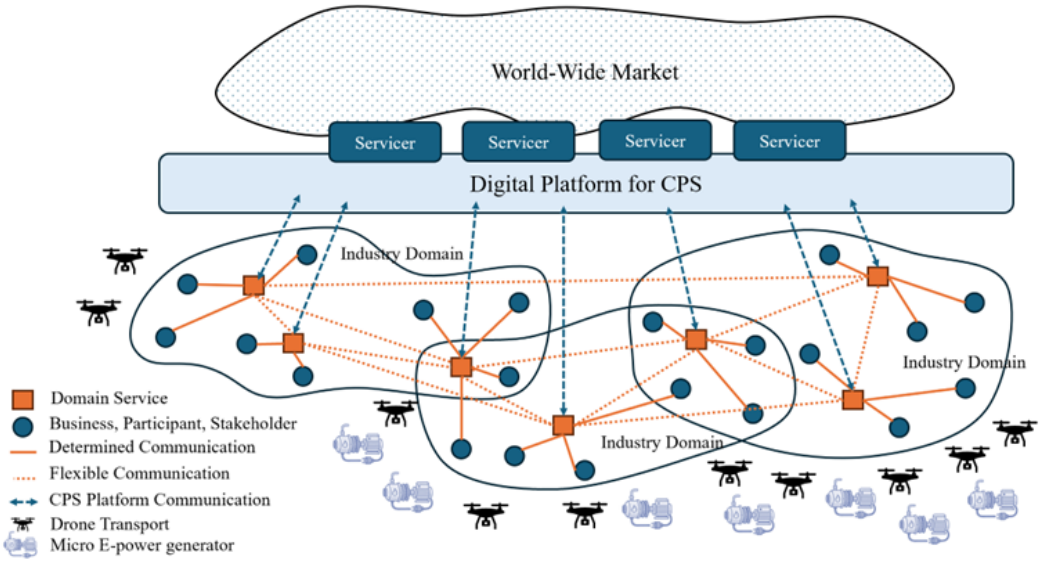
(2) Global South Industry Strategy

The following section introduces the concept of promoting Global South Industry X.0 (hereinafter referred to as GSI X.0) (Figure 2). First, while the training of IT professionals is already underway in the Global South, rather than providing these industrial resources as business resources for the Global North, they will be utilized to build an information infrastructure that promotes the development of the Global South. Along with regional network infrastructure, a group of IT startups will be launched to promote the valorization of primary industry regional resources through digital technology.

Furthermore, to integrate regions and resources where industrial collaboration is difficult due to their dispersed nature into an industrial infrastructure, we will leverage cutting-edge technologies unique to the present era, such as satellite communications, drone wireless communication networks, and the widespread adoption of decentralized ultra-small-scale power generation. Regarding energy, we will promote sustainable energy policies by utilizing plant-based fuels derived from local plants rather than relying on fossil fuels. Furthermore, we will utilize new technological methods that were previously

unimaginable to launch new industries, such as the advanced use of drone-based unmanned transport in environments with poor transportation infrastructure, and the use of additive manufacturing (3D printing) technology to manufacture business equipment at dispersed regional bases. In this way, we

[Figure 2]. GSI 1.0 implementation image



(Source: Author)

will maximize the use of digital connectivity to leverage the strengths of those who lack resources, transitioning from centralized to decentralized systems and accelerating the establishment of a circular economy.

By connecting these diverse element systems at the meta-level (upper layer) through CPS and integrating them for optimized operations, we will digitize methods and insights such as “lean production” to realize value creation in the Global South.

These concepts can be realized through digital and new technologies (such as decentralized energy, drones, 3D printers, and sustainable materials) and are feasible measures that can be implemented today. By leveraging these as an industrial strategy, we can establish the foundation for Global South Industry 1.0 (GSI 1.0).

In this chapter, we will discuss the digitalization policies essential for advancing the Global South industrial development paradigm and GSI 1.0, after introducing the essence of digitalization.

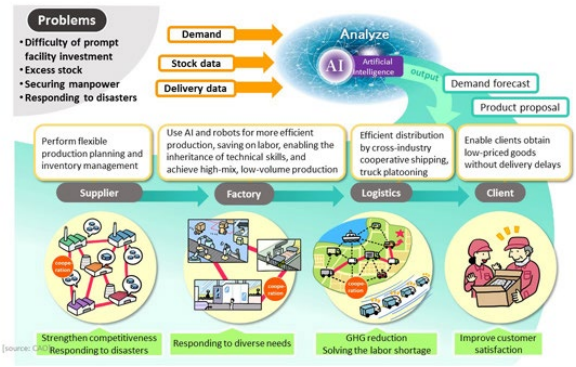
2. Current status of industrial data space strategies

In this section, we will examine the current state of digitization. In considering the future of GSI X.0,

we will review the industrial strategies and approaches to digitization of the Global North, and then examine the elements that should be incorporated into the GSI X.0 strategy.

(1) Global trends in the industrial data space

Figure 3: Realization of Society 5.0



(Source: CAO, Government of Japan)

Figure 4: Ouranos Ecosystem

(Source: METI)

As part of the Global North's industrial strategy, companies are promoting collaboration strategies that leverage data spaces. In industrial data space strategies, various industrial policies are being introduced in each country with the aim of linking individual companies in supply chains and engineering chains. In the EU, based on the Gaia-X policy, the construction of data spaces such as Catena-X for the automotive manufacturing sector, Manufacturing-X, Cofinity-X, and Space-X is being promoted across various industrial sectors. In Japan, industrial data space policies aimed at realizing Society 5.0, the future envisioned by the social system, are being implemented.

(2) Society 5.0

In Japan, the concept of Society 5.0 has been proposed (Figure 3). In the Japanese government's Fifth Science and Technology Basic Plan, it was proposed as “a human-centered society that achieves both economic development and the resolution of social issues through a system that highly integrates cyberspace and physical space.”

The realization of Society 5.0 hinges on two key elements: the means of “integration of cyberspace and physical space” and the values of “a human-centered society.” In Society 5.0, the aim is to transform society by first constructing digital twins of all societal elements in cyberspace, then restructuring systems, business designs, urban and regional development, and other aspects, and finally reflecting these changes in the physical space. Furthermore, by incorporating human-centered values into such new processes, each individual citizen and global citizen is elevated to the center of the decision-making stage, enabling society to flexibly and dynamically evolve into a better form.

Although some time has passed since this vision was announced, it continues to be respected as a forward-looking vision by other countries, including those in Europe and the United States.

In order to transition to Society 5.0 and utilize new technologies in society, it is necessary to take a comprehensive view of the ethical, legal, and social implications (ELSI) that arise, and to build a system that can utilize “comprehensive knowledge” that encompasses not only natural sciences but also humanities and social sciences.

(3) Ouranos Ecosystem : Aiming for Society 5.0

Aiming to realize Society 5.0, the Japanese government has established the Ouranos Ecosystem, a platform for cross-industry data infrastructure and system integration, and is promoting the resolution of social issues and innovation through DX.

Currently, as an institution supporting the calculation of a product's carbon footprint (CFP) using primary data beyond individual companies in the supply chain, the government has begun promoting the adoption of a platform that enables the sharing of activity data across diverse organizations, and is working to expand the scope of services in the future.

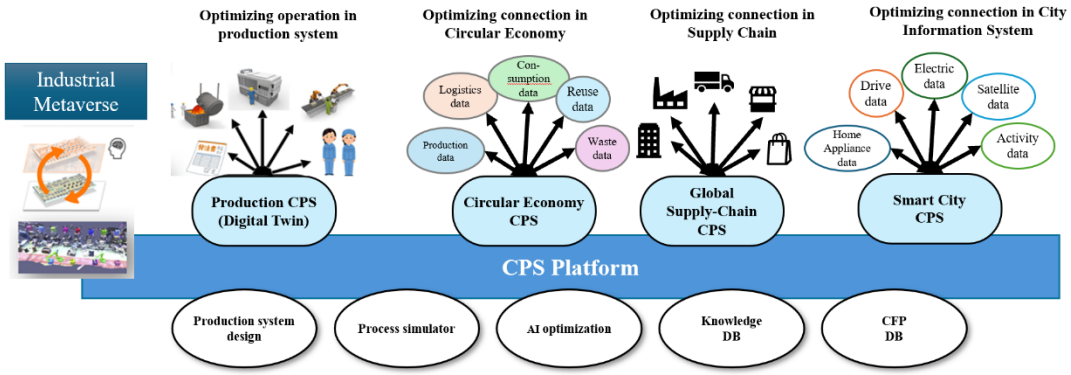
The Ouranos Ecosystem is currently being expanded into various data spaces, with case studies and demonstrations underway with a focus on global south adoption. There is significant anticipation for its future expansion into effective data spaces in the global south.

3. The essence of digitalization and value creation through data integration across different domains

As one of the strategic industrial policies to realize the potential of the Global South, such as GSI 1.0 mentioned in Section 1, we must discuss how to utilize digital technology. The advancement of elemental technologies, including automation and robotization in labor-intensive industries, the use of drones for logistics, the development of transportation system infrastructure, and the optimization of distributed energy networks, can realize their potential through the use of digital technology to integrate and operate them.

Furthermore, connecting the demand side and the supply side appropriately and in a timely manner through digital technology is what creates economic value today.

[Figure 5] Value creation by connecting different domains and data using CPS



(Source: Author)

(1) The essence of digitalization

It is important to note that if digitalization in business operations is limited to the use of IT for information transmission, data sharing, and functionality provision, as well as the utilization of large-scale language-based AI, which are now accessible to anyone around the world, it will not contribute to enhancing Africa's potential. Moreover, if Africa were to remain merely a source of labor for IT development for the Global North, the future of the Global South could not be created. To realize Africa's potential through ICT utilization, it is necessary to understand the essence of digitalization, leverage digital technology, and build a strategic approach tailored to Africa's characteristics and positioning.

Here, we will explain the essence of digitalization. The true aim of digitalization is not merely the transfer of data, but rather the “connectivity that creates new added value through the integration of diverse elements belonging to different domains, such as different ‘spaces,’ 'times,‘ and 'organizations’” (Figure 5). By connecting heterogeneous data from heterogeneous domains to achieve data penetration, fragmented activities can be guided toward a common purpose, generating synergistic effects and contributing to the creation of new value across domains.

(2) Formation of epistemic economic scope and value creation through data penetration framework design

Next, we will explain value creation through data penetration achieved by connecting heterogeneous domains. By setting the scope of combining heterogeneous information with strategic intent, it is possible to establish epistemic (epistemological) relationships. In other words, by assigning special relationships to the scope that has received the intent, it is possible to design special activities that create distinctive characteristics through the collaboration of members within that scope. Furthermore, by giving special functions or powers to this set scope, we can make its uniqueness more obvious. For

example, we can think of methods that create high value in business operations or providing specialized knowledge to solve problems we face.

For example, when forming a value chain network,

- We can intentionally form distinctive business strengths by connecting distinctive resources and functions with a specific purpose.
- Providing engineering navigation based on excellent methodologies such as “lean production” developed by leading industries
- Promoting advanced decision-making by understanding past experience, the wisdom of predecessors, future changes, and predictions across time
- Providing AI agent services that support business operations like a Sherpa in addressing issues encountered in various tasks
- Monitoring activities at remote locations, comprehensively understanding various organizational operations, and optimizing the entire value chain system

and so on.

By providing support mechanisms to enhance collaboration and coordination beyond data penetration, it is possible to create economic value by forming a framework that gives strategic intent, or epistemic positioning, to the scope in question (Figure 6). By combining heterogeneous information to achieve “industrial space penetration” and enhancing the interoperability realized there, it is possible to highlight the characteristics of the business and create new social and industrial value.

(3) Introduction of Special Epistemic Zones (SEZs) to drive industrial advancement with specialized knowledge

Next, we will examine economic growth strategies in the Global South through the connectivity and epistemic frameworks described in the previous section.

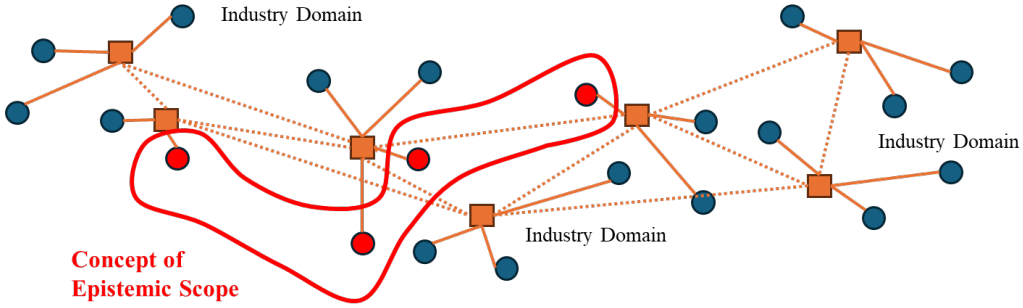
By combining heterogeneous information, it is possible to form epistemic relationships, or societies. By combining heterogeneous information, it is possible to form epistemic relationships, or societies. Today, relationships that are perceived as “supply chains,” “industry structures,” and “industrial ecosystems” generate economic value through epistemic societies created by some form of integration. Since these relationships lead to economic benefits, the key to creating economic value lies in determining what to integrate and how to form epistemic relationships.

In the future growth of the Global South, it is easy to imagine and inevitable that differences in growth rates will emerge in each region as a result of macroeconomic development policies. On the other hand, based on the principle of “leaving no one behind” in the Global South, it is essential to formulate economic policies that promote balanced economic development across the entire Global South while leveraging the characteristics of each region. When considering growth across the Global South as a whole, we propose a data policy that creates economic value within each scope while

achieving overall balance by establishing the epistemic relationships described above. We design this data policy by defining epistemic scopes (societies) as Special Epistemic Zones (SEZs) and deploying specialized knowledge services tailored to each scope (Figure 7). The key feature here is that, rather than defining zones based on traditional regional boundaries, we can form a hyper-distributed zone that transcends regional boundaries through digital networks. By strategically assembling effective pieces that transcend regional boundaries, we can achieve effective value creation.

