CHAPTER

6

PROGRESS IN THE GREENING OF AFRICA'S INDUSTRY

A business-as-usual (BAU) industrialization trajectory in Africa not only reduces the rate of growth in the medium to long term but is also unsustainable (Chapter 5). Africa consequently has no real choice if it is to industrialize but to promote the greening of industry—a sometimes difficult path. It will require painful changes in the pricing system (for example, charging users for the externalities involved in energy and water production and in the cost of cleaning up pollutants), which will need appropriate compensatory mechanisms for poorer consumers and producers. However, as this chapter will show, much—not all—industrial greening provides short-term positive returns alongside longer term gains, and some involves heavy upfront costs. Greening also will require changes in attitudes throughout the population, not just the industrial sector.

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None of these choices are unique to Africa. All economies that pursue a green path of industrialization face the same or similar challenges, but recordable progress is possible even in the short term. In many cases where industry is operating at high levels of inefficiency, industrial greening need not involve short-term trade-offs with slower growth. Instead, greening will enhance productivity and the rate of economic growth. When designed right, greening should also promote social and economic inclusion rather than continued inequitable patterns of growth.

This chapter presents, in 14 case studies, concrete examples of multiple win-win outcomes of green growth and industrialization in Africa. They show that substantial progress has already been made, and that these experiences are replicable across sectors and economies throughout the continent. We lead off with examples of plant-level greening, followed by systemic, sectoral (including agro-industry, energy, water, manufacturing and resource extraction), and then inclusive examples, and we round off with findings on the importance of governments and regulation in greening.

This distinction and links between establishment- and system-level greening were described in Chapter 4, in which we identified three critical systemic components to the green growth agenda: coordinated efforts across sectors; cross-border coordination and decision-making; and coordinated action along the entire value chain. This last component brings transnational corporations (TNCs) and large local firms into the picture because a major driver to greening is consumer demand in final markets, as buyers seek assurance that environmental and social standards have been met along the entire supply chain.

The following examples are based on visits by the ECA team to African countries in late 2015, and comparative evidence drawn from desk research.

6.1 PLANT-LEVEL GREENING

The market has often led to resource de-coupling in African industry (in which output continues to grow but at lesser impact on resource use and the environment), but policy has also been important at this micro-level of industrial greening, as seen in the following two examples.

NATIONAL CLEANER PRODUCTION CENTRES AND THE LEATHER INDUSTRIES OF UGANDA

The United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) launched the National Cleaner Production Centre Programme in 1995 with 8 centres, 2 in Africa (Tanzania and Zimbabwe); by 2015 the programme comprised 60 centres worldwide, 14 in Africa.

A recent UNIDO assessment of a dozen industrial plants targeted in five African countries shows successful decoupling accompanied by high economic benefits. Across food, textiles, leather goods, bottled drinks and chemicals, these results show win-win outcomes from the greening of industry. In each of the plants, there are very significant material savings and pollutant reductions, resulting in considerable financial savings (UNIDO, 2015). Resource-efficient and cleaner production (RECP) is a way to achieve such outcomes. RECP includes the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. The following example illustrates those gains. (Many similar examples can be sourced at www.unido.org/cp.)

Leather Industries of Uganda Ltd. (LIU) is a private limited liability company established by the Aga Khan Development Network that processes raw hides and skins through to their finished state in Uganda. It has an installed capacity to process 1,000 pieces of raw hides and 5,000 skins per day and exports 95 per cent of its produce around the world. LIU consumes some 600 cubic metres of water a day, releases 99 per cent of the consumed water as effluent and generates about 2,000 kg of solid waste a day, which has to be eliminated. Driven by the objectives of addressing pressing environmental challenges and increasing productivity and competitiveness, LIU decided to implement RECP in the entire processing factory (UNIDO, 2015).

This investment in cleaner production to prevent pollution and reduce resource consumption has proved more cost effective than continuing to rely on increasingly expensive end-of-pipe solutions. Since 2010, RECP in LIU has led to a savings of $2,236,450 against investment of $1,676,121, which represents a healthy return of 133 per cent over five years.

LIU has been able to achieve these improvements as a result of the commitment of top management and team spirit from employees. Notably, cleaner production methods have been instituted in the tanning yard and dye house; in effluent treatment; in waste, energy and chemical management; and in water use (table 6.1). Those changes have also resulted in improved occupational health and safety. The RECP "primer", accompanying calculator and further case studies are at www.recpnet.org, www.unido.org/cp and www.unep.fr/scp/cp, respectively.

TABLE 6.1 LEATHER INDUSTRIES OF UGANDA LTD.: CLEANER PRODUCTION METHODS ADOPTED

Action	Benefits		
	Economic investment ($)	Annual economic savings ($ per year)	Environmental effect
Water management			
Install new drums to replace worn-out, leaking drums	22,000	10,000	Reduced chemical loss
Wastewater management			
Construct a secondary wastewater treatment plant	297,860	500,000	Reduced pollution load and better environmental legal compliance
Materials management			
Recycle chrome and tanning bath solutions	50,000	13,700	Reduction in the chemical pollution load of the effluent
Energy management			
Install iron sheets with translucent sheets in the beam house and tanning yard	280	300	Reduction in input costs
Install energy savers for all lights and security lights	320	8,000	Reduced energy consumption
Raise the main water supply tank and use gravity instead of electric pumps to supply water to the factory	4,000	48,434	Reduction of energy used for pumping water
Solid waste management			
Obtain equipment to process animal feed from by-products and waste Ensure proper treatment and disposal of organic waste	50,000	2,736	Legal compliance; reduced soil and water contamination; odour management; improved aesthetics; reduced public complaints; income generation from sale of feed

SOURCE: UNIDO (2015).

The environment-friendly approach to leather tanning has resulted in conservation of natural resources, such as water and energy, as well as control of environmental pollution through reduced chemical consumption. With better awareness of its effects on the environment, LIU is looking for further cost-effective solutions to conserve natural resources and reduce waste. Some of the possible measures include reducing land requirements for the sludge disposal area by directly applying the sludge on land as fertilizer; reduction of water wastage; using energy more efficiently and reducing energy needs through more efficient processing; and adopting better technologies, such as automated switches on drums.

TRANSFER OF ENVIRONMENTAL SOUND TECHNOLOGY PROJECT IN THE SOUTH MEDITERRANEAN REGION

This project, too, exemplifies what can be achieved through clean production methods. Led by UNIDO's Green Industry Initiative, MED TEST (Transfer of Environmentally Sound Technologies) addresses land-based sources of pollution within industrial hot spots of the South Mediterranean,

as part of its Strategic Action Plan (SAP-MED). MED TEST involves a comprehensive diagnosis of enterprise needs, the key outputs of which are to identify and adopt new practices, skills and management approaches, enabling the company to hone its steps to sustainable production.

By 2015, the MED TEST approach had been implemented in 43 companies in six manufacturing sectors in three countries—Egypt, Morocco and Tunisia. In each sector, many resource-efficiency measures and cleaner technology investments have been adopted, including management systems (for example, ISO 14001) that integrate the environmental dimension. The results for Tunisian companies are in table 6.2.

TABLE 6.2 IMPROVED PRODUCTION PRACTICES, 15 COMPANIES, TUNISIA

Company	Size[1]	Investments [USD/year]	Savings [USD/year]	Water Savings [%]	Energy Savings [%]
Food & Beverage Sector					
Générale Industrielle Alimentaires Slama (GIAS)	493	191,200	133,700	12	17
Société de Conserves Alimentaires du Cap Bon	50-250	98,139	73,639	44	9
Tunisie Lait	308	827,410	746,638	16	13
Société de Boissons du Cap-Bon (SBC)	119	56,331	75,454	22	21
Société Nouvelle de Boissons (SNB)	202	29,200	194,600	12	14
Centrale Latiere du Cap nord (CLC)	547	484,945	546,903	13	19
Textile Sector, Finishing					
Teinturerie et Finissae Mediterraneenne (TFM)	55	1,264,645	491,860	56	10
Gartex	185	76,200	67,200	19	15
Megastone	150	76,500	55,600	10	30
Traitex	60	181,800	111,836	19	39
Garment Dyeing Servic	80	139,000	91,300	24	7
Star Wash	40	37,500	28,000	30	14
Leather Sector, Tanneries					
Tanneries Megisserie du Maghreb (TMM)	180	523,000	446,800	14	15
Société Moderne des Cuirs et Peaux (SMCP)	35	287,000	97,200	22	3
Tannerie du Nord Utique (TNU)	50	184,000	125,000	8	70
Total		**4,456,870**	**3,286,530**		

[1] number of employees, 2009

Estimated Environmental Benefits			
Water Savings [m^3/year]	Energy Savings [MWh/year]	BOD5 Reductions [tons/year][2]	COD Reductions [tons/year][2]
650,00	25,083	1,610	2,762

[2] BOD5 and COD are ways of measuring organic pollution in the water supply.

SOURCE: UNIDO (2012).

6.2 SYSTEMS-LEVEL GREENING—FORESTS, FARMS AND FOODS

Many green challenges require changes beyond the plant level and at the broader system level—crossing sectors, national borders and value chains—for which we now present examples. Systemic greening is driven by a combination of regulations and final demand (chapter 4). It invariably requires the "governance" of systems greening by one or a few key stakeholders—in some cases, government; in others, a lead firm.

The majority of Africa's population lives in rural areas, and agriculture remains the continent's largest employer. Agriculture is a major source of livelihood for the poor. Greening of the agricultural chain thus has a critical environmental and developmental effect across the continent.

Three examples—timber and wood products, agro-processing and fish farming—show the potential for win-win outcomes because value chain greening offers prospects for entering high-income and niche markets. The importance of final markets in value chain greening diminishes, however, when the final market destination shifts from high- to low- and middle-income markets.

THE TIMBER AND WOOD VALUE CHAIN

Timber and its array of final products form one of the most widespread land-use sectors in Africa and offer multiple livelihood opportunities to millions of African people and enterprises. Forestry is important in greening the global economy, largely because it is a major carbon sink, and deforestation is a big contributor to global carbon dioxide emissions. The pressures on global forestry arise from a mix of non-market demand for household use and of timber commercialization, feeding into national and global markets. Figure 6.1 shows how this value chain spans a range of service, processing and manufacturing subsectors.

Given its importance in all these areas, forestry's importance to greening is unsurprising. Forests also provide a wide range of non-market functions, such as stemming soil erosion, regulating climate and water processes and providing a harbour to enormous reserves of biodiversity.

