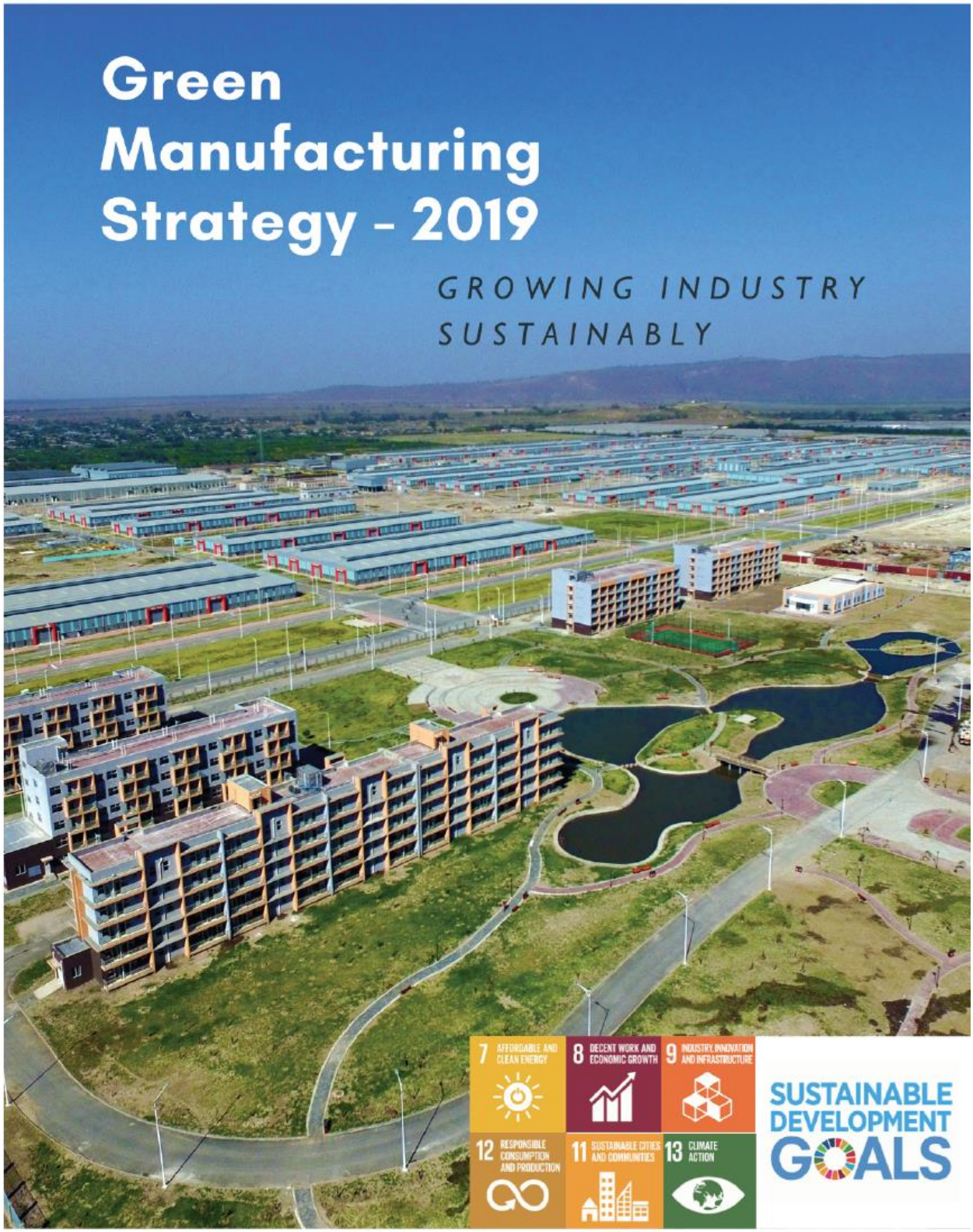
Green Manufacturing Strategy - 2019

GROWING INDUSTRY SUSTAINABLY



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Exchange Rate
1 USD = 27.23 ETB

Acronyms and Abbreviations

ADLI	Agricultural Development-led Industrialization
AfDB	African Development Bank
AGOA	African Growth and Opportunity Act
BAU	Business as Usual
BOD	Biological Oxygen Demand
CCIIDI	Chemical and Construction Inputs Industry Development Institute
CO_2e	Carbon Dioxide Equivalent
COD	Chemical Oxygen Demand
CoM	Council of Ministers
CP	Cleaner Production
CRGE	Climate Resilient and Green Economy
CSI	Cement Sustainability Initiative
EA	Energy Audit
EBA	Everything but Arms
ECCSA	Ethiopian Chamber of Commerce and Sectoral Associations
ECPC	Ethiopian Cleaner Production Centre
EFCCC	Ministry of Environment, Forest and Climate Change
EIA	Environmental Impact Assessment
EIC	Ethiopian Investment Commission
EIPs	Eco-industrial Parks
EMAS	Eco-Management and Audit Scheme
EMP	Environmental Management Plan
ENCS	Ethiopian National Conservation Strategy
EPA	Environmental Protection Authority
EPB	Regional Environmental Protection Bureaus
ESA	Ethiopian Standard Agency
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ETP	Effluent Treatment Plant
EU	European Union
FDI	Foreign Direct Investment
GCF	Green Climate Fund
GDP	Gross Domestic Product
GDS	Global Development Solutions
GEF	Green Environment Fund
GHG	Greenhouse Gas
GHP	Good Health Practice
GMP	Good Manufacturing Practice
GoE	Government of Ethiopia
GRI	Global Reporting Initiative
GTP	Growth and Transformation Plan
HACCP	Hazard Analysis and Critical Control Point
HIP	Hawassa Industrial Park
IDS	Industrial Development Strategy

ILO	International Labour Organization
IP	Industrial Parks
IPDC	Industrial Parks Development Corporation
LIDI	Leather Industry Development Institute
MBI	Market-based Instrument
MDDI	Meat and Dairy Development Institute
MDG	Millennium Development Goal
MIDI	Metal Industry Development Institute
MLE	Medium and Large Enterprises
MoA	Ministry of Agriculture
MoC	Ministry of Construction
MoFEC	Ministry of Finance and Economic Cooperation
MInT	Ministry of Innovation and Technology
MoLSA	Ministry of Labor and Social Affairs
MoMP	Ministry of Mines and Petroleum
MoST	Ministry of Science and Technology
MoT	Ministry of Transport
MoTI	Ministry of Trade and Industry
MoWIE	Ministry of Water, Irrigation and Energy
MSDS	Material Safety Data Sheets
Mt	Million Metric Tonnes
NGO	Non-governmental Organization
OECD	Organisation for Economic Co-operation and Development
OHS	Occupational Health and safety
OHSAS	Occupational Health and Safety Assessment Series
PA	Paris Agreement
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PVH Corp.	Phillips-Van Heusen Corporation
QMS	Quality Management Standards
RA	Risk Assessment
RECP	Resource Efficient and Cleaner Production
ROI	Return on Investment
SDG	Sustainable Development Goals
SDPRP	Sustainable Development and Poverty Reduction Program
SHE	Safety, Health and Environment
SME	Small and Medium Enterprises
SNNPR	Southern Nations, and Nationalities and Peoples Region
TDS	Total Dissolved Substances
ETIDI	Ethiopian Textile Industry Development Institute
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
US	United States
VA	Voluntary Agreement
WB	World Bank

1 Executive Summary

The vision of the Government of Ethiopia (GoE) is for the country to achieve lower middle-income status by 2025 following a green economic development pathway. Accordingly, GoE formulated a climate-resilient green economy (CRGE) strategy in 2011. To realize this vision, GoE has been preparing a series of five-year development plans in the form of Growth and Transformation Plans (GTPs) that aim to increase agricultural production and productivity, expand and strengthen the industrial base and foster export growth. The ultimate goal of the GTPs is to bring about structural change in the economy of the country wherein the rate of growth of the industrial sector surpasses the growth rates of the agriculture and services sectors so that the industrial sector becomes the dominant sector by 2025.

Ethiopia is committed to following a green development pathway in order to attain middle-income status by year 2025. The Ministry of Trade and Industry (MoTI), along with the Industrial Park Development Corporation (IPDC), is leading the industrialization of the country within the context of the GTPs that foresees a dominant role for the industrial sector in the country's economy. Regional governments and other private industrial park developers are also playing crucial roles in contributing toward the industrialization of the country.

From the point of view of greening the manufacturing sector, enterprises in Ethiopia can be classified into two major categories based on the date (month and year) of establishment, with 2008 as the dividing line. The milestone date for Ethiopian industries to comply with rules and regulations for the protection of the environment was July 2008, when the Council of Ministers (CoM) approved Prevention of Industrial Pollution Regulation 159/2008. This regulation provides for environmental prevention and control along with the industrial standards. It is widely agreed by industry stakeholders that no manufacturing plant established prior to 2008 had incorporated systems for waste minimization and pollution prevention. The regulation, therefore, was to be enforced following a five-year grace period to give ample time for existing industries to implement measures to enable them to comply with Ethiopian standards. Companies were required to show progress in complying with the law – i.e., installing primary effluent treatment. Companies that failed to meet standards during the grace period were open to regulatory penalties of fines and/or closure.

Despite the existing regulations, the following major environmental impacts continue to be observed today from the manufacturing sector in Ethiopia:

- Pollution of surface water bodies and destruction of aquatic life from effluents directly discharged into water bodies without treatment;
- Pollution of both surface and underground water bodies resulting from the existence of solid waste dump sites as opposed to properly designed and managed landfills;
- Pollution of land and soil, especially around rivers and solid waste dump sites;
- Increased air pollution and GHG emissions from industrial processes;
- Reduced productivity and profitability by the manufacturing sector due to wastage of raw materials, water and energy resulting from inefficient operational processes; and
- Limited number of manufacturing companies with EMS certification; non-certified companies are exposed to non-tariff export barriers.

With regard to the social dimension, the Ethiopian laws and regulations provide comprehensive protection to employees based on human rights protection enshrined in the Constitution which are conforming to the principles of the Universal Declaration of Human Rights and are also in line with the International Labor Organization (ILO) Conventions. The major governing labor law, Proclamation No. 377/2003, sets the core labor standards for conditions of work and defines employer-employee relationships in conjunction with Tripartite Consultation (International Labor Standards) Convention No. 144/1976 Ratification Proclamation No. 709/2011. The Ministry of Labor and Social Affairs (MoLSA) is empowered to undertake all acts necessary for the implementation of the labor laws and the conventions. There is a national Occupational Health and Safety (OHS) policy that deals with how occupational safety and health are handled at the national level. Moreover, Ethiopia is a signatory to the Occupation Safety and Health and Working Environment Convention No. 155/1981. Nonetheless, the OHS Management System developed by the ILO in 2001 (ILO-OHS-MS 2001) has not been implemented in Ethiopia. Likewise, no organization has developed and implemented OHS policy specific to the organization and appropriate to the organization's size and the nature of its activities.

The Ministry of Labor and Social Affairs (MoLSA) undertakes regular inspections of various organizations – including the manufacturing sector – for recommending and enforcing the minimum requirements to protect the safety and health of employees. Two additional proclamations, namely, the Public Health Proclamation No. 200/2000 and Proclamation on Radiation Protection No. 79/1993, in conjunction with the aforementioned environmental laws and regulations, provide relevant aspects for protection of employee safety and health.

While MoLSA continues to enforce OHS policies, as of mid-2019, Ethiopia still suffers a number of major social impacts in the manufacturing sector including the following:

- Dislocation and resettlement of people as a result of new construction without due consideration for the impact on local population and communities. This disrupts the social network and cultural relationships of people;
- Unclean work environments affecting safety and health of workers and communities in the neighborhoods of manufacturing plants;
- Workers exposed to occupational disease;
- Disability of workers due to accidents and injuries;
- Loss of productivity of workers due to health problems, respiratory system disease, such as asbestosis or byssinosis (occupational lung disease that primarily affects workers in cotton processing) or silicosis (lung disease caused by breathing in tiny bits of silica, a mineral that is a component of sand, rock and mineral ores such as quartz);
- Health effects due to contamination of vegetables and agricultural products irrigated with water laden with chemicals and heavy metals discharged from manufacturing plants into rivers, e.g., Akaki and Modjo rivers;
- Ground water contamination through seepage of polluted waters;
- Negative impacts from urbanization and cultural conflicts including loss of indigenous cultures arising from lack of inclusive ESIA reports for manufacturing enterprises; and
- Ethiopia has no legally binding minimum wage for labor applicable throughout the country. Moreover, there is misuse of outsourcing practices, though limited in number, where workers are underpaid by the companies hiring them. The companies receive

double or triple the monthly wage per worker. Labor outsourcing is not allowed in eco-industrial parks.

The negative environmental and social impacts that have accumulated over the decades in Ethiopia's manufacturing sector can be alleviated if the existing challenges are overcome through strategic interventions. Existing problems (e.g., release of untreated effluent) faced by enterprises can be solved step-by-step through regulations and incentives, while future projects must be implemented according to firms' mandatory Environmental and Social Management Plans, which are required for all new initiatives, with the concomitant law enforcement by regulatory bodies (EFCCC and the Regional Environmental Bureaus).

Notwithstanding the aforementioned need for law enforcement, implementing environmental regulation need not be at the cost of job creation and development, but to support it and ensure competitiveness and sustainable growth of the manufacturing sector.

Although MoTI is responsible for ensuring CRGE implementation and environmental policies within the industrial sector in particular, and in the national and sectoral environmental platforms in general, MoTI has limited instruments at its disposal to foster green financing. For example, it has yet to develop policies to administer grants or provide tax breaks and loan guarantees. Furthermore, there are no specific industrial sector policies or laws that encourage, or provide financial assistance to, greening the manufacturing sector. As a result, the incentives for greening the industrial sector, including green financing mechanisms, are limited. MoTI will, therefore, benefit from capacity development to strengthen its ability to develop and implement a green manufacturing policy framework that will include mechanisms and instruments to create incentives and support service to green manufacturers and establish its involvement in the realm of green financing, i.e., designing appropriate green financing mechanisms targeting environmental, social, economic and governance issues in the manufacturing sector.

MoTI gives high priority for the manufacturing sector in industrial development. The vision of industrial development emphasizes building an *environmentally friendly* industry for achieving global competitiveness. Thus, greening the manufacturing sector dovetails with the CRGE and the vision of industrial development. Accordingly, the vision statement of green manufacturing is:

> ***"For Ethiopia to achieve, maintain and be globally recognized for environmentally and socially conscience green manufacturing on a national scale that will increase competitiveness to open new markets abroad and increase the national export volume and value of manufactured goods, thus support Ethiopia to achieve and maintain middle-income status and preserve the integrity of its environment and the health of its inhabitants for future generations"***

Based on the vision for greening the manufacturing sector stated above, in conjunction with input from key stakeholders in the sector, the following activities were undertaken:

- A review of the existing strategies;

- SWOT analysis based on international best practice for sustainable manufacturing; and
- Preparation of an action plan for greening the Ethiopian manufacturing sector.

Included in the action plan are objectives that must be realized to achieve the vision for green manufacturing in Ethiopia, critical issues preventing the sector from meeting these objectives, strategies needed to overcome the issues and actions required to achieve the strategies. The strategies and actions under each strategic issue in the action plan are tabulated and accompanied by a time frame and responsible bodies for step-by-step implementation.

2 Introduction

The U.S. Forest Service (USFS) and U.S. Agency for International Development (USAID) are working with the Ministry of Trade and Industry (MoTI) of Ethiopia to strengthen capacity and coordination under the Climate Resilient Green Economy (CRGE) strategy of Ethiopia, with broader objectives of strengthening Ethiopia's natural resource management. To this end, USFS engaged Global Development Solutions, LLC (GDS) to provide technical expertise in formulating a national-level green manufacturing strategy for Ethiopia by conducting a comprehensive analysis of the existing strategy, legal, institutional, and operational framework in Ethiopia and drafting a national-level action plan on green manufacturing.

The chapters herein synthesize the review of Ethiopia's existing strategies with international best practices and provide the basis for an action plan for achieving green manufacturing. From this basis, together with consultation from industry stakeholders and experts, a vision for Ethiopia's green manufacturing was set and the action plan was formulated. The strategies and associated actions that comprise the action plan are designed to overcome Ethiopia's environmental and social issues inhibiting the achievement of a green manufacturing sector.

3 Background

The vision of the Government of Ethiopia (GoE) is for the country to achieve lower middle-income status by 2025 by following a green economic development pathway. Accordingly, GoE formulated a climate-resilient green economy (CRGE) strategy in 2011. To realize this vision, GoE has been preparing a series of five-year development plans in the form of Growth and Transformation Plans (GTPs) that aim to increase agricultural production and productivity, expand and strengthen the industrial base, and foster export growth. The ultimate goal of the GTPs is to bring about structural change in the economy so that the industrial sector becomes the dominant sector by 2025.

Ethiopia's industrialization efforts during the last three decades started with the formulation of the Agricultural Development Led Industrialization Strategy (ADLI) of February 1994 which serves as an umbrella strategy. This was augmented by the formulation of the Industrial Development Strategy (IDS) in 2002. To implement the industrialization strategies, successive five-year economic development plans were prepared:

- Sustainable Development and Poverty Reduction Program (SDPRP), 2002/03-2004/05;
- Plan for Accelerated and Sustained Development to End Poverty (PASDEP I), 2005/06-2009/10;
- Growth and Transformation Plan I (GTP I), 2010/11- 2014/15; and
- Growth and Transformation Plan II (GTP II), 2014/15- 2019/20.

The earlier plans focused on increasing production and productivity in all sectors of the economy. In line with Ethiopia's green economic development path, both GTP I and GTP II give due emphasis on sustainable development. Ethiopia is also a signatory to multilateral environmental agreements, e.g., the Sustainable Development Goals (SDGs), the Paris Agreement (PA) and the Africa 2063 Agenda, which are complementary to green economic

development. Moreover, Ethiopia has a constitution that enshrines the right of its citizens to live in a clean environment. It is also stated in the Constitution that no development projects may negatively affect the environment and the people have the right to be consulted when new projects are implemented. In line with the Constitution, a comprehensive environmental policy has been prepared that serves as a foundation for formulating the basic environmental legal framework comprising environmental laws, regulations and standards/norms. Proclamation No. 299/2002 providing for Environmental Impact Assessment, Proclamation No. 300/2002 providing for Pollution Prevention and Control, Regulation No. 159/2008 – as well as its accompanying environmental standards – and Proclamation No. 513/2007 for Solid Waste Management, are the cornerstones of environmental protection and means for legal enforcement in Ethiopia. Institutionally, the environmental regulatory bodies are the Environment, Forest and Climate Change Commission (EFCCC) and the Regional Environmental Protection Bureaus (EPBs). Moreover, CRGE units, present in all ministries, play a great role in addressing issues related to climate change. The government commitment, the plans and strategies formulated, and the existing institutional setup pave the way for green industrial development.

With regard to the social dimension, the Ethiopian laws and regulations provide comprehensive protection to employees based on human rights protection enshrined in the Constitution which are conforming to the principles of the Universal Declaration of Human Rights and are also in line with the International Labor Organization (ILO) Conventions. Ethiopia is a member of the ILO since 1923[1] and a signatory to all eight ILO labor conventions fundamental to individual and collective conditions of work, namely, Forced Labor Convention, Convention on Freedom of Association and Protection of the Right to Organize, Convention on the Right to Organize and Collective Bargaining, Convention on Equal Remuneration, Convention on Abolition of Forced Labor, Convention on Discrimination (Employment and Occupation), Minimum Age Convention, and Convention on the Elimination of the Worst Forms of Child Labor. Ethiopia has ratified these and other related ILO conventions, all of which are listed in Table 1.

Table 1: ILO Conventions Ratified by Ethiopia

Convention	Year of Ratification
Unemployment Convention No.2/1919	1966
Right of Association (Agriculture) Convention 11/1921	1963
Weekly Rest (Industrial) Convention No.14/1921	1991
Freedom of Association and Protection of the Right to Organize Convention 87/1948	1963
Employment Service Convention No 88/1948	1963
Fee-charging Employment Agencies Convention No. 96/1948, denounced on 10-05-1999	1991
The Right to Organize and Collective Bargaining Convention No. 98/1948	1963
Equal Remuneration Convention No. 100/1951	1999
Abolition of Forced Labour No.105/1957	1999
Weekly Rest Commerce Convention No. 106/1957	1999
Discrimination (Employment) Convention No. 111/1958	1966
Minimum Age Convention No. 138/1973	1999
Occupational Safety and Health and Working Environment Convention No 155/1981	1991

[1] https://www.ilo.org/dyn/normlex/en/f?p=1000:11110:0::NO:11110:P11110_ISO_CODE:ETH

Workers with Family Responsibilities Convention No. 156/1981	1991
Termination of Employment Convention No 158/1982	1991
Vocational Rehabilitation and Employment (Disabled Persons) Convention No 159/1983	1991
Private Employment Agencies Convention No. 181/1997	1999
Forced Labour Convention No. 29/1990	2003
Worst Forms of Child Labour Convention No. 182/1999	2003

Source: Compiled by Global Development Solutions, LLC

The major governing labor law is Proclamation No. 377/2003, which sets the core labor standards for conditions of work and defines employer-employee relationships in conjunction with Tripartite Consultation (International Labor Standards) Convention No. 144/1976 Ratification Proclamation No. 709/2011. The Ministry of Labor and Social Affairs (MoLSA) is empowered to undertake all acts necessary for the implementation of the labor laws and the conventions. There is a national Occupational Health and Safety (OHS) policy that deals with how occupational health and safety are handled at the national level. Moreover, Ethiopia is a signatory to the Occupation Safety and Health and Working Environment Convention No. 155/1981.[2] Nonetheless, the OHS Management System developed by the ILO in 2001 (ILO-OSH-MS 2001) has not been implemented in Ethiopia. Likewise, no organization has developed and implemented OHS policy specific to the organization and appropriate to the organization's size and the nature of its activities. On the other hand, the British Standard (BS) OHSAS[3] 18001:2007 has been developed taking into consideration the provisions of ISO 9001, ISO14001, ILO-OSH-MS-2001 for the development and implementation of OHS in a comprehensive manner.

Accordingly, MoLSA undertakes regular inspections of various organizations – including the manufacturing sector – for recommending and enforcing the minimum requirements to protect the health and safety of employees. Two additional proclamations, namely, the Public Health Proclamation No. 200/2000 and Proclamation on Radiation Protection No. 79/1993, in conjunction with the aforementioned environmental laws and regulations, provide relevant aspects for protection of employee health and safety.