In advancing GSI X.0 as mentioned in Section 1, we start from the CPS as the origin, but the data strategy that drives economic value here is the SEZ. Rather than merely focusing on data penetration, this strategy connects the physical layer and cyber layer to capture business realities, thereby ensuring

[Figure 7]: Epistemic economic scope created by penetration, interoperability and knowledge sharing in industrial space



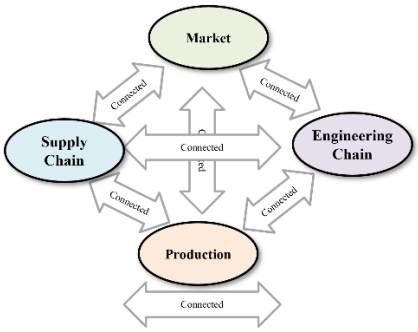
(Source: Author)

the reliability and effectiveness of each data set. By strategically applying SEZ on a CPS where such conditions are ensured, we can build a data-driven social system that fosters economic growth in a manner akin to nurturing a tree of growth.

4. Digitalization approach towards GSI X.0 and SEZ strategy

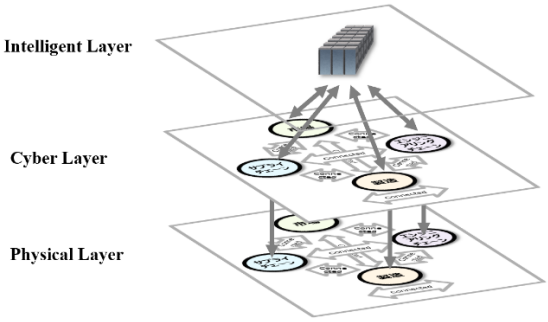
This section outlines the concepts and approaches for advancing digitalization toward Global South Industry X.0. Here, we introduce the concept of CPS as an architecture for promoting value creation through connectivity via digitalization, and explain the steps for its social implementation. The presence of a CPS foundation enhances the effectiveness of SEZs and accelerates economic growth. In particular, we will explain the technologies and methodologies that should be introduced in preparation for the launch of GSI 1.0, as well as the role of human resource development in promoting these initiatives.

[Figure 6] Value creation through interconnection between domains



(Source: Author)

[Figure 7] CPS architecture



(Source: Author)

(1) Potential for industrial value created through digitalization

In order to enhance the value of industries through digitalization, it is necessary to promote activities that increase market value by connecting different domains, as described in Section 2 (Figure 6).

- Improving productivity, increasing operating rates, and reducing waste through automation and systemization at industrial bases
- Accelerating the maturation of industrial systems in the engineering chain/design, implementation, and operation
- Creation of a circular economy community across the Global South through collaboration between supply chain hubs and regions
- Appropriate integration between the market as the demand side and the industrial sector as the supply side
- Digitalization that takes these considerations into account directly contributes to value creation in GSI 1.0.

(2) The significance of CPS for creating value through new combinations

In the growing Global South, it is possible to create new industrial added value by building a commercial distribution network centered on key zones in the Global South. Going forward, it will be important to establish a model that allows for flexible collaboration across the entire emerging Global South, even if it is decentralized. To establish this collaboration model, the concept of CPS will be introduced.

CPS is positioned as the final stage of social implementation in Industry 4.0, but since it requires a solid industrial foundation, it is positioned as a future initiative in Industry 4.0 activities.

In GSI 1.0, the enhancement of industrial and social infrastructure is positioned as a later-stage activity, and the challenge is to determine how much value can be generated using the CPS concept within the current industrial infrastructure. As mentioned in Section 1 of this chapter, if the current

social infrastructure can be managed using cutting-edge technology, it may be possible to establish a paradigm for the Global South era that surpasses the industrial growth paradigm of the Global North.

(3) CPS architecture that connects different elements and activities to create value

The CPS architecture involves digitizing various types of organizations and activities in the cyber layer and then connecting heterogeneous information to generate value (Figure 7).

Therefore, when introducing CPS, systematic management using a structured data architecture from the field activity layer to the top management layer is necessary in order to appropriately connect diverse heterogeneous information.

The goal is to flexibly coordinate diverse organizational activities, and therefore, it can be positioned as a higher-level management system for organizational activities. Since it is a system that integrates existing systems, this concept is called System of Systems (SOS). By implementing SOS in society, it becomes possible to achieve optimal connectivity between social infrastructure, industrial infrastructure, and the market, thereby maximizing the potential of each.

Specifically, GSI 1.0 implementation will be advanced through the following activities.

- Digitalization to enhance transparency of activities at each location (clarification of processes)
- Design of a common framework (model) to achieve SOS interoperability toward supply chain formation
- Supply chain optimization to strengthen connectivity within the supply chain (utilization of logistics, economic simulations, etc.)

In the SOS management layer, the methodology for optimally integrating various heterogeneous activities is a key point.

(4) Methodology for creating value in CPS

Next, we will strategically define what kind of value will be created through digitization using CPS architecture, and consider the methodology for achieving this.

In the implementation of GSI 1.0, the key point is to introduce a methodology that optimally integrates heterogeneous domains through the CPS architecture. This is a concept that creates value through mutual collaboration between various industrial domains, and requires a corresponding framework and knowledge.

In Africa, where the advancement of industrial infrastructure is a future endeavor, a bottom-up approach to creating methodologies is not advisable. It is more effective to leverage existing methodologies, integrate them into the CPS SOS management system, and advance problem-solving through specialized expertise. Select appropriate methodologies, democratize value-creating techniques across the CPS, and utilize them appropriately. Optimize individual actions in actual operations within guidelines that lead to value creation across the Global South, and navigate and

accelerate actions from the management layer to the field activity layer.

(5) Strategies for Effective Application of Value Creation Methodologies

An important point in promoting industrial advancement through digital technology on the CPS platform is the appropriate use of value-creating methodologies. In the industrial development paradigm, as we move from GSI 1.0 to the next stage, we will introduce appropriate methodologies for each stage and promote social implementation. Here, we will flexibly utilize the excellent methodologies realized by the Global North and adapt them to methodologies that are effective in the Global South.

A useful example of methodology utilization is the introduction of methodologies such as “Lean Production,” which connects the demand side and supply side in the supply chain to create market value while maximizing operational resource efficiency without waste (loss).

In GSI 1.0, the focus is on industrial network collaboration methodologies, but it is effective to incorporate the knowledge and experience that led to the success of Japanese manufacturing. Furthermore, it is necessary to establish digitalization methods that can be applied to the industrial sector in the Global South and to promote the development of corresponding human resources. “Lean production” is based on the insights developed by Japan, which has achieved success in manufacturing, to optimize material flow and industrial resource utilization. By restructuring these insights and establishing them as a methodology, and then digitizing them and incorporating them as a method within the SOS system in the CPS architecture, we can accelerate the creation of new industries as part of GSI 1.0.

(6) Utilizing highly specialized knowledge support services

In addition, it is important to incorporate specialized knowledge and expertise that is difficult to integrate into the SOS method in CPS. Digital systems cannot cover all activities. There is knowledge that is difficult to incorporate into digital systems as algorithms or logic. The utilization of such knowledge is the final piece needed to enhance industrial value, making the dissemination of knowledge services crucial. By leveraging digital technology that enables non-experts to utilize experts' insights, we can democratize the sharing of expert knowledge and accelerate the advancement of Africa's leapfrog strategy.

It should be noted that the expertise discussed here differs from the general-level knowledge provided by large language models (LLMs) or AI based on machine learning. Instead, it refers to specialized knowledge that is not publicly available online. In addition to the use of data-collection-based AI such as LLMs and machine learning, it is advisable to incorporate the use of knowledge technologies that handle expertise such as operational know-how and problem-solving methods into industrial policies.

Currently, research on knowledge technology and digital implementation are progressing in Japan,

and contributions to GSI X.0 are expected. The utilization of the knowledge accumulated by Japanese manufacturing is useful for promoting the industrial development paradigm as a Global South. In activities that operate CPS covering the business processes of society as a whole, it is an effective measure to employ expert knowledge.

(7) Developing human resources to promote value creation in digitalization

There is no question that it is necessary to develop human resources who can promote the digitalization approach described above. In order to promote digital human resource development activities, it is necessary to carry out the following activities.

- Designing a national framework for human resource development
- Preparing skill standards for human resource development that supports industrial technology
- Developing human resource development programs that promote DX-GX
- Training instructors for human resource development courses that promote DX-GX
- Cultivating talent capable of building specialized knowledge support services to assist industrial talent
- Institutionalizing organizations and partners to promote industrial talent development courses
- Establishing systems to support on-the-job training (OJT) alongside talent development courses

What is crucial here is the preparation of talent development skill standards aligned with GSI X.0. Rather than simply adopting the global north-type human resource development skill standards, it is necessary to design a human resource development maturity model within the GSI X.0 framework and define the skills required at each stage.

The most important point is not to provide digital talent from the global south as human resources to the global north, but rather to prepare the social framework for how digital talent can be utilized to advance industrial development in the global south.

5. Summary/Digital measures corresponding to this master plan

Let's summarize the paradigm of industrial development in the Global South through digitization that we have discussed so far.

- As a new industrial development paradigm for the Global South, there is no need to follow the industrial development steps taken by the Global North. Strategically implementing steps to build an industrial foundation based on digitalization and CPS will enable the Global South to achieve leapfrogging, which is worth considering.
- Although industrial data space strategies are being promoted in various countries, the current

situation is still in its infancy and remains a challenge for the future. The Global South should not follow suit but instead plan an industrial data space based on its own industrial growth strategy.

- It is important to reexamine the essence of digitalization, and in the Global South, we should consider value creation through the integration of data from different domains. Here, strategic consideration of SEZ (Special Epistemic Zone) to realize the formation of an epistemic economic scope through the design of a data penetration framework is worth considering.
- Digitalization toward GSI X.0 and SEZ strategies will lay the foundation for economic growth policies by introducing CPS-based industrial systems. For the Global South to achieve growth "without leaving anyone behind," it is important to design the relationships within the industrial data space, select industrial resources that highlight its characteristics, and employ appropriate specialized knowledge to accelerate value creation.
- In particular, it is effective to establish a system for developing industrial human resources and a support system for specialized knowledge that promotes the added value and acceleration of industrial activities in line with the maturity of the Global South.

Digitalization will play an important role in the future economic growth of the Global South, so we expect the promotion of strategic development based on the introduction of specialized knowledge support services and scope design, rather than simply digitalization, data penetration, and AI utilization.

References

1) Hibino, H., M. Nakamura, and S. Noritake. (2019). 'Technical Concepts of CPPS and Manufacturing Vision for 2040.' Japan Society of Mechanical Engineers, Connected Cyber Factory CPPS Study Group. (in Japanese) https://www.jsme.or.jp/msd/uploads/sites/33/2023/05/sig_cpps_report20190531.pdf

2) Gaia-X European Association for Data and Cloud AISBL https://gaia-x.eu/

3) Cabinet Office of Japan. (n.d.) 'The Concept of Society 5.0 Proposed in the Fifth Science and Technology Basic Plan.' https://www8.cao.go.jp/cstp/kihonkeikaku/5gaiyo.pdf (in Japanese)

4) Günther, S., A. Reiner, G. JürgenT. H. Michael, and W. Wolfgang (2020). 'Industrie 4.0 Maturity Index. Managing the Digital Transformation of Companies – UPDATE 2020', acatech STUDY, 22 April 2020. https://en.acatech.de/publication/industrie-4-0-maturity-index-update-2020/download-pdf?lang=en

Chapter 7:

GSM

Geographical Simulation Analysis

Satoru Kumagai, Senior Researcher of the Development Studies Center, IDE-JETRO
Ikumo Isono, Director of the economic integration studies group, IDE-JETRO
Souknilanh Keola, Senior Economist ERIA

The development of economic corridors in Africa aims to deepen regional integration, promote trade, and achieve sustainable growth. In particular, the African Continental Free Trade Area (AfCFTA), which came into effect in 2019, seeks to expand intra-regional trade, and its success largely depends on the functioning of efficient and reliable economic corridors.

Japan is also actively cooperating in the development of economic corridors in Africa. The Japan International Cooperation Agency (JICA) focuses on high-quality investment principles for sustainable growth and contributes to the development of economic corridors through a combination of hard and soft infrastructure. The Northern Corridor, which connects the Port of Mombasa in Kenya to several inland countries, is prioritised by the East African Community (EAC) as a top development agenda. For example, JICA has supported the expansion and modernisation of the Port of Mombasa, the renovation and construction of major trunk roads, and the establishment of One-Stop Border Posts (OSBP) to eliminate bottlenecks and improve functionality. The Nacala Corridor, starting from the Port of Nacala in Mozambique, is crucial for the development of Southern Africa, contributing to the improvement of local livelihoods and macroeconomic stability by promoting resource exports. Additionally, JICA has supported the modernisation and expansion of the Port of Nacala, the development of major road networks, the construction of bridges, the renovation of railway infrastructure, the introduction of OSBP, and the training of logistics personnel.

Traditional economic corridor development has taken a phased approach, starting with road development, followed by border facilitation, and then the establishment of Special Economic Zones (SEZ), as suggested by the historical definition of economic corridors as an advanced form of transport corridors. The development of economic corridors brings positive outcomes such as reduced logistics costs and increased trade, but challenges remain in terms of financing, political cooperation, and environmental sustainability. Achieving multiple objectives, such as improving physical connectivity, incorporating digital and green initiatives, maximising the potential of AfCFTA, and ensuring inclusive growth, through a phased approach requires significant costs and time.

