



The Role of Exports in Manufacturing Pollution in Sub-Saharan Africa and South Asia

Executive Summary



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INTRODUCTION: THE TRADE-GROWTH-POLLUTION NEXUS AND GOVERNANCE ASPECTS

In a globalised world economy, trade is among fundamental drivers of economic growth, creates jobs and contributes to poverty reduction, facilitates the diffusion of technology and knowledge spillovers, and encourages competition in domestic and international markets and, ultimately, leads to a higher domestic market income level. In recent decades, the deepening of outsourcing in most industries and its fragmentation in global value chains has changed production internationally. Developing countries, including sub-Saharan Africa (SSA) and South Asia, have increased their participation in industrial activities in this process as producers of final goods or inputs to be exported. As part of that context, global merchandise trade has increased substantially over the last two decades, albeit the most prominent growth occurred between 2001 and 2010, increasing 146 per cent, according to data from ITC (ITC, 2021).

The developing countries participating in global trade and value chains are often discussed but not questioned — they mention the direct benefits of growth, job creation, and technological spillovers. However, a critical policy aspect calls for attention: trade-associated pollution or the trade-growth-pollution nexus. While industries are organising their value chains internationally, which allows for increasing global trade and promoting economic growth to developing economies, including the poorest ones, pollution is a negative externality to be assessed in the development process.

The trade-growth-pollution nexus has been increasingly underlined in trade policies and treaties worldwide, putting pressure on nations to improve environmental standards and reduce adverse effects. By supporting economic growth and development, increased trade can affect the environment positively by enhancing the capacity to manage pollution more effectively (OECD, 2021). The more integrated within the world economy, the more exposed to environmental standards imposed by trade partners the exports will be. Another environmentally beneficial effect of trade is the ease of accessing environmentally friendly technology. Those technologies can make the local production process more efficient by reducing the use per unit of output, saving energy,

water, and avoiding other environmentally harmful substances. External incentives to adopt more stringent environmental standards are key drivers of changes along the supply chain in adopting cleaner production processes and technologies (Harris and Roach, 2013; WTO, 2018).

The study aims to identify the role of trade and value chains in driving manufacturing pollution in SMEP countries, which corresponds to thirteen countries subdivided into SSA SMEP countries, namely the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Nigeria, Rwanda, Senegal, Uganda, the United Republic of Tanzania, and Zambia, and SA SMEP countries, namely Bangladesh, Nepal and Pakistan. Furthermore, four countries are selected for an in-depth assessment: Kenya, the United Republic of Tanzania, Bangladesh, and Pakistan.

The so-called “green revolution” in which producers, government and consumers become aware and consider the impacts of the manufacturing activities in the supply chain is well underway. This mindset change has emerged as a global trend in the search for more sustainable manufacturing. This paradigm shift results from public and private pressures. While countries are increasing the stringency of environmental regulations, there is also pressure exerted by international buyers and consumers along the supply chain towards pollution prevention and cleaner production. Besides being market and economic-driven, these changes occur due to a rising ecological awareness.

In line with the growing global demand for sustainable manufacturing, this study conducted a detailed analysis involving an estimate of impacts on the local environment in economically important sectors. The study also identifies the governance gaps (e.g., public and private) and recommendations for selected country cases, framed in the context of the most polluting manufacturing trade activity.

SMEP ECONOMIES, MAIN MANUFACTURING SECTORS AND KEY POLLUTING INDUSTRIES

The poor economic performance of many Sub-Saharan African (SSA) and South Asian countries has been associated with low growth of total exports, but mainly manufacturing exports (Hartmann et al., 2020; Nabi et al., 2010; Sundaram et al., 2011). Since 2000, along with the commodities boom, these countries have become more integrated into the global trade market, albeit trade openness¹ differs between South Asia and SSA countries. The challenge for SMEP countries remains, however, to accelerate and deepen their integration into global trade.

More than just increasing trade as an absolute measure of currency flows, the quality of their integration into global trade also matters. A country with a high GDP per capita or Human Development Index (HDI) generally experiences a high level of productive capacities (UNCTAD, 2021). SMEP countries are at the bottom of the distribution of Productive Capacity Index (PCI)² scores, with considerable inter- and intraregional variations in country-specific performances. This weak productive capacity affects policies' design and implementation, undermining the effective functioning of regulations and institutions that ensure sustainable economic practices. In terms of trade, it is crucial to foster productive capacities to diversify exports and promote the necessary structural transformation to achieve sustainable development.

The need for further integration of SMEP countries into global trade and the importance of improving for productive capacities, allowing for these countries to export more than just commodities or raw materials, their development strategies should be associated with regulations imposing restrictions on unsustainable trade, whether through tariff or non-tariff barriers such as environmental, health or safety standards (UNCTAD, 2020). These could spur a more rapid transition towards sustainability.

Specific policies and efforts enable environmentally sustainable progress that fosters less-polluting activities and socially inclusive development in SMEP countries (The World Bank and OECD, 2012).

Furthermore, a common characteristic of the Least Developed Countries (LDC), more generally, is the relative dependence on the exports of traditional commodities, which serves as an input to other countries' exports in several sectors. The poor performance observed for SMEP countries regarding the category of structural change demonstrates a dependence on commodities exports and their low degree of integration into global value chains. SMEP countries export-to-GDP ratio average was about 19 per cent in the 2000-2019 period, substantially below the developing country average of about 35 per cent (UNCTADstat, 2021). The relatively minor role exports play in the economic performance of SMEP countries has been shifting over time, with the expansion of exports partially outweighing the reduction of domestic demand. Thus by developing productive and export capacities, SMEP countries can surpass structural obstacles, becoming more competitive and further increase their degree of integration into global value chains.