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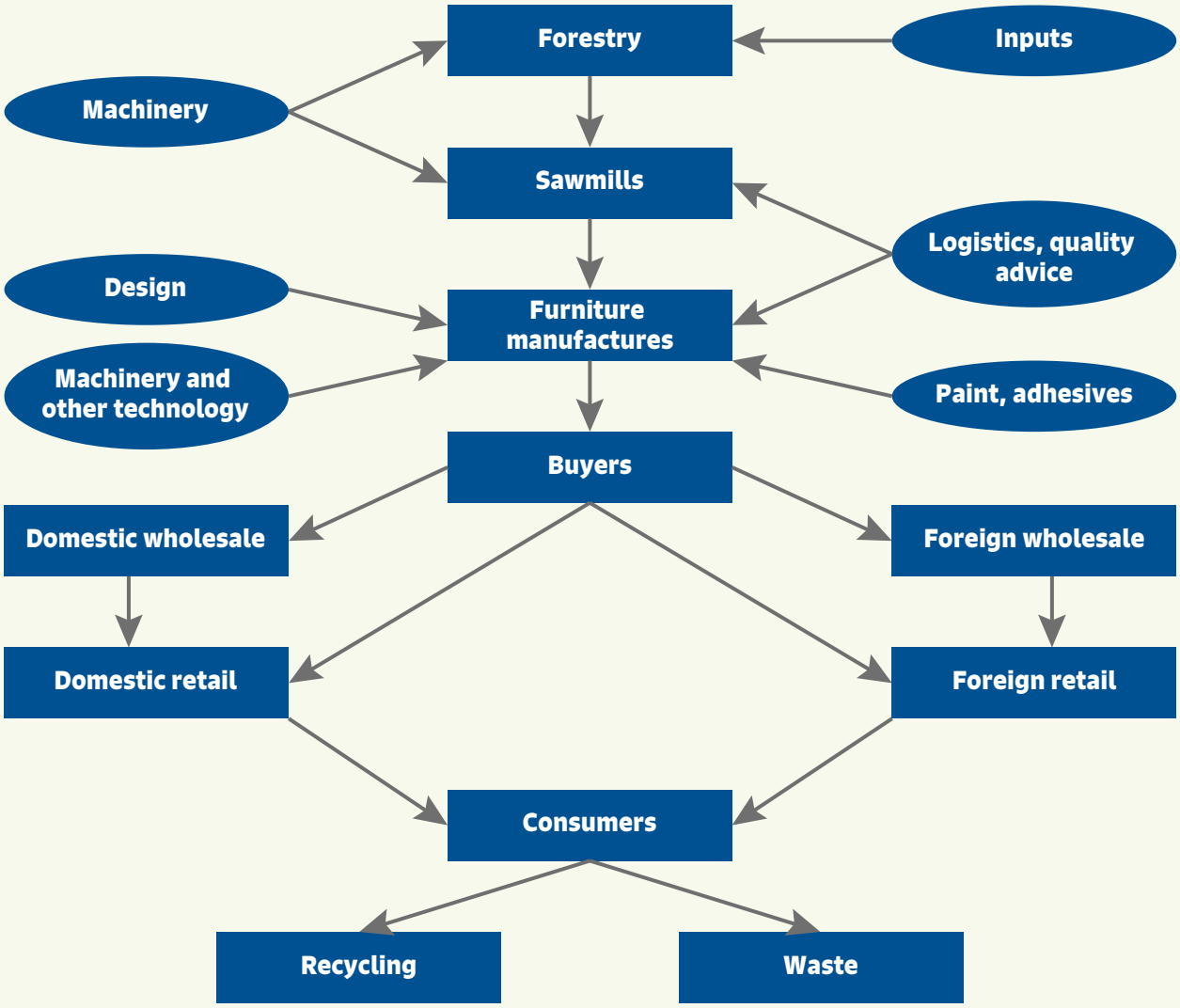
One key driver of forestry's greening comes from high-income markets, in which consumers—individuals or governments—increasingly insist on greening in this value chain. Certification by the Forest Stewardship Council (FSC) provides access to the higher margin niche markets in those economies; it requires systemic greening and a "chain of custody" to verify greening throughout the chain (box 6.1).

In forestry, we can see a clear link between the character of final market demand and pressure

FIGURE 6.1 THE FORESTRY AND TIMBER VALUE CHAIN



SOURCE: KAPLINSKY, R. AND M. MORRIS (2001).

to drive systemic greening along the chain, but many markets do not exert this greening pressure. Although consumers and governments in high-income economies are increasingly sensitive to social and environmental concerns, the same is not always so in low- and middle-income markets. Take Gabon, for example. Its timber and wood value chain had become a major exporter to the European Union (EU)—historically its dominant market—but from the mid-1990s, rapid demand growth in China led to its supplanting the EU as that market; by 2010, exports to China were, by volume, three times those to the EU. The nature of demand in China (figure 6.2), however, was such that it led to a relative de-greening of the Gabonese timber and wood value chain.

BOX 6.1 FOREST STEWARDSHIP COUNCIL

The FSC was founded in 1993 as an international non-profit organization to support environmentally appropriate, socially beneficial and economically viable management of the world's forests. The creation of an international labelling scheme for forest products provides a credible guarantee that the product comes from a well-managed forest.

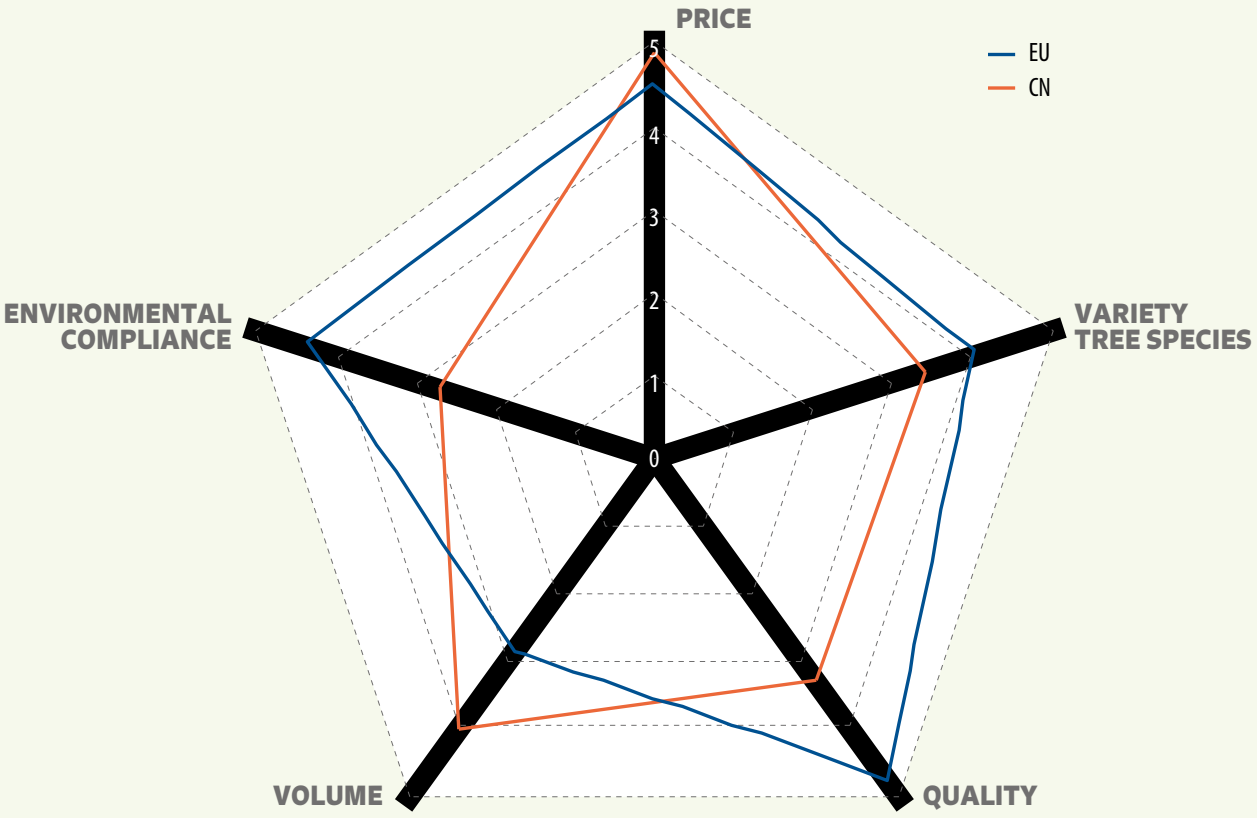
The need for such a scheme arose from pressure groups, consumer bodies, indigenous people's movements, environmentalists and governments concerned about the destruction of the world's natural forests and the plethora of unsupervised and poorly based claims that wood products were "environmentally friendly".

The FSC consists of a diverse group of representatives from environmental and social groups, the timber trade and the forestry profession, indigenous people's organizations, community forestry groups and forest-product certification organizations from around the world. Certification takes place through independent, profit-making certification bodies, accredited by the FSC and operating throughout the world, which are evaluated and monitored to ensure their competence and credibility. Certifiers assess forests' operations against a predetermined set of standards developed by the council. This allows wood to be sold in the market as "certified" wood, bearing the FSC trademark logo.

To ensure that all products manufactured from timber reflect this certification, accredited organizations conduct inspections all along the supply chain to verify chain-of-custody systems for products from certified forests. FSC claims that this provides the consumer with a guarantee that the product has come from a forest that has been evaluated and certified as being managed according to agreed social, economic and environmental standards (www.fscoax.org). In many cases, the global lead firms have become the active drivers of high standards through the value chain of demands emanating from civil society. Business takes on responsibilities for ensuring adherence with high environmental and social standards, which typically would be assigned to the state. The state is seen as less well placed to enforce such social and environmental regulations, however, because of weak governance and limited administrative resources.

SOURCE: KAPLINSKY AND MORRIS (2014).

FIGURE 6.2 EUROPEAN AND CHINESE BUYERS' REQUIREMENTS—WOOD LOGS



SOURCE: KAPLINSKY, TERHEGGEN, AND TIJAJA (2011).

NOTE: 1 = NOT IMPORTANT; 5 = VERY IMPORTANT.

THE GHANAIAN TIMBER VALUE CHAIN[1]

Successful greening in the Ghanaian timber supply chain has involved four main actors: two timber buyers in the United Kingdom (UK), a timber supplier in Ghana and the Global Forest and Trade Network (GFTN) of the World Wide Fund for Nature (WWF).

Travis Perkins, the UK's number one supplier of building and construction materials, had been criticized by civil society organizations (CSOs) for sourcing wood to be used in major government building projects from suppliers with poor sustainability practices. Work on the renovation of the historic Parliament buildings in London heightened the level of interest and concern about the origin and quality of the wood to be used. The UK government requires that all state-run construction projects use materials from sustainable sources. One of Travis Perkins' biggest suppliers, Timbnet Silverman, the largest importer of hardwood in the UK, sources 40 per cent of its wood from Ghana (Emmet and Sood, 2010).

Samartex Timber and Plywood is a company with a long history in the Ghanaian timber industry and has a long-standing business relationship with Timbnet Silverman. The company is now the lead supplier of sustainable timber in Ghana.

The GFTN is a WWF initiative to pressure large construction corporations to source wood materials from environmentally sustainable supply chains. The GFTN creates links between global corporations and local timber suppliers that are committed to creating green supply chains. The network also uses an independent auditor to certify each firm in the supply chain, according to responsible forest management principles.

In response to public criticism and pressure from shareholders to become more environmentally friendly, Travis Perkins and Timbnet Silverman began seeking solutions to green their supply chain. They pressured Samartex to transform its timber-sourcing practices in Ghana in return for an increase in the price and quantity of wood bought by Timbnet Silverman. In 2004, Samartex signed an agreement with WWF to become the first certified sustainable timber supplier under the GFTN. Since Samartex's successful certification, eight other timber suppliers in Ghana have undergone audits for certification.

GFTN, with the help of the United States Agency for International Development (USAID) and the UK Department for International Development, coordinated and funded the technical assistance required for greening Samartex's supply network. Samartex greatly reduced the amount of damage caused by poor timber felling and hauling practices. The company also built new roads and provided new hauling equipment to reduce the environmental impact of transporting timber. In addition to transforming its environmental practices, the company developed corporate social responsibility agreements and established a joint forum with communities in the area, aimed at finding sustainable development solutions and educating the locals about sustainable forestry practices.