On the other hand, Cilliers (2025) points out that leapfrog strategies using digital technology and renewable energy may surpass traditional physical infrastructure

development. The rapid spread of mobile communication and the internet, in particular, transforms the informal economy into the formal economy. In fact, impacts on income improvement and poverty reduction have been reported in several countries, including Ghana.

Based on this recognition, this section proposes a leapfrog economic corridor development strategy that prioritises border facilitation (including OSBP), the deployment of skill-development SEZs through digital education, the development of gateway ports, and the reduction of non-tariff barriers to strengthen connectivity with Asia and Europe, while postponing intra-regional road development. Regarding border facilitation, it has been reported that the introduction of OSBP and the training of specialised personnel in customs and clearance fields in the North-South Transport Corridor have contributed to the reduction of clearance time and the promotion of trade (JICA, 2022). In the context of Africa's supply chain, the introduction of ICT and smart borders accelerates trade facilitation, effectively eliminating bottlenecks and reducing transaction costs (Grater and Hoffman, 2021). The spread of mobile communication and the skill development of the younger generation contribute to improved connectivity and productivity in economic corridors (Bhalla and Chaturvedi, n.d.). Additionally, the development of digital education and vocational training SEZs aligns with the ICT education support and skill transfer that Japan has implemented in African countries, suggesting that these efforts lead to economic diversification and industrial enhancement (JICA, 2022). Furthermore, the reduction of non-tariff barriers through the efforts of individual countries and regional communities (EAC, COMESA) and the harmonisation of electronic customs and SPS regulations may simultaneously facilitate intra-regional trade and strengthen the foundation for connectivity with Asia and Europe. This approach opens the path to more immediate economic integration and economies of scale compared to traditional development focused on physical infrastructure. The triad approach of OSBP development and electronic procedure promotion, SEZ design centred on ICT education, and systematic reduction of non-tariff barriers to enhance global connectivity is extremely rational as a new corridor development model in Africa.

Even without road development, this strategy, which combines improved connectivity and industrial development while considering intra-regional and extra-regional economic interconnections, can be defined as a new economic corridor development model. Moreover, the approach and scenarios in this section do not advocate for measures limited to digital and institutional reforms but also emphasise the importance of physical infrastructure improvements at borders and ports. In fact, delays in development at borders and ports not only hinder trade but also become bottlenecks in the advancement of digitalisation (Almeida and Okon, 2025; World Economic Forum, 2022; World Bank Group, 2023).

To analyse these aspects, we will examine the impact of economic corridor development initiatives in Sub-Saharan Africa on the economies of various countries and regions. Using the Geographical Simulation Model (IDE-GSM) developed by the Institute of Developing Economies, the Japan External Trade Organization (IDE-JETRO), we will evaluate how traditional phased economic corridor development approaches and leapfrog economic corridor development approaches each promote economic growth and mitigate regional economic disparities. Comparing the traditional phased economic corridor development approach with the leapfrog economic corridor development approach is effective in assessing whether the latter can achieve high economic effects in a short period.

IDE-GSM is a computable general equilibrium (CGE) model based on spatial economics, and its development began in 2007 as a joint research project between JETRO's Institute of Developing Economies and the Economic Research Institute for ASEAN and East Asia (ERIA). IDE-GSM is a useful tool for analysing international economic corridors and has been utilised by ERIA, the World Bank, and the Asian Development Bank (ADB) to analyse the economic effects of international infrastructure development. The first advantage of IDE-GSM is that it has regional-level data for multiple countries. This allows policymakers and researchers to understand how economic corridors spanning multiple countries affect different regions within those countries and to formulate effective policies accordingly. Secondly, IDE-GSM responds to changes in economic structure. Unlike models with fixed input-output structures at the national or regional level, IDE-GSM includes firms and consumers within the model, whose behaviour changes. For example, when transport infrastructure is developed, firms and consumers change their sales and purchasing patterns, which alters the overall economic structure. This is effective for scenario analysis involving significant structural changes, such as connectivity with Asia. Thirdly, IDE-GSM can analyse and compare the economic impacts of various policy measures related to international economic corridors, such as the effects of individual infrastructure projects (e.g., the construction of individual bridges and roads), tariff reductions, and trade facilitation. These aspects make IDE-GSM a highly useful tool for analysing international economic corridors.

The main data used in IDE-GSM includes economic geography data (such as sector-specific regional GDP, population, and area) and multimodal route data. Industries are divided into primary industries (agriculture, mining), manufacturing (automobiles, electronics and electrical equipment (E&E), textiles and apparel, food processing, other manufacturing), and services. Route data includes roads, sea routes, air routes, railways, and high-speed railways, with information on routes, speeds, border crossing times, and costs. Economic geography data is constructed according to official statistics, but if regional GDP is not available, other data such as economic censuses or night-time light

and land cover from satellite images are used. For African route data, IDE-GSM incorporates cross-border transport data compiled by NX Research Institute and cross-border transport data based on the OSBP Status Report (AUDA-NEPAD & JICA, 2024).

1. Scenario

In the analysis scenarios, we focus on Sub-Saharan African countries, identifying major corridors and considering the impacts of road development, border facilitation, SEZ development, and the reduction of non-tariff barriers (Table 1).

[Table 1]: Components of Each Scenario

	Road improvement	Border facilitation	SEZ	Connection with South Asia	NTB reduction	Connection with Japan & EU
Traditional corridor-based development strategy						
Scenario 1	✓	✓	(Northern and Central Corridors only)			
Scenario 2	✓	✓				
Scenario 4m (minus)	✓	✓		✓		
Scenario 3	✓	✓	✓			
Scenario 4	✓	✓	✓	✓		
Scenario 5	✓	✓	✓	✓	✓	
Scenario 6	✓	✓	✓	✓	✓	✓
Leapfrog development strategy						
Scenario 7		✓	✓	✓	✓	✓

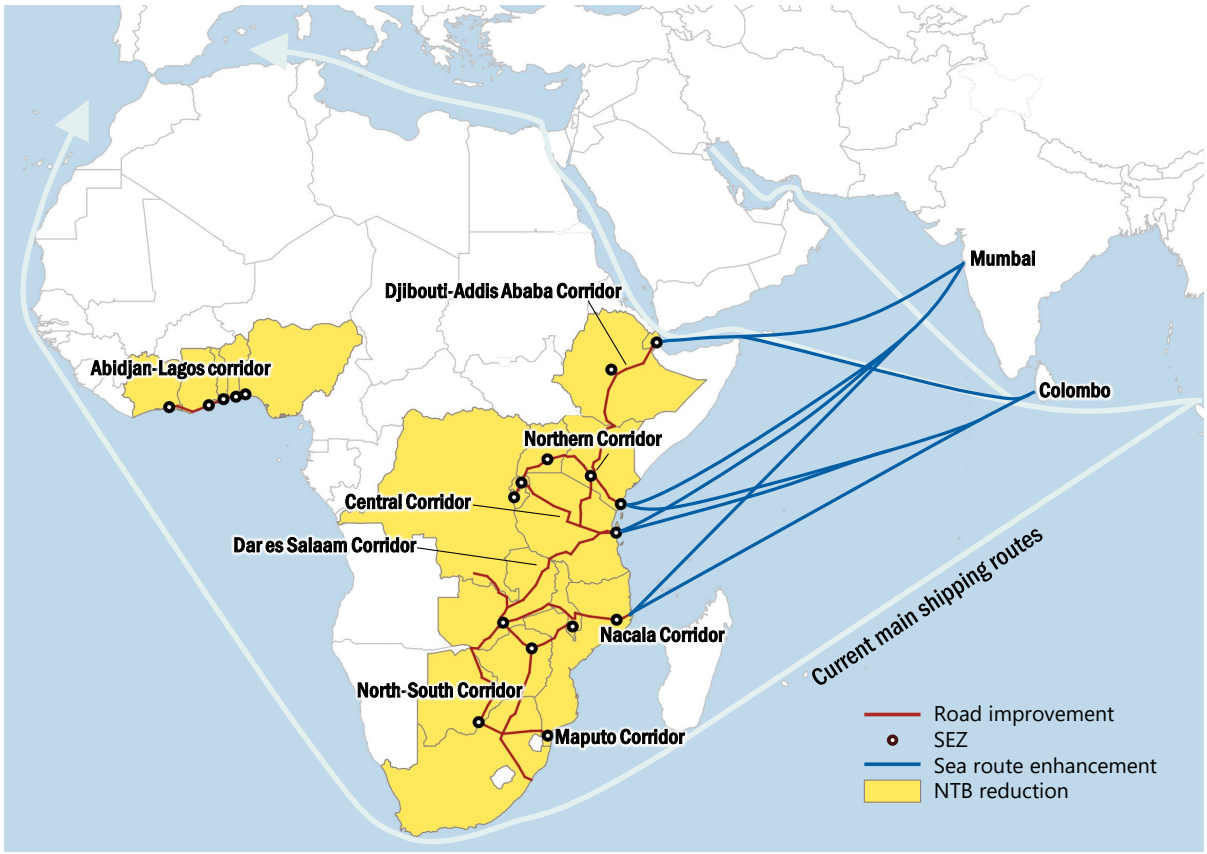
（Source: IDE-GSM team.）

2. Traditional Economic Corridor Development Scenario

In Scenario 1, we consider road development and border facilitation for the ring section consisting of the Northern and Central Corridors. In Scenario 2, we expand the geographical scope to include road development and border facilitation for major corridors in Sub-Saharan Africa. We will improve road infrastructure and reduce border crossing times and costs as indicated in the "Road improvement" section of Figure 1. Scenario 3 assumes productivity improvements in cities designated as "SEZ" in Figure 1, in addition to the elements of Scenario 2. Before Scenario 3, we set up Scenario 4m (minus), which assumes sea route development with Mumbai and Colombo without developing SEZs. Scenario 4 includes sea route development with Mumbai and Colombo

in addition to Scenario 3. Specifically, it connects the ports of Djibouti, Mombasa, Dar es Salaam, and Nacala with the ports of Mumbai in India and Colombo in Sri Lanka. Scenario 5 involves reducing NTBs through institutional reforms in countries designated in the "NTB reduction" section of Figure 1, in addition to Scenario 4. Scenario 6 adds improved connectivity to East Asia via Singapore from Sri Lanka and to Europe from West Africa to Scenario 5.

[Figure 1]: Scenario Analysis Content (Scenarios 1-5)



（Source: IDE-GSM team.）

For road development, it is assumed that trucks will be able to travel at an average speed of 60 km/h. This requires dedicated roads for vehicles in areas other than sparsely populated regions. At borders, the time and cost required for customs clearance will be halved, both where OSBP exists and where it does not. This includes not only the establishment of OSBP but also the development of transshipment facilities and the elimination of congestion before entering border CIQ facilities. For sea route development, it is set on the region's main routes, improving port operation performance and halving the time and cost incurred at ports.

In SEZs, the productivity parameters of the region will be increased by 10%. This involves not only setting up SEZs but also completing infrastructure such as electricity, water supply, and wastewater treatment within industrial parks, and improving access to major corridors.

Non-tariff barriers in IDE-GSM refer to all barriers other than tariffs and difficulty in accessing transportation. This includes not only policy-related non-tariff measures but also the lack of capacity of government agencies handling imports and exports, lack of transparency, and the lack of capacity of individual companies handling imports and exports. Therefore, the reduction of non-tariff barriers in the scenarios specifically includes the promotion of single-window customs clearance, reduction and standardisation of required documents, abolition of paper document submission and presentation, establishment of systems such as AEO, advance rulings, and deferred payment of customs duties before and after transportation, improvement of transparency, and development of digital trade platforms. Additionally, it includes not only the improvement of the capacity of personnel but also the improvement of the capacity of logistics companies and customer companies using the services.

3. Leapfrog Economic Corridor Development Scenarios

In Scenario 7 of leapfrog economic corridor development, as shown in Table 1, only the road development part is excluded from Scenario 6. Although intra-regional road development is excluded, it includes the reduction of time and cost at borders and improvement of port operation performance.

The development of SEZs continues with the scenario of increasing the productivity parameters of the region by 10%, but instead of traditional industrial parks assuming manufacturing, it assumes SEZs targeting ICT education, skill development, DX, and IoT.

4. Results

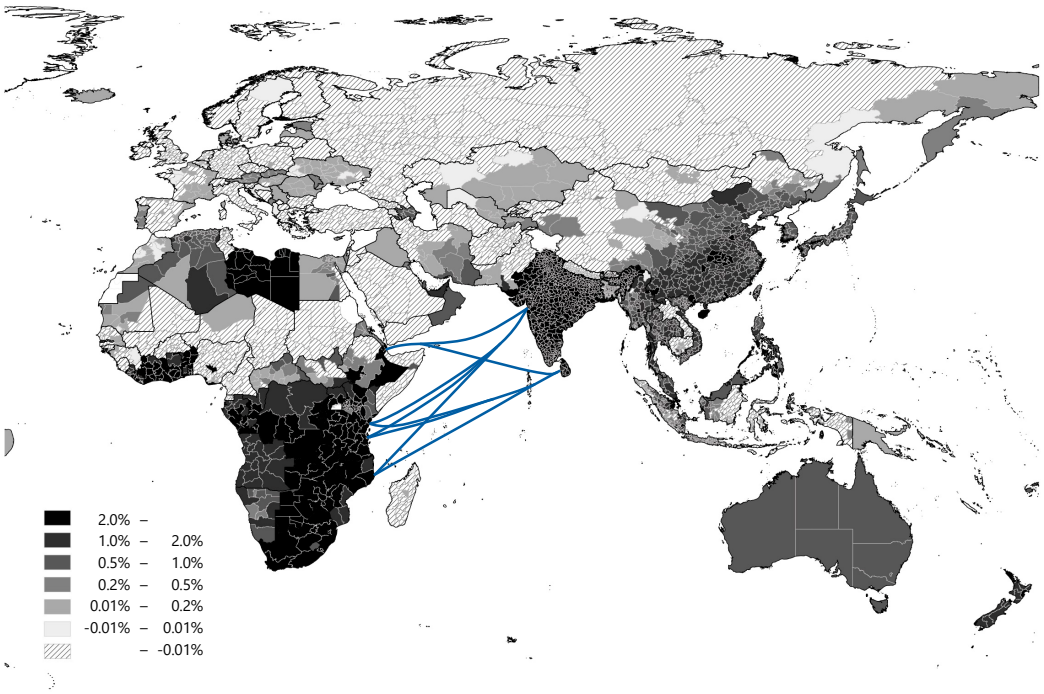
Based on these scenarios, the impacts on countries and regions are evaluated. The findings derived from the simulation results of the traditional economic corridor development scenarios are as follows:

- Infrastructure development and border facilitation initiatives in Sub-Saharan Africa have a significant positive impact on the economies of many countries and regions.
- The strategic combination of road development, OSBP, SEZ, reduction of non-tariff barriers, and connectivity with Asia is crucial.
- Enhancing connectivity with South Asia without regional infrastructure development and human resource development on the African side leads to negative impacts in

some African countries close to Asia. This is partly due to the influx of a large amount of goods from India, which hampers the growth of African manufacturing, and partly because people tend to live in cities closer to Asia, reducing the influx of population into the largest economic cities. African countries already have a very high proportion of the service sector, so both manufacturing and service sectors, which generate high-wage employment, cannot absorb employment. The establishment of such undesirable forms of international division of labour indicates risks to the promotion of African industries.