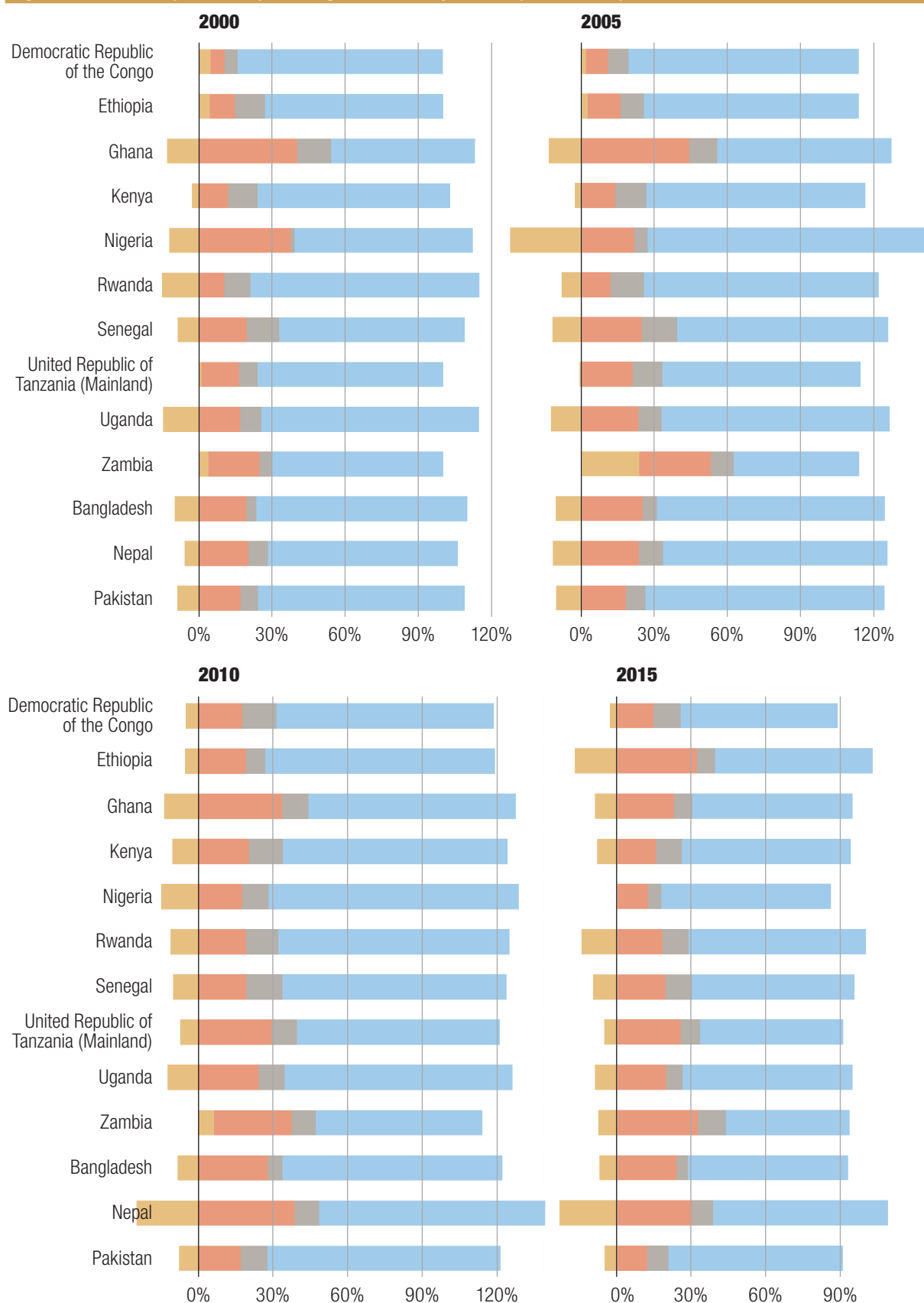
Compared to other economic sectors, such as Agriculture and Mining, Figure 1 shows a minor role of the manufacturing sector as part of SMEP economies.

Although the manufacturing sector in South Asia countries has been increasingly developing since the 2000s, manufacturing remains small and uneven within the region. Differences in the productive structure of SSA economies are similarly significant, whereby manufacturing industries are still at an early stage of development. Within the manufacturing sector, two key polluting industries have been identified as the most likely to threaten the environment and human health in SSA and South Asia regions: Food and beverages in SSA and textiles and wearing apparel in South Asia (O'Neill et al., 2020).

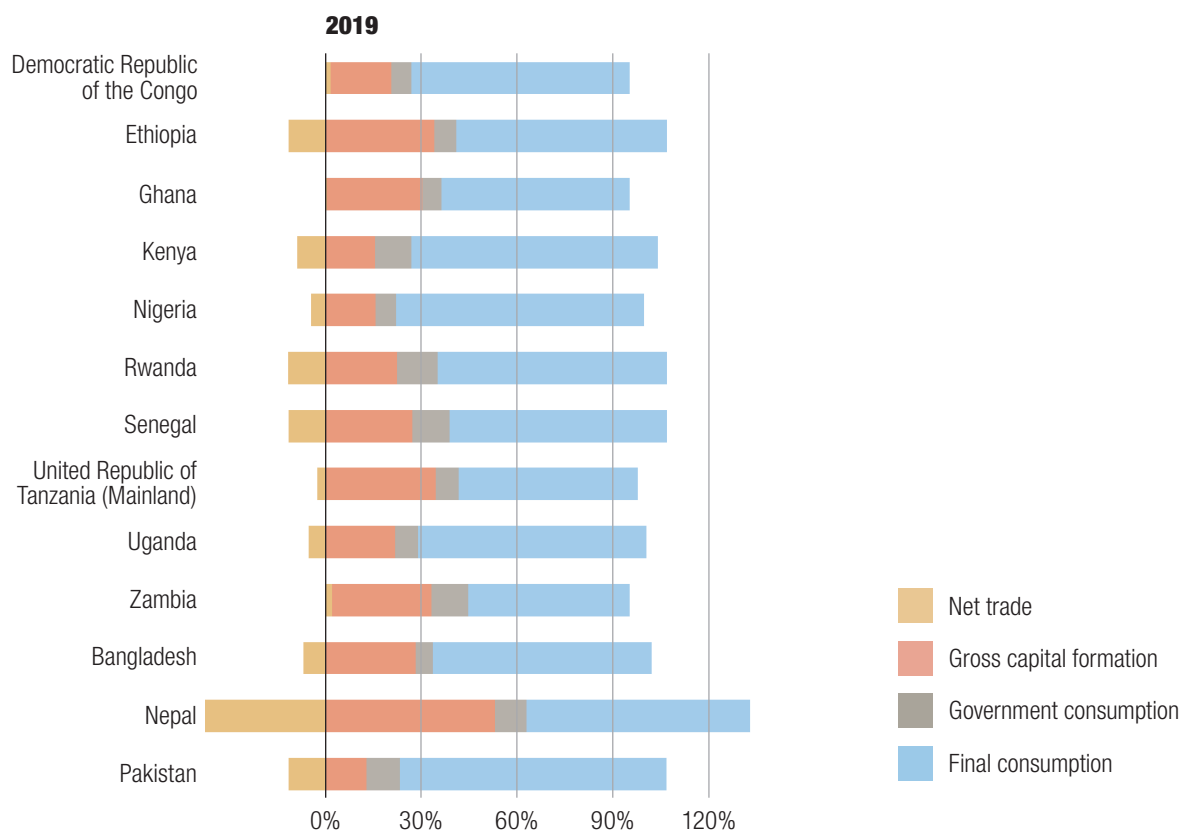
Two South Asian countries that feature in the top three rankings of SMEP manufacturing exports to the global market are Bangladesh and Pakistan, respectively, with 0.15 and 0.13 per cent of total global exports in the same period. The global market share of Nigeria's manufacturing exports ranks in the third position, albeit corresponding to only 0.07 per cent of global manufacturing exports. Evidence suggests that there has been steep growth in total exports attributed to

1 Openness to trade is measured by the ratio of exports plus imports over GDP.

2 PCI ranges between 0 and 100, is a multidimensional index that can help compare the driving forces that fuel progress towards sustainability, details can be seen in the report.