Taking the Industrial Development Strategy of 2002 as a foundation, MoTI prepared three documents in 2014, namely, *Ethiopian Industry Development Roadmap, Ethiopian Industry Development Strategic Plan (2013-2025)* and *Institutional Setup for Ethiopian Industrial Development (2013-2025).* The roadmap and the strategic plan follow the preceding industrial development strategy and give priority to the textile and garment, leather and leather products, agro-processing, chemical and construction, pharmaceutical and metal engineering sectors, as well as the growth of small and medium enterprises (SMEs) and medium and large enterprises (MLEs). There are 2,393 medium- and large-scale manufacturing establishments in Ethiopia registered in 2017 as shown in Table 2 below.

[2] Note that ILO nomenclature is "Safety and Health" and "OSH" as opposed to "Health and Safety" and "OHS" used by British Standard and other internationally recognized institutions as well as in this document.
[3] OHSAS 18001, Occupational Health and Safety Assessment Series, (officially BS OHSAS 18001) is a British Standard for occupational health and safety management systems.

Table 2: Number of Establishments of Major Manufacturing Industries

Manufacturing Sub-sector	Number of Establishments
Textile and Garment	223
Leather and Leather Products	141
Agro-processing	915
Wood and Furniture	176
Paper and Paper Products	135
Chemical and Chemical Products	47
Rubber Products	145
Non-metallic Mineral Products	364
Basic Iron and Steel Products	97
Fabricated Metal Products except Machinery and Equipment	136
Motor Vehicles and Trailers	14
Total	**2,393**

Source: CSA report on the 4th Quarter of the 200 9 E.F.Y Manufacturing Business Survey, October 2017

The government has plans to expand the light manufacturing subsector with the objective of enhancing its export-oriented industrialization. Accordingly, five "plug & play" type industrial parks (IPs) have been completed (Eastern Industrial Zone, Bole Lemi IP I, Hawassa IP, Mekelle IP and Kombolch IP), another five are under construction (Adama IP, Dire Dawa IP, Kilinto IP, Bole Lemi II IP and Jimma IP) and four IPs are in the construction design stage in Bahr Dar, Arerti, Aysha and Debre Berhan – all dedicated for specific sectors, such as textile & apparel, leather & leather products, pharmaceuticals, agro-processing, etc. Furthermore, seventeen integrated agro-industrial parks (IAIPs) have been identified for establishment, out of which four have been selected for pilot development in Tigray, Amhara, Oromia and Southern Nations, and Nationalities and Peoples Region (SNNPR). By establishing the industrial parks, the government aims to attract foreign direct investment (FDI) and lessen the time required for investors to establish manufacturing units and start production, since the IPs provide essential infrastructure including dedicated power substations and waste management systems. The government aims to develop the IPs into eco-parks that fulfill green manufacturing requirements meeting environmental and social standards. The IPs are located along key economic corridors, connected to ports and are built near airports, railway lines, dry ports, universities, etc., thus creating opportunities for large-scale job creation and facilitating technology transfers. Each IP is expected to employ between 10,000 and 60,000 workers.

While Ethiopia has been attracting foreign manufacturing investment, it aspires to bring high-quality companies with export potential into this strategic sector. Ethiopia offers preferential export access to the United States (US) through the US's recently extended African Growth and Opportunity Act (AGOA), and to the European Union (EU) markets through the EU's Everything But Arms (EBA) regime, but has not fully been able to exploit these preferences.[4]

[4] Looking Beyond the Horizon: A case study of PVH's commitment to Ethiopia's Hawassa Industrial Park, World Bank, June 2017. Reasons other than environmental compliance have prevented taking full advantage of the preferences.

Since 2010, FDI flows into Ethiopia have grown at an average annual rate of nearly 50%, reaching $2.2 billion in 2015[5] and $3.2 billion in 2017[6]. Investments have been in commercial agriculture, manufacturing, leather, and textiles sectors. Textile and garment firms – mostly contract manufacturers from India, Bangladesh, China, and Turkey seeking alternative production bases for export to the EU and North America – have made investments in Ethiopia. Seventy-two textile and garment companies had invested in Ethiopia (Addis Ababa, Oromia, Tigray, SNNPR and Amhara regions) by the end of 2017.[7]

One of the more significant investments is by the world-class clothing company, Phillips-Van Heusen Corporation (PVH Corp.). The company has commenced operations in the Hawassa Industrial Park (HIP). In Ethiopia, PVH is pioneering the world´s first fully vertically integrated – i.e., from cotton farming to finished garments – socially-responsible and environmentally-friendly textile industrial supply chain. Calvin Klein and Tommy Hilfiger are other world-class clothing companies that have opened production facilities in the Hawassa IP.

The economy of Ethiopia grew by an average of 9.5% from 2011/12 to 2015/16, during which time the average year-on-year industrial growth rate was 9.8%, thus driving the structural change in the economy. During the 5-year period, industry's average annual contribution to GDP grew considerably faster than that of services (11.3% vs. 0.8%) while agriculture's share of GDP decreased at an average rate of 3.7% per annum. Industry contributed 16.7% to GDP in 2015/16, a hefty increase from the 11.5% contribution in 2011/12 (Table 3).

Table 3: Share of Industry in GDP (%)

Economic Sector	2011/12	2012/13	2013/14	2014/15	2015/16	Ave Annual % Change	Total % Change	2019/20 Planned*
Agriculture	43.1	42.0	40.2	38.7	36.7	-14.8%	-3.7%	33.5
Industry	11.5	13.0	13.8	15.0	16.7	45.2%	11.3%	22.3
Service	45.9	45.5	46.6	47.0	47.3	3.1%	0.8%	44.2
Growth in Real GDP	**8.7**	**9.9**	**10.3**	**10.4**	**8.0**			**11.0**

**Source: GTP II*

Source: Annual Report of National Bank of Ethiopia, 2016/17; http://www.nbe.gov.et/pdf/annualbulletin/NBE%20Annual%20report%202016-2017/National%20Bank's%20Annual%20Rep~1.pdf

As indicated in GTP II, the manufacturing sector contributed 4.8% to the GDP in 2014/15 and it is expected its contribution will increase to 8% by 2019/20. The industry growth rate registered in 2014/15 was 23.5% and is expected to remain high at 20% in 2019/20. In tandem with the industrial growth, the manufacturing subsector registered a growth rate of 21.4% in 2014/15 and is anticipated to increase to 21.9% by 2019/20.

[5] UNCTAD 2016.
[6] UNCTAD Investment Report of 2017.
[7] Looking Beyond the Horizon: A case study of PVH's commitment to Ethiopia's Hawassa Industrial Park, World Bank, June 2017.

From the point of view of greening the manufacturing sector, enterprises in Ethiopia can be classified into two major categories based on the date (month and year) of establishment, with 2008 as the dividing line. The milestone date for Ethiopian industries to comply with rules and regulations for the protection of the environment was July 2008, when the Council of Ministers (CoM) approved Prevention of Industrial Pollution Regulation 159/2008 that provides for environmental prevention and control along with the industrial standards (norms). It is widely agreed by industry stakeholders that no manufacturing plant established prior to 2008 had incorporated systems for waste minimization and pollution prevention. The regulation, therefore, was to be enforced following a five-year grace period to give ample time for existing industries to implement measures to enable them to comply with Ethiopian standards. Companies were required to show progress in complying with the law – i.e., installing primary effluent treatment. Companies that failed to meet standards during the grace period were open to regulatory penalties, like fines or closure.

Note that Regulation 159/2008 set standards for industrial pollution, yet the regulation requiring the preparation of Environmental Impact Assessment (EIA) reports for manufacturing projects had been passed six years prior. Therefore, national industrial standards for action planning or preparing Environmental Management Plans (EMPs) did not exist when the EIA Proclamation was issued in 2002, which compromised the effectiveness of company EIAs.

Few projects had presented EIA reports to regulatory bodies prior to 2008. Those few EIA reports had been concluded to comply with the requirements for loan-extension from development organizations, such as the African Development Bank (AfDB) and the World Bank (WB). Also, a number of tanneries built end-of-pipe wastewater treatment plants as add-ons in order to satisfy customer requirements from abroad. Since 2008, however, the Ethiopian Investment Commission (EIC) requires an investor to obtain an EIA report – approved by pertinent regulatory bodies – for an investment permit to be issued. Moreover, local banks do not grant loans for projects without an investment permit from EIC.

3.1 Environmental Social and Economic Impacts from the Manufacturing Industries

3.1.1 Environmental Impact

Starting from the early 1960s, when the manufacturing sector began flourishing in Ethiopia, many manufacturing plants were established near rivers for easy discharge of both effluent and solid waste into the water bodies. Over the years, however, only a limited number of factories have installed waste treatment facilities to remove waste components such as industrial chemicals, petroleum products, pesticides, and inorganic contaminants (e.g., salts and metallic components). As a result, the Awash River Basin and its tributaries, particularly the Akaki River, are heavily polluted and have become "dead rivers."[8]

[8] The Akaki river, along with several more in Addis Ababa, has been dead for a number of years. The potential for reviving it exists but will require monumental efforts of multiple stakeholders led by the Addis Ababa City Government for this to be realized.

The following are among the major environmental impacts observed today from the manufacturing sector in Ethiopia:

- Pollution of surface water bodies and destruction of aquatic life from effluent directly discharged into water bodies without treatment;
- Pollution of both surface and underground water bodies resulting from the existence of solid waste dump sites as opposed to properly designed and managed landfills;
- Pollution of land and soil, especially around rivers and solid waste dump sites;
- Increased air pollution and GHG emissions from industrial processes;
- Reduced productivity and profitability by the manufacturing sector due to wastage of raw materials, water and energy resulting from inefficient operational processes; and
- Limited number of manufacturing companies with EMS certification; non-certified companies are exposed to non-tariff export barriers.

3.1.2 Social Impacts

Social impacts arise in tandem with environmental impacts following the implementation and operation of new projects as well as the operations of existing factories in the manufacturing sector. These activities cause changes to the environment that may affect human health or safety, cultural heritage – or, in general – alter environmental, social, economic and/or cultural conditions. Managing and improving the social performance of the manufacturing sector contribute to sector competitiveness as much as improving quality and environmental performance. Fulfilling a package of requirements of a standard social management system, such as OHSAS 18001 or ILO-OSH-MS-2001, requires that the manufacturing sector demonstrates that commodities are produced in line with the provisions of the standards that ensure or maintain safe and healthy working conditions.

As of mid-2019, the following are among the major social impacts observed in the manufacturing sector in Ethiopia:

- Dislocation and resettlement of people as a result of new construction without due consideration for the impact on local population and communities. This disrupts the social network and cultural relationships of people;
- Unclean work environments affecting health and safety of workers and communities in the neighborhoods of manufacturing plants;
- Workers exposed to occupational disease;
- Disability of workers due to accidents and injuries;
- Loss of productivity of workers due to health problems, respiratory system disease, such as asbestosis or byssinosis[9] (occupational lung disease that primarily affects workers in cotton processing) or silicosis (lung disease caused by breathing in tiny bits of silica, a mineral that is a component of sand, rock and mineral ores such as quartz)[10].

[9] Also known as Monday fever, brown lung disease, mill fever or cotton workers' lung

[10] Silicosis mostly affects workers exposed to silica dust in occupations such mining, glass manufacturing and foundry work

- Health effects due to contamination of vegetables and agricultural products irrigated with water laden with chemicals and heavy metals discharged from manufacturing plants into rivers, e.g., Akaki and Modjo rivers;
- Ground water contamination through seepage of polluted waters;
- Negative impacts from urbanization and cultural conflicts including loss of indigenous cultures arising from lack of inclusive ESIA reports for manufacturing enterprises;
- Ethiopia has no legally binding minimum wage for labor applicable throughout the country. Moreover, there is misuse of outsourcing practices, though limited in number, where workers are underpaid by the companies hiring them. The outsourcing companies charge the receiving companies double or triple the monthly wage per worker. Labor outsourcing is not allowed in eco-industrial parks.

The aforementioned negative environmental and social impacts accumulated over the past decades in the manufacturing sector in Ethiopia can be alleviated if the existing challenges are overcome through strategic interventions whereby problems being faced by older enterprises are solved step-by-step, and future projects are implemented according to the ESMPs of the mandatory Environmental and Social Impact Assessment (ESIA) reports. These reports require assessment and approval of the Environmental, Forest and Climate Change Commission (EFCCC) in general, and bodies delegated by the EFCCC. Due to insufficient internal capacity, the EFCCC delegates six ministries (as of mid-2019) to review and approve ESIA reports.[11] From an environmental perspective, this is a potential conflict of interest since each ministry is approving ESIAs for projects that fall under its respective jurisdiction.[12] The ESMPs of the ESIA are required to be implemented by the individual firms with the concomitant law enforcement by regulatory bodies (EFCCC and the Regional Environmental Bureaus).

3.1.3 Economic Impacts

Industrial development creates employment and economic benefit to the surrounding communities by adding value to resources and generating foreign exchange for the country. Greening the manufacturing sector and building eco-industrial parks lead to higher resource utilization rates and increased social benefits. However, as of mid-2019, there are limitations to Ethiopia's manufacturing sector, including in the newly established IPs, that result in the following economic impacts:

- Limited linkages with domestic SMEs resulting in loss of potentially greater local employment opportunities.
- Utilization of second-hand plants (machinery and equipment) causing:

[11] The six ministries delegated to issue environmental licenses for projects under their jurisdiction are MoTI, MoWIE, Ministry of Mines and Petroleum (MoMP), Ministry of Transport (MoT), Ministry of Construction (MoC) and MoA (Ministry of Agriculture).

[12] EFCCC is an independent entity, thus mitigating conflicts of interest, but until EFCCC has equitable capacity to handle all ESIA evaluations, a possible short-term fix to alleviate potential for existing conflicts of interest would be to form a review board comprised of representatives from each of the six ministries with the forwarding ministry being required to recurse itself from the evaluation process.

  - More frequent downtimes/stoppages, lower operating efficiency and higher reliance on spare parts which, together, result in lower capacity utilization and profitability when compared to operating new machinery and equipment,
  - Decreased productivity and loss of competitiveness,
  - Higher material loss and waste generation,
  - Frequent need to import and – to avoid extended downtimes – retain stock of spare parts which ties up working capital,
  - Failure of projects to fulfill their desired economic and social objectives.
- Installation of non-integrated and incomplete plants results in rework and extended investment phases at higher costs due to lack of comprehensive feasibility studies to determine if projects are technically and economically/financially viable. For example:
  - Tanneries established without ETPs requiring additional studies and investment,
  - Recently established sugar mills operating but without considering utilizing the byproducts – e.g., molasses used in the production of ethanol or used as a food/food additive for human consumption or as animal feed. Foregoing byproducts results in loss of economic benefits and furthers ecological damages and negative social impacts by contributing more to the waste stream.

3.2 Existing Challenges for Greening the Manufacturing Sector in Ethiopia

3.2.1 Low Level of Concern for the Environment and Lack of Awareness

Due to the apparently overriding development efforts, there is limited understanding and concern for the environment by manufacturing companies and sector stakeholders, both public and private, including decision makers, enterprise owners and management as well as the greater community. The concept of sustainable development, which balances economic, social and environmental benefits, is not well understood, resulting in a short-term focus on production, job creation and other economic and social benefits. Consequently, environmental degradation and pollution from the manufacturing sector are overlooked. Environmental protection tools and practices such as resource efficient and cleaner production (RECP) and EMS are not widely implemented by the manufacturing enterprises. Likewise, compliance with regulatory environmental norms are not observed.

In most cases, manufacturing companies do not consider the implementation of EMS as a mechanism for protecting the environment and addressing legal compliance issues, nor do they understand the potential economic and social benefits brought about by implementing EMS. This lack of understanding results in manufacturing companies' unwillingness to incur the upfront expenses associated with EMS.

3.2.2 Limited Social Concern and Lack of Awareness

Labour Proclamation No. 377/2003 is comprehensive in addressing social issues in connection with human rights, labor rights, working condition, labor administration and occupational health and safety (OHS). It serves as a basis for collective bargaining and agreements between workers and employers' representatives.

Meant to be implemented as a social management standard is the National Occupational Health and Safety Policy and Strategy[13] on OHS, which is in line with ILO's Occupational Safety and Health and Working Environment Convention No 155/1981, to which Ethiopia is a signatory. However, there is a limited number of professionals in Ethiopia who are adept in occupational health and safety and subsequently no professional association established in the country nor is there awareness about the importance of the field. To address this gap, as of mid-2019, medical colleges are providing courses on OHS and the University of Gondar offers a BSc. degree in OHS. However, MOLSA and Regional Bureaus of Labor and Social Affairs (BoLSA) have only 500 inspectors to cover OHS and Minimum Labor Conditions issues for the entire country. Though mandated to inspect and bring to court non-complying companies, the inspectors are poorly supported and ill prepared on how to handle court cases. According to Article 185 of Labor Proclamation No. 377/96, the maximum penalty imposed on non-complying companies is a mere Birr 1,200 per case, which is an insignificant deterrent to enforce compliance.

Based on the provision of Labor Proclamation No.377/2003 Article 92/2, MoLSA had issued a directive requiring all enterprises to establish Health and Safety Committees formed by bipartite partners (workers and employer representatives). The formation of committees is voluntary and lack training and awareness on how to implement OHS at workplaces. This is exacerbated by the lack of law enforcement to enable workers to establish primary labor unions in privatized and newly established manufacturing enterprises. Therefore, the committees are generally dysfunctional, resulting in limited records showing the type and number of accidents and injuries that occur in enterprises throughout the country, and an absence of aggregated sector data. As of mid-2019, active labor unions that can bargain collective agreements and participate in bipartite committees exist mostly in state-owned enterprises. The total number of medium- and large-scale manufacturing establishments stood at 2,393 as of 2016/17; at which time, there were 252 registered and renewed labor unions in Ethiopia, of which only 92 were in the manufacturing sector.[14]

The Department of Harmonious Industrial Relations within MoLSA is mandated with inspecting and enforcing labor and OHS requirements in all industries in general and the manufacturing sector in particular. The department is guided by the ILO Labor Inspection Conventions (Convention No. 81/1947, Convention No 129/69) and comprises two units, namely, the Occupational Health and Safety Team and the Minimum Labor Conditions Team. With only 500 inspectors nationwide, the units are understaffed and cannot inspect all the enterprises in the country.

Moreover, the Department of Harmonious Industrial Relations inspection teams are constrained by a lack of measuring equipment and laboratory kits for ensuring that manufacturing work areas are in compliance with standards. Inspectors are obliged to conduct only visual inspections, which are inconsequential for any purpose. In addition, MoLSA and BoLSAs lack the services

[13] National Occupational Health and Safety Policy and Strategy The Federal Democratic Republic of Ethiopia (FDRE), July 2014, Addis Ababa

[14] National Labor Administration Statistical Bulletin, 2016/17, Harmonious Industrial Relation Directorate, MoLSA, 2018 Addis Ababa

of health officers that can inspect and monitor the health conditions of workers to prevent and protect workers from occupational diseases.

3.2.3 Low Level of Enforcement of Regulations of Environmental and Social Standards

Along with regulations and standards in various industrial subsectors and activities in other economic sectors, Ethiopia has promulgated laws for conducting environmental impact assessments and for pollution control and prevention, as well as for social impact assessments and labor laws that consist of OHS and minimum labor conditions. Due to the limited awareness of policy makers and decision makers regarding environmental protection, health and safety issues, however, the level of enforcement in either environmental or social aspects is minimal. Moreover, some of the emerging social issues are related to basic human and democratic rights enshrined in the constitution. Some company owners in the private sector – specifically, certain (not all) FDI companies – disallow freedom of association to form primary labor unions and the right to organize for collective bargaining. Interviews indicate that MoLSA is unable to enforce the national labor law among FDI companies as these companies are regulated under the Ethiopian Investment Commission. Because it is in the best interest of EIC to increase and protect FDI, EIC provides the inspection for the FDI companies, even though EIC is not authorized to conduct inspections. Regardless, foreign investors do not allow MoLSA to inspect their premise, claiming outright that the mandate for inspection belongs to EIC. EIC, however, lacks technical know-how and skills to evaluate and enforce environmental and social rules and regulations. The opposing interest between EIC and MoLSA demonstrates the lack of intra-governmental coordination and the absence of an overarching policy framework to ensure compliance to environmental and social mandates of the country.

In general, implementation of OHS is weak because of lack of awareness resulting from a limited number of inspectors who are insufficiently equipped with inspection materials, and insignificant penalties for noncompliance, all of which are exacerbated by unclear mandates of various government authorities.

In addition, the implementation of environmental and social regulations in Ethiopia has been constrained by:

- Inadequate expertise and facilities (laboratories, analytical equipment and reagents);
- Limited monitoring and inspection regarding employee health and safety at the workplace, including working conditions and environment;
- Limited public awareness and participation, i.e., limited number of NGOs and activists to promote environmental and social concerns, etc.; and
- Lack of institutional capacity to carry out inspections, enforce regulations and guide organizations toward effective environmental and social planning and management.

3.2.4 Lack of Technical Support Addressing Environmental Issues

There are no public or private Ethiopian entities that can provide technical support regarding RECP and EMS implementation. The Ethiopian Cleaner Production Centre (ECPC), a joint United Nations Industrial Development Organization (UNIDO) and Ministry of Science and Technology (MoST) project, had assisted and facilitated implementation of cleaner production

and EMS by providing technical extension service. The results achieved were encouraging, as seen from the number of certified enterprises and companies implementing cleaner production during ECPC's existence.[15] ECPC activities, however, ceased with MoST restructuring in 2012. As of mid-2019, the CP Directorate of the Ethiopian Standard Agency (ESA) is in the process of revitalizing the activities of the previous ECPC initiatives. The ESA was under the Ministry of Science and Technology, but since the government restructuring of September 2018, ESA has been reporting to MoTI.

Awareness creation and advocacy for addressing environmental concerns in tandem with regulatory requirements are expected to give impetus to exercising cleaner production activities and implementation of EMS.

3.2.5 Lack of Technical Support Addressing Social Management Issues

There are no public or private Ethiopian entities that can provide technical support regarding OHS-, OHSAS-18001- or ISO 26000-based corporate social responsibility (CSR) implementation. A CP directorate has been established within MoLSA to promote waste minimization and pollution prevention in the work areas throughout the manufacturing sector for safeguarding human health and wellbeing. The Department of Harmonious Industrial Relations of MoLSA provides awareness creation and advocacy for addressing social concerns in tandem with regulatory requirements, but its services are limited by constraints the department faces arising from a shortage of technical staff and the lack of testing instruments (laboratory testing equipment, reagents and kits).

3.2.6 Low Level of Institutional Capacity and Capability for Implementing Environmental and Social Protection Tools

Factors contributing to a low level of capacity for implementation include:

- *Lack of resources*: lack of time, lack of knowledge and shortage of skilled human resources in manufacturing enterprises;
- *Negative attitudes and company culture*: lack of, or inconsistent top management support for implementing environmental protection tools such as RECP and EMS and social responsibility standards such as OHSAS-18001 and ISO 26000, as well as general resistance to change;
- *Inadequate understanding and perception*: low awareness of environmental protection tools and lack of knowledge of the requirements for implementing the tools; and
- *Implementation problems*: difficulty in dealing with environmental and social aspects, such as evaluating and determining the significance of impacts, and uncertainty about how to maintain continuous improvements.