The reduction of NTBs also brings positive effects to the African region, but there are regions that experience negative impacts (Figure 2).

[Figure 2]: Economic Effects of Scenario 5 (All Scenarios: Road Development, OSBP, SEZ, Reduction of Non-Tariff Barriers, Connectivity with South Asia)

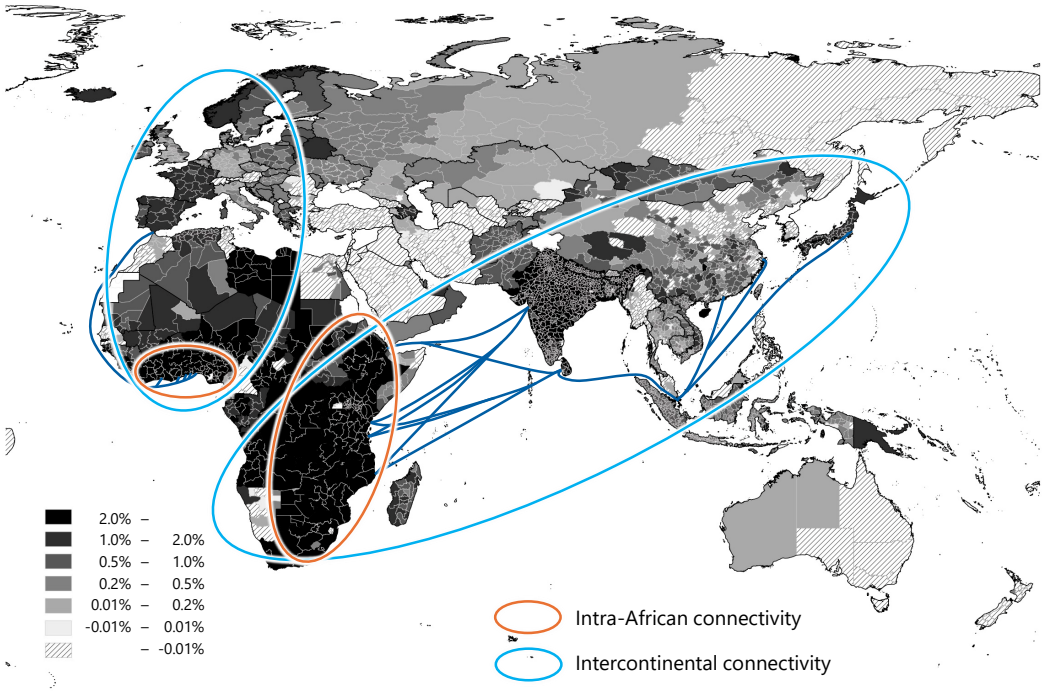


（Source: IDE-GSM simulation result.）

Furthermore, in Scenario 6, by adding improved connectivity to East Asia via Singapore from Sri Lanka and to Europe from West Africa to Scenario 5, positive effects will spread to many regions in Africa, and significant positive impacts will be seen in Japan, Europe, and India (Figure 3). As geopolitical trends change, production systems concentrated in specific countries, sales strategies dependent on specific consumer countries, and systems reliant on traditional major transport routes are becoming

increasingly difficult. Strengthening connectivity within Africa and linking it to intercontinental connectivity can expand positive effects in many regions worldwide and contribute to enhancing the resilience of the global economy.

[Figure 3]: Economic Effects of Scenario 6 (Connectivity within Africa and Intercontinental Connectivity)



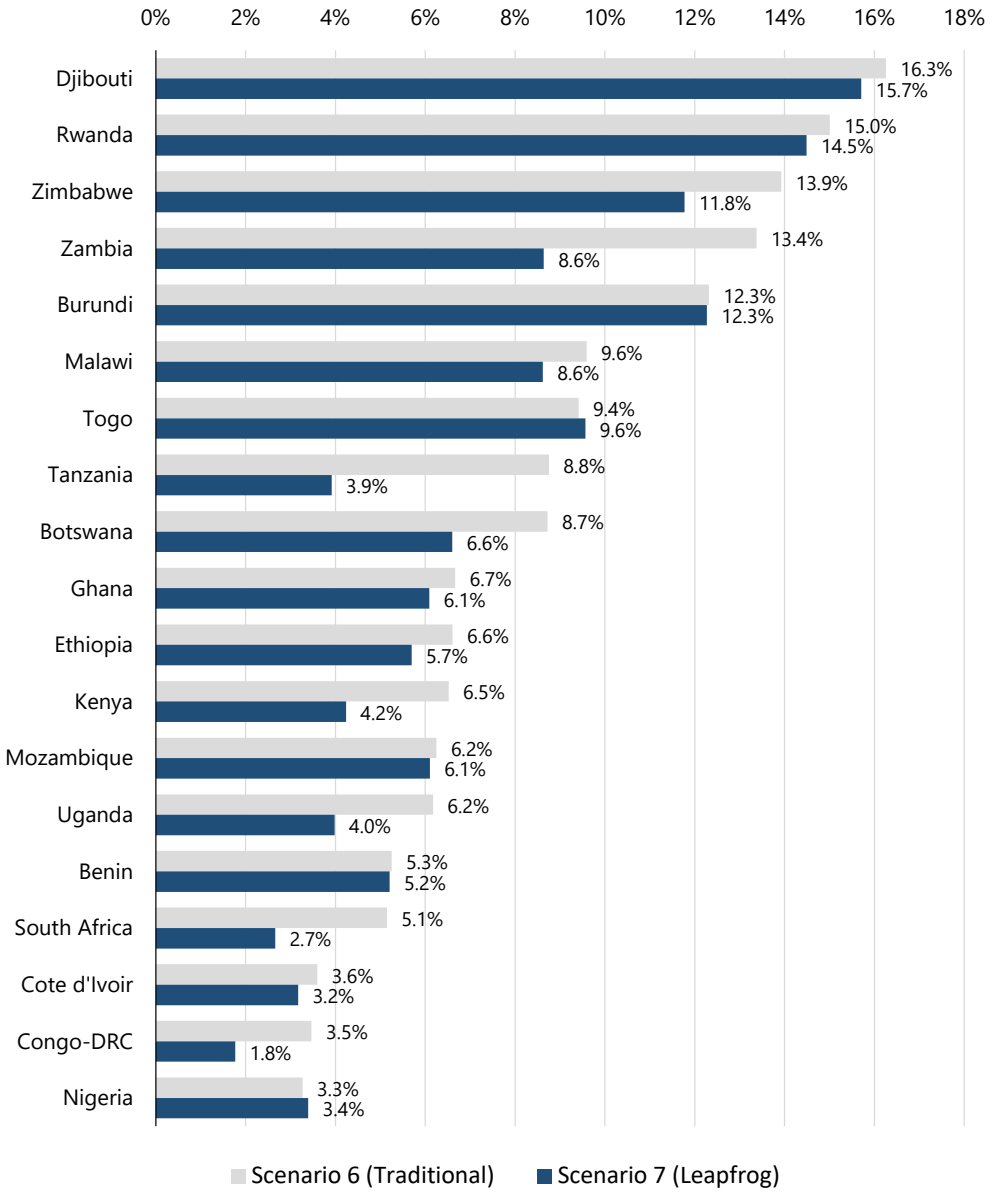
（Source: IDE-GSM simulation result.）

In Scenario 7 of leapfrog economic corridor development, road development is excluded compared to Scenario 6, which considers all aspects. Therefore, it is generally expected that the economic effects will be lower than Scenario 6. The critical question here is the extent to which the difference is decisive.

The comparison between Scenario 6 and Scenario 7 is shown in Figure 4. Scenario 6 exhibits a maximum economic effect of 16.3% in various countries, but achieving this requires large-scale investments and long-term efforts in road development and physical infrastructure installation. On the other hand, Scenario 7 postpones intra-regional road infrastructure development and prioritises border facilitation measures such as OSBP, the establishment of skill-development SEZs accompanied by digital education, and the electronic reduction of non-tariff barriers to strengthen connectivity with Asian and European markets. This achieves high-level positive effects in a shorter period. This clearly demonstrates that even when physical infrastructure development is concentrated

at borders and ports, significantly reducing time and costs, many regions can still achieve comparable economic outcomes.

[Figure 4]: Comparison between Scenario 6 (Traditional Phased Approach) and Scenario 7 (Leapfrog Approach)



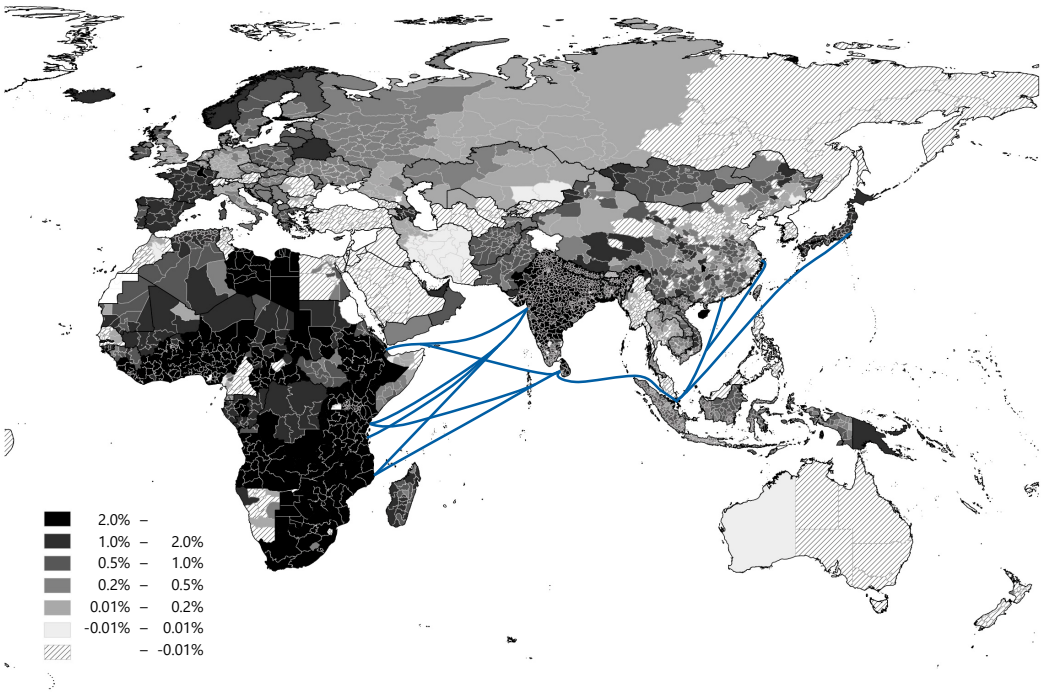
（Source: IDE-GSM simulation result.）

These results are consistent with the continental-level leapfrog + large-scale infrastructure scenario model results by the Institute for Security Studies (ISS Africa) (Cilliers 2025). Here too, it is emphasised that the leapfrog strategy leads to faster

progress by prioritising the development of non-physical infrastructure areas (electricity, ICT access, digitalisation of institutions, etc.).

Figure 5 illustrates the economic effects of leapfrog economic corridor development in Scenario 7. It shows that even without intra-regional road development, the geographical spread of regions that can achieve positive economic effects within the region is ensured, and the risk of leaving rural areas behind is minimal.

[Figure 5]: Economic Effects of Leapfrog Economic Corridor Development (Scenario 7)



（Source: IDE-GSM simulation result.）

5. Conclusion

The development of economic corridors in Africa is essential for deepening regional economic integration, promoting trade, and achieving sustainable growth. In particular, the success of the African Continental Free Trade Area (AfCFTA), which came into effect in 2019, hinges on the establishment of efficient and reliable economic corridors.

Analysis using the IDE-GSM has shown that, in the traditional economic corridor approach, combining road development, border facilitation, SEZ development, reduction of non-tariff barriers, and strengthening connectivity with Asia in a phased and strategic manner promotes economic growth in Africa and mitigates regional economic disparities.

However, if productivity improvements, such as adequate human resource development, are not achieved on the African side, there is a risk of undesirable forms of international division of labour, which could pose risks to the promotion of African industries. Therefore, accumulating successful cases and realising the optimal development path is essential for sustainable development.