Figure 1. GDP components in percentage based on expenditure per selected year

Source: Based on data from World Bank (2021).

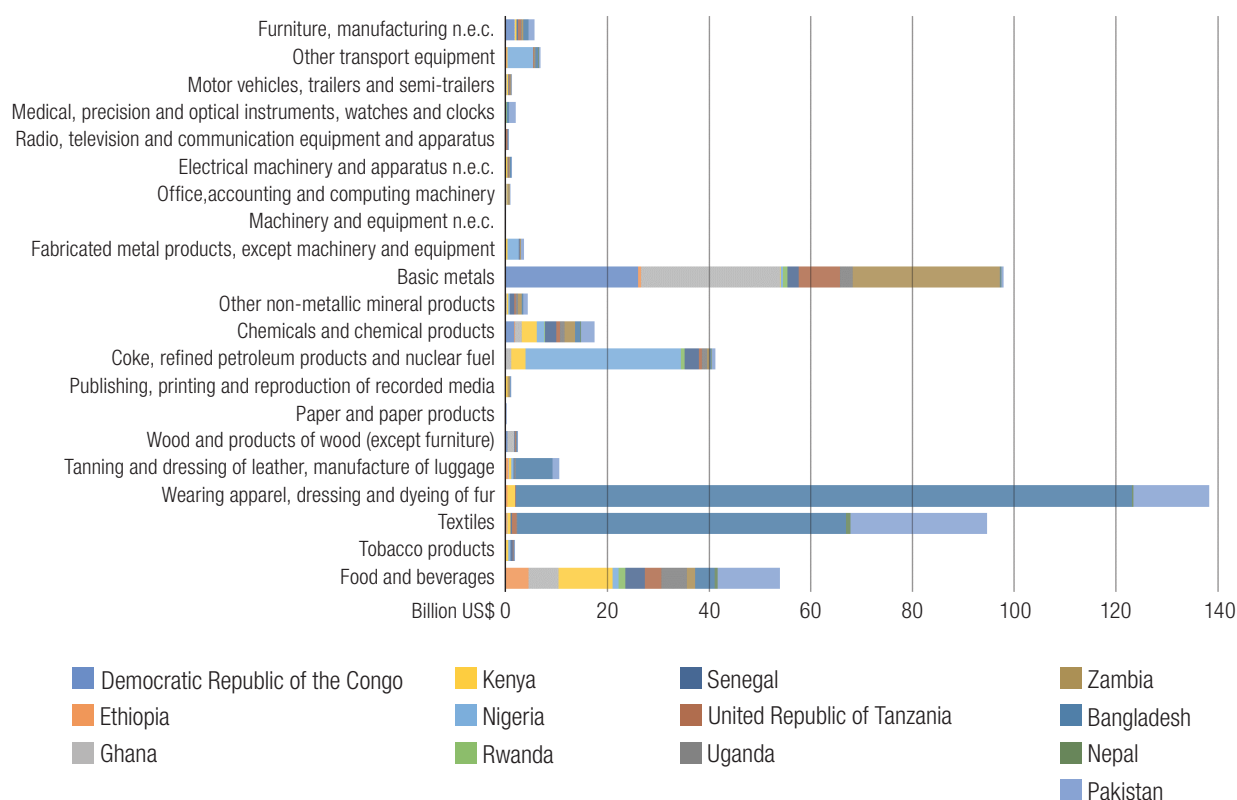
Figure 1. GDP components in percentage based on expenditure per selected year

Source: Based on data from World Bank (2021).

SSA countries. The total export value increased from US\$ 26 billion in 2001 to US\$ 108 billion in 2019. The increase in manufacturing exports of the South Asia region is also noticeable, from US\$ 6.5 billion in 2001 to US\$ 48 billion in 2019.

The majority of SMEP countries are active in one or more food and beverage segments. For instance, in Kenya and the United Republic of Tanzania, the total value exported in 2015-2019 amounts to US\$ 10.7 billion and US\$ 3.2 billion, respectively. Pakistan, in contrast, exported US\$ 12.1 billion and Ghana US\$ 5.9 billion in the same period. This distribution of SMEP manufacturing exports is depicted in Figure 2, which combines the trade performance of manufacturing activities and individual countries. It also shows that a few SMEP countries export certain manufacturing activities, such as Bangladesh, Pakistan, and Nepal, in textiles, wearing apparel and tanning and leather dressing. Moreover, few SMEP countries export basic metals (i.e., Zambia, Ghana, the Democratic Republic of the Congo and the United Republic of Tanzania).

The study identifies possible existing barriers to increase export penetration, such as environmental regulations, a trade barrier that imposes restrictions on pollution-intensive products exported by less regulated countries. For SMEP countries, chemicals and chemical products are another essential exporting activity, usually involving a high polluting production. The sector generated US\$ 17.5 billion to the region in the 2015-2019 period, but its prominence occurs specifically in the Democratic Republic of the Congo, Kenya, Pakistan, Senegal, and Zambia. Pollution driven by the increase of exports of chemicals and chemical products and other pollution-intensive manufacturing industries is detrimental to the environment and health. However, exposing exporters to different product standards and regulations in various countries can help pressure manufacturing industries to transit more rapidly towards sustainability. In other words, to develop the necessary production capacity to promote structural transformation, resulting in a more diversified manufacturing exports portfolio and a higher degree of integration into global value chains

Figure 2. Value of manufacturing exports by activity and country (2015-2019)

Source: Based on data from ITC (2021).

of SMEP countries.

A first assessment of the potential environmental vulnerability of SMEP countries pattern of trade is obtained by observing the total quantity of products exported³. In this analysis, the study shows that the volume of total manufacturing exports in quantity is lower than the volume imported, except in Bangladesh, which has a larger volume of products being exported than imported in the average of 2001-2019. Scale and composition effects, in combination, lead to higher levels of pollution from trading, which can be compensated through the technique effect, for example, the adoption of more efficient and environmentally friendly technologies and practices.

The foreign demand for SMEP manufacturing products underlying the trade volume and the geographical distribution of tradable goods from SMEP countries is

concentrated on five countries that were the leading destination for the volume of manufactured products exported by SMEP countries in 2015, representing 42 per cent of manufacturing exports⁴.

Over the last decade, five SMEP countries stood out in the quantity of manufacturing exports, namely Pakistan (441 million tonnes), Bangladesh (363 million tonnes), Kenya (92 million tonnes), Nigeria (47 million tonnes) and Nepal (15 million tonnes). The extent to which significant exports in quantity imply more pollution will depend on sustainability practices adopted in using resources and production processes.

The fast expansion of trade in manufactured goods can be detrimental to local air quality if this expansion relies on dirty technologies. Considering only carbon dioxide (CO₂) emissions at the country level, the

3 This is an indicator to relate the scale of economic activity to environmental quality, as described in (Grossman, Gene.M Krueger, 1994).