[15] As of 2007, 45 enterprises were implementing cleaner production and 12 enterprises were certified with ISO 14001:2005.

3.2.7 Lack of Institutions or Bodies that Provide Technical Services Leading to Certification of Environmental and Social Management Systems

Although the Ethiopian National Accreditation Office (ENAO) is mandated to accredit capable certifying bodies for management systems, including environmental and social management systems, by mid-2019 only the Conformity Assessment Enterprise (CAE) is able to be accredited to provide certification of quality management system (ISO 9001:2015) and product certification. There is, therefore, lack of locally established certifying bodies for environmental and social management systems.

There are a number of technical support organizations that have the expertise to prepare companies for quality management certification audits. The CP directorate under the Ethiopian Standard Authority also provides technical assistance to enterprises to undertake the development and implementation of EMS as well as facilitate third-party audits administered by accredited bodies from abroad. There is, however, no experience of developing and implementing social management systems in enterprises in Ethiopia.

3.2.8 Government Prioritization Thwarting Regulatory Steps

Although the five-year grace period for manufacturers to comply with CoM Regulation 159/2008 should have ended in 2013, there was a two-year delay in declaring the initial regulation. As a result, the five-year period ran from 2010 to 2015. As the grace period expired, however, government allowed a two-year extension (ending in November 2017). The grace period was reinstated for an additional six months until April 30, 2018. Although the grace period has expired, factories were still producing as of mid-2019; none have been shut down nor have any been penalized.

Companies not working toward meeting standards (i.e., those not making any effort to install ETP) were originally subject to legal action and regulators made efforts to prosecute non-compliant companies. These efforts, however, were short-lived and inadequate. There were closures and fines, but closures were quickly overturned and fines were trivial.

The driving factor behind grace period extensions, which subvert the efforts of regional environmental regulatory bodies to act against manufacturing enterprises with gross non-compliance issues, has been the government's reluctance to lose the foreign capital inflows brought in from exports associated with the manufacturers. As a result, interventions by decision makers have been preventing the regulatory bodies from taking enterprises and their managers to court for due legal prosecution as per the regulation and stipulations of Proclamation 300/2002 for Pollution Prevention and Control. Overriding the actions of regulatory bodies, however, has contributed to eroding the fledgling culture for environmental law enforcement and perpetuates the nonchalance of manufacturing firms disinterested in environmental regulations.

Notwithstanding the aforementioned need for law enforcement, implementing environmental regulation need not be at the cost of job creation and development, but to support it and ensure competitiveness and sustainable growth of the manufacturing sector.

3.2.9 Lack of mechanisms for green financing

Green investment in the manufacturing sector faces several challenges. Perhaps the foremost factor is the negative perception held by private-sector businesses, compounded by the lack of incentives and weak enforcement of regulations. Most private businesses consider green industrialization as an expense and do not associate resource efficiency and cost reductions with greening activities. For these businesses, short-term profits often supersede compliance with the environmental and social standards. In the absence of incentives – both positive and negative – private investors are less committed to environmental protection. On the other hand, in spite of the lack of incentives, there are firms – and entire subsectors – that are developing their own effluent treatment facilities, e.g., the leather subsector. In such cases, complying firms and subsectors have anticipated the imminent enforcement of existing regulations and have proactively taken action. Alternatively, some companies, albeit few, understand that compliance with international environmental and social standards will benefit them when targeting international markets.

Even though MoTI is responsible for ensuring – and actively participates in – CRGE implementation and environmental policies within the industrial sector, and in the national and sectoral environmental platforms in general, it has limited instruments at its disposal to foster green financing. For example, it has yet to develop policies to administer grants or provide tax breaks and loan guarantees. Furthermore, there are no specific industrial sector policies or laws that encourage, or provide financial assistance to, greening the manufacturing sector. As a result, the incentives for greening the industrial sector, including green financing mechanisms, are limited. MoTI, however, has the authority to introduce policies to define a framework and guidelines to introduce incentives and other mechanisms to help accelerate the introduction and proliferation of green financing. MoTI will, therefore, benefit from capacity development to strengthen its ability to develop and implement a green manufacturing policy framework that will include mechanisms and instruments to create incentives and support service to green manufacturers and establishing its involvement in the realm of green financing, i.e., designing appropriate green financing mechanisms targeting the manufacturing sector.

There is a broad range of sustainable financing mechanisms to support green manufacturing that help address social, economic, environmental and governance concerns. The major sources of financing for sustainability, such as the UNFCCC sponsored Green Climate Fund (GCF),[16] and Global Environment Fund (GEF),[17] among others, help address social, economic, environmental

[16] According to UNFCCC, "The [Green Climate] Fund is a unique global platform to respond to climate change by investing in low-emission and climate-resilient development. GCF was established to limit or reduce greenhouse gas (GHG) emissions in developing countries, and to help vulnerable societies adapt to the unavoidable impacts of climate change." (*https://www.greenclimate.fund/home*)

[17] "Global Environment Fund (GEF) is a global alternative asset manager established in 1990 to invest in high-growth clean energy, energy and resource efficiency, environmental, and sustainable natural resource management industries throughout the world." (*http://www.globalenvironmentfund.com/*)

and governance issues classified under the following as identified by the United Nations Environment Programme (UNEP):[18]

- **Environmental issues** related to:
  - Quality and functioning of the natural environment and natural systems including biodiversity loss;
  - Greenhouse gas emissions, renewable energy, energy efficiency, natural resource depletion, pollution;
  - Waste management;
  - Ozone depletion;
  - Changes in land use;
  - Ocean acidification and changes to the nitrogen and phosphorus cycles.
- **Social issues** related to the well-being and interests of people and communities including human rights (as specified in the United Nations' Declaration of Human Rights) and broader rights – e.g., right to live in clean environment, meeting minimum social requirements such as the limits on maximum work hours per day etc., labor standards, health and safety, relations with local communities, health and access to medicine, and consumer protection.
- **Economic issues** related to investee impacts on economic conditions at local, national, and global levels. Performance areas include direct financial performance and risk, and indirect impacts such as through employment, supply chains, and provision of infrastructure.
- **Governance issues** related to managing investors' entities, including
  - Board structure, size, diversity, skills and independence;
  - Executive pay;
  - Shareholder rights;
  - Stakeholder interaction;
  - Disclosure of information;
  - Business ethics;
  - Bribery and corruption;
  - Internal controls and risk management;
  - Relationships between a company's management, its board, its shareholders and its external stakeholders.

Projects fulfilling sustainability standards falling in the investment categories as classified in Table 4 below could be eligible for green financing from funds pertaining to the sector, e.g., climate change projects could apply for financing to the CRGE facility locally or to an international funding organization such as GCF, for example.[19] In general, projects formulated under a respective investment area can apply for funds from related international financing

[18] Design of Sustainable Finance System, Concepts and Definitions, UNEP, Inquiry Working Paper 16/13, September 2016; https://wedocs.unep.org/bitstream/handle/20.500.11822/10603/definitions_concept.pdf?sequence=1&amp%3BisAllowed=

[19] Note that the financing categories in Table 4 are general examples and are not limited to green financing.

sources (e.g., Green Environment Fund for a clean energy project or Green Climate Fund for a climate change-related initiative).

Table 4: List of Common Green Financing Categories

Category	Investment Project Themes
Clean energy	Wind, geothermal, solar, small hydropower, biomass, waste-to-energy, cogeneration
Transmission	Transmission systems for renewable, storage systems, smart grids and mini grids, Improving efficiency of transmission systems
Efficiency	Waste heat recovery, industrial energy efficiency, cogeneration, energy efficient products, energy efficiency in fossil fuel use
Green buildings	Building retrofits, new green buildings, energy audits/ energy services, equipment (e.g., lights, heating, ventilation and air conditioning (HVAC))
Transport	Urban mass transit, non-diesel railways, electric vehicles, hybrids, alternative fuel vehicles, bicycle, pedestrian, waterways
Non-energy GHGs	Coal mine methane capture, carbon capture and storage (CCS), GHG reduction - e.g., in cement, chemicals
Pollution control & waste	Air and water pollution control, soil remediation and mine rehabilitation, waste-to-energy, waste gasification, composting, scrubbers/filters, recycling
Agriculture and land	Water- and energy-smart agriculture, afforestation, reforestation, plantations, sustainable forest management, conservation agriculture, sustainable fisheries, ecotourism
Water	Water saving,(municipal, industrial and agricultural water supply), improved drainage, treatment of wastewater to meet compliance obligations

Source: Adopted from Definitions and Concepts, Background Note, Inquiry Working Paper 16/13, UNEP, 2016

In line with efforts to fulfill the SDG goals, many countries have established and implemented green funds for economic sectors including industrial development. Countries that have taken such action include Indonesia, Thailand, Malaysia, China and Vietnam. Vietnam, for example, has established the Vietnam Environmental Protection Fund, Green Climate Fund and Green Growth Fund in cooperation with a coalition of development partners including UNDP, World Bank, USAID, GIZ, EU and ADB. In Ethiopia, the CRGE facility was established in cooperation with Green Climate Fund predominately to finance climate change-related projects.

The Ethiopian government allows tax-free importing of machinery and equipment by manufacturing enterprises for environmental protection, but much more is needed. Incentives and support for green manufacturing need to be more ubiquitous and diverse, along with the funding mechanisms and procedures, whereby MoTI allocates the necessary budgetary support and creates incentives to encourage formation of technical service providers able to support transition to green manufacturing.

4 Review of Industrial Development Strategies

It is relevant to understand the evolution of Ethiopia's industrial development to better relate to the country's challenges vis-à-vis green growth.

4.1 Historical Context

The manufacturing industry in Ethiopia essentially started following the Ethio-Italian war in the 1940s. During the Italian occupation/aggression, small-scale manufacturers produced personal consumer goods such as soap and textiles.[20] Actual industrialization, however, began in the 1950s with the implementation of three successive five-year development plans (1958-1962, 1963-67 and 1969-74), in which import substitution was the underlying industrial strategy. The imperial regime placed much hope on the contribution of foreign capital. The 1950 issuance of 'Notice for the Encouragements of Foreign Capital Investment' had little concern for domestic investment. The Investment Decree of 1963 and the 1966 Investment Proclamation provided incentives to those investing at least USD 200,000, which excluded all but a few local investors. As a result, most manufacturing firms (approximately 67%) were fully or partially owned and operated by foreigners.[21]

Following the collapse of the imperial regime, the *Derg* socialist military regime nationalized enterprises involved in major economic activities, and the private sector could participate only in small-scale industries and handicraft activities. In 1984, the *Derg* regime issued the "Ten-Year Perspective Plan," covering the period from 1985 to 1994. Similar to the imperial regime, the development strategy focused on industrialization through import substitution; however, during the socialist regime, the strategy was state-led, and government ownership in the manufacturing sector was more than 90%.[22]

The Ministry of Trade and Industry (MoTI) played a major role in the industrialization process during the Ten-Year Perspective Plan by establishing new medium- to large-scale manufacturing plants under the ten corporations (one per subsector) it was administering: textile, leather, chemical, beverage, metal, cement, food, wood, tobacco and pulp and paper. Awareness of environmental protection was limited and varied among the corporations in designing plans for mitigating pollution and establishing end-of-pipe waste treatment units in the new manufacturing plants. Due to the absence of any environmental regulation, all the manufacturing plants established during the *Derg* regime are still facing problems in complying with the current national environmental standards.

4.2 Analysis of Current Ethiopian Manufacturing Strategies

4.2.1 National-level Strategies

The current government of Ethiopia pursues an agricultural development-led industrialization (ADLI) strategy as outlined in the Economic Development Strategy for Ethiopia issued in 1994. ADLI aims to achieve industrialization through the growth of an agricultural sector that provides inputs to the industrial sector. The ADLI strategy is export oriented, with limited consideration for import substitution. With no legal framework for environmental protection, there was no consideration of the negative environmental impacts from the manufacturing sector when the strategy was drafted. Nevertheless, in 1994, the Ethiopian National Conservation Strategy

[20] The Ethiopian Manufacturing Sector: Competitiveness and the Way Ahead; Getnet Alemu and Admit Zerihun, July 2005.
[21] Ibid.
[22] Ibid.

(ENCS) was formulated. The ENCS, introduced by the Ministry of Natural Resources and Environmental Protection, laid some guiding principles for protecting the environment in all sectors of the economy, including the industrial sector. The Environmental Protection Authority (EPA) was established by Proclamation No 9/1995 with the statutory responsibility for overall protection of the environment that led to the development and publication of the Environmental Policy of Ethiopia (EPE) in 1997. To implement the EPE, legal instruments were put in place, namely, the EPA was reestablished by Proclamation No 295/2002 and other proclamations; and Proclamation No 299/2002 for Environmental Impact Assessment (EIA) and Proclamation No 300/2002 for Pollution Prevention and Control were promulgated. The regulations and environmental standards for pollution prevention and control, however, were not endorsed by the CoM until 2008 (CoM Regulation No 159/2008).

The Industrial Development Strategy (IDS) for Ethiopia, developed in 2002, gave due importance to the manufacturing sector. IDS is an export-led industrialization strategy that aims to implement ADLI, giving priority to the main manufacturing subsectors, namely, textile and garment, meat, leather and leather products, agro-processing, and construction. IDS also aims to strengthen micro- and small-scale enterprises and develop industrial zones with readily available infrastructure (e.g., roads, telecommunication, power and water supply).

Despite the existence of the EPA, the IDS did not consider the environmental protection aspects as an issue for ensuring the sustainability of the manufacturing sectors. The legal instruments for pollution prevention and control, as well as the necessity to conduct EIA for new projects, were issued after the issuance of the IDS.[23] Oddly, Investment Proclamation No 37/1996, Article 14, regarding issuance of investment permits, required compliance with conditions stipulated in environmental protection laws, which were not in place at the time.

The two-year plan, Sustainable Development and Poverty Reduction Program (SDPRP) (2002/03-2004/05), and the five-year Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (2005/06-2009/10) for implementing the ADLI and IDS focused essentially on agricultural development and did not provide much emphasis on shifting toward industrialization. The PASDEP included environmental protection plans and adaptation and mitigation measures, mostly related to climate change and natural resource conservation, that helped to meet Millennium Development Goal (MDG) 7 (Ensure Environmental Sustainability). The major focus areas of environmental protection during GTP I (2010-2015) were soil fertility of agricultural land, water supply, and sanitation, with an improved consideration for industrial waste. GTP I had an objective of enforcing environmental laws in all administrative units and sectors with an expected output of enhanced capacity of natural resources to provide raw material and services through less polluting means and a reduction in misuse of resources. Accordingly, it was planned in GTP I to monitor enforcement of environmental regulations in the industrial subsectors as well as the enforcement of the municipal solid waste management Proclamation No 513/2007.

[23] The IDS was issued in August 2002 whereas the Proclamations for Pollution Prevention and Control as well as the Proclamation for EIA were promulgated in December 2002.

For the most part, the legislated environmental protection laws were not fully enforced, leading to the implementation of new projects with perfunctory EIAs and the continuation of pollution from existing manufacturing enterprises. When CoM endorsed the landmark regulations for pollution prevention and control in 2008, it provided enterprises with a five-year grace period for complying with environmental standards, which effectively delayed enforcement of the environmental laws and regulations. The problem with law enforcement, however, persists even at present, as the government to date has prioritized near-term exports and foreign currency over long-term sustainability of the manufacturing sector.

Notwithstanding the above haphazard attempts to implement the environmental laws and regulations and the observed shortcomings, the GoE further strengthened its commitment for environmental protection and a green pathway for its development by formulating the Climate Resilient and Green Economy (CRGE) strategy in 2011. The CRGE has three major objectives:

- Fostering economic development and growth;
- Ensuring abatement and avoidance of future emissions, i.e., transition to a green economy; and
- Improving resilience to climate change.[24]

CRGE follows a sectoral approach and seeks to build a green economy, whose development is supported by four pillars:

- *Agriculture:* Improving crop and livestock production practices for higher food security and farmer income while reducing emissions;
- *Forestry:* Protecting and re-establishing forests for their economic and ecosystem services including as carbon stock;
- *Power:* Expanding electricity generation from renewable energy and clean power sources for domestic and regional markets; and
- *Industry, transport, and buildings*: Leapfrogging to appropriate modern and energy-efficient technologies.[25]

The overall CRGE strategy is geared toward reducing greenhouse gas (GHG) emissions in all sectors of the economy that contribute to climate change. With regard to the industrial sector,[26] the CRGE prioritizes subsectors that constitute virtually all of Ethiopia's GHG emissions from industrial activities:

- Cement (50% of industrial GHG emissions as of 2010);
- Mining (including gold, coal, potash and others) (32%);
- Textile and leather (17%); and
- Steel, engineering, chemicals (including fertilizer), paper and pulp, and food processing (together, less than 2%).[27]

[24] Ethiopia's Climate-Resilient Green Economy Strategy, FDRE, 2011.
[25] Ibid.
[26] Note the distinction between the industrial sector and the manufacturing sector. Manufacturing is a component of the industrial sector. Mining, a significant contributor to GHG emissions, is industrial but not manufacturing and therefore not covered in this strategy.
[27] Ethiopia's Climate-Resilient Green Economy Strategy, FDRE, 2011.

It is estimated that GHG emissions from the industrial sector will increase from approximately 4 megatons (million metric tonnes, or Mt) carbon dioxide equivalent (CO_2e) in 2010 to 71 Mt CO_2e in 2030 under a business-as-usual (BAU) scenario that is without emission reduction measures. It is estimated that, by applying abatement measures such as energy efficiency, alternative fuels, alternative production processes, etc., a total gross abatement potential of 22 Mt CO_2e in 2030 is achievable, wherein the vast portion of the potential reduction comes from the cement industry with a reduction of 16 Mt CO_2e.[28]

One of the outcomes of the CRGE strategy is that units have been established in all government ministries, including MoTI, and focal persons appointed in institutions under each ministry, to follow up on CO_2 emission-reduction activities including planning and monitoring.

However, a green path of economic development involves wider environmental considerations than the GHG emission reduction focus given in the CRGE strategy. A green economy can be thought of as one that is low carbon, resource efficient and socially inclusive. A green economy should aim to reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services supported by targeted public expenditure, policy reforms and regulation changes.

The next notable plan issued by the government was the GTP II, which runs from 2015 to 2020 and lays the foundation for a major structural change toward industrialization.

According to the GTP II plan, manufacturing sector growth will be achieved through an increase in new investments, mainly in export-oriented manufacturing, and improved productivity and competitiveness of domestic manufacturing firms. In addition, all the necessary efforts will be made to link the development of high tech and light manufacturing industries; expand metal and engineering, chemical and pharmaceuticals industries; and substitute strategic imported items with locally produced goods to reduce pressure on foreign exchange demand for imports. From the perspective of environmental protection, the strategic directions for the development of the manufacturing sector focus on deepening fair market competition, supporting social development and ensuring environmentally sound and green manufacturing.

GTP II set targets for reducing GHG emissions for all the manufacturing subsectors during the planning period. Moreover, MoTI, as well as sectoral institutions under the ministry, have adopted set targets for GHG emission reductions in accordance with GTP II. However, the critical concern is that no targets had been set in GTP II for environmental performance improvement in relation to pollution prevention, efficient resource utilization, waste management and safe disposal of hazardous materials in a similar manner to the CRGE strategy.

For example, the MoTI and the Leather Industry Development Institute (LIDI) recognize the high level of pollution from the tanneries in and around Addis Ababa where the polluting enterprises are facing compliance problems, including risk of closures due to not meeting global

[28] Ibid.

and local environmental regulatory standards. Accordingly, MoTI plans to establish a leather industry cluster around Modjo, approximately 70 km south of Addis Ababa, that would include an effluent treatment plant (ETP) serving the cluster's tanneries. As such, tanneries that cannot finance their own ETPs will be requested to relocate to the Modjo leather industry cluster.

The Ethiopian Industry Development Roadmap and the Ethiopian Industry Development Strategic Plan prepared by MoTI for the period 2013-2025, have the vision of "building an industrial sector with the highest manufacturing capability in Africa which is diversified, globally competitive, environmentally-friendly, and capable of significantly contributing to the improvement of the living standards of the Ethiopian people by the year 2025." However, the aspiration to be "environmentally-friendly" has not been translated into actionable objectives and targets by which environmental performance from the point of view of resource utilization, minimization of waste generation, and the degree of compliance with national and international standards can be assessed.

4.2.2 Subsector Strategies

Leather Industry Development Institute (LIDI): LIDI has prepared a strategic plan for the GTP II period (2015-2020) with three strategic objectives, namely:

- Ensure leather and leather products investments follow a green and sustainable development path;
- Increase competitiveness of leather products by applying resource efficient and cleaner production (RECP) and environmental management system (EMS); and
- Increase the market share of products by implementing environmental protection measures.

LIDI will provide technical support and capacity building to enable leather and leather product enterprises to meet environmental industrial standards including:

1. Benchmarking for improvement;
2. Undertake problem-solving R & D and transfer new technologies that enhance productivity of enterprises;
3. Promote Kaizen philosophy and other change management systems that increase productivity and minimize wastes;
4. Enable leather products to achieve global competitiveness by improving the environmental performance of production processes and increase the number of exporting enterprises that apply EMS; and
5. Provide incentives to investors with regard to improving environmental performance.

Notwithstanding, wet processing tanneries are not meeting effluent standards set by the environmental regulation at present and are under threat of closure. LIDI's strategy is to promote the construction of ETPs by the tanneries, including secondary and tertiary effluent treatment stages, to meet the national effluent standards for the leather sector. Moreover, since municipalities are not allowing industrial wastes to be dumped in the municipal solid waste disposal sites, tanneries are facing solid waste management problems which have become a strategic issue. LIDI's strategies focus on reducing the solid wastes at various points of waste

generation throughout the production process through the implementation of RECP techniques, but the ultimate industrial solid waste disposal problem remains prevalent.

Ethiopian Textile Industry Development Institute (ETIDI): ETIDI strategy for the period of GTP II addresses the issue of environmental protection by providing awareness raising and promoting efficient resource utilization. ETIDI will also offer support through the following initiatives to encourage and enable enterprises to reduce wastes generated:

1. Providing international best practices on energy and water consumption per unit of product;
2. Providing technical support and follow-up on the installation of common cost-effective treatment plants, waste collection and disposal systems from clusters of textile enterprises established in industrial parks;
3. Encouraging renewable energy sources in textile enterprises with incentive schemes combined with setting mandatory standards aimed at reducing CO_2 emissions;
4. Promoting replacement of toxic chemicals with benign chemicals while gradually introducing restrictions on the use of harmful toxic chemicals in the industry;
5. Supporting enterprises along the cotton-to-garment value chain in implementing quality and environmental management systems to attain internationally recognized production and product certifications.