After Samartex received its certification, the company's orders increased $2 million from global timber-supply companies wishing to improve their sourcing practices for tropical timber. Samartex has served as a model for Ghanaian companies looking to achieve GFTN certification, which are largely motivated by the paucity of firms able to meet the increasing demand for sustainable tropical hardwood.

This case study shows the importance of adopting a systemic approach to the greening of the whole chain and the associated potential to expand exports into higher yield niche markets. Pressure

for greening was exerted in final markets, and the drivers of this greening process reflected cooperation between foreign lead firms, CSOs and government procurement rules.

AGRIBUSINESS IN CÔTE D'IVOIRE

In 2011, Côte d'Ivoire adopted a strategy to cut its poverty rate by half and to achieve middle-income status by 2020. It has also given increasing prominence to green growth and, in 2013, established a Directorate for Green Economy in the Ministry of Environment. Before an industrial plant can be established, a company now must show an environmental and social impact assessment and an environmental and social management plan. The Chamber of Commerce and Industry of Côte d'Ivoire has been active in promoting green industrialization.

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Growth in the country's gross domestic product (GDP) has been high in recent years, and real GDP per capita increased by 25 percent over the three years 2012–2014, accompanied by a hike in private investment, which grew by 118 per cent over the same period. Côte d'Ivoire is one of the most industrialized economies in Africa, with more than 5,000 industrial enterprises in 2013 which contributed 26 per cent of GDP. The target is to increase that share to 40 per cent by 2020. Manufacturing is dominated by agribusiness, which accounts for 75 per cent of all industrial activity.

Côte d'Ivoire is Africa's largest producer of cocoa, cashews, coffee and rubber; the second-largest of crude palm oil; and the fourth-largest of cotton and pineapples. Processing is low, however, except for crude palm oil and cocoa (table 6.3), which indicates there is major potential for further industrialization through crop processing.

TABLE 6.3 MAIN AGRICULTURAL PRODUCTS, CÔTE D'IVOIRE

Agricultural products	Production 2012–2013 (thousand tonnes)	Rank (in Africa)	Processed domestically (%)
Cocoa	1,671	1	30
Cashews	500	1	5
Crude palm oil	392	2	100
Cotton	350	4	<5
Rubber	290	1	<5
Coffee	104	1	<5
Pineapples	60	4	<5
Mangoes	47	7	<5

SOURCE: MINISTRY OF INDUSTRY, CÔTE D'IVOIRE.

Agricultural crops traded globally are seeing a drive towards green agribusiness, primarily because of final export markets, especially the private sector (mainly leading trans-national corporations (TNCs) selling under global brands). This trend is also present in Côte d'Ivoire. For example, for Nestlé Côte d'Ivoire, greening is not driven by philanthropy but is necessary to ensure that the company maintains access to the high-quality inputs it needs for selling in global final markets. With this rationale, the firm is working with more than 60 cooperatives and more than 28,000 farmers in the Nestlé Cocoa Plan (NCP), under which the company provides training to farmers in its supply chain to improve productivity, the quality of their cocoa, and health and safety on their farms.

The NCP follows a Triple Bottom Line Agenda, combining economic, environmental and social sustainability. The environmental bottom line is addressed through a programme of replanting, with more than 900,000 new seedlings distributed in 2014. Replanting helps to prevent deforestation of new land. Even the plastic bags used for the plantlets are recycled. The NCP also targets social sustainability, and Nestlé ensures that farmers are certified by UTZ or Fairtrade. Nestlé also has put in place a Child Labour Monitoring and Remediation System (CLMRS) that involves 22 cooperatives nationally. Through CLMRS, community liaison officers from farming communities identify the children most at risk and, to combat child labour, the company is building or refurbishing 40 schools. Finally, the company has signed the Women's Empowerment Principles, a partnership between the United Nations Global Compact and UN Women, which is dedicated to gender equality and women's empowerment. From 2013 to 2014, the share of women in decision-making positions in NCP in Côte d'Ivoire's co-ops and farmer organizations grew from 4 to 10 per cent.

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A second agri-TNC, Olam Côte d'Ivoire, sees green industrialization as an opportunity for lower production costs, by which value chain greening reduces the company's environmental impact and lowers reputational risk. Environmental impact is a standard part of Olam's due diligence for new investments and acquisitions, particularly factories or plantations. The company measures its resource use intensity—greenhouse gas emissions and water use in factories—and uses this information to decouple its operation. Olam is affiliated with the Fair Labour Association, which audits Côte d'Ivoire's cocoa supply chains.

A third company, the locally owned Société Ivoirienne de Productions Animales (SIPRA), has developed a major business in poultry production and feed. It has followed an environmental compliance policy since 2012 as a condition for funding from the International Finance Corporation (IFC). SIPRA also developed an environmental and social charter, and an environmental and social action plan, with help from the IFC. Continued IFC financing is linked to the action plan, for which SIPRA produces an annual monitoring report. SIPRA has rationalized its outlets to bring them closer, thereby avoiding costly, time-consuming long-distance transport.

Two of the three agribusinesses show the influence of final market demand on the greening of value chains, while the third demonstrates the power of international funding agencies like the IFC to demand high standards. All three lead firms see a strong alignment between green industrialization and competitive advantage.

AGRO-LED INDUSTRIALIZATION: CATFISH FARMING IN NIGERIA

Nearly two decades ago, Nigerian rivers and lakes were producing fewer and fewer catfish—a premium fish product in Nigeria—at a time when demand was increasing. Freshwater fish accounts for approximately 33 per cent of the value and about 14 per cent of the volume of fish consumed in Nigeria. Food consumption patterns have also been shifting, and by 2006, fish consumption exceeded meat consumption in the country (Dixie and Ohen, 2006).

A Nigerian entrepreneur, Ade Alakija, responded to rising demand by studying aquaculture and starting a catfish farming business, Durante Fish Industries Limited, which originally sourced catfish stock and water-recycling systems from Holland. The firm refined the farming systems while selling catfish and subsequently diversified into selling feed, fingerlings, and other varieties of fish, including tilapia (although catfish is still the primary fish product). Throughout this process, Durante built the foundation for a new farming sector, making continuous improvements and expanding into different activities within the catfish value chain. Durante is a fully integrated business that, in addition to fish products, offers a full range of services, including advisory services and franchise systems to mid-scale farmers. It is one of Nigeria's leading fish-farming businesses (NRI, 2014).

Greening the supply chain has taken place gradually in response to unreliable supplies of energy and water, and a cost-driven need for power, transport and water efficiencies. Durante shifted away from tank culture to pond and cage culture because of power cuts and water constraints. The firm has invested great effort in increasing the energy efficiencies of its fish-farming processes and systems and in introducing water-recycling features (NRI, 2014). Durante found ways of transporting live fish to distribution points along routes frequented by business people on their way home, cutting the need for energy-intensive, costly refrigerated vehicles while expanding the market.

Hundreds of fish farms now supply live fish transported through a network of specialized market "queens and mamas"—the network of women acknowledged as the people with the skills to expand and manage these markets by building on a pool of indigenous knowledge.

Women are important for the catfish supply chain. Other Nigerian entrepreneurs have started to introduce and refine catfish-farming systems, such as flow-through systems and cage farming. Hundreds of fish farms now supply live fish transported through a network of specialized market "queens and mamas"—the network of women acknowledged as the people with the skills to expand and manage these markets by building on a pool of indigenous knowledge. The products are consumed in restaurants or cooked at home. Offshoot businesses have been created in catfish drying, carried out by micro-businesses around Lagos, using renewable energy

The aquaculture sector in Nigeria produces about 250,000 tonnes of farmed catfish, generating aggregate farm gate income of approximately $500 million a year, as well as an equivalent amount in the value chain. The water-recycling systems are yielding attractive rates of return: they have a capital cost of $150,000 and a payback period of 18–24 months. Analytical studies and support to increase market access were conducted by the IFC, USAID, the World Bank, and the Food and Agriculture Organization of the United Nations (FAO), and that helped this new industry to emerge.

High rates of urbanization, population growth and a growing middle class continue to boost the market for catfish. These growth trends are expected to continue (see the scenarios in Chapter 5). Important market linkages have been established, thus generating inclusive economic growth as profits and benefits circulate throughout the local economy. Women, as the market and Buka-café "queens" in Nigerian social structures, are among the primary beneficiaries. A USAID-funded study found that for every 10 tonnes of catfish produced, seven jobs are generated, six of them for women (Dixie and Ohen 2006). By 2006, the catfish industry had generated an estimated 15,000 jobs, a figure that is estimated to have nearly tripled since (Dixie, personal communication, 2015).

What began as one firm seizing a market opportunity has grown into a new, thriving industry that capitalizes on indigenous expertise, seeks continuous improvements in greening the value chain and is experiencing a growing level of dynamism and competitive advantage. It is a highly replicable model of agro-led industrialization, home grown in Africa. Greening is evident through the industry's search for greater water, energy and transport efficiencies and its use of sustainable technologies in private-led enterprise development. It is a useful example of how local economic growth can be achieved through a green approach to agri-food industrialization which needs to be central to African economic growth, and feeding of urban populations.

6.3 THE ENERGY SECTOR

The energy sector is not just a vital foundation for productive employment throughout Africa. Energy access and cost play a major role in people's health, consumer welfare and inclusive development. Here, too, win-win outcomes between greening and inclusive growth are possible to observe—in the production of biofuels in Malawi and renewable energy in Kenya, Morocco and Rwanda. Examples from Nigeria and South Africa demonstrate the vital role of government in framing policy to draw private investment into the renewable energy sector.

BIOFUELS IN MALAWI

The transport sector plays a key role in Malawi's national development. As a land-locked country, Malawi depends greatly on land transport to move people and goods, and fuel is 10 per cent, by value, of the economy's imports. Transport costs in Malawi are the highest among countries in the Southern African Development Community (SADC). They account for up to 56 per cent of landed import costs and 30 per cent of export costs, increasing the cost of imported consumer goods and hurting Malawi's regional trade competitiveness. More than 70 per cent of internal freight traffic and 99 per cent of passenger traffic is handled by road transport. The average consumption of petrol and diesel in the transport sector is 1 million litres a day, making it the largest sectoral consumer of liquid fossil-fuel energy. Transport accounts for 3.8 per cent of the country's energy consumption and 43 per cent of its commercial energy consumption (Government of Malawi, 2015).

The hike in oil prices in 1973 that threatened to derail economic growth triggered investment in ethanol blending in Malawi. A second oil-price shock in 1979 provided a further incentive. Coupled with the outbreak of the civil war in Mozambique, whose seaport provided access to imported commodities, Malawi suffered an unprecedented crisis of shortages of refined petroleum products. This shortage generated social unrest, loss of people's time in long queues for fuel, and significant losses of income, especially for farmers and for small and medium-sized enterprises.

The government believed that these shocks amounted to a national security crisis. It considered diversifying its sources of petrol and modes of supply to be critical in establishing greater energy security. The government further demanded that the National Commission for Science and Technology consider the local production of ethanol-blended fuel. (This coincided with similar initiatives in Brazil and Zimbabwe.) Private sector firms, especially the sugar companies, were challenged to seize the opportunities for investment in such blending. One outcome was a national biofuel policy that involved a public–private part-

[The government] ... considered diversifying its sources of petrol and modes of supply to be critical in establishing greater energy security.