4 They are Afghanistan, Mali, India, the Democratic Republic of the Congo and China.

literature shows a positive relationship between trade openness and carbon emissions, as indicated in the study of Onoja et al. (2014) for the African continent (Onoja et al., 2014). Figure 3 illustrates the level of territorial emissions⁵ by SMEP target countries, totalling 590 million tonnes of carbon dioxide equivalent⁶ (CO₂eq) in 2019. This emission level is relatively low compared to the 16 gigatonnes the region of Asia emitted in the same year. Developed countries in the European region, for instance, released 5.5 gigatonnes of CO₂eq in 2019.

Figure 3 shows an increase in emissions between 2001 and 2019, which raises concern about the level

of local pollution, whether due to the rise of carbon emissions or other types of pollutants. Consequently, it requires that countries make efforts in all sectors of the economy to reduce their pollution and promote cleaner production. As manufacturing processes are also affected, there is a need to adopt more sustainable practices, which is a challenge for SMEP countries, especially in export-driven manufacturing pollution.

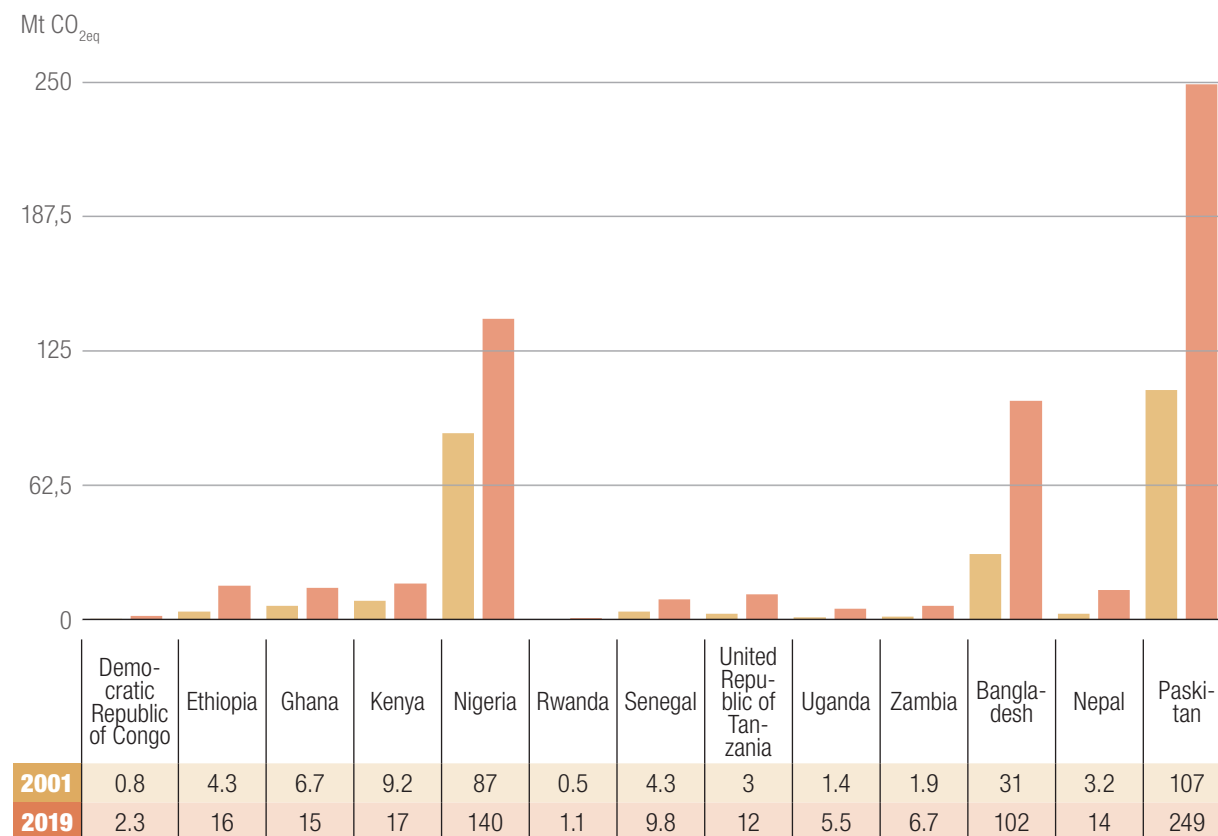
A. Life Cycle Assessment

There is growing attention to the environmental burdens associated with trade, especially considering the producer and the consumer perspectives. Studies addressing these burdens are frequently conducted by implementing Environmentally Extended Input-

5 It refers to carbon dioxide emissions attributed to the country in which they physically occur.

6 A carbon dioxide equivalent is a metric measure used to compare the emissions from various greenhouse gases because of their global-warming potential, by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.

Figure 3. Carbon emissions of SSA and South Asia countries in 2019



Source: Based on data from ITC (2021).

Output Analysis (EEIOA)⁷ combined with process-based Life Cycle Assessment (LCA)⁸ in a hybrid framework (IO-LCA).

The IO-LCA normalises the results to highlight manufacturing sectors and their environmental impact. Normalisation⁹ makes it possible to translate abstract impact scores for every impact category into relative contributions of the production stages or activities to a reference situation, providing a better understanding of impact magnitude.

The analysis used two system boundaries approaches to map the environmental burden. The first considered only the manufacturing activity inside the plant, and this approach is called gate-to-gate system boundary. The second adopted the supply chain perspective, from raw material production to the manufacturing process at the plant. This approach provides a broader view by including upstream processes from the supply chain, called the cradle-to-gate system boundary. The analysis does not include downstream¹⁰ processes starting from the plant gate to end-use or grave given the scope of the

study, which is manufacturing exports. Figure 4 and Figure 5 present the normalised relative contribution of manufacturing sectors in the SMEP countries in South Asia and SSA, respectively.

In South Asia, Figure 4 shows expressive participation of the textiles sector in all the impact categories, considering both the cradle-to-gate and the gate-to-gate system boundaries. The textile industry has long been considered one of the most polluting industries in the world. This impact is mainly related to the use of harmful chemicals, high consumption of water and energy, and the generation of large quantities of solid and gaseous wastes (Roy Choudhury, 2014). The SEI-York study (O'Neill et al., 2020) found that textiles were the industries most commonly associated with pollution by stakeholders in Bangladesh and generated the most significant number of articles in the literature review. Figure 4 also shows non-metallic mineral products, and chemical and chemical products appear as relevant sectors. The non-metallic mineral products sector significantly impacts the environment (Binder, 2001), mainly due to the high energy consumption and high rate of fossil fuel usage and global warming emissions (Hu and Kavan, 2014). Regarding the chemical industry, it is recognised as one of the most potent sources of environmental pollution, and its environmental impacts are well documented (Beschkov, 2009), involving many persistent, bioaccumulative or hazard emissions (OECD, 2001), not bypassing damages originating from the exhaustion of natural resources (Beschkov, 2009).