The action plan of ETIDI's strategic document for the period of GTP II gives due focus on CO_2 emission reduction. However, there is a need to strengthen the strategic plan with the implementation of RECP and EMS along with internal and external capacity and capability building to develop the technical capability and skills in the sector as well as facilities to measure environmental performance. Moreover, the issue of safe disposal of sludge and industrial solid wastes need to be considered for the textile sector as well.

Metal Industry Development Institute (MIDI): MIDI strategies for the period of GTP II identify environmental issues: solid and liquid waste generation as well as GHG emissions in enterprises, need for energy efficiency and pollution prevention, and use of renewable energy sources for reduction of GHG emissions. Accordingly, MIDI has planned the following initiatives:

1. Capacity building and training:
    a. Capacity building on energy efficiency, energy audit, ESIA, waste minimization, use of renewable energies;
    b. Establish a laboratory to research means by which enterprises can reduce waste generation; and
    c. Capacity building (training) on managing solid waste, effluent, GHG emissions, dust, and noise.
2. Provide support to:
    a. Implement energy-efficient practices;
    b. Conduct energy audits;
    c. Implement EMS in sector enterprises;
    d. Prepare ESIA reports for new projects;
    e. Conduct environmental audits in existing enterprises;
    f. Improve environmental performance of polluting enterprises;

g. Conduct studies on solid waste minimization and recycling and disseminate results to the pertinent enterprises; and
h. Identify sources and raise financing to conduct studies on electricity generation from renewable energy sources as well as convert to renewable energy generation if research finds it financially and operationally feasible.

The action plan, however, has not considered mainstreaming RECP and EMS in the enterprises so that enterprises address environmental issues in a holistic and sustainable manner.

Chemical and Construction Inputs Industry Development Institute (CCIIDI): CCIIDI strategies for the period of GTP II identify pollution prevention, efficient resource utilization, reduction of GHG emissions through increased energy efficiency and use of renewable energy sources, enabling companies to implement RECP and exercise recycling as well as improving the working environment in enterprises and ensuring occupational safety. Accordingly, the sectoral plan for implementing GTP II objectives focuses on undertaking the following activities:

1. Capacity building and training:
   a. Energy efficiency and energy audit; and
   b. RECP implementation and recycling.
2. Provide support to:
   a. Implement energy-efficient practices;
   b. Conduct energy audits;
   c. Implement quality management standards (QMS) to achieve globally competitive products for the market;
   d. Utilize resources efficiently through technology transfer;
   e. Develop baseline data on pollution for cement, glass, ceramics, paper, paint and chemical enterprises;
   f. Reduce climate change impacts of enterprises; and
   g. Identify sources of electricity generation from renewable energy to reduce GHG gasses.
3. Occupational safety:
   a. Improve the working conditions in enterprises through environmentally safe practices; and
   b. Adopt safe chemical handling and storing practices in enterprises and keep material safety data sheets (MSDS) of chemicals.

Environmental issues addressed by the five-year strategic plan are in line with the CRGE strategy and the Ethiopian Cement Industry Development Strategy, 2015 – 2025 prepared by the Ministry of Industry. Moreover, the institute has prepared strategic plans for the period 2013 – 2025 for construction inputs – namely, wood, adhesive, aluminum, ceramic, glass, gypsum, marble, paint and plastics – with the objective of achieving higher production efficiency, energy efficiency and environmental performance. The institute has included in its strategic plans the objective of pollution prevention to protect soil and water, but has not considered the incorporation of effluent treatment, solid waste management and hazardous waste disposal schemes in the strategic plans. Also, not covered in the plans is mainstreaming RECP and EMS for the enterprises to address environmental issues in a holistic and sustainable manner.

Meat and Dairy Development Institute (MDDI): MIDDI strategies for the period of GTP II and the strategic plan of MoTI for the period 2015 – 2025 focus on waste treatment systems in the meat industry as well as quality and safety improvement programs. This is because out of the existing eleven large-scale abattoirs preparing meat for export, eight have fulfilled export requirements that include installation and functional operation of wastewater treatment plants. Accordingly, MDDI has planned to:

1. Encourage and enforce implementation of international standards for waste treatment plants and waste disposal systems;
2. Consult with abattoirs regarding implementation of waste treatment plants and facilities in their plants according to international standards so that they become environmentally friendly and obtain good manufacturing practice (GMP), Hazard Analysis and Critical Control Point (HACCP) and Good Health Practice (GHP) standards that can lead to increased exports;
3. Improve the capacity of the workers on waste treatment and hygienic practices according to international codes of practice;
4. Support newly established meat processing plants with consultation, incentives, supervision and technical support to develop and maintain management systems that include GMP, HACCP/ISO 22000 and GHP;
5. Provide support to conduct training and workshops to build the capacity of abattoir workers; and
6. Assist abattoirs and meat processing plants to obtain finance for establishing waste treatment plants.

The MDDI strategic plan could be strengthened by incorporating the implementation of RECP and EMS in the abattoirs and meat processing enterprises as well as adding strategies for manure management (to reduce CH_4 emissions during the period animals are kept in the premise of the abattoirs before slaughtering) and solid waste management (slaughter by-products) and sludge from ETPs. Only eight abattoirs that have ETP with primary and secondary wastewater treatment are eligible to export meat to international buyers from United Arab Emirates (U.A.E), Viet Nam, China, South Africa and Thailand who consider the existence of environmental sanitation and effluent treatment in the exporting abattoirs as a requirement.

MDDI also needs to develop a strategy and action plan for the dairy subsector. The dairy processing plants have problems of effluents laden with high biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total dissolved solids (TDS). Out of the existing 25 dairy plants, 5 have installed ETPs, of which 3 have biogas digesters. Viewed as environmentally friendly and able to fulfill the requirements of international customers, these three dairy plants export cheese to Sudan and Djibouti.

Food, Beverage and Pharmaceutical Development Institute (FBPDI): FBPDI deals with the agro-processing and the pharmaceuticals sectors and had prepared an action plan for fiscal year 2017/18 as part of fulfilling the national CRGE strategy. FBPDI plans include:

1. Identify new projects that have approved ESIA reports for implementation for follow-up and providing technical support;
2. Monitor wastewater discharges from ETPs to follow up compliance with environmental standards;

3. Provide technical support to enterprises so that they do not pollute their surroundings and negatively affect the communities in which they operate;
4. Support enterprises to establish ETPs with both primary and secondary treatment;
5. Provide technical support and promote common wastewater treatment plants in integrated agro-industrial parks and clusters;
6. Promote industrial solid waste management and recycling;
7. Establish baseline data on GHG emission in enterprises;
8. Support enterprises to substitute fossil fuel with renewable energy sources such as solar and wind; and
9. Implement ISO 14001-based EMS in selected enterprises by raising funds for training and implementation.

FBPDI's strategies have not considered the issues of solid waste disposal, implementation of RECP and EMS in enterprises and the necessity of installing aerobic and anaerobic digesters to reduce BODs and remove bad odors from beverage and food processing plants.

On the other hand, the pharmaceutical subsector has formulated a strategic plan, namely, National Strategy and Plan of Action for Pharmaceutical Manufacturing Development in Ethiopia (2015 – 2025) in line with the strategic plan of MoTI. However, there is neither consideration of issues regarding environmental pollution nor GHG emissions from the pharmaceutical enterprises.

With mega projects underway, the government has given high priority to the development of the sugar industry, which is a major agro-processing subsector in Ethiopia managed by the Sugar Corporation.[29] As of mid-2019, the operational sugar factories are Tendaho, Fincha, Metehara, Wonji Shoa, Arjo Dedesa, Kessem, Omo Kuraz 2 & 3. The new sugar factory projects underway are Tana Beles 1 &2 Welkait, Omo Kuraz 1, 4 & 5. Despite the fact that the sugar industry is not administered under MoTI, it is critical for the government and the Sugar Corporation to adopt and incorporate all relevant principles put forth in this green manufacturing strategy.

The Federal Small Scale and Medium Manufacturing Industry Development Agency (FeSMMIDA): FeSMMIDA has prepared a five-year plan in line with GTP II for the period 2015 to 2020. According to the plan, Goal No. 5 aims to provide capacity building trainings to 500 executives as well as 3,000 experts from all regions and City Administrations on environmental protection and energy efficiency.

However, the existing challenges and solutions to the prevailing environmental problems have not been identified and there are no strategies for implementation in the five-year plan, nor its plan has considered the issues of solid waste disposal, implementation of RECP and EMS in the subsector.

[29] The Sugar Corporation, with a vision of executing large-scale sugar development activities, came into existence on October 2010 via the Council of Ministers Regulation No.192/2010. The Corporation operates under a board of directors and is accountable to Public Enterprises' Property and Administration Agency, as dictated in proclamation No. 1097/2018.

4.3 Findings from the review of existing environmental and social strategies

a. Timing of issuance of the Industrial Development Strategy and the environmental regulations: lack of coordination or cross referencing

The IDS did not consider the environmental protection aspects as an issue for ensuring the sustainability of the manufacturing sector in spite of the existence of the EPA. The legal instruments for pollution prevention and control, as well as the necessity to conduct EIA for new projects, were issued after the issuance of the IDS.[30] Oddly, Investment Proclamation No 37/1996, Article 14, regarding issuance of investment permits, required compliance with conditions stipulated in the environmental protection laws, which were not in place at the time.

b. The industrial strategies do not consider legal compliance issues

Industrial strategies developed after the IDS focus only on production and productivity, and do not consider the existing environmental proclamations and regulations. The vision of the Ethiopian Industry Development Strategic Plan (2013-2025) mentions the need for being environmentally friendly but does not elaborate further regarding how this is to be done nor does it set objectives for sustainable development and environmental protection. The latest example is the strategic plan for the pharmaceutical sector formulated in 2017, which does not consider any environmental protection issues. The pharmaceutical sector strategy demonstrates the need for a comprehensive green manufacturing strategy that enables all sectors to upgrade their strategies by incorporating/mainstreaming green manufacturing practices and standards.

c. Lack of capacity for implementing environmental protection laws

The former Environmental Protection Authority (EPA) – now elevated to a ministerial level as the Ministry of Environment, Forest and Climate Change (EFCCC) – has the mandate to assess and approve Environmental Impact Assessment (EIA) reports of new projects before implementation. However, due to lack of capacity (mostly human resources), EFCCC has delegated its powers to six sectoral ministries – including the MoTI – to review and approve EIA reports. This has resulted in limited adherence to the spirit of the law while reviewing and approving projects as a result of conflict of interest in which the ministries review and approve projects of their respective sector without prejudice. Consequently, projects are implemented without incorporating environmental protection or environmental management plans (EMPs) covering the life cycle of the projects. Even if a project has an EMP, there is a lack of regular environmental inspection to check the environmental performance of enterprises due to the lack of capacity either in the EFCCC together with the Regional Environmental Bureaus or in the delegated MoTI. The delegation given to MoTI to review and approve EIA reports creates a conflict of interest as MoTI cannot both authorize and monitor projects.

[30] The IDS was issued in August 2002, whereas the Proclamation for Pollution Prevention and Control and the Proclamation for EIA were both promulgated in December 2002.

d. Lack of mainstreaming RECP and EMS practices in enterprises

RECP implementation, other than providing training, requires employee involvement and participation. On the other hand, EMS is a structured management tool and is implemented as an integral part of a company's strategic plan. In general, RECP provides the techniques and tools for finding solutions for environmental problems and EMS provides the structure for RECP practices and continuous environmental improvement in a sustainable manner. A review of the existing national and subsector strategies reveals that there is need for mainstreaming RECP and EMS in enterprises.

e. Lack of implementation of social management systems and social standards, and low level of social performance:

From the social impacts identified through in-depth assessment of the manufacturing sector, as well as the existing challenges in addressing social issues and insights obtained from interviews and responses obtained from the institutes under MoTI, the major findings regarding social issues are summarized as follows:

- Limited social concern and lack of awareness;
- Absence of social and environmental safeguard policies within each enterprise;
- Lack of technical support addressing social management issues (OHS, OHSAS management system and CSR);
- Low-level enforcement of laws, regulations and social standards;
- Low implementation capacity of occupational health and safety through strengthening national collaboration and cooperation; and
- As a part of their investment agreement, FDI companies are required to fully implement their corporate social responsibility agreement, but many enterprises fail to comply with these agreements and go unpunished for non-compliance.

5 Review of International Best Practices in Green Manufacturing Strategy

5.1 Defining Green Manufacturing

Although green manufacturing is widely discussed globally, there is no generally accepted definition of the concept.[31] Early interpretations described green manufacturing as merely being environmentally friendly,[32] and were later refined to focus on three fundamental goals: (1) minimize emissions, effluents, and accidents; (2) minimize the use of virgin materials and non-

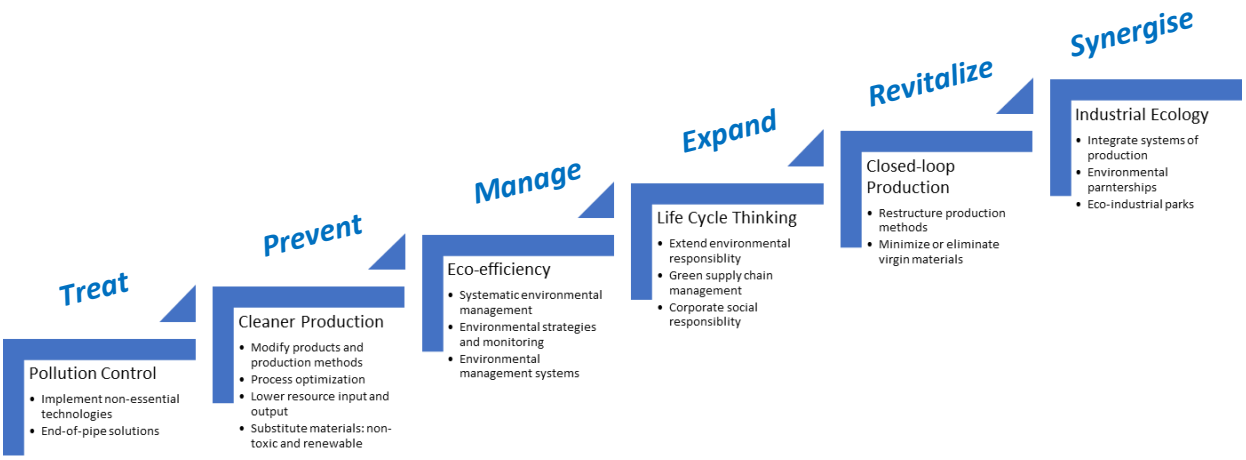
[31] Eco-innovation in industry: Enabling green growth, OECD, 2010, as cited in N Hami et al, The Impact of Sustainable Manufacturing Practices and Innovation Performance on Economic Sustainability, 12th Global Conference on Sustainable Manufacturing, Elsevier BV, 2015.

[32] U.S. Department of Commerce. Promoting competitiveness: Partnerships and progress of the office of manufacturing and services. International Trade Administration; 2007, as cited in N Hami et al, The Impact of Sustainable Manufacturing Practices and Innovation Performance on Economic Sustainability, 12th Global Conference on Sustainable Manufacturing, Elsevier BV, 2015.

renewable forms of energy; and (3) minimize the life-cycle cost (cradle to grave) of products or services.[33] More recently, green manufacturing is defined within an ecosystem, as the creation of manufacturing products that use processes that are non-polluting, conserve energy and natural resources, and are economically sound and safe for employees, communities and consumers.[34]

The concept of green manufacturing evolved over time, from its initial focus on treatment (such as end-of-pipe solutions), to prevention (e.g., reducing greenhouse gas (GHG) emissions), to environmental management systems (e.g., reduce energy consumption), to expanding beyond the production floor (e.g., life cycle management and greening of the supply chain), to revitalizing (e.g., minimize use of virgin materials and non-renewable energy, thus changing the paradigm from single life cycle to multiple life cycles), to a more synergistic, integrated approach today (Figure 1). The current industrial ecology approach takes a systems view of patterns of production, consumption and resource recovery (e.g., within eco-industrial parks), and plans for greater resource efficiency and reduced pollution, integrated across resource flows, economic sectors, public and private activities, and short- and long-term horizons.[35] As the field of green manufacturing evolves, governments must continually revisit and refine national green manufacturing strategies.

Figure 1: The Evolution of Green Manufacturing Concepts and Practices



Adapted by Global Development Solutions, LLC (GDS) from OECD, 2010, as cited in UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.

Though the concepts of "green" and "sustainable" are often used interchangeably, the terms are, for the moment, distinct. Manufacturing is "green" when it helps reduce the footprint it leaves on the natural environment and on the health of those producing and using what is produced.

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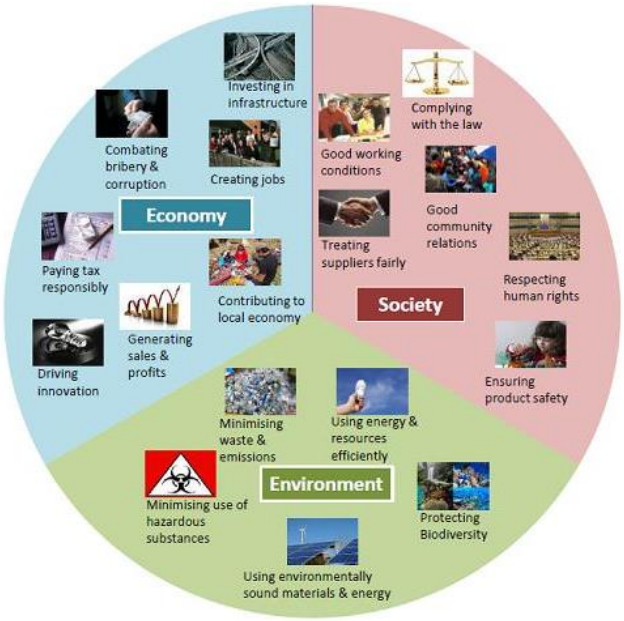
[33] Reference for Business, http://www.referenceforbusiness.com/small/Eq-Inc/Green-Production.html#ixzz58fdGYdHy

[34] N Hami et al, The Impact of Sustainable Manufacturing Practices and Innovation Performance on Economic Sustainability, 12th Global Conference on Sustainable Manufacturing, Elsevier BV, 2015.

[35] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011, www.greenindustryplatform.org/wp-content/uploads/2013/02/UNIDO_GI_GREEN_POLICIES_E.pdf

Manufacturing is "sustainable" when it has both a present- and forward-looking orientation and manages three mutually-reinforcing objectives of fostering economic growth and competitiveness, reducing social inequalities, and preserving the natural resource base and environment (Figure 2).[36] Robert Stern, Dean of the Yale School of Architecture, noted that "in ten years we are not going to talk about sustainability anymore, because it is going to be built into the core processes."[37] Thus, governments should structure "green" strategies around the tenets that also are "sustainable," since it is likely that the definition of green manufacturing eventually will converge with that of sustainability.

Figure 2: Three Dimensions of Sustainable Manufacturing



Source: OECD

Key Concepts
• The definition of green manufacturing evolves over time, from its initial focus on treatment (such as end-of-pipe solutions) and prevention (e.g., reducing GHG emissions) to a more synergistic, integrated approach today. As the field of green manufacturing evolves, so too must a government's strategic, legal and institutional frameworks for green manufacturing. • While the concepts of "green" and "sustainable" differ today, the concepts intersect in a green economy, and thus forward-looking green manufacturing strategies should incorporate not only manufacturing's green footprint and but also economic and societal dimensions that are part of a government's broader goals.

5.2 Benefits of Green Manufacturing

From an enterprise's perspective, several economic benefits potentially arise from green manufacturing, including reduced resource use and production costs, reduced regulatory

[36] M. Martty, The Difference Between Green and Sustainable, Architecture, 6 October 2015.
[37] Ibid.

compliance costs, improved sales and brand reputation, greater access to financing and capital, and improved employee hiring and retention.[38]

From a government's perspective, there are three primary benefits to a green manufacturing strategy: economic benefits, job creation and poverty reduction (Table 5). The greening of industries has become a core determinant of economic competitiveness and sustainable growth. Since resource inputs, such as raw materials and energy, represent an important production cost for industries, improving efficiency gives industries a competitive advantage. The greening of industries also plays a role in poverty alleviation, through promoting energy security, health and safety, jobs, and reducing costs through increased productivity.[39]

Table 5: Public Sector Benefits of Green Manufacturing Strategy

	Benefit	Detail
1	Economic benefits	• By using less resources and increasing energy efficiency, manufacturers reduce production costs, as well as reduce the demand for energy, water and virgin resources, thus increasing competitiveness and reducing the need for public sector investment in new energy and water supply infrastructure and extractive industries.[40] For example: • It has been estimated that every USD1 invested on the demand-side of management of electricity can save nearly USD3 in investment in the power sector in developing countries.[41] • Reduced production cost and improved compliance with international standards improves competitiveness, which boosts exports and foreign exchange revenue.[42] For example: • Carbon Trust (UK) estimates that most businesses can cut their energy bills by up to 20% with only a small investment – a saving that could equate to as much as a 5% increase in a firm's overall profits, thus making industries more competitive.[43] (http://www.carbontrust.co.uk/Publications/pages/publicationdetail.aspx?id=GIL136) • For many countries, unsustainable economic growth is resulting in resource depletion and severe environmental degradation, as production and consumption patterns outpace the renewal capacity of natural resources and the capacity of local governments to manage waste products. A national green manufacturing strategy can help governments efficiently plan for managing resources and waste.
2	Job creation	• Both the greening of existing industries and the creation of new green industries are expected to create jobs, particularly for small and medium-size enterprises (SMEs), where small adaptations in production processes (e.g., use of renewable energy,

[38] OECD Sustainable Manufacturing Metrics Toolkit and Sustainable Manufacturing 101 Module, U.S. Department of Commerce, 25 January 2012.
[39] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011, www.greenindustryplatform.org/wp-content/uploads/2013/02/UNIDO_GI_GREEN_POLICIES_E.pdf
[40] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.
[41] Ibid.
[42] Ibid.
[43] About Sustainable Manufacturing and the Toolkit, OECD, https://www.oecd.org/innovation/green/toolkit/aboutsustainablemanufacturingandthetoolkit.htm

		water treatment, recycling measures) can significantly reduce the environmental impact of enterprises.[44] • The environmental goods and services industry is likely to expand significantly in the future, as demand increases for "next-generation" environmental services targeted toward renewable energy, cleaner technologies, reductions in environmental risk, and resource management (including recycling and resource recovery).[45] For example: • Basic manufacturing industries such as steel, aluminum, cement and paper are starting to stimulate green jobs through scrap use, greater energy efficiency, and reliance on alternative energy sources. Secondary scrap-based steel production requires up to 75% less energy than does primary production. Worldwide, 42% of steel output was based on scrap in 2006, possibly employing more than 200,000 people.[46] • Renewable energy employed 9.8 million people around the world in 2016 – a 1.1% increase over 2015, with the largest employment in solar photovoltaic (PV) power (3.1 million jobs globally, up 12%) and the highest growth (7% increase) in new wind power installations, especially in USA, Germany, India and Brazil.[47] • It is estimated that India alone could create some 900,000 jobs by 2025 in biomass gasification. Of this, 300,000 jobs would be with manufacturers of gasifier stoves (including masons, metal fabricators) and 600,000 would be in biomass production, supply chain operations, and after-sales services. Another 150,000 people might find employment in advanced biomass cooking technologies.[48] • Green manufacturing enables access to new markets, which in turn increases demand for goods and services and jobs to fulfill that demand. • Investment, skill enhancement and innovation in green infrastructure are more likely to benefit job creation for urban populations.[49] • A greener economy is not inclusive and socially sustainable by default. Social and labor market policies will need to complement economic and environmental policies to buffer the downside risks of transitions to a green economy. Positive progression at national level will also depend largely on policy coordination and prior planning including retraining of workers and upgrading of skills. Special focus needs to fall on young women and men who need to be equipped with the right knowledge and skills to be successfully integrated into the green economy.[50]

[44] Frequently Asked Questions on green jobs, International Labour Organization, http://www.ilo.org/global/topics/green-jobs/WCMS_214247_EN/lang--en/index.htm

[45] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.