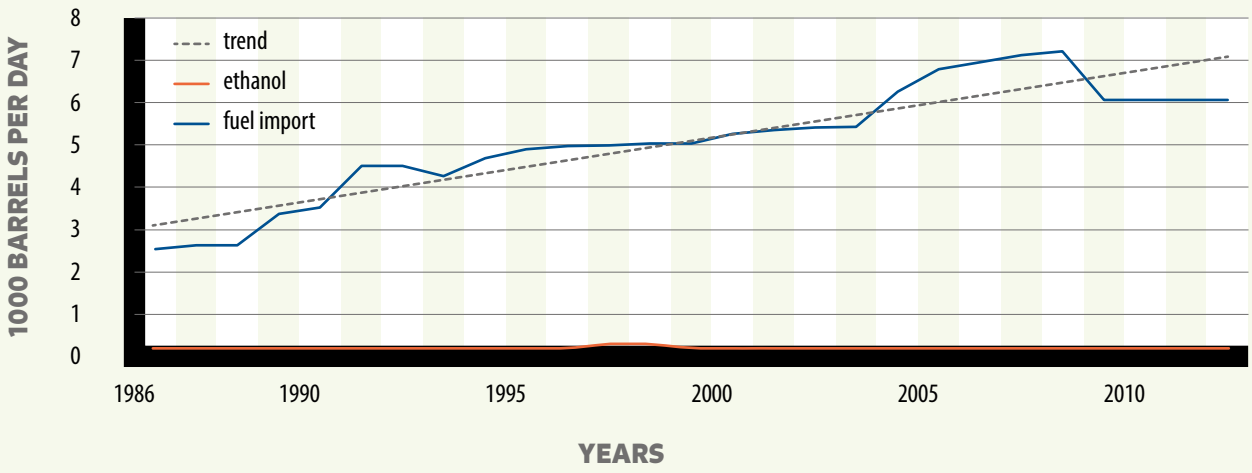
nership from the outset. The government set the policy framework and provided the incentives and infrastructure, within which the private sector could respond. The leading investor was Press Corporation Limited, a publicly listed company incorporated in Malawi.

The feedstock for bio-ethanol is molasses, a byproduct from sugar production. The first ethanol plant was built by Press Corporation in 1982, with a final blending ratio of 10 per cent, and in 2004, they opened a second plant, with a combined total capacity of 18 million litres a year. However, currently, both plants operate at 50 per cent of capacity, as a result of inadequate molasses feedstock, much of it imported from neighbouring Mozambique. The blending ratio today is 20 per cent, which constitutes the maximum ratio that does not require mechanical adjustment of the engine (nor technicians to fit the required conversion kits to vehicles). In Malawi, fuel prices are regulated by an automatic pricing mechanism, with the price of ethanol linked to that of fossil fuels.

The Malawi government commissioned a second study on the possibility of vehicles running purely on ethanol, which was carried out by the National Commission for Science and Technology. The results, submitted to the government in 2012, concluded that vehicles can indeed run on 100 per cent ethanol. With an increasing shift towards ethanol blending in the liquid fuel use of Malawi, the current relationship between fuel imports and ethanol use (figure 6.3) is likely to change, even with an increasing number of car owners and users in the country.

The long-standing government policy commitment presents a sound business case for private sector investment in ethanol production and blending. Press Corporation also seeks deeper integration in the liquid energy value chain, and is in partnership with Puma Energy Malawi to distribute liquid fuels in the latter's filling stations. Puma has become the launch pad for commercializing 100 per cent ethanol use in cars. This includes an advisory service for consumers seeking to buy cars that rely on ethanol.

FIGURE 6.3 FUEL IMPORTS AND ETHANOL PRODUCTION TRENDS, MALAWI (1000 BARRELS PER DAY)



SOURCE: EIA (2015).

In the run-up to the Paris Climate Summit, the Government of Malawi announced plans to expand bio-ethanol production from 18 to 40 million litres/year under its climate mitigation plan (Government of Malawi, 2015).The government's goal is to alter the current trajectory of greenhouse gas emissions from liquid fuels, which are projected to increase from 290,000 to 420,000 million tons of carbon dioxide equivalents between 2015 and 2040. The ambition is also to increase biodiesel production from 2 million to 20 million litres a year so that 5–7 per cent of all vehicles will be running entirely on ethanol by 2020.

However, because ethanol production is restricted by a shortage of feedstock, the government has established a Greenbelt Initiative to encourage sugar cane production by smallholders, using contract farming arrangements that safeguard the interests of smallholders in a buy-back scheme. The long-term interest of the government is to steadily wean farmers off tobacco production, which had been the country's major cash crop, because tobacco's export value is declining and the domestic market is small. More than 4,200 ha of sugar cane are expected to be developed using smallholder-grower schemes in partnership with Press Corporation.

The development of ethanol as a green feedstock is an attempt by the government to improve fuel security and create viable incomes for smallholders. By pegging the price of ethanol to the price of oil, these objectives can be met without raising the cost to consumers, even in times of low oil prices. Meeting these greening objectives in ethanol production, however, requires integration along the chain (ethanol production, distribution and car conversion), as well as systemic coordination between the agricultural and industrial sectors. Government regulations and strategic policymaking have been the principal drivers of this value chain greening.

The long-term interest of the government is to steadily wean farmers off tobacco production, which had been the country's major cash crop, because tobacco's export value is declining and the domestic market is small.

SOLAR ENERGY IN RWANDA[1]

Rwanda has made impressive headway in inclusive growth over the past decade. Under the Economic Development Poverty Reduction Strategy (EDPRS, the economy has grown at an average 8 per cent a year, which has translated into a fall in inequality, a significant reduction in absolute poverty and an increase in life expectancy from 43 to 64 years (WHO, 2016).

The government recognizes the importance of mainstreaming climate change—not only in its Vision 2020 and EDPRS 2 but also in its sectoral strategies. It introduced the National Strategy on Climate Change and Low Carbon Development in 2010/11 to mainstream climate resilience and low-carbon development into key sectors. Its long-term strategy, "Vision 2050", aims to transform Rwanda into a developed country, with a strong service sector, low unemployment and low poverty rates. This strategy also envisages that agriculture and industry will have a minimal negative impact on the environment, operating sustainably and enabling Rwanda to be self-sufficient in basic necessities (Republic of Rwanda, 2011).

FONERWA (the national environment and climate fund) was established in 2012 as the engine for

green growth in Rwanda. It attracts and streamlines climate finance with the national strategy and leverages private investment for low-carbon initiatives. Putting FONERWA into operation has been a strategic move to facilitate access to international climate finance, especially Fast-start Finance for adaptation. Under the National Strategy for Climate Change and Low Carbon Development (2011), there is a programme of action focusing on the Low Carbon Energy Mix Powering the National Grid. The programme proposes the introduction of renewable energy feed-in tariffs and the promotion of public–private partnerships. Another programme of the National Strategy encourages small-scale energy installation, especially in rural areas, to promote access to electricity and reduce dependence on wood fuel. Rwanda intends to use public funds to serve as the guarantee for investment in electricity-generation projects and to introduce terms that will attract private investment in energy (Republic of Rwanda, 2013).

The government sees electricity generation as a critical factor for socioeconomic development and the main vehicle for diversifying the economy. It aims to achieve 70 per cent access to electricity by 2017—a substantial increase from 19 per cent in 2012—and to increase electricity-generation capacity more than tenfold, from 100 megawatts (MW) in 2012 to 1,160 MW by 2017. The estimated investment needs are at least $500 million a year. About $200 million a year is planned to come from the public sector and $300 million from the private sector (AfDB, 2013).

The programme proposes the introduction of renewable energy feed-in tariffs and the promotion of public–private partnerships. Another programme of the National Strategy encourages small-scale energy installation, especially in rural areas, to promote access to electricity and reduce dependence on wood fuel.

To achieve these objectives, the government envisages two main scenarios: accelerated and delayed. The former would need investment of approximately $4.2 billion from 2013 to 2017 (an annual $845 million). The latter requires an estimated $2.5 billion for 2013–2017 ($510 million a year), which would then continue at the rate of $550 million a year (AfDB, 2013). Potential sources of financing for this expansion include electricity tariffs, government budgets, development partners, the private sector and revenue from the Rwanda Energy Group.

The strong direction taken by government policy has provided the framework for a range of investments. One is a solar field funded by Gigawatt Global, Norway's Investment Fund for Developing Countries (Norfund) and Scatec Solar and backed by US President Obama's Power Africa Initiative. The $23.7 million project is the first utility-scale, grid-connected, commercial solar field in East Africa. The field generates 8.5 MW and has increased Rwanda's power-generation capacity by 6 per cent. Construction began in February 2014 and was completed by July. It produced an estimated 15 million kilowatt-hours in its first year, sending power to a substation 9 km away. The solar field is linked to a central server in Oslo, Norway, and can be monitored remotely via the Internet. The project is built on land owned by the Agahozo-Shalom Youth Village, whose mission is to care for Rwanda's most vulnerable children orphaned before and after the genocide. This lease provides the biggest source of income to the

six-year-old village, currently home to 512 young people, who are offered schooling and extracurricular activities (Guardian, November 23rd 2015).

Rwanda's progress in renewable energy is embedded in a larger, systemic framework that invests in the provision of inclusive, decentralized production of green energy technologies. This programme is driven primarily by the Rwandan government but seeks to build into its development greater private sector participation. International agencies and external support—regional and global—are important components of this greening programme.

MOROCCAN SOLAR ENERGY

A large concentrated solar power plant was completed in central Morocco, near Ouarzazate in 2015. Covering the equivalent of 35 football grounds and generating 160 MW in phase 1, it works by concentrating heat from the sun using parabolic mirrors to generate heat in turbines, from which electricity can then be generated.

Morocco is the only North African country with virtually no fossil-fuel resources. In 2009 the country imported 97 per cent of its energy needs, at a cost to the state of Dh62 billion ($6.2 billion) a year. With rapid growth in energy demand, Morocco needed to take a decisive step in a new direction (Financial Times, 23 November 2015).

The driving force behind this investment has been the commitment of the government to use its enormous solar potential. A specialized agency was set up, MASEN, the Moroccan Agency for Solar Energy. This first phase of the project, Noor-Ouarzazate, will be followed by two further phases, which together should take capacity to 500 MW, enabling Morocco to obtain more than 40 per cent of its electricity from renewable sources by 2020.

Funded by a consortium including the EU, the World Bank, European Investment Bank, African Development Bank (AfDB), Germany's Kreditanstalt für Wiederaufbau and Agence Française de Développement, it has been built by a Saudi Arabian construction company. Projects like that at Ouarzazate could also offer a secure supply of renewable energy to neighbouring Europe, especially Germany, where nuclear power is being phased out.

GEOTHERMAL ENERGY IN KENYA

Only 16 per cent of Kenya's population currently has access to electricity, and demand outstrips supply. The national grid is unreliable and costly, in part because hydropower is frequently interrupted by drought and is, in the long term, vulnerable to climate change. Geothermal power has the potential to provide reliable, cost-competitive power with a small carbon footprint. If the ambitious target of producing 5,000 MW from geo-thermal sources by 2030 is achieved, this form of energy from east Africa's Rift Valley could power 15 million homes (Guardian November 22nd, 2013).

Geothermal resources in Kenya are along the Rift Valley and have estimated potential of 7,000–10,000 MW at 14 prospective sites. Kenya has been leading other countries in the region by complementing investment in Olkaria's geothermal power plants with policies designed to make this energy transition as efficient as possible. The country's links to other geothermal countries, especially Iceland, have also enabled knowledge sharing to improve technologies, geothermal training and education.