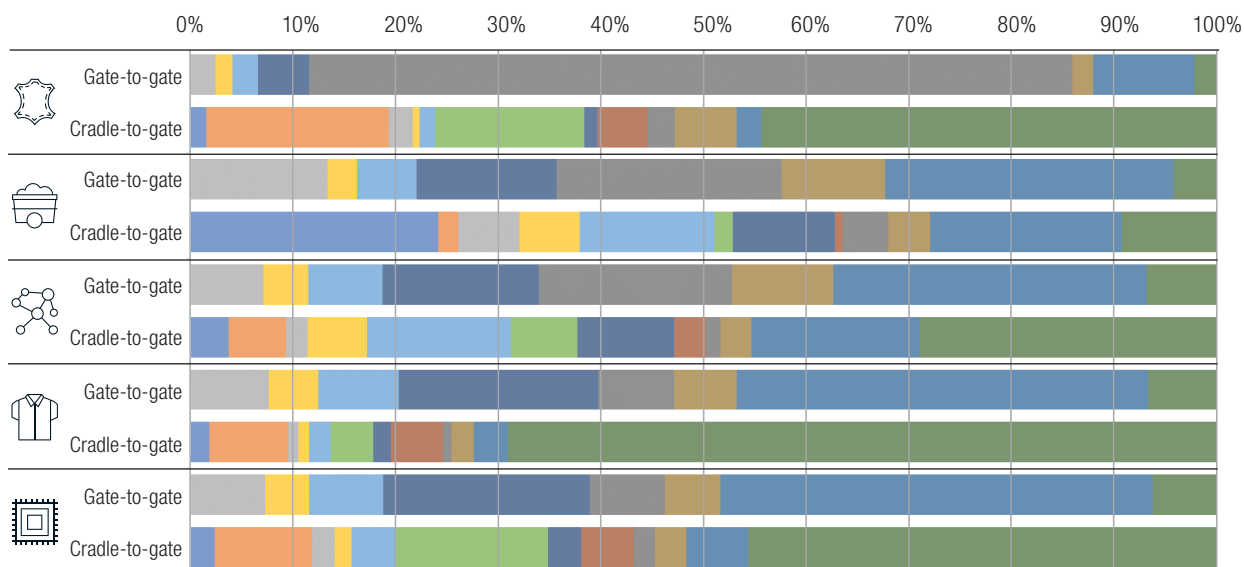
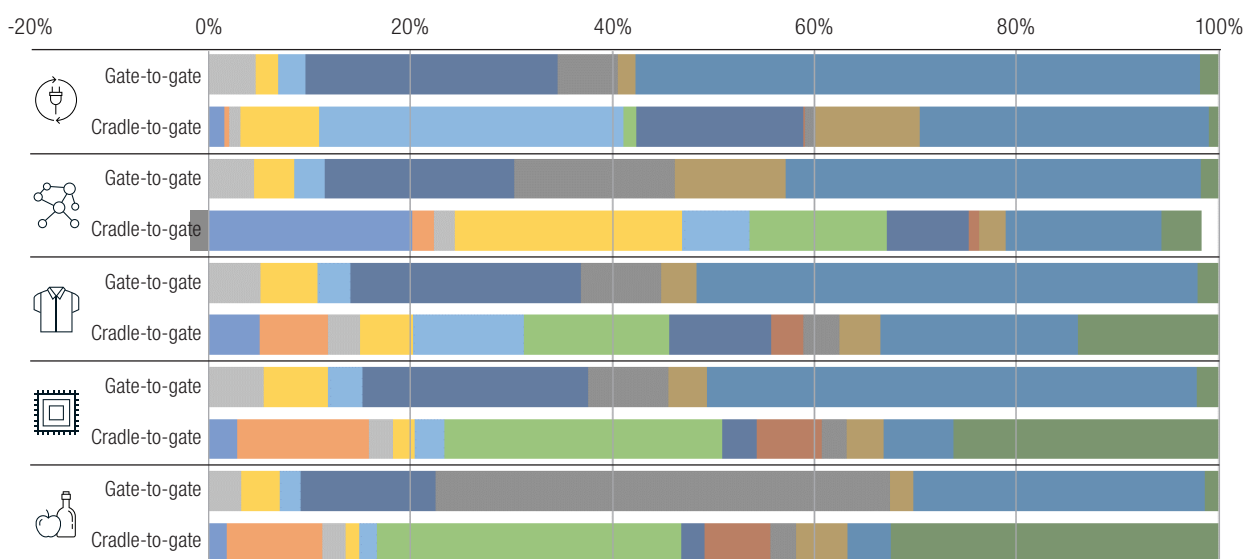
In SSA, Figure 5 shows the importance of the food and beverages sector, especially when considering the cradle-to-gate system boundary. In terms of products, processes, and company size, the food and beverages sector is a very diverse sector, but in general, it has the most relevant environmental impacts on energy use, water consumption, solid waste, and wastewater. The chemicals & chemical products sector is also relevant regarding environmental impacts on fossil resource scarcity and human carcinogenic toxicity. When considering the gate-to-gate system boundary, this sector contributes to ecotoxicity categories and ozone formation.

7 EEIOA is based on the extension of monetary input-output (IO) tables with environment-related information for each sector, such as its emissions, primary resource use, land use and other external effects per sector. Monetary input-output (IO) tables give insight into the value of economic transactions between different sectors in an economy, including output for exports, capital formation and final government and private consumption. When added by the environmental externalities, they calculate how increased demand for output from one sector influences the input of resources from or the output of pollutants to the environment.

8 LCA, in turn, is the “compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle”, as described by the ISO 14040. It is the factual analysis of a product’s life cycle (or part of it) in sustainability. Each part of a product’s life cycle: (i) the extraction of raw materials from the environment, (ii) the production process, (iii) the use phase and the end of life. Each part can impact the environment and be evaluated.

9 Normalisation factors are calculated as results of global inventories of emission and resources characterized through impact assessment methods. These inventories are built after several modelling choices and assumptions, which may increase uncertainty in the assessment. Nonetheless, normalisation makes it easier to make comparisons between impact scores of different impact categories.

10 Downstream lies at the export destination.

Figure 4. Impact results for the SMEP target countries in South Asia (normalised relative contribution)**Figure 5. Impact results for the SMEP target countries in SSA (normalised relative contribution)**

Fossil resource scarcity Human non-carcinogenic toxicity Ozone formation
 Freshwater eutrophication Land use Terrestrial acidification
 Global warming Marine ecotoxicity Terrestrial ecotoxicity
 Human carcinogenic toxicity Marine eutrophication Water consumption

Electrical equipment

Chemicals and chemical products

Wearing apparel

Textiles

Food and beverages

Non-metallic mineral products

Leather, leather products and footwear

B. Health impacts

Manufacturing is often seen as a pathway to more significant economic growth. However, polluting activities are increasingly prevalent in lower- and middle-income countries, where environmental and public health protections are limited, and there are few resources to implement sustainable practices.