Furthermore, even in the leapfrog economic corridor development scenario, which intentionally excludes road development from the traditional economic corridor approach, it has been shown that countries can maintain high economic effects and ensure the geographical spread of regions that can achieve positive economic effects within the region. This scenario still includes infrastructure development at borders and ports, indicating the necessity of modernising these ports and facilitating logistics. Although SEZs are assumed to be skill-development SEZs rather than traditional industrial parks, similar to the analysis results of the traditional economic corridor approach, it is emphasised that improving connectivity with South Asia without securing sufficient skills could lead to undesirable forms of international division of labour, hindering the promotion of African industries.

As policy recommendations, a strategic deployment based on the following three pillars is appropriate. First, prioritising the introduction of OSBP and the digitalisation of customs as border facilitation measures to eliminate trade bottlenecks. This can achieve a reduction in customs clearance time and optimisation of transaction costs. Secondly, in skill-development SEZs, making digital education a mandatory requirement and introducing IT and digital-related vocational training as a set. This allows for simultaneous endogenous human resource development and industrial diversification. Thirdly, promoting the reduction of non-tariff barriers through digitalisation and strengthening cooperation with AfCFTA and COMESA to enhance integrated market access with Asia and Europe. By comprehensively implementing these measures, African countries can achieve maximum economic effects in a short period with minimal cost and time. This analysis demonstrates that the leapfrog corridor strategy, as an alternative to the traditional corridor model, excels in policy effectiveness and cost performance.

Regarding leapfrog development in Africa, there are also sceptical and critical perspectives in the literature. Alzouma (2005) and Tan and Taeihagh (2020) point out that there are limitations to the introduction of technology without understanding the structural constraints of society and the economy (education, institutions, market size). Awoleye (2021) highlights that as long as technology is dependent on foreign capital, there are issues of data sovereignty. These suggest that without the design of digital governance systems, such as data protection, the effects will be limited.

Asian countries are expected to strengthen their connectivity with Africa and contribute to the construction of sustainable trade networks. It is particularly important to promote

trade facilitation through the digitalisation of logistics systems and the enhancement of sea route connections. In addition to infrastructure development support, it is desirable to contribute to human capital development through technology transfer and support for educational institutions.

From a long-term perspective, it is desirable to optimise large-scale logistics infrastructure investment in the African region in parallel. The difference in economic effects between traditional economic corridor scenarios and leapfrog economic corridor development varies by country, indicating that domestic road infrastructure investment remains important. It is crucial to select key corridors such as the Northern Corridor, Central Corridor, and Nacala Corridor, and to develop roads, ports, and railways. Furthermore, to strengthen inter-regional cooperation, it is necessary to establish coordinating bodies among AfCFTA member countries and formulate infrastructure investment plans.

Japan should strengthen international cooperation and actively contribute to the development of economic corridors in Africa. It is important to continue infrastructure development support through JICA and deepen cooperation with local communities. Additionally, it is necessary to formulate economic corridor development strategies and promote sustainable projects in collaboration with African countries. Furthermore, actively transferring technology and knowledge to contribute to the improvement of local industrial competitiveness is essential. In terms of trade and investment environment development, it is worth considering strengthening policies to promote the entry of Japanese companies into Africa (such as risk management support and tax incentives). Moreover, it is desirable to deepen business exchanges between Japan and Africa and promote economic cooperation through public-private partnerships.

References

Almeida, F. and Okon, E. (2025), "Contribution of digitalization initiatives in African ports to the sustainable development", African Journal of Economic and Management Studies, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/AJEMS-01-2025-0066

Alzouma, G. (2005) “Myths of digital technology in Africa: Leapfrogging development?” *Global Media and Communication*, 1(3), 339–356. https://doi.org/10.1177/1742766505058128

Awoleye, O. M. (2021). *Reconfiguring data infrastructure ecosystem in Africa: A primer toward digital sovereignty*. arXiv. https://doi.org/10.48550/arXiv.2109.14186

Bhalla, R., & Chaturvedi, B. (n.d.). *The African Leapfrog Index*. Digital Planet, The

Fletcher School, Tufts University. Retrieved June 28, 2025, from https://digitalplanet.tufts.edu/african-leapfrog-index/

Cilliers, J. (2025) Leapfrogging. Published online at futures.issafrica.org. Retrieved from https://futures.issafrica.org/thematic/09-leapfrog/

Grater, S., & Hoffman, A. (2021). Digital technologies: Benefits for transport and trade facilitation in Africa. In W. Viviers, A. Parry, & S. J. Jansen van Rensburg (Eds.), *Africa's digital future: From theory to action* (pp. 201–239). AOSIS.

JICA (2022) Towards TICAD8: Africa's Corridors Break Down Barriers, Ensure Equitable Growth Retrieved from https://www.jica.go.jp/english/TICAD/approach/special_report/news_220823_01.html

Tan, S. Y., & Taeihagh, A. (2020). *Smart city governance in developing countries: A systematic literature review*. *Sustainability, 12*(3), 899. https://doi.org/10.3390/su12030899

World Bank Group (2023) *Status of digitalization and regulatory frameworks in African ports: Final report summary*. Africa Transport Policy Program (SSATP), African Union Commission, IAPH, & AFD.

World Economic Forum (2022) *Growing Intra-African Trade through Digital Transformation of Border and Customs Services,* Retrieved from https://www3.weforum.org/docs/WEF_Regional_Action_Group_for_Africa_2022.pdf

Chapter 8:

Development Strategy

Development Strategies for Digital Logistics and the Circular Economy in the Global South Based on Field Research in Ethiopia, the African Union, and Kenya

Mitsuhiro Maeda, Musashino Institute for Global Affairs (MIGA)

1. Problem Statement

The Musashino University Institute of Global Affairs (MIGA) held the "Africa Master Plan Development Project Study Meeting" in the 2025 fiscal year and undertook the "Master Plan Development Project for Strengthening Digital Connectivity in African Regional Logistics to Facilitate Resource Circulation." The primary theme of this project is to establish a circular economy system through the enhancement of logistics digital connectivity. While this may appear to be focused solely on the industrial sector, in practice, it necessitates the establishment of new perspectives on the development strategies that Global South countries should adopt to achieve long-term, sustainable economic growth. This, in turn, raises issues related to the evolutionary history of modern civilization. This chapter will organize and discuss these issues.

The Musashino University Institute of Global Affairs (MIGA) has been conducting a series of seminars since the 2024 fiscal year to examine the content of development strategies that Global South countries should adopt in the future, within the broader framework of the evolutionary process of modern civilization. The findings of this work have been compiled in the report titled " " (Musashino University Institute of Global Affairs (MIGA), November 2024), available at . This report was distributed to all sherpas at the G20 Sherpa Meeting held in Rio de Janeiro in November 2024, and was also presented at the G20 Social Summit (November 14, 2024), which was held in conjunction with the G20 Summit, thereby disseminating information to the world. This chapter examines the approach to advancing the construction of a circular economy system through the enhancement of logistics digital connectivity, in line with the content of the report regarding the potential development strategies that Global South countries should adopt in the era beyond the mid-21st century.

2. Challenges in advancing the construction of a circular economy system through the enhancement of logistics digital connectivity

Based on the discussions conducted in the study group and field surveys, it can be said that to

practically advance the construction of a circular economy system through the enhancement of logistics digital connectivity, it is necessary to address the following three major challenges mentioned in the general overview: .

The first challenge is to establish a comprehensive cyber-physical system in the target region.

Logistics digital connectivity is based on the premise that it is possible to completely supplement information on the location and status of materials subject to logistics at any given time. Based on this, it is necessary to implement control measures necessary for efficient logistics. In other words, a system that enables complete digital supplementation and control of materials is required, which is possible through a comprehensive cyber-physical system.

In addition, in the construction of a circular economy system, it is necessary to completely supplement and control all resources that have the potential to be recycled, beyond the scope of resources that have traditionally been considered as resources for production activities. This includes many items that have traditionally been considered waste (garbage). Furthermore, in order to reintroduce these new "resources" into the production process, it is necessary to accurately capture and control the capacity of production facilities, in addition to supplementing and controlling the new "resources." Furthermore, to appropriately predict the generation and availability of new "resources" in the near future, it is necessary to grasp extensive information beyond industrial sectors, including information related to people's daily lives.

In other words, it will be necessary to grasp and control comprehensive information not only in the industrial and logistics sectors but also in all aspects of people's lives in the target region, and the means to achieve this will be the construction of a comprehensive cyber-physical system. The greatest challenge in practically promoting the construction of a circular economy system through the strengthening of logistics digital connectivity is the construction of a comprehensive cyber-physical system in the target area. Conversely, it is extremely difficult in practice to promote the construction of logistics digital connectivity and a circular economy system without first constructing a comprehensive cyber-physical system.

It is important to note that the necessity of construction being emphasized here is not for cyber-physical systems specialized for industrial use, but for comprehensive cyber-physical systems.

The concept of cyber-physical systems was first proposed by Germany in the 2010s as part of its Industrie 4.0 initiative. Since then, Germany has introduced the RAMI 4.0 data architecture and the GAIA-X conceptual model for industry, and is promoting the development of data integration systems such as CATENA-X for the automotive industry.

In contrast, this study argues for the construction of a comprehensive cyber-physical system that encompasses all human actions within the scope of the target area, not limited to the industrial or logistics fields. This is because human behavior not only directly triggers economic movements as consumption behavior, but also forms the foundation for the creation of new value required for the

construction of a circular economy system, as described below. Here, we will distinguish between specific cyber-physical systems tailored to specific industries, such as GAIA-X and CATENA-X, which we refer to as specific-purpose cyber-physical systems, and the comprehensive cyber-physical systems described in this study, which we refer to as general-purpose cyber-physical systems.

The second challenge is to develop methodologies to promote the creation of new value in relation to the new philosophy of circular economy systems that have emerged in the history of modern civilization.

Since the first industrial revolution, which is said to have begun in the mid-18th century (Note 1), industrialization has been understood as consisting of three types of human behavior: production, logistics, and consumption. After consumption, waste (garbage) is generated, which is considered economically worthless because it must be disposed of at a cost and cannot be used as input for new production activities. Furthermore, since disposal incurs costs, waste is regarded as having negative value.

On the other hand, a circular economy system involves reintegrating waste (garbage) generated from the three types of human activities—production, logistics, and consumption—into the supply chain as resources for new production. This requires a fundamentally different philosophy from the traditional industrialization paradigm. To implement such a new system in society, it is necessary to construct a fundamentally different way of thinking from the traditional notion that the three types of human activities unfold sequentially and that industrialization comes to an end with the cessation of consumption. In particular, since waste (garbage) becomes a resource for new production activities and is incorporated into the supply chain, it must be recognized as having positive value, and a new supply chain system must be constructed based on this premise.

In other words, to fully operationalize a circular economy system, it is insufficient to merely revise certain aspects of traditional industrialization concepts or add new factors partially. Instead, it is necessary to comprehensively evolve the concept of industrialization within modern civilization and develop new wisdom regarding the nature of an artery-vein integrated development strategy. Based on the various research findings on "wisdom creation" methods currently being pursued, it is considered necessary to systematically aggregate the wisdom of the world in a decentralized (democratic) manner in order to generate such new wisdom. The only feasible method for achieving this is to establish a new methodology for promoting value creation through an interoperability platform for cyber-physical systems, as described in . In other words, the construction of cyber-physical systems also serves as an indispensable intellectual infrastructure for value creation to address entirely new challenges in the industrialization of modern civilization, such as the construction of a circular economy system.

The third challenge is digital human resource development (d-HRD).

To implement digital logistics systems in most of the Global South, it is necessary to have digital talent in place in all regions where such systems are required. Furthermore, the construction of cyber-

physical systems will require digital human resources of an extremely high standard in the local areas of the Global South. Additionally, digital human resources of a high standard will be necessary to construct and operate cyber-physical systems that enable the excellent wisdom located in the local areas of the Global South to participate in global activities that promote value creation through the aforementioned interoperability platform.

From the above, it is clear that the construction and operation of cyber-physical systems is indispensable for promoting the construction of a circular economy system through the enhancement of logistics digital connectivity, and that it is therefore necessary to cultivate digital talent of sufficient quality and quantity in each region of the Global South.

The need to cultivate a large number of digital human resources in a short period of time in rural areas of the Global South has already been recognized by many governments in the Global South, and measures are being taken to address this issue. In some Global South countries, digital talent development has been successful in capital cities, leading to rapid economic growth through connection to global outsourcing networks. However, in rural areas, the promotion of new industries has not progressed. The resulting expansion of regional economic disparities is a concern from the perspective of national integration, as noted by some countries (e.g., the Office of the President of the Kyrgyz Republic, March 2020).

To address the challenge of rapidly producing a large number of digital talent in the Global South's rural areas, the "Global South d-HRD Initiative" promoted by APEN (Asia Professional Education Network), an international network established by the Tokyo Metropolitan University of Industrial Technology targeting East Asian countries, serves as a reference. This is a distance learning program for the training of junior and intermediate digital talent, where registered students watch videos remotely, take regular exams, and receive support for connecting to a global outsourcing network upon graduation. Of course, there are various methodologies for digital talent development, but in any case, the implementation of a globally scalable remote education system and the connection of graduates to a global outsourcing network are key.

As we have seen, in order to promote the establishment of a circular economy system through the strengthening of logistics digital connectivity, it is necessary to address the following three issues: first, the establishment of cyber-physical systems; second, the establishment of methodologies for promoting new value creation related to the circular economy (interoperability platforms for cyber-physical systems); and third, the development of digital human resources. Conversely, without appropriately addressing these challenges, it will be practically difficult to promote the construction of a circular economy system through the enhancement of logistics digital connectivity.

The argument of this chapter is that since the strategy of constructing a circular economy system through the enhancement of logistics digital connectivity requires appropriate responses to the above challenges, the construction of such a system must rely on a "leapfrog-type" development strategy that

differs from conventional thinking regarding the development strategies of Global South countries. The construction of a circular economy system through the enhancement of logistics digital connectivity compels a fundamental shift in thinking regarding the development strategies that Global South countries should adopt.