[46] Renner, Sweeney & Kubit (2009), as cited in UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.

[47] Renewable Energy and Jobs – Annual Review 2017, International Renewable Energy Agency (IRENA), May 2017.

[48] The Energy and Resources Institutes (2009), as cited in UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.

[49] Greening Africa's Industrialization, Economic Report on Africa, United Nations Economic Commission for Africa (UNECA), 2016, http://www.un.org/en/africa/osaa/pdf/pubs/2016era-uneca.pdf

[50] Frequently Asked Questions on green jobs, International Labour Organization, http://www.ilo.org/global/topics/green-jobs/WCMS_214247_EN/lang--en/index.htm

3	Poverty reduction	• The greening of industries plays a role in poverty alleviation, through promoting energy security, health and safety, jobs and skills development, and reducing costs through increased productivity.[51] • Greater efficiency in resource use over the life cycle of goods and services reduces production cost and increases competitiveness. • The greening of industries promotes energy security in developing countries via access to ample, reliable and affordable energy, which enables economies to develop, given energy demand challenges. The IEA's outlook to 2030 of global energy supply and demand trends estimates that 1.6 billion people (one-quarter of the world population) have no access to electricity and that in the absence of vigorous new policies, 1.4 billion people will continue to lack electricity in 2030. Currently, four out of five of these people live in rural areas of the developing world, mainly in South Asia and sub-Saharan Africa (Mandil, 2003). • Green manufacturing can improve health conditions through access to clean water (resulting from water supply infrastructures and protection programs), clean energy (from decentralized renewable energy programs), improved nutrition (resulting from sustainable agricultural practices), and reduction in direct and indirect harmful exposure to pollutants (e.g., those in air, water, food and solid waste). • Urban planning to foster environmentally friendly infrastructure and smart cities helps mitigate environmental degradation, informal and unregulated settlements, haphazard disposal of waste and industrial products, unsustainable transport systems, high demand for energy (especially fossil fuels) and unregulated use of land and natural resources.[52]

Key Concepts

- From an enterprise's perspective, green manufacturing provides economic benefits including reduced resource use and production costs, reduced regulatory compliance costs, improved sales and brand reputation, greater access to financing and capital, and improved employee hiring and retention.
- The economic benefits for enterprises translate into economic, job creation and poverty alleviation benefits for governments, as there is improved utilization of resources and infrastructure; enhanced industrial competitiveness; more and better jobs from greening of existing industries and the creation of new environmental goods and services; and improved health and environmental conditions.

5.3 International Best Practices for Green Manufacturing

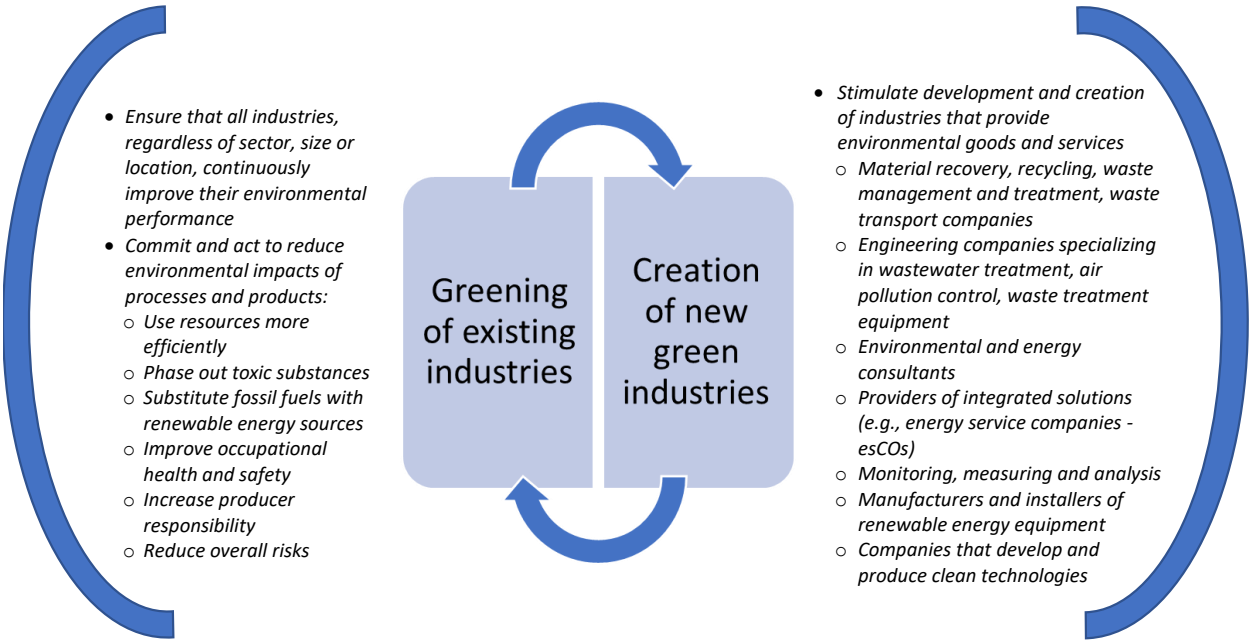
According to the United Nations Industrial Development Organization (UNIDO), a national green manufacturing strategy requires an integrated approach: first, the greening of existing industries and enterprises, whereby a government ensures that all industries, regardless of sector, size or location, continuously improve their environmental performance and commit to, and take actions toward, reducing the environmental impacts of processes and products; second, the creation of new green industries, in which a government stimulates the development of industries and enterprises that provide environmental goods and services necessary to responsibly manage

[51] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011, www.greenindustryplatform.org/wp-content/uploads/2013/02/UNIDO_GI_GREEN_POLICIES_E.pdf

[52] Freire (2013) as cited in Greening Africa's Industrialization, Economic Report on Africa, United Nations Economic Commission for Africa (UNECA), 2016, http://www.un.org/en/africa/osaa/pdf/pubs/2016era-uneca.pdf

products throughout their life cycle.[53] This symbiotic approach implies that a national green manufacturing strategy should look not only toward improving the manufacturing processes of key subsectors, but also consider new industries that can support and benefit "greening" efforts of manufacturing and other sectors.

Figure 3: Integrated Approach to Green Manufacturing Strategy



Adapted by Global Development Solutions, LLC (GDS) from UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011

Examples of eco-industrial parks are seen globally. In Japan, Kawasaki zero-emission industrial park is one of the most prominent eco-industrial parks and is known for efficient resource utilization through recycling. Several industrial parks in Indonesia have received acclaim. Out of the 233 IPs assessed by Solidiance, five of Indonesia's IPs were found to be outstanding: East Jakarta Industrial Park, Jaba Beka Industrial Estate, Kota Bukit Indah Industrial City, MM2100 Industrial Town, and Suryacipta City of Industry.[54] There are also IPs that have transformed into eco-industrial parks by applying green practices. The oldest IP that has evolved through time into an eco-industrial park is Kalundborg of Denmark.

Snapshots of Kalundborg and East Jakarta eco-industrial parks and their major green practices are provided in **Error! Reference source not found.** and **Error! Reference source not found.**, respectively.

[53] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.
[54] Indonesia's Green Industrial Estates and Best Practices, Solidiance, November 2015

Box 1: Kalundborg Eco-Industrial Park, Denmark

The industrial park was established in 1959 and has since evolved into an eco-industrial park by applying the concept of industrial symbiosis. A company's byproduct becomes a valuable resource to one or many of the other companies in the co-located industrial symbiosis network. This network of recycling and reusing has generated new revenue and cost savings for the partnering companies and has the additional benefit of reduced air, water and land pollution in the area.

Enterprises in the eco-industrial park: NovoNordis, Novozymes, Gyproc, Kalundborg Municipality, Dong Energy, RGS 90, Statoil, Kara/Novoren, and Kalundborg Forsyning A/S.

Major green practices in the eco-industrial park: inter-companies' mutually beneficial relationships between companies within the EIP (industrial symbiosis), energy efficiency by using thermal heat from other companies, treating wastewater to convert it to a usable water resource, and material byproduct exchange between companies.

Source: Indonesia's Green Industrial Estates and Best Practices, Solidiance, November 2015

Box 2: East Jakarta Industrial Park (EJIP), Indonesia

EJIP – the first private industrial park established in Indonesia with foreign investment from Japan – does not tolerate any violations against environmental damages. EJIP monitors and regulates its tenants to comply with every environmental standard. Moreover, training is facilitated by EJIP to the industrial park tenants to ensure better management. EJIP believes there should be a balance between the economic, environmental and social aspects.

Enterprises in the eco-industrial park: 101 tenants on total land size of 320 ha.

Major green practices in the eco-industrial park: Wastewater treatment, environmental emergency response team, laboratory facility for environmental audit and fire protection.

Source: Indonesia's Green Industrial Estates and Best Practices, Solidiance, November 2015

Key Concepts

A national green manufacturing strategy should look not only toward improving the manufacturing processes of key subsectors, but also create new industries that can provide environmental goods and services that support "greening" efforts of manufacturing and other sectors.

5.3.1 Strategy Framework

Figure 4: Sustainable Development Goals

Source: United Nations Development Programme (UNDP)

To be effective, a green manufacturing strategy does not operate in isolation, but rather is integrated with a country's broader sustainability goals. The United Nations Sustainable Development Goals (SDGs), adopted in 2015 and with a target date of 2030, provide 17 goals (Figure 4) and 169 underlying targets that tackle major issues impacting the world, from ending poverty, to protecting the planet, to ensuring prosperity for all as part of a new sustainable development agenda. Many of these goals align with goals of green manufacturing. Manufacturers that understand the priority SDGs for the countries in which they operate may also have insight into how the policy and regulatory environment in which they operate may evolve, helping them to develop more resilient business models.[55]

Similar to green manufacturing, the SDGs are anchored on economic, social, and environmental dimensions. The SDGs, with a target date of 2030, provide a framework for green industrialization because they embed industrial development in the larger context of environmental sustainability.[56] Unlike the Millennium Development Goals (MDGs) (target date of 2015), which formed a blueprint agreed upon by governments and development institutions, achieving SDGs requires participation of governments, the private sector, civil society and individuals. The manufacturing sector can play a role in achieving all seventeen SDGs (see examples in Annex 1).[57]

Applying SDGs to green manufacturing begins with identifying priority SDGs for the country as a whole and then aligning goals of government and manufacturers.[58]

Key questions aligning goals of government and manufacturers include:

- Which are the most relevant SDGs in the home country and in targeted export markets?
- What impact will priority SDGs have on regulations, policy and other governmental influence?

[55] Navigating the SDGs: A Business Guide to Engaging with the UN Global Goals, PwC, 2016, https://www.pwc.com/gx/en/sustainability/publications/PwC-sdg-guide.pdf
[56] Greening Africa's Industrialization, Economic Report on Africa, United Nations Economic Commission for Africa (UNECA), 2016, http://www.un.org/en/africa/osaa/pdf/pubs/2016era-uneca.pdf
[57] Ibid.
[58] Delivering the Sustainable Development Goals: Seizing the Opportunity in Global Manufacturing, PwC, 2017, https://www.pwc.com/m1/en/publications/documents/delivering-sustainable-development-goals.pdf

- How should manufacturers align their strategy and goals with the goals of the government(s), and is such an alignment more likely to strengthen a manufacturer's operations?
- Do manufacturers have the resources needed to review and change their business practices to be fit for purpose in an SDG-centric economy?[59]

As an example, the United Arab Emirates (UAE) determined that they should prioritize SDGs 2, 6, 12, 14 and 15 (see Box 3). According to PwC, the SDGs most relevant to Ethiopia are 2: zero hunger, 3: good health and well-being, 4: quality education, 5: gender equality, and 6: clean water and sanitation.[60]

Box 3: How the UAE Applied the SDGs to Green Manufacturing[61]

The United Arab Emirates (UAE) recently applied the SDGs in framing its green growth strategy, including green manufacturing. As a first step, in 2016, the then UAE Ministry of International Cooperation & Development (MICAD) (now part of the Ministry of Foreign Affairs), and the Dubai Carbon Centre of Excellence formalized a Memorandum of Understanding (MOU) that outlined their collaboration on SDGs, identified synergies and developed joint initiatives to further the UAE's sustainable development.[62] They then carried out a preliminary analysis to identify and prioritize SDGs of highest concern in UAE (2: zero hunger, 6: clean water and sanitation, 12: responsible consumption and production, 14: life below water and 15: life on land).[63] Next, the two parties worked closely to outline a sustainable framework and success stories for relevant sustainability goals.[64] The subsequent State of Sustainability: UAE 2016 report highlighted how UAE would implement sustainable measures and work toward realizing the goals in the next 15 years. To achieve these and other priority targets across sectors of the country's economy, the UAE adopted several policy frameworks to support the development of a sustainable and diversified economy, including the National Green Growth Strategy (NGGS), which serves as the primary vehicle to deliver the sustainability targets of the UAE Vision 2021, and will drive the implementation of 12 comprehensive green growth programs that aim to accelerate the UAE's transition to a green economy. Finally, UAE held a Global Manufacturing and Industrialization Summit (GMIS) that showcased UAE and Gulf Cooperation Council (GCC) manufacturing capabilities as well as technologies that have been introduced by global organizations that have revolutionized the manufacturing sector, with the goal of encouraging partnerships and raising awareness of industrial achievements and investment opportunities in different industrial sectors.

[59] Delivering the Sustainable Development Goals: Seizing the Opportunity in Global Manufacturing, PwC, 2017, https://www.pwc.com/m1/en/publications/documents/delivering-sustainable-development-goals.pdf
[60] SDG Selector, PWC, https://dm.pwc.com/SDGSelector/
[61] Delivering the Sustainable Development Goals: Seizing the Opportunity in Global Manufacturing, PwC, 2017, https://www.pwc.com/m1/en/publications/documents/delivering-sustainable-development-goals.pdf
[62] Navigating the SDGs: A Business Guide to Engaging with the UN Global Goals, PwC, 2016, https://www.pwc.com/gx/en/sustainability/publications/PwC-sdg-guide.pdf
[63] Delivering the Sustainable Development Goals: Seizing the Opportunity in Global Manufacturing, PwC, 2017, https://www.pwc.com/m1/en/publications/documents/delivering-sustainable-development-goals.pdf
[64] The UAE Progresses on Sustainable Development Goas, Dubai Carbon, 19 January 2016, http://dcce.ae/news-home/uae-sdg/

Key Concepts
• Although the field of green manufacturing is continuously evolving, a government can mitigate risk of green manufacturing strategy obsolescence by aligning the green manufacturing strategy with other long-term frameworks such as the SDGs. • To apply the SDGs in a framework for green manufacturing strategy, a government should first determine which are the most relevant SDGs at home and in the international markets that green manufacturing targets, then use the priority SDGs to guide regulations, policy and other governmental influence. • Within the manufacturing sector, key industries such as food processing, chemicals and industrial manufacturing can follow specific targets that help government achieve both green manufacturing and SDG targets. • Realization of green manufacturing opportunities requires collaboration among governments, the private sector and other stakeholders.

5.3.2 Legal Framework

Governments can support the greening of industries through effective policy development and implementation. UNIDO notes that best practices for a policy framework for green manufacturing can be summarized in five measures:

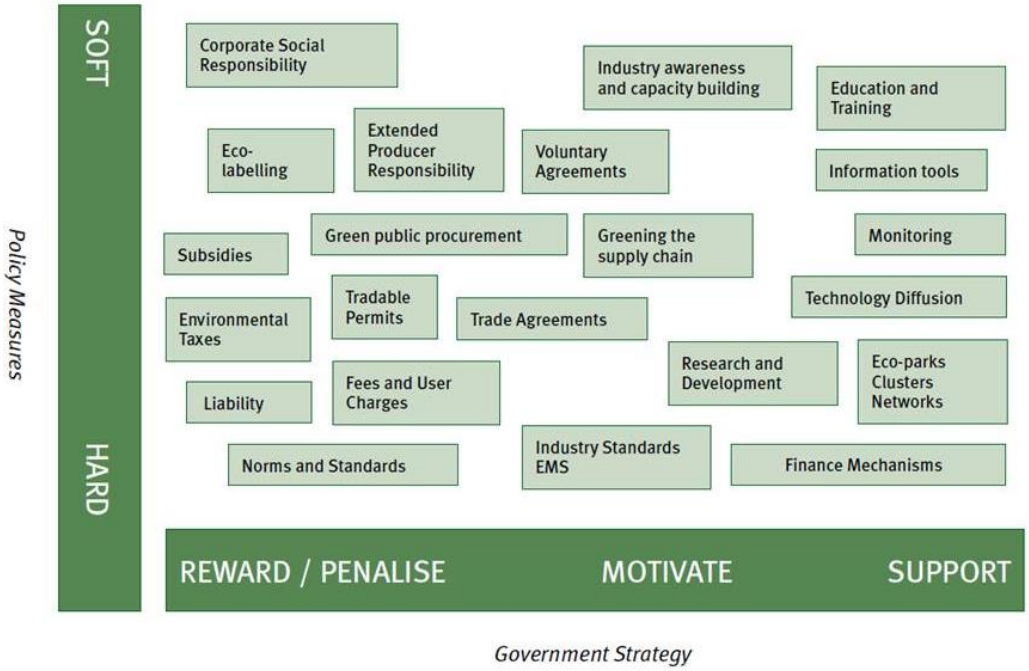
1. Develop a framework integrated vertically within different tiers of government and horizontally between different sectors of government; [65]
2. Create an enabling environment;
3. Support industry-led initiatives;
4. Harness environmental technologies;
5. Promote greening of industries via a mix of market-based, regulatory, voluntary and information-based instruments.[66]

In promoting greening of industries, governments can apply various levers that motivate, reward, penalize and support green manufacturing (Figure 5). Reward/penalty strategies, such as environmental taxes or standards, can establish parameters for compliance, although lead times are needed to enable manufacturers to adapt. Supporting measures, like eco-park clusters or finance mechanisms, can foster an enabling environment and a more organic transition to green manufacturing.

[65] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011, www.greenindustryplatform.org/wp-content/uploads/2013/02/UNIDO_GI_GREEN_POLICIES_E.pdf

[66] Ibid.

Figure 5: Strategy and Policy Matrix for the Greening of Industries



Source: CSCP, WI and GTZ (2007), as cited in UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.

No single instrument can effectively promote the greening of industries. Governments need to ensure that they have an optimal mix of instruments in place, which are supported by national strategies and integrated policy frameworks. Policy instruments need to be championed, designed, adopted and implemented by all levels of government (local, state and national) and across all relevant policy sectors. Furthermore, instrument mixes should be flexible and broad-based, and should not overlap in their application.[67]

Regulatory policies (e.g. norms, standards and abatement policies) form the basis of most environmental management regimes. To be effective, regulatory policies should be flexible and well-designed so not to stifle technological innovations. Market-based instruments (MBIs) such as taxes, charges and tradable permits, are least-cost policy instruments and can spur technological innovations. However, successful implementation of MBIs requires a system of monitoring, revenue collection and enforcement.[68] Voluntary Agreements (VAs) can be useful tools for governments to help raise industry awareness, and can offer more ambitious goals rather than relying solely on regulations, while lowering administrative and enforcement costs. However, it is generally accepted that VAs are most useful when used in combination with other policy instruments. Likewise, information-based instruments (e.g., eco-labelling, public

[67] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011, www.greenindustryplatform.org/wp-content/uploads/2013/02/UNIDO_GI_GREEN_POLICIES_E.pdf
[68] Ibid.

disclosure) can strengthen the effectiveness of other policy measures, such as environmental taxes.[69]

Consultation with business and other stakeholders is imperative during all policy development processes. Governments can establish consultative bodies or taskforces which may include representatives from the community, non-governmental organizations (NGOs), industry, trade unions and other stakeholders. Policy indicators are instrumental to policy development as a means of tracking progress against policy targets and to assess the effectiveness of implementation programs.[70]

Environmental monitoring and reporting systems should be established to identify violations and to assess whether policies have been effective over the long-term. Indicators should form part of all monitoring and enforcement regimes as a tool to simplify, quantify and communicate environmental data. Effective compliance regimes should include a combination of promotion, monitoring and enforcement tools, which are mutually supportive. Methods to promote compliance, such as education, training and outreach, are important features of enforcement and compliance regimes.[71]

International experience indicates that it is extremely important to establish effective monitoring guidelines at the beginning of a green industry program. Clear and transparent monitoring guidelines would specify what needs to be reported and to what level of accuracy, when it would be reported, how it would be reported, and to whom. For example, the Top-1000 program in China requires all participating enterprises to report directly to the National Bureau of Statistics. Via an online website, all enterprises complete a generic spreadsheet to report their energy consumption by fuel type and output on a quarterly basis.[72] At the country level, successful monitoring of the green metrics often requires strengthening a county's statistical capacity of local and central administrations, so that the data attached to the indicators are reliable, regularly collected, known and used by policy makers, and broadly disseminated to the media and the population at large.[73]

Several systems exist for measuring and monitoring "green" metrics at the enterprise, sector or country level (Table 6). Accurate estimations at the sector and country levels require standardized input from enterprises, which in turn must measure products, processes and/or facilities. Among the common global measurement systems is the Organisation for Economic Co-operation and Development (OECD) Sustainable Manufacturing Toolkit, in which quantitative indicators are normalized, thus enabling comparison of data within and across

[69] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011, www.greenindustryplatform.org/wp-content/uploads/2013/02/UNIDO_GI_GREEN_POLICIES_E.pdf
[70] Ibid.
[71] Ibid.
[72] Resource Efficient Greening of Industry Initiative for Pakistan, UNIDO – Pakistan and Ministry of Industries and Climate Change Division, Government of Pakistan, January 2014.
[73] Sustainable Development Goals: Ukraine, July 2016, http://sdg.org.ua/images/2016_SDGs_Ukraine_expert_opinion_eng.pdf

subsectors. This is unlike voluntary reporting initiatives such as Global Reporting Initiative (GRI) or the EU Eco-Management and Audit Scheme (EMAS), which are customized to individual reporting enterprises so cannot be aggregated at the national level.[74] Although the OECD Toolkit performance indicators were developed to help measure the environmental impact of a single facility (e.g., site, factory, office), the indicator data can also be aggregated to monitor and evaluate the performance of a subsector or nationally and to inform other governmental reporting requirements, thus benefitting both private sector and government.