The impacts on human health from the food and beverages sector arise by producing or consuming agricultural products and not directly by land degradation or aquifer depletion. However, some environmental changes directly affect the quality of human health, such as a rise in temperature, which causes thermal stresses, respiratory problems and deterioration of aquatic ecosystems leading to waterborne diseases (Masood et al., 2014).

The textile production industry is one of the oldest and most technologically complex of all manufacturing sectors. With escalating demand for textile products, textile mills and their wastewater have increased proportionally, causing a significant pollution problem, especially in developing countries. Many chemicals used in the textile industry cause environmental and health problems¹¹ associated with water pollution caused by the discharge of untreated effluent and those because of toxic chemicals, especially during processing. Among the many chemicals in textile wastewater, dyes are considered key pollutants. Textile effluent is a cause of a significant amount of environmental degradation and human illnesses. About 40 per cent of globally used colourants contain organically bound chlorine, a known carcinogen (Khan and Malik, 2014).

The significant changes in health conditions and the emergence of new diseases require understanding and call for new solutions in implementing

environmental and health policies for manufacturing activities, especially in the SMEP target countries. The linkages between manufacturing-sourced pollution and related human health impacts constitute an area that needs further research, especially concerning SSA and South Asia, where quantitative assessments are limited in literature (O'Neill et al., 2020).

11 The dyes used in textile industries are potential health hazards as they may be converted to toxic and/or carcinogenic products under anaerobic conditions. Inhaling dust produced during cotton, flax, or hemp handling causes byssinosis, which is a respiratory syndrome. The noise level resulting from the machines used in the textile industry, especially from the dry processes, may violate the limit allowed by the law and cause hearing problems. The use of dyestuffs and pigments may cause a number of adverse effects to health. Health effects may be exerted directly at the site of application (e.g., affecting the workers) and later in the life cycle (e.g., affecting the consumers) (Khan and Malik, 2014).

CASE STUDIES

The LCA analysis allows a better understanding of which economic activities drive a more significant pollution share in the supply chain. It also identifies the pollutants that make these activities stand out in terms of environmental impacts. LCA results, combined with public and private governance analysis, provides recommendations for each case study country.

The chosen case study countries are Kenya, the United Republic of Tanzania, Bangladesh, and Pakistan. The following four criteria were applied to select the sectors in each case study country, and they carry the same weight when determining the selected sector. They are:

- Economic Impacts considers the most important products exported between 2015-2019 by each of the target countries.
- IO-LCA Impacts considers damages on ecosystems (i.e., environmental impact) and human health (i.e., health impact).
- Secondary data availability considers access to the private sector information about pollution management and control.

Table 1 presents the most relevant sector for each criterion, and the sector with more representation is selected.

The report, in Section 2, analyses the specific cases of the four countries highlighted in Table 1. Given a historical background, for each country, there is a description of the current situation on:

- **Bilateral Trade Agreements (BTA)**, with an overview, presents environmental governance and gaps identified.
- **National Environmental Law** describes main legal acts and the normative content related to manufacturing pollution control.
- **Public Environmental Governance** presents the institutional architecture and public policies.
- **Private Sector Governance**, focusing on the sectors selected in the study, providing an overview of each sector in each country, mainly focused on sustainability aspects of the sectors, specific enterprises and business associations initiatives.

For this Summary, succinct boxes with some of the findings and briefings and samples of BTAs, National Environmental Laws, Public and Private Governances are below organised as “countries at a glance”, in boxes 1 to 4. These details are challenging to summarise and are systematically organised in the report. It is strongly advisable to read the report for a comprehensive description.

Table 1. Selection criteria table and selected sectors for case study analysis in target countries

Region	SMEP Target Country	Economic Impacts	IO-LCA Impacts				Secondary Data Availability	Selected Sector
			Environmental Impact		Health Impact			
			Cradle to Gate	Gate to Gate	Cradle to Gate	Gate to Gate		
South Asia	Bangladesh	Wearing apparel	Textiles	Textiles	Textiles	Textiles	Textiles	Textiles
		Textiles		Chemicals and chemical products		Chemicals and chemical products		
	Pakistan	Textiles	Textiles	Textiles	Textiles	Textiles	Textiles	Textiles
		Wearing apparel		Non-metallic mineral products		Non-metallic mineral products		
Sub-Saharan Africa	Kenya	Food and beverages	Food and beverages	Chemicals and chemical products	Food and beverages	Food and beverages	Food and beverages	Food and beverages
		Chemicals and chemical products			Chemicals and chemical products	Chemicals and chemical products		
	United Republic of Tanzania	Basic metals	Food and beverages	Chemicals and chemical products	Food and beverages	Food and beverages	Food and beverages	Food and beverages
		Food and beverages			Chemicals and chemical products	Electrical machinery and apparatus		

Box 1. Bangladesh at a glance

Selected sector: Textile

- Economic impact: Leading sector was wearing apparel with US\$ 121 billion, followed by textiles with US\$ 65 billion in exports (2015-2019).
- Environmental and health impacts: The textile sector reaches the highest-ranking – more than 80 per cent for eight categories (Environment) and three categories (Health).
- Secondary data availability: The textile sector has the most available data.

Environmental and health impacts: The most exported products for the textile sector are from class 171: “Preparation and spinning of textile fibres; weaving of textiles”. Among the products included in this class, jute yarn was chosen as a case study due to its relevance in exported quantity (84.2 per cent of its total exports). The life cycle impact results indicate that the major contributor to the potential impact is the cultivation stage due to tillage, fertilisers, irrigation, and waste wood treatment. Nonetheless, the manufacturing stage also plays its role in the impact profile, primarily due to the electricity consumption, the production and transport of the chemical inputs required for the plant operation, the waste treatment, and the fibre transport to the spinning plant.

Bilateral Trade Agreements (BTA), Bangladesh has multiple BTA, and they generally have environmental provisions with an approach that follows the pattern of its Regional Trade Agreements (RTA), although some of the BTA do not have environmental aspects. The report highlights three BTA with relevant trade-environment nexus: European Union Cooperation Agreement; United States BTA; Uzbekistan BTA.

National Environmental Law, a 2011 amendment to the Constitution, incorporated the obligation to protect, preserve, safeguard, and improve natural resources. The primary Environmental Law, Conservation Rules and policies are from the 1990s and have been strengthened in the 2000s and recent years.

Public Environmental Governance, the Ministry of Environment, Forests and Climate Change is the primary institution responsible for the environment, with four institutions in the Ministry. Enforcement and the fight against pollution lay mainly on the Department of the Environment (DoE), with offices in divisional cities and 22 districts. Overlapping of the mandates may be a problem due to the conflict of interests. The powers of the DoE indirectly derive from the powers of its Director-General. Personalisation and political capture are risks, leading to a potential conflict of interests. Specifically, to the prevention of industrial pollution, there is little or no coordination between agencies. The report presents evidence of a lack of institutional capacity, continuity and transparency.