By 2015, the 70 per cent state-owned Kenya Electricity Generating Company (KenGen) had built three plants to exploit the Olkaria geothermal resources. Kenya aims to acquire 5,530 MW of geothermal power (26 per cent of total power

generating capacity) by 2030, making it the largest source of clean energy. As a share of national power, by 2030 geothermal power in Kenya could reach the same level as in the world leader, Iceland (CDKN, 2014).

The government has been the main driver of investment in geothermal energy, and it formed the Geothermal Development Company (GDC) following agreement of the 2006 Energy Act to assume the high upfront risks of exploration and deployment. The government is providing considerable financing for the programme through budgetary allocations and infrastructure bonds. It has provided $399 million for the three ongoing projects and has helped facilitate loans. For the three projects, a combination of grants and loans have been committed from the World Bank $222 million, the European Investment Bank $204 million, and AfDB $120 million. The GDC is designed to become financially self-sustaining by generating revenues from the sale of energy, progressively relieving the government of the burden of funding. GDC's projections indicate that it will require investment of $2.57 billion in the next 10 years, $1.52 billion from accrued revenues (Ngugi, 2012).

Investments in geothermal power are embedded in a wider programme to increase foreign investment. Kenya Electricity Generating Company (KenGen) and independent power producers (IPP) are projected to raise $12 billion for investment in several power plants, whereas GDC, supported by the government, will raise $6 billion. A considerable investment gap of more than $18 billion remains, however in the power sector. A key concern for investors is whether these projects are bankable, in terms of project viability and risk. In an attempt to ease investors' anxieties, the government has liberalized the exchange rate and created an independent judiciary.

The government provides incentives in the form of full cost recovery of investment through power purchase agreements, steam supply agreements, feed-in-tariff policies and government guarantees. Another undertaking is a commitment to $166 million in partial risk guarantees to reassure investors concerned about state-owned electricity use and its obligations towards them. Further, Kenya has structured its geothermal power-generation prices to afford a reasonable return to private investors and adequate funds for the government entities.

Finally, KenGen receives carbon credits from the World Bank's Community Development Carbon Fund for investing in renewable energy, since it displaces higher carbon sources in the national grid (World Bank 2013). The fund pays KenGen a premium on the credits, but in return requires that part of the revenue from the credits be used for social co-benefits. The money from the sale of carbon credits is used to build schools and finance training to educate students in the skills required in tapping geothermal energy, which has stimulated investment from the private sector.

The expansion of green geothermal energy in Kenya is driven by the state, and supported as a systemic initiative by a range of complementary policies, including those designed to attract foreign direct investment. Still, the government's long-term aim is that green energy will involve strong participation from the private sector.

TRADE-OFFS AND CHOICES FOR ENERGY IN NIGERIA[1]

The government has pursued strategies to promote greener industrialization, even though no formal green industrialization policy exists. Energy security is perhaps the most critical challenge to industrialization in Nigeria, green or otherwise. The government employs a mix of instruments to

decouple economic growth from environmental pressures, including command and control regulations and self-regulation by industries.

Shortage of electricity remains the critical bottleneck to industrialization. With levels of power generation of just over 4,000 MW and demand exceeding 10,000 MW, Nigeria faces a huge gap. The Renewable Energy Master Plan intends to increase the share of renewable energy in electricity production from the current 13 per cent to 23 per cent by 2025 and 36 per cent by 2030. Although the government plays a major role in defining such a strategy, in practice the difficulties faced by major industries in securing energy for their activities mean that a significant expansion of coal-fired electricity supply is under way, alongside long-standing reliance on diesel-fuelled generators.

The government of Nigeria recently announced measures to stimulate demand for renewable energy in electricity production and distribution, under the National Renewable Energy and Energy Efficiency Policy, which entered into force in 2015. The government has adopted a renewable energy feed-in tariff (REFIT), which requires electricity-distribution companies to source 50 per cent of their total electricity from renewable energy producers. In addition to assuring a market for renewable energy, REFIT has established guaranteed prices through 20-year power purchase agreements that provide stable income and returns on investment. Tariffs offered are technology specific, varying by renewable energy source and by scale. For automatic integration into the grid, REFIT targets electricity generated from small plants of 1–30 MW. Plants greater than 30 MW will be subject to competitive bidding. By 2020, it is hoped that growth in renewable energy generation will be achieved through additional capacity in solar (387 MW), wind (412 MW), small hydro (675 MW) and biomass (526 MW). Were it to be achieved, this new capacity would make a significant contribution to energy availability, as it compares with total installed capacity of 7,500MW, and average generating capacity of 3,800MW. Different regions in the country have been mapped and allocated REFIT quotas based on their comparative energy potentials.

Investors have shown strong interest in the renewable energy and efficiency sector. The solar sector has received a major boost ...

For the Nigerian biofuel industry, the government has developed a biofuel program to avoid distorting food production and food security. The Nigerian Biofuel Programme is led by the Nigerian National Petroleum Company, with the goal of helping the domestic ethanol fuel industry to take off. As with Malawi, the programme aims to blend up to 10 per cent of fuel ethanol with gasoline to attain an E10 blend. The programme aspires to achieve 100 per cent domestic production of biofuels consumed in Nigeria by 2030.

Investors have shown strong interest in the renewable energy and efficiency sector. The solar sector has received a major boost with the November 2015 announcement by Access Infra and Quaint Global Energy Solutions of a $100 million solar project of 50 MW capacity. Dangote Group Cement Plc, a large Nigeria-owned cement company, established its sustainability strategy in 2015 to coincide with the company's expansion into other regions of Africa. This strategy aims to "attain carbon and dust emission resource efficiency performance in line [with], or above, peers in the industry, and implement a reliable and systematic assurance and sustainability reporting system" (dangote.com).

The Nigerian government is adopting a broad approach towards energy provision. Coal-based energy is expected to rise significantly to 2040 (IEA, 2014), but the government has simultaneously introduced policies designed to achieve greater energy decoupling through the industrial sector and to expand the production of renewables. The government is the driving force, given the scale of the challenges faced and the gap between current capacity and untapped demand.

BENEFITS OF RENEWABLE ENERGY DEVELOPMENTS IN SOUTH AFRICA

A combination of skills, markets, resources and pragmatic policy instruments are accelerating uptake and investment in renewable energy in South Africa, offering a sustainable opportunity for mitigating the energy crisis in the country and the related economic fallout.

Renewable energy resources (solar, wind, and biomass) are abundant in the country, which is partly why the National Development Plan, launched in 2012, included a 21 per cent target for renewable energy supply by 2030. Budgetary constraints and rising electricity tariffs for households, however, meant that this target had to be achieved at no cost to the government or to electricity consumers. A highly pragmatic policy instrument was needed. The result was a green procurement programme designed to provide significant incentives to private investors seeking new markets, to integrate the financial services sector (which is relatively robust in South Africa) and to ensure rural development and community benefits.

Competitive energy pricing has been made possible by steep price falls in renewable energy technologies globally, and the procurement programme's competitive rolling-bid process.

The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), was launched in 2011. Having completed its fourth round in 2015, it has channelled substantial private expertise and investment into grid-connected renewable energy at competitive prices (Eberhard, et al., 2014), at no additional cost to consumers. Government expenditure is limited to off-take and tariff guarantees (underwriting part of the risk). The processes followed by government have transferred other major risks to the private sector (high penalties for underperformance, Environmental Impact Assessments, technical assessments, expensive bid bonds, and so forth), thus discouraging more inexperienced energy companies from putting forward proposals. The government has also encouraged the financial sector to develop the skills needed to support the major role to be played by domestic energy firms..

Competitive energy pricing has been made possible by steep price falls in renewable energy technologies globally, and the procurement programme's competitive rolling-bid process. Although round 1 in 2012 did not see much in the way of competitive pricing in bids, in subsequent rounds, greater competition meant that project selection could focus on the top projects in price, technology and socioeconomic benefits.

This investor-friendly programme has realized valuable social and economic benefits. South Africa's Council for Scientific and Industrial Research (CSIR) (2015) found that these renewable energy investments had created $400 million in financial benefits, including the following:

- A large increase in foreign direct investment (FDI) in South Africa—of the cumulative $20 billion total investment between rounds 1 and 4, 28 per cent was foreign, amounting to 85.8 per cent of all FDI in 2014;
- A large contribution to decentralized energy delivery—South Africa is now the 10th biggest solar market in the world for installations of less than 5 MW, which offers a shift towards more decentralized energy delivery models;
- Reduced load shedding;
- Reduced carbon emissions (by the equivalent of 4.4 million tonnes of carbon dioxide);
- Creation of 109,000 jobs (and more to come)—the renewable energy sector is expected to create 462,000 jobs by 2030;
- A manufacturing boost—the new solar photovoltaic plant in Durban employs 160 people, and the solar tower facility in Atlantis employs 200;
- Stimulation of research and public–private partnerships, establishment of research chairs and centers for renewable and sustainable energy studies at South Africa's top universities and the Battery Research Unit at the CSIR, funding by the government and private sector of the RE Technology Centre to train technicians to service renewable energy projects;
- Communities' ownership of 10.5 per cent of renewable energy projects (the required minimum is 2.5 per cent);
- Expected net income of $290 million over 20 years; and
- $1.1 billion in goods and services to be procured by 2030 from Black Economic Empowerment (BEE) suppliers.

Since the first request for proposals in 2011, local content requirements for project bids have grown, resulting in the emergence of new manufacturing activities in renewable energy components. In the photovoltaic industry, for example, local content (measured by share of total project spending) increased from 53 per cent in round 1 to 65 per cent in round 2. The trend is expected to continue. As REIPPPP continues, price competition is expected to level out, increasing emphasis on higher local content contributions for winning bids. In response, solar manufacturers have set up bases in South Africa, increasing employment from 13,000 full-time employees in round 1 to 26,000 in round 4. International investors are increasingly viewing South Africa as a potential manufacturing hub and entry point into the nascent renewable energy sectors of other African countries.

Critically, the success of REIPPPP, particularly in considerably lowering the cost of entry for renewables, is also stimulating the development of other IPP models in South Africa (and replicable outside the country). An entrepreneurial renewable energy company, Tombolo Energy, is developing the IPPs that underpin decentralized renewable energy models. The company's vision is to build localized energy networks by creating agreements directly with municipalities and large consumers. It is building on precedents established by innovative power agreements in the country, such as that between Amatola Green Power and Nelson Mandela Bay Municipality, a deal that includes a 20-year off-take agreement with BHP Billiton South Africa for renewable energy credits.

Another spin-off is the establishment of a local wind turbine manufacturing plant that brings world-recognized German technology developed by Aerodyn GmbH to Cape Province, South Africa, under licence to manufacture locally. The company, I-WEC, is a joint venture between two local entities, Tawk Energy (40 per cent) and IWECON (60 per cent). In addition to creating jobs for local economies (2 people employed for every single turbine produced), I-WEC's local manufacture of wind turbines and blades will be exported

to neighbouring countries and reduce the impact of exchange rate volatility for developers.

The renewable energy developments in South Africa over the past five years reach far and range wide, to include new jobs and skills, circulation of financial benefits in local economies, improved national and local energy security, emission reductions, foreign investment, and welcome changes to the regulatory environment—not least of which is the facilitation of decentralized energy generation. With market demand for renewable energy going from strength to strength and rising local and foreign investment, every indication is that the central role of renewable energy for green industrialization—and its co-benefits—will ratchet up.