3. "Leapfrog-type" development strategy (Pathways to Inclusive Growth)

(1) Two Pathways

At present, the so-called "aid community" (advanced country governments, international organizations, and other entities that "provide" development assistance) generally understands that developing countries in the Global South should adopt the following development strategy in the future. That is, regardless of the era, there is only one form of development strategy that developing countries should adopt to achieve long-term, sustainable economic growth, and that is the strategy adopted in East Asia in the latter half of the 20th century.

Specifically, this refers to a development strategy that begins with the promotion of labor-intensive manufacturing. In the first stage, labor-intensive manufacturing is promoted, and once this yields results, the second stage involves advancing the diversification of manufacturing, i.e., promoting capital-intensive manufacturing. Once this also yields results, the third stage involves promoting knowledge-intensive industries and digital transformation (DX). Such a

① labor-intensive manufacturing
⇒② Advancement of manufacturing (promotion of capital-intensive manufacturing)
⇒③ Promotion of knowledge-intensive industries (promotion of DX)

is referred to here as the traditional or "prograde arrow" development strategy.

In contrast, the Musashino University International Research Institute (MIGA) has been conducting research on the possibility of the following development strategy. This strategy prioritizes the promotion of knowledge-intensive industries and DX before the promotion of all manufacturing industries, including labor-intensive manufacturing industries. Specifically, the first stage involves promoting the development of knowledge-intensive industries and DX. Once this achieves results, the second stage involves applying those results to promote manufacturing, and the third stage involves applying those results to infrastructure development. This is referred to as

① DX promotion (promotion of knowledge-intensive industries)
⇒② (Utilizing the outcomes of DX) Revitalization of manufacturing
⇒③ (Infrastructure development leveraging DX outcomes)

is referred to here as the "leapfrog-type" or "reverse arrow" development strategy.

The construction of a circular economy system through the enhancement of logistics digital

connectivity, which is the subject of this study, requires the development of generic cyber-physical systems and the cultivation of digital talent for its practical implementation. Therefore, efforts must first be made to establish these foundations ( ). As such, the promotion of this system constitutes an example of the "leapfrog" development strategy discussed here.

Example 20th century Throughout the 20th century, the international regime based on a strict distinction between developed and developing countries, as described above, demonstrated high effectiveness in many areas despite containing numerous issues. However, we believe that the following changes, in particular, have significantly impacted the effectiveness of the international development regime, and as a result, the once-effective structure of distinction is becoming increasingly meaningless today.

(2) Characteristics of the "leapfrog-type" development strategy (in contrast to the traditional "kaizen" development strategy)

The characteristics of this "leapfrog" development strategy are clearly evident when contrasted with traditional development strategies. Here, we will compare this strategy with the "kaizen" (improvement) approach to manufacturing promotion, which is a representative traditional development strategy implemented by Japan in Africa.

Manufacturing industry promotion support using "Kaizen" as a method has been implemented by the Japanese government in East Asian countries since the 1980s and has historically yielded significant results. The Japanese government made the policy decision to extend this approach to Africa at the 4th TICAD (Tokyo International Conference for African Development) in 2008. The background to this decision can be summarized as follows.

With the end of the Cold War, major Western European countries faced the challenge of integrating Eastern Europe and were forced to raise enormous amounts of funds for this purpose. As a result, they drastically reduced the amount of aid they had been providing to African countries during the Cold War era. Many African countries, which had fallen into severe fiscal crises, turned to Japan, whose economy was booming at the time, for assistance. In response, TICAD was launched in 1993. At the first TICAD in 1993 and the second TICAD in 1998, many African leaders visited Japan and appealed to the Japanese government for aid, significantly enhancing Japan's status on the African continent.

Meanwhile, the following developments between the second and third TICAD summits (2003) had a major impact on the status of TICAD thereafter.

First, China, which sought to expand its influence over African countries, launched the Forum on China-Africa Cooperation (FOCAC) in 2000, a summit meeting similar in format to TICAD. As a result, African countries gained the option of requesting assistance from China in addition to Japan through the TICAD platform as a means of compensating for the decline in aid from Western European countries.

The second factor was the creation and adoption of NEPAD (New Partnership for Africa's

Development) by the African Union in 2001. This was a plan for the future development of Africa, formulated by Africans themselves. A similar movement followed in 2013 with the adoption of Agenda 2063, subtitled "The Africa We Want" (adopted in 2015), which outlines a long-term plan for the entire African continent through 2063, entitled " ." At the first and second TICAD conferences, the Japanese government took the position that Japan could offer not only aid but also the knowledge gained from its successful economic growth in Asia. However, with these developments, Africans came to take the position that they would base their thinking on their own ideas, and as a result, competition with China came to be based on the "amount" of aid and investment.

At the third TICAD in 2003, African countries requested a fundamental shift in support from aid to trade, including agricultural products, which are major exports of African countries. In response, a TICAD Trade Ministers' Meeting was held in Makuhari in 2004, where intensive discussions were held on how to address this request.

During this period, China successfully held the second FOCAC in Addis Ababa in 2003 and the third FOCAC in 2006.

Against this backdrop, the 4th TICAD was held in 2008. Although the Japanese government sought to expand new yen loans, many African countries were unable to do so due to issues related to IMF signaling (Note 2). Against this backdrop, the policy that was formulated was the expansion of "Kaizen"-related technical cooperation, which Japan had previously implemented in East Asian countries, to Africa. The common theme of TICAD was also set as "Bringing East Asia's Success Experience to Africa." This common theme directly stated that African countries should adopt the same development strategy as East Asian countries, with the content focusing on traditional, labor-intensive manufacturing as the starting point.

Subsequently, according to Akira Ooka [2025] (Note 3), "Kaizen"-related technical cooperation in Africa has been implemented as follows:

The first "Kaizen"-related technical cooperation was implemented by JICA in Tunisia following the 4th TICAD in 2008. Inspired by the achievements in Tunisia, the pioneering introduction of Kaizen was advanced in Ethiopia between 2009 and 2011. At the request of then Prime Minister Meles Zenawi, the Japanese government responded by implementing the first technical cooperation project (Quality and Productivity Improvement Plan Survey Phase 1) from 2009 to 2011. At the same time, a "Kaizen" unit (KU) was established within the Ethiopian Ministry of Industry, and in 2011, the Ethiopian Kaizen Institute (EKI) was established (later renamed the Kaizen Excellence Center, or KEC).

Subsequently, JICA implemented technical cooperation projects in nine countries, including Ghana, Kenya, Tanzania, Zambia, Cameroon, and South Africa, in 2018, and the number of countries receiving support increased to 35 by 2024. Additionally, in April 2017, JICA and the African Union Development Agency (AUDA-NEPAD) launched the "Africa Kaizen Initiative (AKI)," a 10-year initiative spanning from 2017 to 2027.

The "Kaizen"-related technical cooperation is progressing smoothly under these circumstances, and it has already begun to yield significant results in many African countries. There is no doubt that it will continue to make a significant contribution to Africa's long-term and sustainable economic growth.

However, our concern is whether this alone is sufficient, and whether we should consider entirely new approaches with different perspectives to achieve long-term, sustainable economic growth in Africa.

To begin with, achieving long-term, sustainable economic growth across the entire African continent, and more broadly across the Global South as a whole, is an extremely challenging task. It is unlikely that any single approach alone will be effective in achieving this goal, and we believe that multiple approaches with different content should be pursued simultaneously.

While "Kaizen"-related technical cooperation has already yielded significant results in Africa, it is a typical traditional development strategy and therefore inherently limited by the principles of such strategies.

According to a workshop on "Building a Circular Economy System through Strengthening Logistics Digital Connectivity" held in Ethiopia from May to June 2025 by the Musashino University Institute of Global Affairs (MIGA) in collaboration with major universities in Ethiopia (Note 4), traditional development strategies are likely to contain the following fundamental problems.

The first issue is the adoption of a unilinear evolutionary perspective on development strategies, and more broadly, on the evolutionary trajectory of modern civilization. Based on this perspective, it is argued that all countries in the world must adopt the same development strategies that were previously followed by leading nations.

The biggest problem with this unilinear evolutionary view is that, as long as it is followed, African countries that were late in starting modernization (long-term, sustainable economic growth) will be unable to escape their position at the bottom of the global hierarchy, at least until the middle of the 21st century.

Such a logical conclusion is intolerable for many Africans, and there are already those among them who express a strong desire to adopt a new development strategy that is completely different from that of East Asian countries. A representative example of such a new development strategy is the "leapfrog" development strategy, which is based on a polycentric evolutionary historical perspective that fully acknowledges the possibility of multiple development strategies (evolutionary paths of modern civilization) on Earth under modern civilization. The "leapfrog-type" development strategy must be grounded in a polycentric evolutionary historical perspective. It is expected to promote economic development in ways that no one in the world has ever attempted before.

This simply means a "leapfrog-type" development strategy based on a multilineal evolutionary historical perspective. In fact, the Southern African Development Bank and the Tokyo Metropolitan University of Industrial Technology jointly launched a "Workshop on 'Leapfrog-Type' Development

Strategies in Africa" in 2015.

Additionally, during discussions held in June 2025 between the Musashino University International Comprehensive Research Institute (MIGA) and the Kenyan Ministry of Industry, the following remarks were made: "In the digital field, we are seeing rapid growth, such as MPESA. Therefore, Kenyans today are beginning to feel that, in addition to the traditional approach of starting with labor-intensive manufacturing, it is necessary to consider new policies (Stanley Koske Sawe, Director of Industry, Ministry of Industry, Kenya, June 10, 2025).

The second issue is that traditional development strategies are based on a sector-targeted approach.

The sector-targeted approach assumes that aid is provided only to the targeted areas, and that all systems outside the scope of aid are assumed to be identical to those in developed countries. For example, looking at "Kaizen"-related technical cooperation, in its most basic interpretation, this refers to support provided solely within the "manufacturing plant" domain, excluding systems outside this domain, as well as the broader social systems that encompass it.

However, in Global South countries, it is entirely unrealistic to assume that systems outside the "manufacturing factory," such as enterprises, supply chains, logistics, economic systems of the national economy, social systems of the state, and cultural systems, are similarly developed as in developed countries. Under these circumstances, even if Japan's assistance improves production processes within manufacturing plants, the fact that the structure of surrounding businesses, logistics, and economic systems differ significantly from those in Japan means that such improvements are not necessarily likely to lead to fundamental improvements in the national economy or industrial conditions.

Therefore, in providing assistance from advanced countries, it is strongly recommended not only to implement assistance targeting specific sectors but also to take necessary measures regarding external systems that have "institutional complementarity" with the targeted sectors.

In this way, we refer to the methodology of providing assistance not only to targeted specific sectors but also to external institutions that are "institutionally complementary" to them, as the institutional complementarity approach (as opposed to the sector target approach). This concept is based on the "combined approach" proposed by the Addis Ababa University of Science and Technology.

Incidentally, regarding technical cooperation related to "Kaizen," as noted in the footnote "most basic interpretation," the issues with the sector-targeted approach are already well understood by JICA and other relevant parties. The "Kaizen" concept has evolved over many years of research and is now widely applied not only to production processes within manufacturing plants but also to corporate management methods and even to the governance functions of social systems. In other words, while the "Kaizen" concept was initially constrained by the sector-targeted approach, it has since evolved over time to promote an institutional complementarity approach.

However, such success stories are difficult to find outside of "Kaizen"-related technical cooperation.

As outlined above, the characteristics of the "leapfrog-type" development strategy can be summarized as follows in contrast to traditional development strategies.

The first characteristic is that it is based on a polycentric view of the evolution of modern civilization rather than a monistic view.

The second characteristic is that the implementation method is based on an institutional complementarity approach rather than a sector-targeted approach.

(3) The feasibility of the "leapfrog-type" development strategy

The next question is whether the "leapfrog-type" development strategy can realistically bring about long-term, sustainable economic development for Global South countries. In contrast to the traditional development strategy, which has already been sufficiently proven by the success of many East Asian countries, there are still no concrete examples worldwide that demonstrate the effectiveness of the leapfrog-type strategy.

This issue was examined in the study on the "Leapfrog-type" development strategy included in "Pathway Diversity for Inclusive Growth" (Musashino University International Research Institute (MIGA), November 2024) (Note 5, hereinafter referred to as "Anbashi et al. [2024]").

According to this study, the promotion of labor-intensive manufacturing in East Asian countries led to long-term, sustainable economic growth because it facilitated the accumulation of human capital (high-quality labor), physical capital (private machinery, equipment, and buildings), infrastructure (public capital such as roads, railways, ports, and airports), social capital (efficient contractual systems and trust relationships), and intellectual capital (scientific, technological, and managerial knowledge) required for industrial development were accumulated over an extended period. On the other hand, in the current global context where DX is advancing, it is argued that the benefits of DX enable East Asian countries to achieve long-term, sustainable economic growth without going through the lengthy process of accumulating these stocks, i.e., the "leapfrog model" is possible.

The key to this is said to be the development of modern service industries and innovation through digitalization. In other words, the technological gap between today's advanced countries and Global South countries can be bridged by the Global South countries utilizing cutting-edge digital technology, and the institutional inefficiencies that are currently hindering economic development in Global South countries can also be improved through the use of digital technology.

Furthermore, specific methodologies for putting the "leapfrog-type" development strategy in the Global South into practice are proposed. These include, first, the promotion of small and medium-sized enterprises (labor-intensive IT industries) utilizing digital technology; second, the "heavy industrialization" of digital services (large-scale corporate organization); and third, the participation of existing manufacturing industries in renewed supply chains.