Private Sector Governance, Textile and Wearing Apparel (T&A) is the country’s largest manufacturing sector and export sector. Composed by more than 7,000 companies, responsible for 4.1 million direct jobs and 5 million indirect jobs, indeed, the sector is the most important of Bangladesh’s economy. However, this has been accompanied by the deterioration of the natural environment. Labour and social standards compliance are another significant challenge.

Sustainable manufacturing practices are gaining a place in Bangladesh due to significant forces: international market, buyers, agencies, community pressure, business associations, customer awareness, and government regulations. T&A companies, particularly the large ones, gradually discover the social, environmental, and economic benefits of such practices. A mindset change is already happening, which would help the sector gain a competitive edge over the global market. However, this “green revolution” is not a reality among the whole sector, there is still business reluctance, and non-compliance with environmental, social, and labour policies is still an issue. The report also presents samples of sustainable enterprises, business associations and international initiatives.

Box 2. Pakistan at a glance

Selected sector: Textile

- Economic impact: Leading sector was textile with US\$ 27 billion, followed by wearing apparel with US\$ 15 billion exports (2015-2019).
- Environmental and health impacts: Textile has the most significant impact for both aspects – more than 80% for eight categories (Environment) and three categories (Health).
- Secondary data availability: The textile sector has the most available data.

Environmental and health impacts: The most exported products for the textile sector are the ones from class 1721: “Manufacture of made-up textile articles, except apparel”. Among the products included in this class, articles of woven cotton (toilet linen, kitchen linen, bed-linen, table linen, wadding, and sacks and bags for packaging) are chosen as a case study due to their relevance in terms of exported quantity (30.4% of the country total exports). The life cycle impact results indicate that the cultivation and the manufacturing stages have the potential impacts worth considering. This impact is mainly due to the transport of cotton yarn to the woven cotton production plant, the maize starch consumption, and electricity for cotton yarn production. From the processes that come after woven cotton production, batch dyeing is the most relevant one due to waste and wastewater treatment.

Bilateral Trade Agreements (BTA), Pakistan has nine BTA in force, and almost all of them mention obligations with other legal instruments, such as reinforcing compliance with GATT and WTO rules. The study highlights three BTA with the trade-environment nexus: European Union, United States, and China.

National Environmental Law, in the country’s Constitution, the environment is not expressly mentioned. However, the Supreme Court recognised in the 1990s the environment protection as a constitutional right, as part of the right to life. In 2010 an amendment to the Constitution shifted the legal and governance systems for the environment significantly. Legislation from the late 1990s and 2000s constitute the main pillars of the environmental law and policy frameworks.

Public Environmental Governance relies on a decentralised model, although the federal level has powers over the environment. The environmental laws and governance structure applicable to the textile sector depend on the environmental impacts’ location and terrestrial extension. If the extension does not transcend the provincial limits, then the Provincial Laws are applicable. If impacts transcend the limits, it is in the capital or the federally administered tribal areas, so the Federal Law is applicable. Despite existing legal and policy frameworks, both local and federally articulated, which have been changing its environmental architecture in the past ten years, there are gaps and challenges for public environmental governance to control pollution. Institutional capacity constraints were also identified, accountability and transparency were reported with limitations.

Private Sector Governance, Textile and Apparel (T&A) manufacturing sector is the largest manufacturing and export sector in Pakistan, and the second-largest employment generator (about 40 per cent of the total labour force), being the main contributor to the country’s economy. Nonetheless, many environmental and social challenges do exist. Labour and social standards compliance are other challenges, including the need for skills development.

Textile and Apparel companies started to commit to sustainability, and regulations become more stringent to cope with international brands and consumers’ demands for a sustainable manufacturing process and products. However, the high cost associated with technology acquisition and operation increased production costs, often forcing companies out of business. The report also presents samples of sustainable enterprises, business associations and international initiatives.

Box 3. Kenya at a glance

Selected sector: Food and Beverages

- **Economic impact:** Leading sector was food and beverages with US\$ 11 billion, followed by chemicals and chemical products with US\$ 3 billion of exports (2015-2019).
- **Environmental and health impacts:** Two sectors, food and beverage and chemicals and chemical products, present a similar impact on the environment and health sector.
- **Secondary data availability:** In the case of Kenya, this criterion was the determinant factor to overall sector selection. The Food and Beverage sector has more data available.

Environmental and health impacts: The most exported products for the food and beverages sector are class 1514: “Manufacture of vegetable and animal oils and fats”. Among the products included in this class, crude palm oil is chosen as a case study due to its relevance in exported quantity (23.8 per cent of its total exports). The life cycle impact results indicate that the major contributor to the potential impact is the cultivation stage due to land use, fertilising, irrigation, agricultural machinery, wood chipping, and direct emissions. Nonetheless, the oil palm manufacturing stage also plays its role in the impact profile, mainly due to the production and transport of the chemical inputs required for the process, the water consumption, the emissions related to the energy supply from combustion of extraction residues, and the waste treatment.

Bilateral Trade Agreements (BTA), only the Economic Partnership Agreement (EPA) between the United Kingdom and Northern Ireland was identified and is available (the country lacks transparency and information disclosure on agreements signed). The EPA approaches the trade-pollution-environment nexus in different parts; and has many innovative provisions that may inspire environmental provisions in future BTAs.

National Environmental Law, Kenya’s Constitution, 2010, is a very advanced one. Human Dignity is protected, and the environment is a dimension of Human Dignity. The legislation was approved in the 1990s with recent amendments and additional policies, providing the legal basis and creating an institutional framework for managing the environment. Kenya also has a large set of sectoral environmental laws that deepens the trade-production-pollution nexus from a legal perspective.

Public Environmental Governance, National Environmental Policy (NEP), 2013, is the general policy that leads the environmental agenda in Kenya, adopting a rights-based approach. NEP sets goals, objectives, and principles for environmental management, including the fisheries and agricultural processing sectors. Contrasting with advanced legislation and comprehensive institutional architecture, the study found weak implementation, compliance, and enforcement in Kenya.

Private Sector Governance, manufacturing is dominated by food and beverages (F&B) companies, which account for over 35 per cent of total manufacturing sector output and around 45 per cent of total exports. Initially, the F&B was dominated by subsidiaries of multinational corporations, mainly from Europe and North America. Production is concentrated around the country three most significant urban centres. Many F&B manufacturing companies operate across the country as informal businesses. Further industrialisation can provide substantial opportunities for economic growth. However, it comes often with environmental degradation, usually associated with public health concerns.

Recently sustainability is gaining a place among businesses. Eco-labelling and cleaner production are being considered essential tools. The report also presents samples of sustainable enterprises, business associations and international initiatives.

Box 4. The United Republic of Tanzania at a glance

Selected sector: Food and Beverages

- Economic impact: Leading sector was basic metals appeared with US\$ 8 billion, followed by food and beverage with US\$ 3 billion exports.
- Environmental and health impacts: Food and beverage sector was chosen for showing up as the leading sector for Environment and Health Impacts.
- Secondary data availability: Food and Beverage sector has the most available data.