Table 6: Systems for Measuring Green Manufacturing Performance

Measurement system	**Level of technical detail**			**Where measured**					
	Low	**Medium**	**High**	**Product**	**Process**	**Facility**	**Enterprise**	**Sector**	**Country**
Life-cycle assessment (LCA) analysis			X	X	X				
Organisation for Economic Co-operation and Development (OECD) Toolkit		X		X	X	X			
Global Reporting Initiative (GRI)		X	X				X		
European Union (EU) Eco-Management and Audit Scheme (EMAS)	X	X				X	X		
Material Flows Accounting (MFA)		X	X					X	X
Environmental Footprint (EF)	X							X	X
Intergovernmental Panel on Climate Change Pollutant Release and Transfer Registers (IPCC PRTRs)	X	X							X

Source: OECD Sustainable Manufacturing Metrics Toolkit and Sustainable Manufacturing 101 Module, U.S. Department of Commerce, 25 January 2012

For an example of a best practices legal framework for greening industry, one can look to a UNIDO study[75] of energy efficiency green industry programs in China, India, Indonesia, Japan, Malaysia, Thailand and Vietnam, which found that the more effective programs shared common features including:

- A quantitative target for decoupling of energy use and industrial output (a percentage reduction in energy use compared to the energy use associated with the business as usual scenario);
- Government programs that
    - offered financial incentives (loans and tax reductions)
    - imposed specific auditing and reporting requirements; and
- Involvement of the manufacturing subsectors in designing and implementing targets as they apply to individual enterprises.

[74] OECD Sustainable Manufacturing Metrics Toolkit and Sustainable Manufacturing 101 Module, U.S. Department of Commerce, 25 January 2012.

[75] Resource Efficient Greening of Industry Initiative for Pakistan, UNIDO – Pakistan and Ministry of Industries and Climate Change Division, Government of Pakistan, January 2014.

Thailand, for example, applied the above principles to design a program to improve energy efficiency in its industrial sector, given anticipated sector growth and energy demand (see Box 4).

Box 4: Thailand's Program for Energy Efficiency in the Industrial Sector

In the 20 years 1990-2010, energy consumption in Thailand continuously increased at an annual average rate of 4.4%, in line with the average annual economic growth rate of 4.5%, and overall energy consumption reached 2.3 times the amount it was in 1990. However, industry and commercial sectors took an increasing share of energy, with growth of 3.0 and 3.7 times, respectively, versus 1990. Under the business-as-usual (BAU) scenario for 2010-2030, energy demand was expected to increase 2.1 times, from 71,000 ktoe/year in 2010 to 151,000 ktoe/year in 2030, with demand by the industrial and commercial sectors accounting for an ever-increasing share. The transportation and industrial sectors were expected to consume 13,400 ktoe and 11,300 ktoe, respectively, in 2030.

To improve manufacturing energy efficiency, Thailand formulated a 20 Year Energy Efficiency Development Plan (EEDP) (2011-2030), which:

- Set specific quantitative targets:
  - Reduce energy intensity by 25% in 2030 compared with that in 2005, equivalent to reduction of final energy consumption by 20% in 2030, or about 30,000 thousand tons of crude oil equivalent.
  - Reduce energy elasticity (the percentage change in energy consumption to achieve 1% change in national GDP) from an average of 0.98 in the past 20 years to 0.7 in the next 20 years.
  - Realize cumulative energy savings at an average of 14,500 ktoe/year, worth 272 billion baht/year, and cumulative CO_2 emission reductions at an average of 49 million tons/year.
- Included both mandatory measures (via rules and regulations) and supportive/promotional measures:
  - Enforcement of the Energy Conservation Promotion Act, B.E. 2535 (1992), as amended up to No. 2, B.E. 2550 (2007), the establishment of Minimum Energy Performance Standards (MEPS), and energy efficiency labeling.
  - Emphasis on measures that will bring about market transformation and energy consumers' behavioral change by enforcing energy-efficiency labeling for equipment/appliances, buildings and vehicles so as to provide options for consumers.
  - Large-scale energy businesses, e.g., those in the electricity, oil and natural gas industry, are required to implement energy conservation promotion measures to encourage their customers to reduce energy use by a specified minimum standard (Energy Efficiency Resource Standards: EERS), instead of allowing such measures to be voluntarily undertaken as previously practiced.
  - Assistance measures, both financial and technical, were established for SMEs, particularly the provision of funding via the Standard Offer Program and technical assistance via the Energy Efficiency Resource Standards.
  - Measures promoting the use of highly energy-efficient vehicles, e.g., mandatory energy labeling, enforcement of MEPS and tax measures.
- Involved the private sector in design:
  - Responsibilities for energy conservation promotion will be the responsibility of all sectors of society. The private sector will become an important partner and greater roles will be entrusted to local administration organizations. In addition, government agencies must set a good example of energy conservation practices.

Source: Resource Efficient Greening of Industry Initiative for Pakistan, UNIDO – Pakistan and Ministry of Industries and Climate Change Division, Government of Pakistan, January 2014

In setting quantitative targets, it is recommended to develop implementation plans for subsectors rather than for the manufacturing sector as a whole. Subsector action plans that focus on energy efficiency, conservation, water and materials, would consist of the following components:

- Resource efficiency targets set for subsectors;
- Targets incorporated into established or revised subsector development strategies that reflect a consensus of state owned, foreign direct investment and domestically owned enterprises; and
- A written long-term agreement between industry associations and the government on how and when targets would be achieved.[76]

Government support programs likely also will target the subsector rather than the sector level, to make them more relevant to the specific subsectors. Support programs can include financial incentives, technical assistance, rewards and publicity for enterprises that reach targets and perhaps penalties for failure to achieve targets. Financial incentives for investing in energy efficiency technologies and measures could include targeted grants or subsidies, tax relief, loans for investments in energy efficiency and partial risk guarantees for loans made by banks. Financial disincentives could include differentiated rates for electricity and other energy sources based on levels of energy efficiency, with the more inefficient plants bearing a higher price, elimination of tax rebates for exports of energy-intensive products and penalties.[77]

Given that it takes time for a government to formulate required and voluntary standards, and it takes time for the private sector to attain compliance with such standards, a phased approach is recommended. In Pakistan, for example, a green industrial policy focused on energy efficiency was designed to be implemented over six years (see Box 5).

[76] Resource Efficient Greening of Industry Initiative for Pakistan, UNIDO – Pakistan and Ministry of Industries and Climate Change Division, Government of Pakistan, January 2014.
[77] Ibid.

Box 5: Pakistan's Phased Approach to Greening Industry

In developing its Resource Efficient Greening of Industry (REGI) initiative, which had the goal of decoupling the use of resource inputs used in production processes, primarily energy, from industrial output, Pakistan took a phased approach, as follows:

Phase One: Years 1 and 2

- Set a timetable and identify responsibilities for issuing general guidance for formulation of an REGI initiative with its principal objective being the decoupling of energy use from industrial output. Draw on international expertise as needed, particularly that of China, the Netherlands and Japan.
- Initiate a survey of the top energy consuming enterprises. The survey could start with large electricity using enterprises, if the government maintains such a data base. However, it would need to be expanded to fuel use to have a complete picture of total energy consumption;
- Review procedures for data collection of water and pollutant discharge and raw material utilization with the aim of building a national database. Initiate a survey similar to the one being undertaken on energy utilization;
- Collect and analyze all cleaner production case studies (completed by Cleaner Production Centre in Sialkot, by Cleaner Production Institute in Lahore, Faisalabad, Multan & Karachi; and National Cleaner Production Centre-Foundation in Rawalpindi) to assess their usefulness in estimating the potential for improving energy/water/material use efficiency and benchmarking. Design a comprehensive resource use compliance monitoring and reporting requirement to complement the current requirement for an environmental compliance permit.

Phase Two: Years 3 and 4

- Set decoupling target for energy use and industrial output translated into energy use efficiency and total energy use targets for the manufacturing sector and more importantly for subsectors. If possible, also set water and materials use efficiency and total resource use targets for the manufacturing sector and more importantly for subsectors.
- Establish two subsector working groups to agree upon subsector targets that take into account the social and environmental implications of their implementation.
- Provide national and international expertise on a cost-sharing basis to the subsector associations and participating plants in the subsector on accurate measuring of energy use and on managerial and technological measures to improve energy efficiency.
- Allocate enterprise-specific energy/water/material efficiency and conservation targets. The subsector association would have to agree on a physical indicator for the subsector.

Phase Three: Years 5 and 6

- Launch a "lean and mean" energy/water/materials efficiency program for all resource-intensive manufacturing subsectors, which would be integrated into national development plans;
- Issue energy efficiency targets for non-energy intensive subsectors as well as industrial boilers if needed at the completion of the International Finance Corporation project, using existing best available technology guidelines.

Source: Resource Efficient Greening of Industry Initiative for Pakistan, UNIDO – Pakistan and Ministry of Industries and Climate Change Division, Government of Pakistan, January 2014

Similarly, in Bangladesh, roadmaps for key subsectors, including leather, plastics, textiles, and engineered goods, currently are being developed. Although focused primarily on jobs, the

roadmaps incorporate greening elements, in that they address resources needed for sustainable manufacturing growth. Key components of the roadmaps include:

- Improving the availability of and access to finance;
- Improving raw materials;
- Improving productivity including skills and technology upgradation;
- Enabling policy and regulatory support;
- Improving market access;
- Diversifying into new markets; and
- Donor mapping to ensure coordinated implementation.

A green manufacturing strategy should take care to include small- and medium-size enterprises (SMEs), which generally compromise the largest number of enterprises and the greatest environmental pressure. For example, in the United Kingdom it is estimated that SMEs account for 60% of total CO_2 emissions from enterprises and 70% of all air pollution.[78] Typically lacking an environment division or a designated specialist responsible for environmental compliance and management in the company, SMEs often are slow or reluctant to adopt efficiency measures and improved environmental practices. SMEs often lack awareness of their environmental impact or the environmental legislation affecting them. Further, many SMEs lack the in-house expertise to identify and even properly implement environmental technologies. Also, SMEs often lack resources (e.g., substantial assets or collateral) and therefore have difficulty accessing conventional loans and credit; this lack of resources often leads to SMEs being risk-averse and less willing to invest in new environmental technologies, partly because the payback period of these investments is often over several years. Finally, SMEs also tend to have a short-term economic perspective, which often results in the perception that environmental management is peripheral to core business.

Key Concepts

- Various levers are available to a government to directly and indirectly encourage and support green manufacturing; a green manufacturing strategy can consider the desired potential levers and estimate their cost/benefit to determine priorities for policy setting and implementation.
- Successful legal frameworks include quantitative targets, financial incentives, regulatory and support features, auditing and reporting requirements, preferably set at the subsector level rather than for the manufacturing sector as a whole.
- Dialogue between the government and private sector is key to setting, attaining and monitoring green manufacturing targets. Subsector associations can play a role in reaching consensus among members and drafting long-term agreements between industry associations and the government on how and when targets would be achieved.
- Given that it takes time for a government to formulate required and voluntary standards, and for the private sector to attain compliance with such standards, a phased approach is recommended.
- Governance of green manufacturing requires identification and monitoring of key quantitative indicators, which should be normalized across enterprises and subsectors to enable aggregated and disaggregated analysis.
- Collection and interpretation of indicator data often requires strengthening a country's statistical capacity at the local and central levels to ensure that data are reliable, regularly collected and useful

[78] IEEP, 2006, as cited in UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.

to policy makers and industry stakeholders.

- SMEs account for the greatest share of environmental degradation, emissions and pollution; therefore, integration of SMEs is critical for a successful green manufacturing strategy. SMEs require awareness building, skills development and technology training, access to finance, long-term business planning and compliance assistance in order to transition to green manufacturing.

5.3.3 Institutional Framework

The greening of industries requires effective and coordinated governance regimes to champion and support the implementation of green industry policies and initiatives. Clear government commitment needs to come from the top, with supporting leadership throughout the public sector. Policy and institutional integration are paramount, and can be supported by clear processes for integrating environmental, social and economic goals, along with national strategies for implementing goals across responsibility areas. Policy integration should take place both vertically within different tiers of government; and horizontally across different sectors of government.[79] Advancing green industrialization in Africa will not be cost-neutral: it will require a boost in domestic resource mobilization and the support of the international community in financial and technological resources. [80]

Greening initiatives can be incorporated within the context of broader investment incentives and in a "carrot and stick" approach. For example, Tunisia's Investment Law, in force since 1 April 2017, combines the "carrot" of matching grants with the "stick" of requiring all manufacturers, regardless of size, to complete an environmental impact assessment, a risk assessment and an energy audit (see Box 6).

[79] UNIDO Green Industry: Policies for Supporting Green Industry, United Nations Industrial Development Organization (UNIDO), 2011.

[80] Greening Africa's Industrialization, Economic Report on Africa, United Nations Economic Commission for Africa (UNECA), 2016, http://www.un.org/en/africa/osaa/pdf/pubs/2016era-uneca.pdf

Box 6: Tunisia's Carrot and Stick Approach to Investment Incentives for Green Manufacturing

Tunisia's Investment Law, in force since 1 April 2017, provides many investment advantages while also encouraging enterprises to reduce their environmental footprint.

The Law provides investors with financial incentives in the form of "Sustainable Development Grants" that match the enterprise's investment, by providing 50% of the approved investment component (maximum TND300,000, equivalent of USD125,718) for investments made to reduce pollution and protect the environment including:

- Investment in water and air pollution treatment resulting from the activity of the enterprise;
- Projects for the adoption of clean and non-polluting technologies to reduce pollution from its source or control the exploitation of resources; and
- Collective decontamination equipment used jointly by public and private operators for enterprises that carry out the same activity.

The Law also requires all manufacturers in Tunisia – including domestic, foreign, SMEs and large companies – to comply with environmental standards. Manufacturers are required to use tools including:

- ***Environmental Impact Assessment (EIA):*** Required under Tunisian regulations in order to obtain any administrative authorization; the requirements for EIA vary by sector and project, with certain industrial, agricultural and commercial projects required to provide a more in-depth and detailed assessment of the predictable impact on the environment;
- ***Risk Assessment (RA):*** The RA must describe the risks of major accidents that might happen and how they could be handled. In addition, the RA must explain and justify the preventive measures and procedures intended to reduce the probability of accidents and limit their effect on people, property and the environment; and
- ***Energy Audit (EA):*** The EA is based on three mechanisms intended to promote energy savings and reduce greenhouse gas effects on key economic sectors: a legal system, an incentive system and an institutional system.

Source: Foreign Investment Promotion Agency (FIPA-Tunisia)[81]

5.3.4 Green Manufacturing in IPs

Concept and Evolution of an Industrial Park: An industrial park (also known as industrial estate) is an area zoned and planned for the purpose of industrial development. An industrial park differs from its counterparts such as an industrial zone, industrial cluster and industrial region. Each is defined as follows.

Industrial Park: IPs provide investors with turnkey infrastructure, sheds (factory buildings) and comprehensive and well diversified services and facilities. The advantage of industrial parks for investors is that it minimizes bureaucratic delays, shortens the implementation period of projects

[81] Provided Financial Incentives (http://www.investintunisia.tn/En/provided-financial-incentives_11_622) and Respecting Environment (http://www.investintunisia.tn/En/respecting-environment_11_621).

and reduce overall establishment costs. For reasons such as these, industrial park development is often referred to as the best means to attract foreign direct investment (FDI). In this regard, governments develop industrial parks as a strategy for accelerating economic growth and industrial development. Originating in the United Kingdom in 1896, the importance of industrial park development has been evidenced by more than 100 countries having established a collective total of approximately 20,000 industrial parks around the globe.[82]

Industry Clusters: Industry clusters are geographic concentrations of interconnected companies and institutions in a particular field. Ideally, clusters also include the institutions and professional organizations that provide research assistance and support to the industry.[83]

Industrial Zones: An industrial zone is an area established by zoning authorities as being most appropriate for industry or manufacturing. A zone, which simply permits certain industrial activities as an incident to the primary land use designation, is not considered to be an industrial zone.[84] Industrial zoning is the practice of designating an area for industrial development.[85] There is no uniform definition of an industrial zone but the term is understood to mean a dedicated area segmented and prepared for investment of several companies. It features an installed shared infrastructure (common facilities - e.g., wastewater treatment) and is in close proximity to other companies. As opposed to an industrial park, an industrial zone does not include sheds; it is not a turnkey solution. For example, the CzechInvest Agency defines an industrial zone as "a comprehensive continuous area of approximately rectangular shape, which is defined in the binding part of the approved development plan of large territorial unit or of the approved development plan of local area which is or will be covered by subject of industrial production, trade, services or as a buildable land suitable mainly for placement of industrial production, trade and services." Preparing the area designated as an industrial zone is associated with the transfer of the land, with construction or with rerouting of technical infrastructure (water supply, sewerage, pipeline, electrical power lines, local roads, railways, capacitive ICT) and with field modification.[86]

In Ethiopia, the first industrial park was established in Mekelle in 1962 and the second in Addis Ababa in 1982. Unfortunately, the two industrial estates were not operational due to technical, financial, marketing, managerial problems, and for political reasons. Established in 2006 by Chinese companies, the Eastern Industrial Zone in Dukem (approximately 25 km south of Addis Ababa) was Ethiopia's first operational IP. The Industrial Parks Development Corporation (IPDC) established the first state-owned operational IP in 2016 in Hawassa, located 250 km south of Addis Ababa.

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[82] Industrial Project Service, Feasibility Study for The Establishment of Hawassa Industrial Park of 1St Cycle Phase I of 100 Hectare, 2015

[83] Regional Growth Opportunities: Select Industry Clusters in Fort Collins, R&M Resource Development and Development Research Partners, October 2006

[84] Lawinsider.com

[85] https://www.lawinsider.com/dictionary/industrial-zone

[86] https://is.mendelu.cz/eknihovna/opory/zobraz_cast.pl?cast=58384

To realize Ethiopia's ambitious development plan of rapid industrialization through nurturing manufacturing and agro-processing industries and to accelerate economic transformation and attract domestic and foreign direct investment, the Ethiopian government committed to developing industrial parks that provide the necessary services and facilities for industries. In this regard, two kinds of industrial parks are currently being developed:

- Large-, medium- and light-scale industrial parks; and
- Integrated agro-industrial parks.

To provide a consistent, legal framework for establishing and managing industrial parks, the Ethiopian Government introduced the Industrial Parks Proclamation 886/2015, which stipulates that industrial parks can be developed by any profit-making public, public-private or private enterprise. This includes IPDC, which is in charge of managing the development of large-, medium- and light-scale industrial parks, and MoTI and MoA, which are responsible for the integrated agro-industrial parks development.[87] The investment is open to domestic and foreign investors. Many Chinese companies are leasing in the IPs built by IPDC, while larger Chinese developers are establishing IPs as private ventures; at least five such private Chinese IP developments are under construction. Additionally, regional states have also planned IP developments in the pipeline.

Industrial Parks Proclamation 886/2015 and its regulation provide for environmental protection and the wellbeing of people. The Proclamation sets obligations for IP developers, operators and enterprises to comply with environmental and social norms, standards, safeguards, management and mitigation plans. The Industrial Park Council of Ministers Regulation No. 417/2017 for the implementation of IP Proclamation 886/2015 stipulates that enterprises in IPs must comply with the issuance of an EIA report and certificate before obtaining an investment permit.

Greening of IPs: Firms established in IPs, industrial zones, industrial regions or industrial clusters are obliged to comply with rules and regulations of the country and fulfill requirements per national and international standards. As such, this green manufacturing strategy for Ethiopia, inclusive of all initiatives presented in the action plan, applies equally to all manufacturing firms, within or outside IPs, zones, etc. Abiding by these greening practices will bolster firms' sustainability and competitiveness in the global market.

IPs will need to develop an operational framework that incorporates the green manufacturing practices presented in this document to manage firms based in the IPs according to the requirements stipulated in International Framework on Eco-Industrial Parks prepared by UNIDO, WB and GIZ.[88] According to this international framework, an industrial park can be converted into an eco-industrial park (EIP) by fulfilling managerial, environmental, social and economic requirements in a holistic manner (see example of Kalundborg eco-industrial park in **Error! Reference source not found.** above). The International Framework provides the basis

[87] Industrial Parks Development in Ethiopia, IPDC Brochure; Published by Embassy of the FDRE in Brussels, May, 2016

[88] The framework can be found here: https://openknowledge.worldbank.org/bitstream/handle/10986/29110/122179-WP-PUBLIC-AnInternationalFrameworkforEcoIndustrialParks.pdf?sequence=1&isAllowed=y

for defining and setting prerequisites and performance requirements for EIPs. At a minimum, EIPs will be required to comply with all applicable national regulations in alignment with international standards. To ensure specificity within each EIP, the International Framework should be adapted into a series of guidelines by the respective IP developer (e.g., IPDC, etc.) – and be subject to MoTI's approval – depending on the operational focus of industries within the respective parks. It will not be necessary to develop a separate regulation or policy.

The International Framework describes the performance requirements for EIP centers according to four categories, namely:[89]

1. Park management performance:
    - Park management service
    - Monitoring
    - Planning and zoning

2. Environmental performance:
    - Environmental management and monitoring
    - Energy management
    - Water management
    - Waste and material use
    - Natural environment and climate resilience

3. Social performance:
    - Social management and monitoring
    - Social infrastructure
    - Community outreach and dialogue

4. Economic performance:
    - Employment generation,
    - Local business and small and medium enterprise (SME) promotion
    - Economic value creation

5.4 Sector-Specific Best Practices for Green Manufacturing

While some aspects of green manufacturing, such as compliance with ILO labor standards, are cross-cutting across manufacturing, other aspects may vary among different sectors, particularly when considering a product life cycle and the emerging need for transparency along the supply chain. For example, sustainable livestock rearing practices will be relevant to a green leather industry. This section provides an overview of best practices for green manufacturing for some key subsectors of Ethiopia's manufacturing sector.