6.4 THE WATER SECTOR

THE TRANSBOUNDARY CUBANGO-OKAVANGO RIVER BASIN

The Okavango River Basin is in Southern Africa, spans the three countries (Angola, Botswana and Namibia) and provides water for a population of some 922,000 in the immediate region—a figure expected to increase to more than 1.67 million people by 2025 (OKACOM, 2015). Because of its relatively pristine state, the basin is of global interest, and the Okavango Delta, in the Botswana portion of the basin, is the third-largest designated wetlands site on earth, recognised as such by the international Ramsar Convention. The delta, as a major global tourist attraction, is a hefty contributor to Botswana's economy, generating $866 million a year in tourism income (Murphy, 2013). It is also a source of diverse livelihoods (such as farming, fishing, tourism services, and basket weaving) for the many ethnic groups dependent on it.

As one of the world's largest inland water systems, the basin is a critical shared natural resource for its riparian countries. The Okavango River is the only exploitable perennial river that flows through countries of Botswana and Namibia ...

As one of the world's largest inland water systems, the basin is a critical shared natural resource for its riparian countries. The Okavango River is the only exploitable perennial river that flows through countries of Botswana and Namibia (OKACOM, 2015). It is also a rich but fragile source of biodiversity and is of regional and global importance.

Although Botswana derives significant socioeconomic benefits from the basin, Angola has the largest portion of it, with 48 per cent of the basin's area; Botswana has 15 per cent and Namibia 37 per cent. The source of the Okavango is in the Angola highlands, so Angola's development decisions have fundamental consequences for the downstream riparian countries. Since Angola's civil war ended in 2002, the country has become increasingly dependent on water abstraction from

the Cubango-Okavango River System as a means to boost economic growth and enhance the livelihoods of its population (SAIIA, 2014). Although permanent water scarcity does not threaten the basin overall, the river swells and contracts with regular, periodic flooding; economies and tourism are heavily dependent on the basin's biodiversity. Regular flooding is an essential event for the delta because it supports the ecological system that provides the foundation for tourism, biodiversity and livelihoods.

The Okavango Watercourse Commission (OKACOM) was set up in 1994 to provide a vehicle for joint management and coordination. Through promoting regional cooperation and sharing benefits, OKACOM aims to reduce unsustainable activities in all three countries and prevent development activities that exceed the constraints of the system, while enhancing the ecosystem services of the basin for the benefit of all riparian countries (OKACOM, 2015). The institution strives to deepen cooperation to ensure that the three countries define and respect those system thresholds, or the upper limits of sustainable abstraction.

Although donor funding supports OKACOM, cooperation is primarily attributable to the political will of all three countries. Historical political alliances have formed trust, which is still a key success factor, primarily because those alliances encourage a shared vision among the countries, facilitating water policy in a way that preserves the ecological integrity of the basin and protects the system's socioeconomic benefits. One example of important transboundary cooperation is that all three countries have ratified the UN Framework Convention on Climate Change, the UN Convention on Biological Diversity, the UN Convention to Combat Desertification and the Southern African Development Community (SADC) Revised Protocol on Shared Watercourses; Botswana and Namibia have also ratified the Ramsar Convention (OKACOM, 2015).

Still, the cooperative basis on which the basin is managed is under threat from three drivers: climate change and the consequent increased variability in rainfall and water flows; population pressure: and economic expansion.

Still, the cooperative basis on which the basin is managed is under threat from three drivers: climate change and the consequent increased variability in rainfall and water flows; population pressure: and economic expansion. They are systemic drivers of change that, together, could destabilize political alliances, as countries believe that they have no choice but to focus more on their national interests. Solutions require adoption and alignment of green policies by all the riparian countries. Those policies include climate change adaptation plans; compatible water, environmental and development plans; innovative approaches to payment for ecosystem services; and pre-emptive conflict management. Thus, trade-off analyses and consultations must deepen further and consider the long-term nature of costs and benefits flowing from choices made today.

Management of this water basin is inherently systemic, crossing national boundaries and affecting the growth of the services and agricultural sectors. The drivers of coordinated intergovernmental action are a proactive concern for this ecosystem, which is vulnerable to climate change and over-abstraction. The key governance bodies of this systemic response are governments rather than the private sector.

GREENING THE MARITIME CHAIN IN MAURITIUS

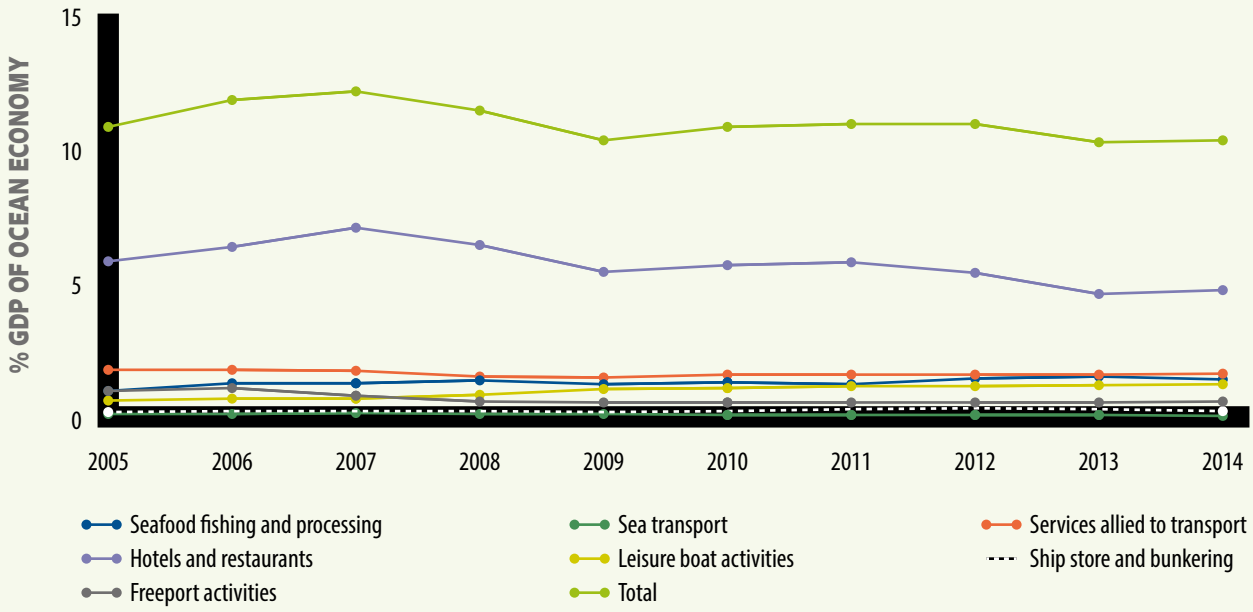
Greening the maritime chain in Mauritius is progressing well. Policy initially was a response to comply with international standards for marine safety and pollution prevention, but it has matured into a strategic vision for how the maritime system can provide multiple green development opportunities. The sector accounts for more than 10 per cent of Mauritian GDP, and its constituent subsectors—of which tourism and hospitality are the most important—span a range of sectors, including fishing, transport, agriculture and services (figure 6.4). The maritime sector provides many jobs and is an important driver of inclusive development.

Critical to the vision that drives government policy is its green identity, observable in a range of individual policy initiatives, including the exploration and exploitation of hydrocarbons and minerals from the seabed, the hospitality sector, fisheries, renewable energy, marine technologies, international transport and the provision of water for sustainable agriculture.

The green maritime vision was catalysed by proactive adherence to a set of green standards and conventions from the International Maritime Organization (IMO), notably the following:

- The International Convention for the Safety of Life at Sea (SOLAS) 1983, which defines minimum standards for the construction, equipment and operation of ships. They cover aspects such as design specifications for oil tankers and carriage of cargoes, including dangerous goods. A flag state—a state in which a vessel is registered—has to ensure compliance with a series of environmental requirements for ships operating under its jurisdiction. SOLAS also has a port state control provision, through which contracting governments can inspect ships of other

FIGURE 6.4 OCEAN ECONOMY AS A PERCENTAGE OF GDP, MAURITIUS



SOURCE: STATISTICS GOVERNMENT OF MAURITIUS, ECA ANALYSIS (2015).

contracting states in case of doubt regarding non-compliance. This power of inspection has provided a growing source of revenue to Mauritian port-based companies.

- The International Convention for the Prevention of Pollution from Ships (MARPOL, short for "marine pollution") 1973, which defines regulations aimed at preventing and minimizing pollution from ships. It covers pollution that is accidental and that happens through routine operations, such as pollution by oil, sewage, garbage and noxious liquid substances from ships.
- The Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) agreed in 1978, which defines basic requirements for mariners. Countries must at least meet these standards. STCW is crucial in building the required skills and capabilities and increasing employability in important marine sectors, such as general provisions, the engine department, master and deck departments, and emergency, occupational safety and medical care and survival departments.

Compliance with the IMO and similar standards has led to significant progress in greening the maritime transport chain. Some of the green practices that have emerged include using energy-efficient engines and less polluting fuels to control nitrogen oxide and sulphur oxide particulates and other noxious emissions, waste management methods, and skill- and capability-building standards to ensure safety at sea and green stewardship of the sea. These developments have resulted in Mauritius being included in the IMO's "white list" of 127 nations that are in full compliance with the regulations. (Countries not on the list may find their ships denied entry into ports, detained or subject to very close inspection.)

Beyond the marine sector are its linkages to the economic hinterland. The country's export-oriented industrial sector feeds into global and regional value chains; 84 per cent of exports go to high-income economies, such as those in the EU. This requires environmentally compliant transport chains, particularly for ships flying the Mauritian flag, which has now gained a strong international reputation for complying with high standards in environmentally sensitive global maritime trade. Those green credentials have allowed Mauritius to become a platform for ship registration, trans-shipment, fuel storage, ship repairs and related activities, allowing it to take full advantage of its oceanic location.

Some of the green practices that have emerged include ... ... standards to ensure safety at sea and green stewardship of the sea

Mauritius has therefore seen a shift from environmental compliance as a response to IMO standards to adoption of a green vision for managing its ocean resources—the "Blue Economy". This vision is supported by legal, strategic and policy frameworks, such as those that follow:

- **Maurice Ile Durable (MID).** This strategic framework embraces five development pillars: energy, equity, employment, education and environment (the "five Es"), aiming to sustainably harness the social, ecological and environmental landscape of Mauritius.
- **The Ocean Economy Roadmap.** This document outlines how the Blue Economy will be harnessed sustainably. It covers mid- and long-term priority areas and enablers.

- **Related laws.** Those laws include the National Oil Spill Contingency Plan; Environment Protection Act; Marine Pollution Bill; Port Master Plan; Fisheries and Marine Resources Act; National Coast Guard Act; Maritime Zones Act; and Continental Shelf Act. Each targets a green agenda—not just as an act of compliance but as a strategic area for sustainable income growth and employment.
- **Greening agendas.** They are supported by government subsidies to the Mauritius Maritime Training Academy, which aims to boost the stock of skills and employability of young people in the marine sectors.
- **Resource mobilization.** One aim is to develop the Port Louis Harbour into a regional maritime hub for services such as fish processing, maritime transport and ancillary businesses.