Environmental and health impacts: The most exported products for the food and beverages sector are class 1514: "Manufacture of vegetable and animal oils and fats". Among the products included in this class, oil-cake resulting from the extraction of sunflower is chosen as a case study due to its relevance in terms of exported quantity (45.2 per cent of the country's total exports). The life cycle impact results indicate that the major contributor to the potential impact is the cultivation stage due to land use, tillage, sowing, fertilisers, herbicides and insecticides, heat and water consumption, harvesting, and direct emissions. Nonetheless, the manufacturing stage also plays its role in the impact profile, primarily due to the water, heat, and electricity consumption.

Bilateral Trade Agreements (BTA), only one BTA ratified was found in the study, and the country lacks transparency and information disclosure on agreements signed. The BTA ratified the agreement signed with India in 1966 (the major Tanzania trading partner). It is a concise trade agreement that does not mention specifically the pollution linked to the exports of manufactured goods.

National Environmental Law, the protection of the environment is not present in the country's Constitution, but the United Republic of Tanzania's High Court Jurisprudence recognises the right to the environment as a dimension of the right to life. Legislation from the 1990s and early 2000 provides a comprehensive Environmental Law that offers the legal and institutional framework for environmental management.

Public Environmental Governance, the institutional architecture for controlling and reducing pollution, is a complex system. The Ministry responsible for the environment is allocated at the Vice President's Office (VPO). One of its missions is the coordination of environmental management and policies. Thus, there is no entirely devoted Ministry of Environment. However, environmental issues are also distributed at all specific sectoral Ministries and Regional Authorities. Besides the national level, Local Governments authorities also have powers to operate.

Private Sector Governance, Food products processing companies accounts for 40 per cent of all the manufacturing companies in The United Republic of Tanzania. Among them, 90 per cent are micro-, 8.9 per cent are small-, 0.18 per cent are medium- and 0.3 per cent are large companies. Regarding the number of employees, food manufacturing prevails, with 45,299 employees, accounting for 36.7 per cent of the total. Initially, the F&B was Government-owned. In the early 2000s, the private sector started moving into operations, and privatisation improved efficiency. Water pollution (particularly on dairy products) and air pollutants (especially on vegetable and animal oils) were highlighted. The report identifies a scarcity of practical qualifications and work skills.

Global markets, through international buyers, are pressuring large and MSMEs companies towards sustainable manufacturing. Those buyers set up conditions and standards to which local companies must comply. Nevertheless, local companies still consider legislation compliance and the adoption of environmental initiatives as a burden due to the additional investment needed to implement sustainable manufacturing.

KEY CONSIDERATIONS AND RECOMMENDATIONS

The report and this Summary have discussed the trade-growth-pollution nexus and the importance of developing productive capacities and robust governance on public and private matters. It is also stressed that trade and consumer demand have driven growth in the manufacturing industries of SMEP countries. While environmental and health burdens can be associated with the emergence of manufacturing activities, sustainable production and trade have not yet been realised. In this sense, building productive capacities is a key strategy to help foster the necessary structural transformation while promoting inclusive growth and achieving sustainable development. Both public institutions and the private sector greatly influence the achievement of this goal.

As shown in the report, besides accounting for the economic aspects, companies must consider their activities' environmental and social performance into the planning and coordination of business practices into the decision-making process. Integrating environmental thinking into business day to day practices into the business strategy is thus a challenge for companies to overcome. From the analysis conducted, a set of recommendations is proposed for Bangladesh, Kenya, Pakistan, and the United Republic of Tanzania, which could boost the transition to more sustainable manufacturing in the near future. Even though at different stages, the four countries are building a diversified economy throughout industrialisation and are focusing on export-led economic growth. Companies, particularly large and export-oriented ones, are moving towards sustainability to comply with a multiple dimension and scale requirements system. Domestic and International Environmental and, to some extent, trade laws are one dimension. Importing countries regulations and standards are the other. Hence, companies are implementing environmental management initiatives and tools, pursuing certifications, complying with labour standards. Those companies, by its turn, are pressuring MSME in the supply chain. This mindset change results from external market pressure exerted by international brands, international organisations and even consumers, making those companies sustainable. In this context, based on the gaps and challenges identified in the study for the case study countries, recommendations are summarised as

follows.

Based on the gaps and challenges identified through case studies, the report proposes recommendations for Kenya, the United Republic of Tanzania, Bangladesh, and Pakistan along with the main three areas of research: (i) Environmental Law and Public Governance, (ii) Private Sector Governance, and (iii) Life Cycle Assessment. Even though at different stages, the four countries are building diversified economies by developing their industrial sectors. As exports play a significant role in their economic growth, those countries gain from more sustainable manufacturing practices.

Environmental Law and Public Governance

The analysis shows that most of the Regional Trade Agreements (RTAs) and Bilateral Trade Agreements (BTAs) have environmental provisions valid for pollution control through a general exception to trade rules, cooperation in the environment, or the interplay with other legal tools, including Multilateral Environmental Agreements (MEAs). Recommendations include:

- Countries to consider at least the general exceptions of the international trade regime and the interplay with the ratified MEAs.
- Policy coherence and coordination, interplay, transparency, and accountability are governance principles that countries shall consider in negotiating and implementing RTAs and BTAs.
- Environmental information disclosure, especially regarding the BTAs.
- Strengthening institutional capacities for law enforcement.
- Developing governance mechanisms to tackling informal activities.
- Focus on social sciences and categories, such as culture, politics, power, poverty, gender.
- Strengthening public participation and social movements and Non-Governmental Organisations (NGOs).

Private Sector Governance

Adopting more sustainable practices to reshape the production base is a challenge for SMEP target countries, especially in the context of export-driven manufacturing pollution. Demand-side initiatives to meet sustainable consumption criteria in trade partners reinforce the need for improved manufacturing pollution management. Recommendations include:

- Green manufacturing guidelines accessible for different manufacturing sectors and companies.
- Countries could benefit from the Eco-industrial parks (EIP) concept.
- Adopting the National Industrial Symbiosis Programme (NISP) could enhance EIP development in SMEP countries and foster capacity building, regulatory framework, and sustainable manufacturing practices.
- Accelerated local Environmental Management System (EMS) certification.
- Adoption of Resource Efficient and Cleaner Production (RECP) measures.
- Create training courses on Circular Economy and identify opportunities for circularity across selected manufacturing sectors.

Life cycle assessment

The LCA approaches performed in this study enabled identifying the most relevant export-oriented manufacturing sectors regarding environmental and health impacts for the SMEP target countries. The following are the key considerations:

- Essential to create or update IO-LCA databases for the SMEP target countries since EXIOBASE present them aggregated as the Rest of the World (RoW).
 - Improve export data quality and availability, especially regarding traded volumes. Creating a local database for SMEP target countries is pivotal to increasing the understanding of trade-environment governance.
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