In conclusion, under the premise that the conditions of accumulating human capital and social

capital through the promotion of digital education targeting a wide range of society, and the promotion of the penetration of modern institutions into countries and societies are met, "leapfrog-type economic development strategies are possible without going through manufacturing if digital services are activated in accordance with each country's social issues" (, Masato Yasuhashi et al. [2024], p. 77).

In other words, a "leapfrog-type" development strategy is feasible for future Global South countries, and the construction of a circular economy system through enhanced logistics digital connectivity is expected to be realized as a typical attempt at a "leapfrog-type" development strategy by advancing it in a manner that addresses the considerations and prerequisites outlined in the aforementioned paper.

4. Regional Revitalization in the Global South

(1) Global South Regional Revitalization

As described above, promoting the construction of a circular economy system through the enhancement of logistics digital connectivity, as outlined in " " ( ), based on the framework of a typical "leapfrog-type" development strategy, is expected to bring significant new development opportunities to the regional areas of Global South countries centered on Africa.

Prior to DX, when traditional manufacturing industries dominated the economy, adopting a "leapfrog-type" development strategy was practically impossible, leaving Global South countries with no choice but to follow traditional development strategies. On the other hand, traditional development strategies are labor-intensive manufacturing-led, and therefore, it was extremely difficult to envision a scenario in which the rural areas of the Global South, which had limited population concentration, inadequate logistics infrastructure for large markets, and low technological standards, could achieve steady economic growth. In fact, there are very few examples of such steady economic growth in these regions.

However, with the arrival of the full-scale DX era, the adoption of so-called "leapfrog-type" development strategies has gained practicality. In this current situation, the possibility of adopting entirely new development strategies has opened up significantly for these regional areas. Today, the barriers to local regions in Global South countries utilizing cutting-edge digital technologies developed in advanced countries are relatively low. The adoption of such technologies can bridge the technological gap between advanced countries and local regions in Global South countries, as well as improve institutional inefficiencies. As a result, disadvantages in population concentration, logistics, and technological standards no longer constitute decisive obstacles to achieving steady economic growth.

Such a "leapfrog" development strategy will powerfully promote the development of rural areas in Africa, which has been difficult to achieve through conventional development strategies that focus on promoting labor-intensive manufacturing. The fact that rural areas in Global South countries can

promote substantial economic development through global connectivity based on DX can be seen as a real-world example of Richard Baldwin's Third Unbundling.

F urthermore, by leveraging interoperability platforms in cyber-physical systems to disseminate the unique wisdom of regional areas in Global South countries to the world, these regions—which have traditionally been mere "recipients" of development strategies—can assume the role of "donors" that share their wisdom with the world, at least from a technological perspective. Such information dissemination by local regions in Global South countries could be seen as a catalyst for guiding the evolutionary history of modern civilization toward a genuine multilinear evolutionary model.

The arrival of a new era of regional revitalization in the Global South is upon us.

(2) The role of universities/research institutions as "nodes of knowledge" (SEZs)

Finally, we will examine the role of universities/research institutions in the local regions of Global South countries when promoting the construction of a circular economy system through the strengthening of logistics digital connectivity as a typical "leapfrog-type" development strategy.

To summarize the challenges of promoting the construction of a circular economy system through the enhancement of logistics digital connectivity as a typical "leapfrog-type" development strategy, the following points can be identified.

First, it is necessary to address three challenges specific to the construction of a circular economy system through the strengthening of logistics digital connectivity. The first is the construction of cyber-physical systems, the second is the construction of methodologies to promote new value creation related to the circular economy (interoperability platforms in cyber-physical systems), and the third is the development of digital human resources.

In addition to these, the unique challenges of adopting a leapfrog-type development strategy include the accumulation of human and social capital through the promotion of digital education targeting a wide range of society, and the promotion of the penetration of modern institutions into the country and society. Based on this, the first challenge is the promotion of small and medium-sized enterprises utilizing digital technology (labor-intensive IT industry promotion), second, the "heavy chemical industry" transformation of digital services (large-scale corporate organization), and third, the promotion of participation in renewed supply chains by existing manufacturing industries.

It is expected that universities and research institutions in the local regions of Global South countries will play a particularly important role in enabling these regions to appropriately address the aforementioned challenges.

Universities and research institutions possess the necessary capabilities to address the aforementioned challenges effectively. First, universities and research institutions with engineering and information science departments are well-positioned to advance the development of cyber-physical systems and interoperability platforms for such systems in the local regions of Global South

countries. In fact, such institutions are the only entities capable of fulfilling this role.

Regarding digital talent development, universities are institutions of higher education, their educational content is higher education, and their students are university students. On the other hand, the main targets of the digital education promotion and the rapid development of a large number of digital talents, which are the issues raised here, are at a lower level than higher education. In other words, in rural areas of Global South countries, the biggest challenge is to connect a large number of people to the global outsourcing network as digital talent in a short period of time . Developing cutting-edge AI through higher education is not particularly required. However, as long as universities exist and their systems are in operation, it is not difficult to provide secondary education-level education programs separately from the regular education of universities as higher education. Masato Yasuhashi et al. [2024] cite examples of investments in human capital for the revitalization of manufacturing in Japan, such as the establishment of training centers, vocational training schools, and higher vocational schools. The same applies to the development of digital human resources under a "leapfrog" development strategy, where vocational training targeting a wide range of social strata and the expansion of secondary education are necessary, in addition to higher education.

To achieve this, while establishing entirely new educational institutions (Note 6) as Japan did to promote manufacturing industry revitalization is an option, from a cost perspective, it is more practical to provide special educational programs within universities. While it is impossible for secondary education institutions to offer higher education programs, universities, as higher education institutions, are fully capable of providing secondary education or vocational training programs.

Third, regarding the challenge of promoting the penetration of modern systems into countries and societies, in the local areas of the Global South, universities often have close ties with local governments, and their policy recommendations are often adopted by local governments. Therefore, it is reasonable to place sufficient expectations on universities in this regard.

As described above, when promoting the establishment of a circular economy system through the strengthening of logistics digital connectivity in rural areas of the Global South as a typical "leapfrog" development strategy, universities are strongly required to go beyond their roles as higher education institutions, and research institutions are required to go beyond their roles as research institutions tasked with conducting research on assigned topics, in order to address the above issues.

A "leapfrog-type" development strategy is one that prioritizes the development of knowledge-intensive industries from the outset, rather than following the traditional sequence of labor-intensive manufacturing, capital-intensive manufacturing, and then knowledge-intensive industries. Naturally, this strategy places significant demands on the level of intellectual activity. In the local areas of the Global South, universities and research institutions are the only entities capable of demonstrating such a high level of intellectual activity.

Thus, universities and research institutions that go beyond their originally assigned roles of

providing higher education and conducting research to contribute to the implementation of leapfrog development strategies in the Global South's rural areas are required to undertake new tasks related to "wisdom" that transcends the conventional concepts of physical capital and human capital (as industrial human resources), and connects humanity with the world in civilization.

In modern civilization, only specific forms of "wisdom" derived from the utilization of specific brain functions have been employed, and these specific forms of "wisdom" have also been utilized in development strategies. On the other hand, it is widely recognized in Eastern philosophy that "wisdom" exists not only in the form used in modern civilization but also in various other forms obtained by utilizing different parts of brain functions. According to "Brain Functional Analysis of Civilizations (BFAC)" (Note 7), examples of civilizations other than modern civilization that utilize these various forms of "wisdom" in the construction and operation of their civilizations can be found in several cases.

Drawing on these examples, the tasks required for implementing a "leapfrog-type" development strategy can be understood as activating various brain functions in humans, identifying forms of "wisdom" that differ from the conventional ones based on these functions, and mapping them onto actual economic development activities.

The act of mapping such "wisdom" obtained through the activation of brain functions that are different from the usual ones onto actual society can be called "epistemic." From this, I consider it appropriate to capture the role of universities/research institutions that play a role in promoting "leapfrog-type" development strategies in the local areas of the Global South using the new concept of SEZ (Special Epistemic Zone).

During the field survey conducted by the Musashino University International Research Institute (MIGA) in Ethiopia from May to June 2025, all local universities that participated in the workshop expressed a strong desire to fulfill the role of SEZ, and the establishment of global collaborative organizations was strongly requested. This fact concludes this chapter.

[Note]

(Note 1) The evolutionary history of modern civilization, including the process of industrialization (Industrial Revolution), is analyzed in detail in Applied Infosocionomics. See Shumpei KUMON and Mitsuhiro MAEDA, Applied Infosocionomics: A Guidebook for Building an Information Society in Developing Countries (ERISE Press, 2011). The English translation of this book is Shumpei KUMON and Mitsuhiro MAEDA, Applied Infosocionomics: A Manifesto of Informatized Society Building in Developing Economies (ERISE Press, 2011).

(Note 2) The IMF Signaling System classifies countries as Signal Green if, under the assumption that current conditions remain unchanged, they are deemed capable of repaying their debts even after stress tests are conducted, such as a significant decline in international prices for major exports (e.g., specific agricultural products) and a significant increase in international prices for major imports (e.g., crude oil). countries that are expected to maintain debt sustainability under current conditions but may face issues under stress tests are classified as "yellow," and countries that are expected to face debt sustainability issues under current conditions are classified as "red." New loans should be strictly limited to countries classified as "green." The Japanese government is strictly adhering to this system, and new yen loans are limited to countries with a green signal. New yen loans are not provided to countries with a yellow (or red) signal.

(Note 3) Akira Ooka, "The Trajectory of Kaizen in Africa: From the Origins of Japanese-Style Kaizen in Ethiopia to the Ambitions of the Entire Continent (2009–2025)," Civilization Diversity Association, 2025.

(Note 4) Addis Ababa University of Science and Technology (May 28, 2025), Dire Dawa University (May 30, 2025), Jimma University (June 2, 2025), Adama University (June 3, 2025), Addis Ababa University (June 4, 2025).

(Note 5) Masato Anbashi, Sozo Iwasaki, Ryosuke Fujioka, and Keita Oikawa, "Policy Proposal IV: 'Leapfrog-Type' Development Strategy," in Pathways to Inclusive Growth: Diversifying Development Strategies (Musashino University International Comprehensive Research Institute (MIGA), November 2024), pp. 72–80.

(Note 6) The Japanese government established higher vocational schools in 1961 as new higher education institutions in response to demands from industry. The Higher Vocational School Act, enacted in 1961, is a special provision under the School Education Act. It is important to note that while higher vocational schools are not recognized internationally under the Washington Accord, they are classified as higher education institutions within Japan.

(Note 7) Mitsuhiro Maeda, "The Civilizational Diversity and the Evolution of the Modern Civilization -Towards the Brain Functional Analysis of Civilizations," ERISE Press, 2022

Profiles

Prof. Hidetoshi NISHIMURA, Director, Musashino Institute for Global Affairs Specially Appointed Prof. Director of Musashino Institute for Global Affairs Supreme Advisor to the President of Economic Research Institute for ASEAN and East Asia (ERIA) Graduated from the Faculty of Law, the University of Tokyo and obtained a Master's Degree in International Development and Economics from Yale University. Joined the Ministry of International Trade and Industry in 1976. Has assumed numerous positions, Vice Governor for International Affairs of Ehime Prefecture, Director-General of the Business Support Department of the Small and Medium Enterprise Agency, Executive Managing Director of the Japan-China Economic Association.Assumed position of founding ERIA Executive Director in 2008 and subsequently was appointed as ERIA's first President in 2015, and was reappointed as President of ERIA till 2023.Haiku Poet as Gania Nishimura.Editor of The Matsuyama Declaration1999.Representative of Haiku Magazine TEN I.

Prof. Mitsuhiro MAEDA, Musashino Institute for Global Affairs

Born in 1962. Graduating from Department of Law, University of Tokyo, Prof. Maeda has stepped up so-called ' a Revolving Door Career Path' between the Government and Academia. In the Government of Japan, he served as Director for International Finance, and Director of Financial Cooperation Division, Ministry of Economy, Trade and Industry. In Academia, he served as Associate Professor of University of Saitama, Visiting Professor of Graduate Institute of Policy Studies (GRIPS), Visiting Fellow of the Royal Institute of International Affairs (Chatham House, UK), Visiting Fellow of Johns Hopkins University School of Advanced International Studies (SAIS, USA) and Visiting Fellow of University of Cambridge. He is now serving as Professor of Advanced Institute of Industrial Technology (AIIT), President of ERISE (Epistemic Research Institute of Social Ethics), Vice President of the Global Society of Applied Infosocionomics (Glo-SAI), and Visiting Professor of Musashino University.

Masahiro Nakamura, Ph.D. Representative Director and CEO, LEXER RESEARCH Inc. and President, Green CPS Council. Dr. in Engineering from the Graduate School of Engineering, Osaka University. 1993 joined Komatsu Ltd. and conducted research and development of spatial understanding and cognitive technology at the Production Technology Research Laboratory, and promoted the development of applications for automation systems, etc. In 1993, he established LEXER RESEARCH Inc. and became its representative director. In 2022, he founded the Green CPS Council, which promotes GX/DX activities for a carbon-neutral society. In 2016, the company announced the "CPPS Technology Concept and 2040 Manufacturing Vision (Japan Society of Mechanical Engineers)," which sets out guidelines for manufacturing in Japan, and was featured in the Ministry of Economy, Trade and Industry's Manufacturing White Paper. In 2022, he established the Green CPS Council, an incorporated association promoting GX/DX activities towards a carbon-neutral society, and became its representative director. In addition to promoting proposals for new social systems with members from industry and academia, he has been focusing on GX/DX human resource development, and has developed human resource development courses not only in Japan but also in collaboration with industry, academia and government in ASEAN countries, focusing on activities to enhance Japan's international appeal.

Takahiro Fukunishi, Ph. D (Economics) IDEAS Professor / Senior Research Fellow, Institute of Developing Economies, JETRO
Ph. D (Economics)

〈Field of Research〉

Development Economics in sub-Saharan Africa with focus on labor market, urban informal sector and industrialization.