The greening of the Mauritius maritime chain is systemic, not just in spanning the different economic maritime subsectors but also in greening logistics in export-oriented global value chains. The driver initially came from the government's desire to comply with international conventions and standards, as discussed, but increasingly the commercial benefits flowing from the greening of the maritime system have attracted a wide range of private actors.

Focusing on the higher returns in green niche markets, private firms—national and foreign—are seizing those opportunities and pursuing corporate strategies that provide for sustainable growth and profits and that create jobs throughout the economy (in the maritime-related hospitality sector, for example). A holistic approach is required to implement this vision and has led increasingly to policies among the Ministry of Ocean Economy, Marine Resources, Fisheries, Shipping and Outer Island; the Ministry of the Environment, Sustainable Development and Disaster and Beach Management; and the Mauritius Ports Authority. The government has been central to the design of this strategic vision and of associated policy, such as the Ocean Economy Roadmap. The private sector is increasingly pivotal to implementation.

6.5 THE RESOURCE SECTOR: WATER AND SUSTAINABLE MINING IN SOUTH AFRICA

South Africa is a water-stressed country. It is projected to experience a 17 per cent gap between water demand and supply by 2030. The risks associated with this growing gap and the pressures on supply from unprecedented environmental impacts are becoming a major concern to businesses in the country. Leading companies are increasingly recognizing that current approaches to water management are no longer sufficient, and those companies are waking up to the challenge that responsibility for water management cannot be left solely to government.

One corporate initiative is the annual South Africa Water Report, part of the international Carbon Disclosure Project (CDP) Report that summarizes annual surveys of the way business is addressing major environmental issues. Fifty-eight of the 100 top companies listed on the Johannesburg Stock Exchange took part in the 2014 survey. The Carbon Disclosure Project (CDP) Water Report indicates that a large number of companies experienced detrimental water-related impacts during the previous 12 months, including declining water quality, flooding and drought, government regulation of discharge volumes, increased water stress and high water prices. The CDP Water Report also illustrates some of the response strategies that companies are putting in place to address water-related risks and impacts, and it highlights examples of how companies are partnering with non-governmental and governmental bodies in water stewardship.

Historically, most of South Africa's industrial development and wealth are associated with extractives. Mining accounts directly for about 9 per cent of the country's GDP (19 per cent if related activities are included), about 50 per cent of the country's merchandise exports, and 35 per cent of the value of the Johannesburg Stock Exchange (CDP, 2014). Mining employs half a million people directly and another half a million indirectly, accounting for 1 million of the 8 million people formally employed in South Africa.

Coal mining is the largest contributor to mining value added. In 2013, 72 per cent of South Africa's primary energy consumption came from coal, and that is unlikely to change much in the decades to come, primarily because of the country's lack of investment in alternatives. South Africa is the fourth-largest producer of coal globally, and with more than 100 years of proven coal reserves remaining, coal is set to remain a valuable resource if the current business-as-usual scenario continues. Coal mining imposes severe demands on water resources, given its huge uptake of water and its pollution impacts, so it is an important challenge for greening (albeit partial greening because coal is the least green source of energy), with water efficiency and pollution management important entry points.

One coal mining company—Exxaro Resources Limited—provides an example of how the corporate sector can green its activities. Established in 2006, Exxaro is one of the largest diversified resource groups based in South Africa. Listed on the Johannesburg Stock Exchange, its current business interests span Australia, South Africa and the Republic of the Congo. Its capital expenditure programme is dominated by the coal-based business in South Africa, from which it produces more than 39 million tonnes of coal a year. The firm employs more than 7,500 full-time employ-

ees, with about the same number employed by contractors. Of its full-time employees, 17 per cent are women, compared with the industry average of 11 per cent.

Exxaro's business is based on a "five capitals model" (natural, human, social, manufactured and financial), which seeks a balanced approach to sustainable growth. The company considers sustainability not as a separate objective but as an input into and an outcome of its operations. It seeks to add value to these capitals throughout the lifetime of every mining operation, with the intention of leaving each area holistically richer after mine closure. Each stage of the mining value chain, referred to as the resource-to-market business model, is thus designed to leave a cumulative net positive effect.

For Exxaro, water is a strategic natural resource, critical to its business. It therefore promotes water resource management with this consideration built into its plans. Exxaro has launched initiatives to conserve water at all sites, adopting an overall strategy to manage water-related risks, minimize impacts, and operate through reduction, reuse and recycling. It participates in the CDP Water Disclosure Project surveys. Exxaro has partnered with the government's Department of Water and Sanitation and the Chamber of Mines through a steering committee to set water-use efficiency targets for the mining sector. The company achieved all its 2013 targets, which included 5% savings in potable water used, a cut in water intensity, and an increase in the proportion of water re-used and re-cycled over the previous year.

Exxaro has also prepared a water conservation plan that supports the national water strategy to ensure equitable distribution of water resources while enabling business growth and promoting sustainable use. The company seeks to enhance the protection and improvement of water quality by ensuring that the water discharged from its operations is of the same quality as or better than the original consumed. This informs the company's policy and strategy on mining and wastewater management in preventing pollution; in minimizing environmental impacts; and in maximizing water reuse and reclamation, responsible water discharge and disposal, and water treatment.

The company has developed a management standard on water for mining and industrial use that articulates its commitment to implement integrated water and waste management plans. The standard applies to the full lifecycle of a mine, including planning, construction, decommissioning, closure and rehabilitation. The water management programme entails water-use and related risk issues—from security of supply for operations to water efficiency and water-cost management—and manages those components within the framework of current and expected regulatory requirements.

In addition to three- to five-year goals, Exxaro pursues aspirational goals that include becoming self-sufficient in operational water needs and becoming a leader in water technology solutions. Its research and development department, with the University of the Free State, is evaluating innovative passive water treatment systems as a long-term solution to water management, including post–mine closure.

This example of a corporate commitment to environmental stewardship reflects the interplay of systems, markets and chain governance. Exxaro recognizes the need to focus on the whole value chain. It shows how green industrialization can be driven by a nationally owned lead firm that is responding to concerns expressed in financial markets about the nature of its environmental impact. It also shows the complexity of the greening challenge because it illustrates the challenge of greening an intrinsically high-carbon, non-green economic activity.

6.6 MANUFACTURING EXPORTS: ETHIOPIA'S HAWASSA ECO-INDUSTRIAL PARK (OQUBAY 2015)

Ethiopia has had annual GDP growth of 10.5 per cent from 2005-2014 (WDI, 2015). Although its economic take-off has been based on agriculture, it has recently focused on manufacturing for sustaining rapid growth and structural transformation. The country also has focused on long-term infrastructure, in particular energy, and transport to which it has allocated almost 60 per cent of its capital budget. In 2015, Ethiopia set a goal to achieve fourfold growth of manufacturing output by 2025, which entails attracting new investment and industrial infrastructure.

Ethiopia is a latecomer to industrialization—and to industrial parks. In 2015 it had four industrial zones, three of them foreign-owned. The Eastern Industrial Zone at Dukem, the Lebu Industrial Zone which is owned by Huajian Group and Modjo Industrial Zone owned by George Shoe. Only one Industrial Park is owned by the government; the Bole Lemi Industrial Zone. Hawassa Industrial Park is situated 275km south east of the capital. While these parks have created 11,000 jobs, they have generated insignificant export earnings to date. The government decided that its 2025 vision must be based on a thorough understanding of industrial parks and investment promotion. It thus commissioned policy research on industrial parks, with a focus on countries that have used industrial parks for industrial catch-up, notably China, the Republic of Korea, Singapore and Vietnam in Asia, and Mauritius and Nigeria in Africa. The state is the driver of the industrial park programme, and the lead organizations are the Ethiopian Investment Commission and the Industrial Parks Development Corporation.

Ethiopia has targeted manufacturing for its industrial parks, focusing on priority sectors. Choice of investor is based on a close understanding of final markets and the role played by lead firms in the value chain. Initial engagement started with the two largest US buyers in the textile and apparel industry. The 10 leading Asian manufacturers were then approached, with the intent of building a vertically integrated value chain, including production of high-quality cotton (ginning, spinning and weaving), establishment of fabric mills and output of garments. The country also aims to attract a network of support industries and accessory manufacturers.

Ethiopia has targeted manufacturing for its industrial parks, focusing on priority sectors.

Understanding the nature of the industry and the requirement of the clients has been essential. Construction of this specialized industrial park—Hawassa Eco-Industrial Park—was started in mid-2015 to host the leading firms, to be completed in nine months. The location was selected because of the competitive labour cost, skills and physical infrastructure. The design of the park has been focused on the needs of the lead buyers in

global textiles and apparel. The layout and design of buildings draw from the latest standards developed in the industry, such as those established by the US Customs authority after the September 11, 2001, terrorist attacks, to ensure security of trade, and safety at work, after the fire disasters in Bangladesh textile factories in April 2013. A one-stop government service has been introduced to cut red tape and improve the business environment. The China Civil Engineering Corporation, a leading construction company is building the park as a turnkey "design and build" project. Efforts are being made to generate positive spill-overs by integrating the industrial park with the city of Hawassa and contribute to a stronger service sector. Studies are being conducted to design resource-efficient housing units, to accommodate local workers.

The Hawassa Eco-Industrial Park is nested within Ethiopia's green economy strategy. Ethiopia has also sought to leapfrog global competition by using the green identity of the park to provide a competitive advantage over rivals from Bangladesh and China. The green industrial park recycles water, uses LED (light-emitting diode) and intelligent lighting systems, plants trees, and uses natural ventilation and lighting. To achieve zero pollution—and making it one of the first such industrial parks globally to do so—the park has adopted state-of-the-art "zero liquid discharge" technology, reflecting its similar reliance on 100 per cent renewable energy. Ethiopia is just completing Africa's first electric-driven railway network, from the capital Addis Ababa to the port of Djibouti, and a spur will be constructed to link Hawassa with this mainline, to ease transport from the industrial park.

All future industrial parks in Ethiopia are to be green, and will be based on the design of Hawassa Eco-Industrial Park. Even before formal opening in early 2016, Hawassa has registered 100 per cent occupancy and by 2017 will have 60,000 workers (75 per cent of them expected to be female), and with gross export earnings of $1 billion anticipated. Of the 10 leading international firms investing in Hawassa, two manufacturers each come from India and Hong Kong; one each from Sri Lanka, Indonesia, Taiwan and China; and a couple are local firms. Ethiopia aims to employ 2 million workers in a dozen export-oriented industrial parks by 2025.

Hawassa Eco-Industrial Park aims to show how targeted manufacturing investment in a world-class green industrial park will generate manufacturing jobs, increase export earnings, build production capabilities and generate spill-overs to the domestic economy. It is hoped that the success of the programme will follow from a deep engagement with and understanding of the requirements of final buyers. In the case of Hawassa, the Ethiopian government early recognized commercial and economic rewards to greening the value chain as an instrument of competitive advantage. Understanding the global value chain and the structure of each industry and focusing on lead firms has been challenging but is proving essential for obtaining commitment.

6.7 INCLUSION AND GREENING

Africa faces a dual challenge of promoting green and more inclusive forms of industrialization (chapters 3 and 4). Those efforts usually require discrete but complementary top-down actions by governments. Some cases exist, however, in which a natural, market-led and bottom-up co-evolution of development occurred, as with the Kumasi Hub recycling project in Ghana.

Enterprises have tended to evolve into specialized operations or producers, and some small engineering workshops emerged, producing new or reconditioning old parts.