[89] An International Framework for Eco-Industrial Park, UNIDO, WB and GIZ, December 2017 https://openknowledge.worldbank.org/bitstream/handle/10986/29110/122179-WP-PUBLIC-AnInternationalFrameworkforEcoIndustrialParks.pdf?sequence=1&isAllowed=y

In designing best practices and standards for manufacturing subsectors, one should consider what are the most pressing issues and relevant standards not only locally, but also in targeted export markets. Regulations and policies of key markets must be monitored, and the sector strategy adapted to meet evolving norms. By working in concert with manufacturers, governments can help the sector strengthen operations to align their enterprise strategy and goals with that of the local and target government(s).

Key manufacturing industries such as food processing, chemicals and industrial manufacturing can look to the SDG Industry Matrix to identify specific ways to support both green manufacturing and SDGs (see Table 7 below). Realization of these opportunities requires collaboration among governments, the private sector, and other stakeholders.

Table 7: Opportunities for Greening Key Industries

Industry	Opportunities for Greening
Agro-processing, Food & Beverage, and Consumer Goods	• Provide training and best practice guidance to small-scale producers and retailers, including women-owned businesses, to improve the productivity, capacity, logistics and market efficiency of their operations. • Reduce natural resources and energy used in agriculture and raw material production, processing, packaging and distribution. • Reduce waste and emissions by reducing chemical byproducts. • Embed sustainability criteria in procurement processes and project evaluation. • Find alternatives to palm oil. • Take steps to measure, reduce and report climate exposure, and set measures of accountability for all parties involved in supply chains. • Understand end-of-product use and disposal impacts. • Monitor and reduce food loss and waste throughout the value chain. • Develop consumer knowledge around sustainable agriculture and consumer products and encourage recycling and sustainable disposal of products. • Increase organizational awareness of the sustainability aspects of products, including product design, use and disposal.
Chemicals, Energy, and Natural Resources	• Collaborate with governments and other stakeholders to extend electricity grids to underserved communities including fragile states. • Provide off-grid communities with access to affordable renewable energy (e.g., through low-carbon micro-grids or low-cost community solar systems). • Encourage public-private partnerships to collaborate on developing and scaling up breakthrough technologies to accelerate the transition to a higher share of renewable energy (solar, wind, hydro, geothermal and biomass) in the global energy mix. • Collaborate with industrial manufacturers to substantially increase the capacity and efficiency of power storage systems. • Reduce and eliminate routine flaring in oil production. • Reduce methane emissions along the gas value chain. • Develop and implement improved processes to reduce inputs, i.e., raw materials, water, nonrenewable minerals, etc. • Source materials and raw inputs with lower embedded energy. • Minimize waste and effluent resulting from production and improve recycling and reuse of outputs. • Invest in research and development to expand the application and cost-effectiveness of chemical bio-alternatives (e.g., to replace single-use plastics). • Encourage public-private partnerships to collaborate on developing and scaling up new energy technologies, chemicals and production methods that reduce

	contamination and air and water pollution. • Ensure mines and production facilities are resilient to extreme climatic events. • To minimize the risk of injury, illness and fatality from hazardous chemicals, air pollution, road collisions, mine collapses and other industrial accidents, establish a forum (web-based or physical presence-based forum) through which health and safety innovations and best practices can be shared within and across industries.
Industrial Manufacturing (Forestry and Paper, Metals and Mining)	• By providing tax incentives and/or supporting marketing efforts, governments can encourage development and awareness-raising of more resource-efficient machinery that generates less – or more effectively and efficiently filters – effluent, waste and pollutants. • Apply a circular economy mindset when designing products so that there is improved end-of-product lifecycle reuse and recycling. • Incorporate innovative technologies, such as 3D printing, into manufacturing processes to reduce waste from long-run production and prototyping. • Develop and implement improved processes (e.g., closed-loop manufacturing) to reduce, reuse and recycle water, raw materials, non-renewable minerals, other inputs, by-products and waste. • Source materials from sustainable sources (e.g., forestry products from certified sustainably managed forests) and components with lower embedded energy. • Increase energy efficiency in industrial manufacturing plants and across distribution networks. • Increase the proportion of materials and components that are sourced locally in low- and middle-income countries. • Build the resilience of suppliers in emerging economies to reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

Source: Adapted by Global Development Solutions, LLC from Jean-Grégoire Manoukian, How These 5 Key Industries Can Advance Sustainable Development Goals, Enablon, 11 May 2017

5.4.1 Cross-cutting Standards

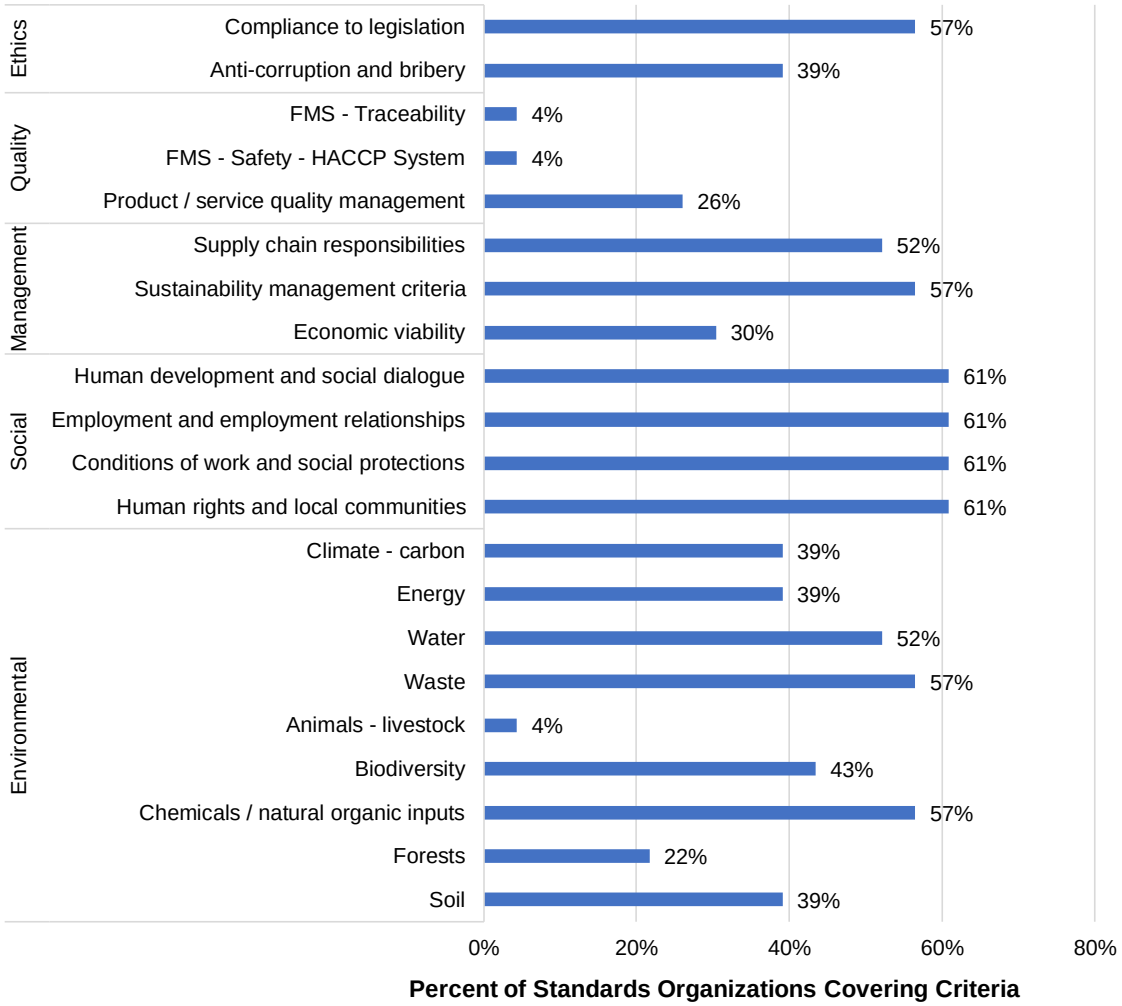
Best practices for green manufacturing were examined in accordance with key subsectors of Ethiopia, including leather, agro-processing, textiles and cement. Global legal and voluntary standards provide a model for green manufacturing, especially for export-oriented subsectors. Applicable to all subsectors are cross-cutting voluntary standards, such as the UN Global Compact's ten principles in the areas of human rights, labor, the environment and anti-corruption, as well as the labor standards promulgated by ILO. While these and other standards are voluntary for manufacturers, components of them increasingly are becoming the *defacto* - if not *dejure* - norm globally. As such, the voluntary standards provide a roadmap and present goals around which Ethiopia can develop and prioritize its green manufacturing strategy.

Figure 6 below examines the voluntary standards applicable to key Ethiopian manufacturing subsectors, in aggregate, to identify priorities for greening Ethiopia's manufacturing sector. Each standard (e.g., Fairtrade) consists of one or more components (e.g., environmental, social, etc.), sub-components (e.g., energy, soil, etc.) and specific requirements (e.g., respect of a list of prohibited chemicals) for which a standards body sets criteria for compliance. The tabulation of sub-components across the applicable voluntary standards reveals areas where Ethiopia can focus efforts in helping manufacturers achieve compliance with voluntary standards. For example:

- 61% of standards contain requirements for social compliance including employment, working conditions and other labor and community issues;
- Key environmental concerns of standards organizations are management of waste (57%), chemicals (57%) and water (52%);
- More than half (57%) of the standards require manufacturing companies to establish sustainability management criteria, such as environment and social management systems, and assess environmental risks;
- 52% of the standards require the manufacturer to follow responsible supply chain practices, including mapping supply chain stakeholders and encouraging suppliers to consider sustainability issues, such as reducing GHG emissions, waste and water use; and
- Within ethics, 57% of the voluntary standards require compliance to legislation, including international regulations, norms and conventions and local environmental laws and regulations.

Sustainable manufacturing integrates environmental, social, management, ethical and quality mandates. Ethiopia can support manufacturers' greening efforts by establishing and enforcing standards for waste, chemicals and water management in line with international norms and by providing support regarding technology and infrastructure centered on these key areas.

Figure 6: Focus of Voluntary Standards Relevant to Ethiopia's Manufacturing Subsectors



The figure tabulates the frequency of sub-components (e.g., energy, soil, etc.) within components (e.g., environmental, social, etc.) of voluntary standards applicable to key Ethiopian manufacturing subsectors. The percentage shown indicates the frequency with which the voluntary standards have requirements for the indicated sub-components.

Source: Global Development Solutions, LLC (GDS) analysis of ITC Standards Map

Specific aspects of green manufacturing best practices for target Ethiopian manufacturing subsectors of leather, agro-processing, textiles and cement are discussed subsequently, including key environmental challenges, legal requirements, voluntary requirements and sources of guidance for the public and private sector.

5.4.2 Leather

Beyond animal welfare standards for hides/skins input, the key environmental issues at the processing stage for leather include chemicals, dyes, water use and wastewater, specifically the need for effluent treatment and wastewater handling facilities to prevent groundwater contamination in the surrounding area, and the need for on-site safety standards to minimize direct exposure of workers to toxic chemicals. Approximately 80% of leather globally is tanned

using chrome, involving a highly toxic process that results in significant toxic waste being released into waterways and serious harm to industrial tannery workers. Conventional chrome-tannery leather results in significant water pollution that is toxic to the natural environment and the people that rely on the water supply and eco-system.[90] The use of outdated equipment, lack of formal training of tannery workers and lack of enforced environmental standards constrain the leather industry's ability to minimize its environmental impact.[91]

Because of the environmental and social effects, numerous legal requirements exist regarding the import of leather goods to address sanitary measures, concentration of chemicals and adherence to stringent certification measures (e.g., ISO 9000 certification). Although only some are explicitly environmental (e.g., EU's Environmental Market Requirements), many of these standards intersect with the totality of green manufacturing as they span a product's lifecycle and can include requirements regarding the raw material from which a product is made, the manner in which a product is fabricated, the management of production processes, and labelling standards and packaging requirements. These standards ensure that imported products satisfy environmental, consumer health, consumer safety and social concerns, thus falling under the sustainability umbrella. Legal requirements for imports by EU, China and USA of hides, skins and leather are noted in Table 8.

Table 8: Legal Requirements for Leading Leather Importing Markets

Import market	Requirement		Detail
1 EU	1.1	Directive (2002/61/EC)	Limits the use of dangerous substances and preparations (azocolourants) in textile and leather products. Note that Germany and The Netherlands have stricter regulation pertaining to the usage of azo dyes, Pentachlorophenol (PCP), chromium and disperse dyes.
	1.2	Directive (94/27/EEC)	Restricts nickel and nickel compounds for metal products in direct contact with the skin.
	1.3	Regulation (338/97 EC)	Streamlines the implementation of CITES in the EU. CITES contains provisions to protect endangered species through controlling international trade in these species.
	1.4	Directive (85/374/EEC)	Assigns liability to a manufacturer, or his representative in the EU, for compensation to person and property caused by a product that turns out to be not as safe as expected.
	1.5	Social Market Requirements	Certification schemes have been developed for social management systems, e.g., SA8000, which include basic labor standards based on international ILO conventions.
	1.6	Environmental Market Requirements	Although countries have developed their own standards, it is simpler for an exporter to satisfy two general standards: BS 7750 and ISO 14001. These standards are based on the ISO 9000 series and stipulate the requirements for an environmental management system. Environmental issues pertaining to leather production occur in cleaning, tanning, finishing and waste treatment processes.

[90] S. Edwards, The Environmental Impacts of Leather, 2 May 2016.
[91] Value Chain Analysis for the Skin, Leather and Footwear Sector in Lesotho: Final Report, Global Development Solutions, LLC (GDS), December 2017.

Import market	Requirement		Detail
	1.7	Quality Market Requirements	The most important quality management systems are those under the ISO 9000:2000 series. The *Schadstoffgeprüfft* (SG) label stands for "tested for dangerous substances."
	1.8	Directive 94/62/EC	Establishes common objectives for member countries regarding the recovery and the recycling of packaging, limiting the content of heavy metals such that the sum of concentration levels of lead, cadmium, mercury and hexavalent chromium present in packaging or packaging components shall not exceed 100 ppm by weight.
	1.9	Directive 2004/102/EC	Requires wooden packaging material that is imported in its function of packaging material or dunnage with the import of goods to be treated and marked according to the international ISPM 15 standard.
2 China	2.1	Overview	The Chinese Government issues 'Public Information Notices' to inform of actual or impending policy changes and categories of goods. Many of these notices are issued in Chinese and are not translated into English. The preferred route to enter the Chinese market is generally to find a Chinese partner who knows the market and understands local requirements and expectations. Exporters to China are encouraged to discuss relevant Chinese national standards with importers prior to shipment to ensure that their interpretation of the regulation is accurate. Some of the regulations are listed below.
	2.2	Law of the Peoples Republic of China on the Entry and Exit Animal and Plant Quarantine	Animals and plants, their products and other quarantine objects, containers and packaging materials used for carrying animals and plants, their products or other quarantine objects, as well as means of transport from animal or plant epidemic areas shall, on entry or exit, be subject to quarantine inspection in accordance with this Law. Quarantine of import and export plants, plant products, import and export animals and import animal products shall be undertaken by the Animal and Plant Quarantine Service. Quarantine of export animal products shall be undertaken by the commodity inspection authorities.
	2.3	General Administration for Quality Supervision, Inspection and Quarantine (AQSIQ) 2004 Announcement 111	The announcement eliminated importers' requirements to apply for a Quarantine Import Permit (QIP) for specified animal and plant commodities before contracts are signed and products are imported into China. However, the animal and plant products still are subject to quarantine examination upon arrival in China. The report contains an UNOFFICIAL translation of the announcement along with the list of designated commodities no longer requiring a QIP.
	2.4	AQSIQ 2002 Decree No. 40	The *Provisions for the Administration of Risk Analysis on Entry of Animals and Animal Products* was adopted on October 18, 2002 and approved on December 31, 2002 for implementation from February 1, 2003.

Import market	Requirement		Detail
	2.5	AQSIQ 2002 Announcement Number 34	*The Administrative Rules on Agencies Applying for Import and Export Inspection and Quarantine* was published on the AQSIQ website on November 6, 2002 for enforcement from January 1, 2003 and in Issue 17 of the China Foreign Trade and Economic Cooperation Gazette on March 18, 2003. The announcement provides guidelines and requirements for agencies/business enterprises that use agents for importing and exporting commodities.
	2.6	Regulation on Animal Origin Feed Products - CH3093	Regulates the importation of animal and animal products from Bovine Spongiform Encephalopathy (BSE) affected countries.
3 USA	3.1	Fish and Wildlife (FWS) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	If the product is derived from exotic wildlife or endangered species, it must comply with Fish and Wildlife (FWS) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) license, permit, country of origin, import documentation and record-keeping requirements.
	3.2	USDA Animal and Plant Health Inspection Service (APHIS)	If the product is derived from domestic animals, it must comply with USDA Animal and Plant Health Inspection Service (APHIS) import, quarantine and permit and certification requirements.
	3.3	Veterinary certificate	A veterinary certificate issued by a salaried veterinarian of the country of origin stating that the animal products are free from applicable animal diseases must accompany each consignment. The specific information required varies depending on the species.

Sources: TIPS; A Profile of the South African Hides, Skins and Leather Market Value Chain, Department: Agriculture Forestry and Fisheries (DAFF), Republic of South Africa, 2016, and European Virtual Institute for Speciation Analysis; http://www.speciation.net/Public/Linklists/EVISA.html

Besides the regulatory requirements noted in the previous section, the leather sector can comply with voluntary requirements that represent best environment, social, management, quality or ethics practices as promulgated by organizations such as Worldwide Responsible Accredited Production (WRAP), Fairtrade Textile Standard, Workplace Condition Assessment (WCA), Oeko-Tex, Bluesign, ILO and more. Such standards apply throughout the leather value chain from livestock rearing to finished goods. Compliance with such standards can help maintain quality, sector sustainability, labor safety and market access. Synergies are possible with the voluntary requirements of the textile and garment industry.

Managing the environmental impact of leather tanning is an emerging field (see Box 7). In managing green leather goals, manufacturers and governments can look to the aforementioned certification bodies, as well as to the Leather Working Group (LWG), a resource for all stakeholders in the leather industry, including brands, manufacturers, suppliers, NGOs and end users.[92] The multi-stakeholder group strives to develop and maintain a protocol that assesses the environmental compliance and performance capabilities of leather manufacturers and promotes sustainable and appropriate environmental business practices within the leather industry. For

[92] Leather Working Group, https://www.leatherworkinggroup.com/

example, over the course of several audits, member manufacturers were able to reduce water use by an average of 35% and energy consumption by an average of 48%.[93] The LWG is comprised of member brands, retailers, product manufacturers, leather manufacturers, chemical suppliers and technical experts that work together to maintain an environmental stewardship protocol specifically for the leather manufacturing industry. The LWG currently has approximately 450 global members, including 350 leather manufacturers under certification, and covers 15% of global finished leather production.[94,95]

[93] Ibid.
[94] Ibid.
[95] The Sustainable Apparel Coalition (SAC), discussed more in detail in the next section (*5.4.3 Textiles and Garments*), also provides leather industry guidance, and advocates, among other measures, zero discharge of hazardous chemicals in the textile, *leather*, and footwear value chain, thereby reducing harm to the environment and human well-being.

Box 7: Emerging Technologies for Managing Tannery Effluent Sludge

The tannery industry is renowned for creating a large amount of toxic solid and liquid waste, generated from the cleaning, fleshing, splitting, tanning, shaving and buffing of raw materials. Typically, between 45 and 75% of the raw hides being processed end up as tannery solid waste (TSW). While pollution prevention and promotion of cleaner leather processing are the ultimate goals for tanneries, both for environmental protection and cost-savings measures, waste management of TSW effluent sludge remains an issue for the leather industry at present. Several uses for TSW recently were tested globally; two of these methods (clay bricks for construction and briquettes for fuel) look promising.

In Bangladesh, where chromium-rich TSW has the potential to become a serious environmental burden, researchers investigated whether the sludge could be disposed of by stabilizing it in clay brick products for building construction. For such an industrial technique to be sustainable, it must meet several conditions: the engineering properties of the bricks as a building material must not be diminished by addition of sludge, the production process must be energy efficient, and the use of such bricks must not pose any harmful environmental effects in the long run. The researchers prepared clay bricks with different proportions of sludge (10%, 20%, 30% and 40% by dry weight) in both laboratory-controlled and field conditions. Construction material suitability was assessed based on the strength, water absorption, shrinkage, weight-loss on ignition and bulk density of the bricks. Tests found that the bricks with TSW satisfied both American Society for Testing and Materials (ASTM) and Bangladesh Standards (BDS) requirements for bricks as a construction material. Depending on the proportion of sludge in the brick, 15-47% energy savings during firing was achieved versus firing of conventional clay bricks. Leaching of heavy metals from TSW-amended bricks was much lower than Dutch and USA Environmental Protection Agency (USEPA) regulatory limits. Study results indicate that TSW can be sustainably stabilized in clay bricks, and large-scale application of this technique can be envisaged in the context of Bangladesh and elsewhere, where brick remains a dominant building material and housing is needed for refugees and other displaced persons.

In Nigeria, a study investigated the use of TSW in biomass briquettes. TSW was collected from a tannery in Kano, Nigeria. Scanning electron microscopy and proximate analysis were carried out on the samples. Briquettes, comprising varying ratios of TSW hair, flesh, chrome shavings and buffing dust, were molded and characterized. Thermal efficiency, durability and compressive strength, among other properties, were determined for the briquette formulations. The TSW briquettes had calorific values comparable to other fuel sources such as sub-bituminous coal, and durability of the briquettes ranged from 98.12% to 99.77%. The study showed that TSW can be used for fuel briquette production as an environmentally friendly, cost effective and affordable alternative to fossil fuel. Such technology may have application in Ethiopia as an alternative to wood charcoal briquettes to preserve forest and rangeland.

Source: Introduction to Treatment of Tannery Effluents, United Nations Industrial Development Organization (UNIDO), 2011; Md. Ariful Islam Juel, Al Mizan, Tanvir Ahmed; Sustainable Use of Tannery Sludge in Brick Manufacturing in Bangladesh, Waste Management, Vol 60, February 2017; I. Onukak et al, Production and Characterization of Biomass Briquettes from Tannery Solid Waste, Recycling, 20 Oct 2017.