Papers in process

- Structural Changes in Africa: Accounting for rural-urban wage gap
- Skill Mismatch of Vocational Trainees in Ethiopia
- Displacement Effects of Educational Expansion: Vocational Secondary Education in Ethiopia

〈Publication〉

Kiyoyasu Tanaka, Takahiro Fukunishi 2022. “Rules of origin and exports in developing economies: The case of garment products,” *Journal of Asian Economics*, Volume 82.

Takahiro Fukunishi, and Christian Samen Otchia 2019. “Youth Employment under Economic

Growth in sub-Saharan Africa: School-to-Work transitions in urban Ghana and Kenya," IDE Discussion Paper (759).
Takahiro Fukunishi, and Tomohiro Machikita 2017. "Vocational Education and Employment Outcomes in Ethiopia: Displacement Effects in Local Labor Markets," IDE Discussion Paper (678).
Takahiro Fukunishi and Tatsufumi Yamagata eds. 2014. *The Garment Industry in Low-income Countries: An Entry Point of Industrialization*, Palgrave Macmillan.
Takahiro Fukunishi ed. 2014. *Delivering sustainable growth in Africa: African farmers and firms in a changing world*, Palgrave Macmillan.

Mr. Satoru Kumagai serves as the Senior Researcher of the Development Studies Center at the Japan External Trade Organization's Institute of Developing Economies (IDE-JETRO). He holds an MSc in Global Market Economics from the London School of Economics and Political Science and a Master in Media and Governance from Keio University.

Most significantly, Mr. Kumagai was awarded the prestigious 40th Masayoshi Ohira Memorial Prize in 2024 for his groundbreaking work with Dr. Nakamura on Malaysia's economic development strategy, specifically addressing solutions for overcoming the middle-income trap. This recognition underscores the significant impact of his research on understanding economic development in Asia.
His major publications on Malaysia include:
"Economic Development Strategy Learning from Malaysia: Hints for Overcoming the Middle-Income Trap" (with M. Nakamura, Sakuhinsha, Nov 2023)
"How Politics and Economy Changed in Post-Mahathir Malaysia" (with M. Nakamura, IDE-JETRO, 2018)
"The Middle-Income Trap from the Viewpoint of Trade Structures: Are the Geese Trapped or Still Flying?" (Journal of International Commerce, Economics and Policy, 6(3), 2015)
His other influential works on Asian economic integration and development include:
"The Economics of East Asian Integration: A Comprehensive Introduction to Regional Issues" (with M. Fujita and I. Kuroiwa, Edward Elgar, 2011)
"Economic Integration in East Asia: Perspectives from Spatial and Neoclassical Economics" (with M. Fujita and K. Nishikimi, Edward Elgar, 2008)
"Economic Impacts of the US-China Trade War on the Asian Economy: An Applied Analysis of IDE-GSM" (with T. Gokan, K. Tsubota, et al., Journal of Asian Economic Integration, Jul

2021)

His research uniquely combines theoretical frameworks with practical policy implications, making it valuable for both academic researchers and policymakers. Mr. Kumagai's expertise in using the IDE Geographical Simulation Model (IDE-GSM) has provided crucial insights into regional economic development and integration patterns across Asia.

Ikumo Isono was educated in Japan and received a bachelor's degree in economics from Saitama University in 1998. He has a master's degree in economics from the University of Tokyo in 2000. He joined the Institute of Developing Economies, JETRO (IDE-JETRO) in 2005 as a research fellow. He was a research fellow in the Bangkok Research Center, JETRO from 2009 to 2011. He was seconded to the Economic Research Institute for ASEAN and East Asia (ERIA) from 2011 to 2013 as an economist and from 2020 to 2024 as a senior economist. He was seconded to European Commission, Joint Research Centre (JRC-Seville) as a visiting researcher from 2017 to 2018. He was appointed director of the economic geography studies group at IDE-JETRO in 2024, and was appointed director of the economic integration studies group at IDE-JETRO in 2025. His expertise is in spatial economics and connectivity aspects of economic integration in ASEAN and East Asia, including infrastructure development, economic corridors, logistics, trade and transport facilitation, free trade agreement (FTA), and digital connectivity. He has participated in several ERIA's flagship projects, such as the Comprehensive Asia Development Plan, Mid-Term Review of the Implementation of AEC Blueprint, and ASEAN Vision 2040.

Souknilanh Keola is a Senior Economist at ERIA. He received his Diploma of Engineering from Tokyo National College of Technology in 1995, Bachelor of Computer Sciences from Toyohashi University of Technology in 1997, and Master of Economics from Nagoya University in 1999. He joined the Institute of Developing Economies (IDE-JETRO) in 2006. His journal publications primarily focus on regional economics and the application of big spatio-temporal data, especially remote sensing data, in the social sciences.

Select publication:

1. Hayakawa, K., Keola, S., Sudsawasd, S., & Yamanouchi, K. (2025). International

bridges and informal employment. *Journal of Comparative Economics*.

2. Andersson, M., Hayakawa, K., Keola, S., & Yamanouchi, K. (2025). Impacts of international transport infrastructure: Evidence from Laotian households. *Journal of Asian Economics*, 97, 101876.

3. Hayakawa, K., Keola, S., & Urata, S. (2022). How effective was the restaurant restraining order against COVID-19? A nighttime light study in Japan. Hayakawa, K., Keola, S., & Urata, S. (2022). How effective was the restaurant restraining order against COVID-19? A nighttime light study in Japan. *Japan and the World Economy*, *63*, 101136.

4. Tanaka, K., & Keola, S. (2017). Shedding light on the shadow economy: A nighttime light approach. *The Journal of Development Studies*, 53(1), 32-48.

5. Keola, S., Andersson, M., & Hall, O. (2015). Monitoring economic development from space: using nighttime light and land cover data to measure economic growth. *World Development*, 66, 322-334.

6. Kumagai, S., Hayakawa, K., Isono, I., Keola, S., & Tsubota, K. (2013). Geographical simulation analysis for logistics enhancement in Asia. *Economic Modelling*, 34, 145-153.

Maika Watanuki Senior Consultant,

NX Logistics Research Institute and Consulting, Inc. (NXLIX)

Maika is a Senior Consultant at NXLIX. She provides private companies with consulting services to improve their logistics and rebuild supply chain. She also conducts research on various industries to develop new logistics business. Prior to joining the NXLIX in 2018, she worked for the Trade and Competitiveness unit at the World Bank as a Trade Facilitation Analyst. She engaged in analyzing logistics infrastructure and services that were embedded in policy works for African governments to boost foreign and regional trades and to reduce trade costs. In her earlier career, she was in the freight forwarding industry with Yusen Logistics for 3 years where she gained her expertise in forwarding and logistics business for both air and ocean transport. She also contributed to infrastructure export at the Infrastructure & PPP team at PwC Advisory where she worked on feasibility

studies globally for both policy makers and Japanese companies, aiming to enter overseas infrastructure markets. Her publication includes "*Logistics Guidebook 2024- Kindle Edition* (2024, NXLIX)"; "*Logistics Technical Handbook 2024-Kindle Edition* (2025, NXLIX)", and "*Review of logistics service regulations for freight forwarding businesses: what should be addressed for a better logistics regulatory framework ?* (2015, World Bank)"

Yutaka Hosoyamada NX Logistics Research Institute and Consulting, Inc. Senior Consultant

He graduated from the Faculty of Economics at Hosei University. He joined Nissin Corporation in 2001 as a licensed customs specialist, responsible for customs clearance operations related to apparel, miscellaneous goods, food products (including alcoholic beverages), and machinery, handling both import and export procedures. In 2004, he participated in practical training at Shanghai Gaosin International Logistics Co., Ltd., gaining hands-on experience in local export and import declarations, customs duty payments, and refund procedures.In 2005, he joined Macnica Inc. and was assigned to the Product Marketing Department, where his responsibilities included managing marketing and sales of semiconductors and electronic components to major electronics manufacturers.Since 2007, he has been working at NX Logistics Research Institute and Consulting Inc. (formerly Nittsu Research Institute and Consulting, Inc.), actively engaging in a wide range of logistics consulting projects. These include promoting modal shifts, supporting joint logistics distribution, and conducting domestic and international logistics research. Additional responsibilities encompass trial transportation support and feasibility studies for local business entry.

He possesses extensive experience as a lecturer at various institutions and organizations, including Sompo Japan Insurance Inc., Waseda University Social Logistics Research Institute, Ryutsu Keizai University Special Lectures, Japan International Freight Forwarders Association (JIFFA), and Japan Customs Brokers Association. He has also published articles on international logistics research, including contributions to " *Transportation and Economics* "(2017, Institute for Transport Economics), sharing insights and research findings on international logistics.

TASAKA Mikio Research Fellow: After graduating from the Faculty of Law at Chuo University in 1978, he joined Nippon Express Co., Ltd. After graduating from the Institute for International Study and Training (IIST) in 1983, he was sent to Nippon Express U.S.A., Inc. (NEU) and Union Pacific Railroad for training. Since then, he has traveled back and forth between Japan and the US three times, working in the US for a total of about 17 years. In 2005, he was appointed GM, Chicago Ocean Cargo Branch of NEU. In 2008, he returned to Japan as GM, Logistics Consulting Division of Nittsu Research Institute and Consulting, Inc., the predecessor of the current NX Logistics Research Institute and Consulting, Inc. He was appointed Executive Managing Director of the company in 2014. And then he was appointed Research Fellow of the company in 2018. He is currently active as an academic member of the National Land and Infrastructure Development Special Committee of the Japan Chamber of Commerce and Industry, and a visiting lecturer at Kyoto University Business School, the Japan International Freight Forwarders Association, the Japan Institute of Logistics Systems, etc.

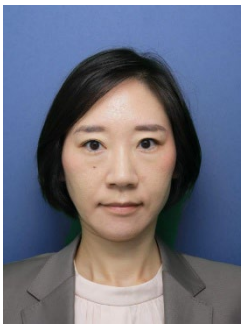
Dr. Venkatachalam ANBUMOZHI

Venkatachalam Anbumozhi is the Director of Research and Strategy and Innovations at the Economic Research Institute for ASEAN and East Asia (ERIA), Indonesia. His previous positions include Senior Capacity Building Specialist at the Asian Development Bank Institute, Assistant Professor at the University of Tokyo, Senior Policy Researcher at the Institute for Global Environmental Strategies, and Assistant Manager at Pacific Consultants International, Tokyo. He has published several books, authored numerous research articles, and produced many project reports on renewable energy policies, green infrastructure design, and private sector participation in low-carbon green growth. Anbumozhi was invited as a member of the G20 task force on Green Financing, APEC Expert Panel on Green Growth, the US-ASEAN advisory group on Smart Low carbon cities, and the ASEAN Panel for promoting climateresilient growth. He has taught energy resource management, international cooperation for sustainable development, and finance for inclusive growth at the University of Tokyo He obtained his Ph.D. from the University of Tokyo.

Dr. Yasushi UEKI Yasushi Ueki is President of Bangkok Research Center and Senior Research Fellow, Institute of Developing Economies (IDE)/JETRO Bangkok, Bangkok, Thailand. He is also Adjunct Researcher of Research Institute of Automobile and Parts Industries, Waseda University, Tokyo, Japan and Research Fellow of Economic Research Institute for ASEAN and East Asia (ERIA), Jakarta, Indonesia. He received Ph.D. in international public policy from Osaka University, Japan in 2004. After joining IDE in 1999 as research fellow, he served United Nations Economic Commission for Latin America and the Caribbean (ECLAC) in Santiago, Chile as an expert from 2002 to 2005 and ERIA as an economist from 2014 to 2018. His recent research focuses on technologies, management, and policies for industrial development and innovation.

Mr. Fusanori IWASAKI, Research Institute of Economy, Trade and Industry (RIETI) Fusanori Iwasaki is a Consulting Fellow of the Research Institute of Economy Trade and Industry (RIETI), specializing in international relations. He is also a Non-Resident Fellow of the Institute of Developing Economies, Japan External Trade Organization (IDEJETRO) in Japan. He obtains a master's degree from the Graduate School of Law in Kyoto University, Japan.

Yu Akiyama Visiting Researcher, Musashino University



Graduated from the Faculty of Law at Kokugakuin University in 2005. Joined Misawa Home Co., Ltd. in 2005. Joined Aichi Co., Ltd. in 2008 and worked as a preschool teacher at Ishigami Kindergarten, affiliated with the Kenchu Welfare Association, a social welfare corporation, from 2019. October 2023: Joined the Economic Research Institute (ERIA) as Chief Advisor Secretary, supporting various research projects including the Global South Research Group.December 2024: Became a Visiting Researcher at MIGA. Supported the establishment of the Global South Research Society and engaged in network-building activities. Participated in the research project “Urban Development to Strengthen Water Ecosystems,” jointly promoted by MIGA and the Japan Disaster Risk Reduction Platform (a general incorporated association).April 2024: Presented at the “Global Environmental Issues Countermeasure Seminar” at Da Nang Dong A University (Da Nang) on the topic “Enhancing

Urban Development through Water Ecosystems" (co-presented with Professor Mitsuhiro Sanada of the Institute of Industrial Technology, Tokyo Institute of Technology). November 2024: Supported the presentation of the Global South Research Society's policy package "Path Diversity" at the T20 Brazil Side Event themed "No One Left Behind."December 2024: Contributed to the signing of a contract for the "Master Plan for Strengthening Resource Circulation through Enhanced Digital Connectivity in Logistics in Africa" under the Ministry of Economy, Trade and Industry (METI)'s "2023 Supplementary Budget 'Global South Future-Oriented Cooperation Project (Formulation of a Strategy to Strengthen Economic Partnerships with Africa and Promotion of Overseas Expansion of Japanese Companies, etc.)'."