MAKING, MENDING, REPAIRING—GHANA'S MECHANICS IN KUMASI (SCHMITZ, 2015)

Africa's biggest recycling hub, in Ghana, illustrates the strength of a circular economy that seeks to reuse and recycle valuable metals and machinery. This vehicle repair and metal-working cluster in Suame, a constituency in the Kumasi Metropolitan district, is remarkable for its scale and the technical skills available. Recycling has been practised here for more than 30 years and involves huge numbers of people working in individual enterprises that, together, have the ability to mend and re-build old vehicles.

The collective effect of the thousands of small workshops is remarkable (Schmitz, 1990). This agglomeration of small producers and traders, known locally as the Magazine, coalesced in part because of the unavailability of imported materials and spare parts, which necessitated people to repair and recycle—in particular, cars, lorries and small buses. Local workshops found ingenious ways to prolong the life of vehicles. Enterprises have tended to evolve into specialized operations or producers, and some small engineering workshops emerged, producing new or reconditioning old parts. None of these workshops could have existed in isolation, but together they achieved an impressive collective efficiency that helped to stop the transport system from collapsing.

In the 1980s, the Suame Magazine provided earnings to approximately 40,000 people; 30 years later, some 200,000 work there, in perhaps 12,000 businesses. Earnings in the cluster are a little better than in most other parts of the local economy. Some entrepreneurs have become rich, employing dozens of apprentices.

The cluster has specialized to cope with the challenge of electronics—which on new vehicles control the windows, door locks, fuel injection and other functions—and greater ease in importing spares. Although the skills base of the cluster lies primarily in mechanics, some workers have acquired skills in electronics; a few work at the larger workshops, but more are self-employed, providing their electronics expertise to other workshops. For example, an electronic diagnostic—to identify where the problems lie—costs 50 cedis ($12.50). Sometimes the repair can be rectified by replacing faulty components (bought from specialized traders); sometimes the electronically controlled part is replaced by a mechanically controlled part.

Second-hand reconditioned engines are widely available in the cluster. Lorries and cars are stripped down and then reassembled with reconditioned parts—or, where required, with new parts, such as plugs, gaskets or piston rings. A problem that seems unsurmountable for one workshop may become an opportunity for another.

The Suame cluster of recycling businesses was not established, nor has it been driven, by green objectives. Planetary boundaries and resource depletion are not subjects for discussion among members of this cluster. Instead, the concerns are focused on making a living or a profit by offering cost-effective transport solutions for the local market. Recycling is a mere by-product of such concerns.

Local scarcity and poverty are thus the drivers of recycling in Ghana. What is special about Suame is that local enterprises do more than just collect, sort and sell materials. They deepen the value chain by remaking a finished product from recycled materials or by providing a complete service. Thus, although Ghana's capital city Accra has a cluster of auto-parts traders in Abossey Okai, Kumasi has a cluster of both traders and makers in Suame, making the Magazine particularly interesting from the perspective of resource efficiency and urban livelihoods.

LOCAL CONTROL AND INCLUSION IN GREENING THE FORESTRY SECTOR (IIED 2015)

The forestry sector is important for green industrialization through different types of interventions, such as greening forest-related value chains and establishing sustainable forest management. When locally controlled forest enterprises implement those interventions, many benefits for inclusion arise. Such local control can offer a viable solution to address complex demands on forests during industrialization by helping local businesses transform their activities better to meet market opportunities. Local control helps them, for example, secure land and resource tenure; form larger coalitions and achieve economies of scale and the power of collective bargaining more easily; invest in programmes that strengthen business know-how; and revitalize technical extension services and deliver local and global public goods.

Many initiatives around the world are shifting towards a more local approach to generate inclusive livelihoods and respond to weak governance in the forestry sector. The Forest Governance Learning Group (FGLG) initiative is an informal alliance of 10 in-country groups of partners, including 7 from Africa (Cameroon, Ghana, Malawi, Mozambique, South Africa, Tanzania and Uganda). The FGLG thematic areas focus on strengthening forest rights; supporting small forest enterprises; encouraging trade in legal forest products; and advocating for pro-poor climate change mitigation and adaptation through forestry.

For example, in Cameroon, the FGLG took actions to increase the rights for very small forest enterprises to access, process and market forest products.. It made forest governance more effective by involving all stakeholders, certifying forest products, increasing employment via local processing, fighting corruption (through new anti-corruption cells) and supporting environmental decentralization in giving a greater role to civil society. In Malawi, the FGLG consortium of partners has aimed to bridge the gap between the well-designed forest policy and its weak implementation on the ground, formal recognition of the "illegal" charcoal trade, and strengthening village based management of local forests and associated revenues (Mayers 2014, Sibale et al., 2014).

The Forest and Farm Facility (FFF), hosted by FAO (Food and Agriculture Organization of the United Nations), works with FGLG to encourage invest-

ment in locally controlled forestry. The facility recognizes four preconditions to attract investment into forest enterprise: secure commercial tenure; solid business capacity; sound technical extension; and effective producer groups. The FFF works by strengthening forest farm producer organizations, operating through global, regional and national federations, representing more than 200 local forest and farm producer organisations, with more than 40 million members. In terms of business development by forest farm producers, more than 100 enterprises now produce for a wide range of markets- timber, bamboo, rattan, textiles, fisheries, fruit juice, honey, craftwork, nuts, cinnamon and cardamom and other non-timber forest products. Business takes time to develop and service provider organisations play a key role in helping enterprise develop and grow, as do international exchanges amongst forest enterprises, from which new technical or business practices are transferred (Macqueen et al., 2015).

As with Ghana's recycling cluster, this example from local forest enterprise shows that inclusion can be integrated into green industrialization through a locally grounded strategy—here, as part of a wider programme of linking local initiatives across African forestry. It also shows how such integration can be achieved by linking producers to potential investors and to the enabling institutions, such as those which secure land rights, and offer technical support, required to draw in such investment.

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The key stakeholders in the inclusive greening of the timber value chain are governments in Africa and Asia, cooperating closely with international and local civil society organizations (CSOs). Market forces alone seem unable to facilitate the inclusive greening of these and similar chains; hence, the change calls for a combined approach.

6.8 SYSTEMIC GREEN INDUSTRIALIZATION: LESSONS FOR GOVERNMENT

We observed at the start of this chapter the significant gains to be realized from discrete investments in greening at the level of individual manufacturing establishments in Africa. Although the examples given were all drawn from manufacturing, greening gains could similarly be evidenced in agriculture and services.

The greening challenge cannot be limited to these micro-interventions, though; to be successful, green industrialization must necessarily target the greening of systems. Systemic greening may span sectors, countries and value chains, but because it involves complex interconnections, we must understand the primary drivers to systemic greening and the key stakeholders who make it possible.

Table 6.4 summarizes the evidence of the 14 case studies in this chapter. Each shows systemic processes at work. In some cases the systems cross national boundaries, such as the Cubango-Okavango River Basin. They may also cut across economic sectors (the water and marine sector, agro-forestry and agri-food processing, bio-ethanol, the Cubango-Okavango River Basin) and ministries (Kenyan geothermal, Ethiopian industrial parks). Characteristically, these greening case studies also cut across value chains (forestry, the resource sector and industrial eco-industrial parks).

Three primary drivers of green industrialization stand out. In the case of public goods, such as infrastructure—energy and water— incentives, investment and government vision are critical and are the primary driver of systems greening, as with the renewable energy examples and the marine sector in Mauritius. In some cases, the vision is driven by governments acting in concert, as with the Cubango-Okavango River Basin. By contrast, in the productive sector, the primary drivers of green industrialization are final markets, in which consumer demand, environmental activism by CSOs and government regulations force greening along the value chain. There are also good examples of publicly funded programmes which have helped firms achieve major improvements in resource use efficiency and cuts in pollutant discharge.

A variety of primary stakeholders are involved in these cases. As with the drivers of greening, in the infrastructure sector governments (often aided by external donors) are responsible for requiring industrializing along green lines. Where market pull is the primary driver, the key implementers are lead firms (not always foreign owned, as can be seen from the examples of Exxaro in South Africa, SIPRA in Côte d'Ivoire and Dangote in Nigeria), sometimes responding to pressure from, or cooperating with, international CSOs.

A green industrialization agenda cannot, in short, be pursued by one set of stakeholders alone. CSOs, government, the private sector (domestic and foreign) and development partners and funders must act in concert.

The lessons from these case studies help to define the policy options and recommendations for promoting green industrialization in Africa. As seen from table 6.4, the government will always be a key player in setting the wider vision, putting in place consistent and credible incentives for private investment, ensuring delivery of key public goods—energy and water—and creating a shared platform for stakeholders to build a green agenda

TABLE 6.4 MAJOR STAKEHOLDERS AND DRIVERS IN SYSTEMIC GREENING

Case study	Systemic component	Greening drivers	Greening stakeholders
Timber value chain—Gabon and Ghana	Greening from forest to consumer	Consumer pressure in high-income final markets and CSOs	Lead TNC buying firms and local and foreign domestic producers
Agribusiness in Côte d'Ivoire	Greening of value chains	Final markets in high-income economies; foreign donor conditions.	Lead TNC and local firms
Catfish farming in Nigeria	Greening of fish supply chain	Local consumers; urban demand	Small entrepreneurs testing new processes
Bio-ethanol in Malawi	Coordination between retail, industrial and agricultural sectors	Government policy	Mainly government, with growing private sector participation
Rwanda renewables	Government policy and investment fund	Government policy	Commercial investors in solar, with strong state backing
Kenya geothermal	Combined government policy, crossing ministries and sectors	Government policy; foreign donors	Mainly government, with growing private sector participation
Nigerian renewables	Systemic approach towards energy decoupling and renewable production	Government policy	Mainly government, with growing private sector participation
South Africa renewable energy	Combined government policy	Falling photovoltaic-cell prices; high demand for energy; funders ready to invest	Government-set framework for investor opportunities, multiplying jobs and economic benefits
Cubango-Okavango River Basin	Cross-border water management; integration of agricultural and service sector needs	Governments aware of fragility of ecosystem and risks to commercial exploitation of resources	Intergovernmental action
Mauritian Blue Economy	Systemic approach towards marine and water sector	Government policy	Mainly government, with growing private sector participation
Exxaro resource sector	Greening of water in the value chain	Market pressure and corporate commitment	Domestically owned lead firm
Hawassa Eco-Industrial Park	Greening of the value chain	Competitive advantage in export markets	Government, with mainly foreign-owned lead firms
Recycling in Ghana's vehicle industry	Greening through supply and service activities	Foreign exchange and spare parts shortages	Thousands of small informal enterprises, working as a cluster
Inclusion in forestry	Inclusion in value chain; cooperation across national borders	Government policy; CSOs; market pressure	Government, private sector and CSOs

SOURCE: AUTHOR'S COMPILATION.

NOTE: CSO = CIVIL SOCIETY ORGANIZATION; TNC = TRANSNATIONAL CORPORATION.

together. Equally clear is the importance of CSOs, external donors and the private sector to this endeavour.

In the final chapter, this report considers the steps required to turn a vision of green and inclusive industrialization into reality—a feat that entails cooperation among the many stakeholders.

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6.10 ENDNOTES

1 This case study draws on Kaplinsky and Morris 2014.

2 Case study based on Rwirahira, J. and Fisher, S. 2015. Inclusive financing for low carbon resilient development in Rwanda, IIED Country Report, IIED, UK.

3 Source: Personal interviews with representatives of key ministries as well as the Cement Manufacturer Association.