5.4.3 Textiles and Garments

The textile industry is among the top-five polluting global industries, according to the National Resources Defense Council.[96] The fashion industry was responsible for approximately 5.4% of global carbon emissions in 2015.[97] Further, textile mills contribute about one-fifth to the world's industrial water pollution, by using thousands of toxic chemicals during production, some of which are found to be carcinogenic. In China, the textile industry was the third largest source of industrial wastewater effluent in 2015 and accounted for 10.1% percent of China's total industrial wastewater discharge.[98]

Global apparel brands increasingly look beyond low-cost production and seek to build sustainable supply chains. Key goals for greening textile and garment production include:

- Ensure safe and fair working conditions across the supply chain;
- Minimize energy, water and pesticide use for inputs, e.g., intense cotton production;
- Ensure good standards of animal welfare associated with leather and wool production;
- Minimize use of manmade fibers that take longer to degrade in landfill sites;
- Manage chemical use, to avoid damage to worker health and the local environment;
- Manage waste products, including wastewater and surplus/scrap textiles;
- Reduce energy consumed during production; and
- Minimize the carbon footprint of transportation globally.[99]

In managing green textile goals, manufacturers can look to the Sustainable Apparel Coalition (SAC), a coalition of brands and retailers, manufacturers, academic institutions, affiliates, government and NGOs, seeks to develop a universal approach to measuring sustainability performance. The SAC Higg Index suite of tools, used by more than 10,000 manufacturers globally, provides standardized supply chain measurement of environmental, social and labor impacts across the supply chain. Firms use the web-based sustainability tools to track progress, connect with business partners, benchmark results against industry peers and identify areas of improvement.[100]

Additionally, textile producers must conform to legal and voluntary standards of destination markets. Legal standards for import by target markets can be basic. For example, the primary requirements for export of apparel to USA are labeling of content, care, country of origin and compliance with product flammability standards.[101] However, global apparel buyers require that suppliers provide assurance of responsible supply chain practices, including minimal

[96] J. L. Ravelo, Mapping the Environmental Impacts of China's Textile Industry, Devex, 18 Jan 2018.
[97] Ibid.
[98] Ibid.
[99] Adapted from Fashioning Sustainability, Forum for the Future, https://www.forumforthefuture.org/project/fashioning-sustainability/overview
[100] Sustainable Apparel Coalition (SAC), https://apparelcoalition.org/
[101] Regulations for Importing Textiles, U.S. Customs and Border Protection, https://help.cbp.gov/app/answers/detail/a_id/205/~/regulations-for-importing-textiles

environmental impact, to maintain brand reputation and lower business risks.[102] To this end, leading global buyers, and their corresponding suppliers, require certifications such as those indicated in Table 9.

Table 9: Key Certifications for Green Manufacturing of Textiles and Garments

Certification	Description
Business Social Compliance Initiative (BSCI)	To improve working conditions in international supply chains; the Code of Conduct draws on international labor standards protecting workers' rights such as ILO conventions and declarations, the United Nations (UN) Guiding Principles on Business and Human Rights as well as guidelines for multinational enterprises of the Organization for Economic Co-operation and Development (OECD).
CPI_2	Know-How Tool provides products by providing practical advice to manufacturers to minimize the negative social and environmental impact in global supply chains. CPI_2 recently partnered with the Sustainable Apparel Coalition (SAC).
Global Organic Textile Standard (GOTS)	Leads textile processing standards for organic fibers, including ecological and social criteria, backed up by independent certification of the entire textile supply chain.
Oeko-Tex	Provides product certification of operational quality assurance to companies along the textile chain, including verification regarding textile processing chemicals.
Supplier Ethical Data Exchange (SEDEX)	Works with buyers and suppliers to deliver improvements in responsible and ethical business practices in global supply chains.
U.S. Green Building Council (USGBC) Leed	Rating system that evaluates the environmental performance of a building.
Worldwide Responsible Accredited Production (WRAP)	World's largest independent certification program mainly focused on the apparel, footwear, and sewn products sectors. Certifies effective management systems for social compliance of a facility.

Compiled by Global Development Solutions, LLC (GDS) from certification organizations and Ethical and Sustainable Apparel Sourcing

The aforementioned certifications are voluntary and may take time for manufacturers to achieve. Further, global certifications may not reflect local conditions, including issues identified as critical locally. Bangladesh, for example, created local compliance standards for the garment industry, to develop standards for critical worker safety issues in the wake of the Rana Plaza building collapse, via two global agreements with key buyers and stakeholders (see Box 8). These efforts illustrate the importance and potential of collaborative partnerships in solving textile sustainability challenges. Ethiopia could improve on Bangladesh's actions by proactively structuring its own compliance certification(s) that provides a stop-gap structure around key issues unique to Ethiopia.

[102] Ethical and Sustainable Apparel Sourcing, www.eandsources.com/apparel-sourcing-1

Box 8: Local Sustainability Certifications for Bangladesh Garment Manufacturing

In the wake of the Rana Plaza building collapse, Bangladesh worked with apparel brands to create local compliance safety standards for the garment industry. Collaborations among government, global brands, retailers, trade unions and manufacturers resulted in two standards that addressed key challenges in textile production that could not otherwise be addressed by existing global certifications. Dual standards were developed to meet the needs of various target export markets.

The Accord on Fire and Building Safety in Bangladesh (Accord), signed 15 May 2013, is a five-year independent, legally binding agreement signed by more than 200 apparel brands, retailers and importers from over 20 countries in Europe, North America, Asia and Australia; two global trade unions, eight Bangladesh trade unions and four NGO witnesses. The Accord consists of six key components:

- A five-year, legally binding agreement between brands and trade unions to ensure a safe working environment in the Bangladeshi ready-made garment (RMG) industry;
- An independent inspection program supported by brands in which workers and trade unions are involved;
- Public disclosure of all factories, inspection reports and corrective action plans (CAP);
- A commitment by signatory brands to ensure sufficient funds are available for remediation and to maintain sourcing relationships;
- Democratically elected health and safety committees in all factories to identify and act on health and safety risks; and
- Worker empowerment through an extensive training program, complaints mechanism and right to refuse unsafe work.

The Alliance for Bangladesh Worker Safety (Alliance) is a legally binding, five-year commitment by 28 global apparel companies, retailers and brands that recognized the urgent need to rapidly improve working conditions for garment industry workers and have joined together to help improve worker safety in Bangladeshi RMG factories. Organized in 2013, the Alliance represents the majority of North American imports of RMG from Bangladesh. Key pillars of the Alliance include:

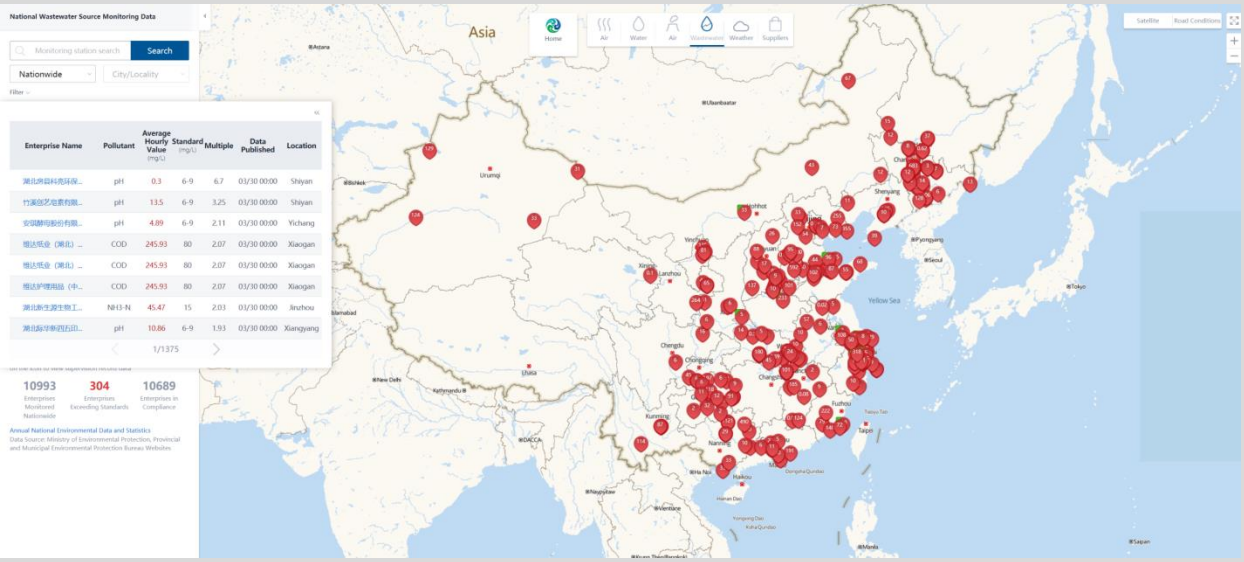
- Standards and inspections, with assessments conducted by independent Qualified Assessment Firms (QAFs) to provide factory owners with a technical understanding of the fire safety and structural concerns related to their facilities, and prompt action plans that aim to systematically and sustainably improve safety conditions for garment workers;
- Remediation to substantially improve structural integrity, electrical and fire safety by guiding factories through the CAP process to ensure credible and compliant upgrades, while providing access to loans for remediation equipment and compensation to workers negatively affected by factory closure;
- Worker empowerment to provide factory workers with the opportunity to voice safety concerns, and support establishment of democratically elected Safety Committees in accordance with the Bangladesh Labor Rules;
- Training for workers and management in 100% of Bangladeshi RMG factories producing for Alliance members; and
- Sustainability by continuing to work with the government of Bangladesh, donor governments, and other stakeholders to address the long-term needs of Bangladesh to meet its governance and capacity challenges.

*Source: Alliance for Bangladesh Worker Safety (*http://www.bangladeshworkersafety.org*) and Accord on Fire and Building Safety in Bangladesh (http://bangladeshaccord.org/about/)*

While certifications provide roadmaps and assurances to buyers and consumers, certifications also substitute for lack of transparency. When production practices and technology evolve such that the supply chain is fully transparent, third-party certification may no longer be needed, since buyers will be able to monitor suppliers in real time. Improved technology and reporting are enabling China's textile production to move toward real-time environmental transparency (see Box 9).

Box 9: Environmental Transparency of Textile Manufacturing in China

The IPE Green Supply Chain Map tool shows how multinational apparel brands' suppliers are contributing to air and water pollution. An initiative by Beijing-based environmental research organization The Institute of Public & Environmental Affairs and New York-based international environmental advocacy group Natural Resources Defense Council, the map contains data for nearly 15,000 major industrial facilities in China and creates real-time maps for textile producers' water quality, wastewater, air emission and air quality. It identifies brand suppliers' name and location, emissions data, waste and water consumption and environmental violations over time. It also provides a visual of air and water quality in different Chinese cities and localities. The maps are developed with publicly available existing data and supplier lists. The wastewater maps, for example, use national wastewater source monitoring data from China's Ministry of Environmental Protection, and Provincial and Municipal Environment Protection Bureau websites, to show wastewater pollutant compliance and violations by production facility and supplier (see below).



By making such data public, the two organizations hope to raise awareness among brands and their consumers of the impacts of textile manufacturing on the environment and to create an accountability mechanism for brands and suppliers to maintain positive performance and publicly respond to any issues as soon as they arise.

*Source: IPE Green Supply Chain Map (*http://wwwen.ipe.org.cn/*) and L. Ravelo, Mapping the Environmental Impacts of China's Textile Industry, Devex, 18 Jan 2018*

By following green manufacturing best practices protocol advocated by SAC and global certification bodies, developing national standards tailored to Ethiopia, and facilitating

transparency of green manufacturing data, the Ethiopian textile industry can assure responsible supply chain practices, minimize environmental impact, mitigate risk and maintain reputation and jobs for Ethiopia.

5.4.4 Agro-Processing

Global concerns are rising about food production practices. For example, a recent study of U.S. consumers found that 98% of consumers want transparency in their packaged food.[103] Beyond a list of ingredients and materials, consumers seek information on the source of ingredients; the manufacturing, handling, and shipping of the product; and the sustainability, charitable, and labor policies of a brand.[104] Environmentally-friendly manufacturing practices are integrated with the entire brand value proposition regarding sustainability.

Navigating global food export standards for manufacturing practices is complicated, as standards vary by country and product, with many oversight bodies. For example, commercial food imports by the USA are regulated at a minimum by the U.S. Department of Agriculture (USDA), the Food and Drug Administration (FDA), the Fish and Wildlife Service (FWS) and the U.S. Customs and Border Production (CBP), with additional oversight based on product, such as the National Marine Fisheries Service (NMFS) for seafood.[105] Requirements can readily shift, for example the USDA Animal and Plant Health Inspection Service (APHIS) can ban all imports of a particular product from a country after a disease or pest is detected in a single shipment. EU legal requirements can be similarly complex and must assure food safety by compliance with the General Food Law, the European Food Safety Authority (EFSA) and the New Official Control Regulation (effective 27 April 2017); implementation of the Hazard Analysis of Critical Control Points (HACCP) system; and meeting requirements regarding contaminants, maximum residue levels (MRLs) for pesticide, irradiation, labeling and packing requirements, and many other conditions.[106] Similar to the USA, EU controls regulations are constantly evolving and require continuous monitoring.

Beyond the legal requirements, there are numerous voluntary certification requirements (see Table 10).[107] Although the standards are voluntary in theory, in practice they are often mandatory, depending on the market or the buyer. As noted above, HACCP is required for food imports to the EU. Although food safety certification is not obligatory under European legislation, the majority of European buyers will ask for GFSI certification.[108] Other management systems vary by market, with British Retail Consortium (BRC) more common for

[103] 2017 Transparency Study, Response Media, 2017, www.responsemedia.com/wp-content/uploads/2017/07/RM_Transparency_Survey_Final.pdf
[104] Ibid.
[105] U.S. Customs and Border Protection (CBP).
[106] Which requirements should processed fruit and vegetables comply with to be allowed on the European market? CBI Ministry of Foreign Affairs, https://www.cbi.eu/market-information/processed-fruit-vegetables-edible-nuts/buyer-requirements/
[107] The list is not exhaustive, and food certification systems are constantly evolving.
[108] Ibid.

UK buyers and International Featured Standard (IFS) for Germany.[109] Since agro-processors often must shift target markets based on pricing and seasonality of product, they must maintain compliance with a multitude of standards at any given time, in order not to miss market opportunities. For example, a major Moroccan agro-processing firm, producing fresh and processed citrus, vegetable and dairy products, attained certifications including BRC, C-TPAT, Freetrade, GlobalG.A.P., HACCP, PIAQ, SEDEX, and Tesco Nurture. Multiple certifications give the company flexibility to sell to markets in Morocco, USA, Canada, EU and Russia, depending on pricing opportunities and production quality. The company is actively pursuing more certifications, in order to be flexible in targeting export opportunities.[110]

Table 10: Key Certifications for Green Manufacturing of Agro-Processing

Certification	Description
British Retail Consortium (BRC) Global Standard for Food Safety	A trade association in the United Kingdom, the BRC Global Standards is the world's first GFSI-recognized standard and is used by retailers worldwide when looking for food safety from food suppliers. Recertify annually.
Business Social Compliance Initiative (BSCI)	A leading supply chain management system that supports companies to drive social compliance and improvements within factories and farms in their global supply chains. BSCI is a European social monitoring system for ethical sourcing initiated by the Brussels-based Foreign Trade Association (FTA). BSCI is based on ILO labor standards and supports the continuous improvement of the social performance of suppliers. Its ultimate objective is to become certificated to standards such as SA 8000 or equivalent, thereby promoting sustainable working conditions in factories worldwide.
Customs-Trade Partnership Against Terrorism (C-TPAT)	A voluntary, joint government-business partnership to increase border security through supply chain management.
Fairtrade	A third-party certification process that sets standards for fair prices for farmers and decent working and living conditions for workers.
Food Safety System Certification (FSC 22000)	Established in April 2016, FSSC 22000 is a complete certification scheme for Food Safety Systems based on international, independent standards: ISO 22000, ISO 22003 with sector-specific technical specifications for prerequisite programs (PRPs) that must be followed to attain certification for a specific sector, and additional scheme requirements. FSSC 22000 is the only ISO-based FSMS Certification Scheme that is recognized by the Global Food Safety Initiative (GFSI).
Global Food Safety Initiative (GFSI)	An umbrella under which major retailers have come to a common acceptance of four GFSI-benchmarked food safety schemes.
GLOBALG.A.P.	An internationally recognized set of farm standards dedicated to Good Agricultural Practices (GAP). GlobalG.A.P. was introduced by FoodPLUS GmbH, derivative of GLOBALG.A.P., to raise standards in the production of fresh fruit and vegetables. Certification to the Standard ensures a level playing field in terms of food safety and quality and proves that growers are prepared to constantly improve systems to raise standards. Certification demonstrates production processes of agricultural (including aquaculture) products according to "good agriculture practice."

[109] Ibid.

[110] Morocco - Agriculture Sector Programmatic Study: Value Chain Analysis, Job Creation and Women and Youth Participation for Moroccan Citrus and Olive Sectors, Global Development Solutions, LLC (GDS), 2016.

Certification	Description
Hazard analysis and critical control points (HACCP)	A risk management system that identifies, evaluates and controls hazards related to food safety throughout the food supply chain. It is a systematic preventive approach to food safety from biological, chemical, and physical hazards in production processes that can cause the finished product to be unsafe, and designs measurements to reduce these risks to a safe level.
International Featured Standard (IFS)	A quality and food safety standard for retailer (and wholesaler) branded food products, intended to assess suppliers' food safety and quality systems, with a uniform approach that harmonizes the elements of each. Certificate issued by Deutscher Akkreditierungs Rat (DAR).
International Organization for Standardization (ISO)	An international standard-setting body composed of representatives from various national standards organizations. ISO is the world's largest developer of voluntary international standards, which facilitate world trade by providing common standards between nations. The majority of food safety certification programs are based on ISO 22000.
Supplier Ethical Data Exchange (SEDEX)	A not-for-profit membership organization focused on supporting ethical global supply chains. The SEDEX is a self-certify checklist for social activity to international standards.
Sure-Global-Fair (SGF)	Certifies fruit processing companies, packers and bottlers, traders and brokers for fruit juices, as well as transport companies and cold stores in almost 60 countries worldwide. SGF certification covers not only food safety but also product quality and Corporate Social Responsibility (CSR) principles.
Safe Quality Food (SQF) Program	Established in March 2018, the SQF Code is a site-specific food safety and quality process and product certification standard that emphasizes the systematic application of CODEX Alimentarius Commission HACCP principles and guidelines for control of food safety and food quality hazards, compliance with the requirements of the SQF Code and compliance with applicable regulatory requirements.
Tesco Nurture	A program by Tesco (UK retailer) that sets standards for food safety and environmental & labor conditions. Such certification is generally for export versus local suppliers (though there are some exceptions).
United States Department of Agriculture (USDA) Organic	A certification program for farms and businesses to ensure organic integrity in the supply chain and facilitate trade and market opportunities for certified organic farms and businesses worldwide.

Compiled by Global Development Solutions, LLC (GDS)

SME agro-processors in particular may struggle to meet global and even national standards for green manufacturing. Governments can support agro-processor compliance with green manufacturing standards by strengthening agri-business value chains, increasing commercialization and encouraging registration with a body that can provide technical assistance regarding safety and environmental management practices. Morocco, for example, is embarking on a plan to integrate SMEs to national and international value chains and shift practices from the informal to the formal sector. A key component of the program is increasing agro-processor registration with the national office for food safety.

In meeting the demand for transparency, as well as navigating the multitude of compliance requirements, agro-processing stakeholders can look to the Global Ecolabeling Network (GEN). Founded in 1994, GEN is a non-profit association of 27 leading ecolabelling organizations worldwide, and fosters co-operation, information exchange and standards harmonization among members, associates, and other ecolabelling programs. "Ecolabelling" is a voluntary method of

environmental performance certification and labelling. An ecolabel identifies products or services proven environmentally preferable overall, within a specific product or service category. GEN members operate some of the world's strongest ecolabels. In contrast to "green" symbols, or claim statements developed by manufacturers and service providers, the most credible labels are awarded by an impartial third party for specific products or services that have been independently determined to meet transparent environmental leadership criteria, based on life-cycle considerations. GEN itself does not develop criteria or certify products, but supports members' development of environmental leadership standards, and ecolabelling of products and services. To this end, GEN tracks its members' active standards, and compiles and updates the information annually, to bring collective expertise to the agro-processing industry.

5.4.5 Cement

Key green manufacturing issues for cement manufacturing include health and safety, climate protection, fuels and materials, emission reduction, biodiversity, water, and sustainable construction.[111] Many of these issues cross national and international boundaries. Public and private sector guidance is available from the Cement Sustainability Initiative (CSI), a multi-stakeholder collaboration of the World Business Council for Sustainable Development (WBCSD) and 24 major cement producers with operations in more than 100 countries. Collectively, these companies account for around 30% of the world's cement production and range in size from very large multinationals to smaller local producers.[112]

Climate protection cement industry initiatives by CSI include a global cement emissions and energy database ("Getting the Numbers Right" or GNR), key performance indicators (KPI), accounting and reporting protocols, and an industry technology roadmap. The roadmap, developed in 2009 by the International Energy Agency (IEA), WBCSD and CSI, outlines existing and potential technologies for reducing CO_2 emissions and guides governments and financial institutions regarding working with the cement industry to adapt green manufacturing practices.[113] CSI also boosts member awareness of research in new technologies that can reduce the cement industry's emissions levels and energy consumption. For example, by increasing use of clinker substitutes and alternative fuels in cement production, cement producers significantly reduced direct (e.g., from limestone decarbonization) and indirect (e.g., from electricity use) emissions.

As part of its global mission, CSI uses its technical expertise and policy experience to help address sustainability concerns in emerging economies, where booming infrastructure development fuels demand for cement. CSI estimates that 80% of the future emissions from cement plants will take place in developing economies. CSI considers emerging economies as focal points for CSI efforts in capacity-building and in distributing guidelines and best practices for climate management (see **Error! Reference source not found.**).

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[111] Cement Sustainability Initiative (CSI).
[112] Ibid.
[113] Global Cement Technology Roadmap, Cement Sustainability Initiative (CSI), http://wbcsdcement.org/index.php/key-issues/climate-protection/technology-roadmap

Box 10: Greening the Cement Industry in China

For the global cement industry to become more sustainable, especially regarding achieving significant cuts in CO_2 emissions, China in particular needs to be and has become an active contributor to climate protection efforts. China alone produces over half of the world's cement, and this proportion is expected to rise further in the years to come, driven by continued economic development and cement demand as China provides housing and infrastructure for its burgeoning population. Greening of the cement industry is a balancing act – cement is a key material for any country's economic and social development, but the cement sector has an ecological footprint that must be managed over the long term.

CSI conducted training workshops in China on use of the WBCSD/CSI CO_2 Accounting and Reporting Protocol, in close cooperation with the World Resources Institute (WRI) and the Asia-Pacific Partnership (APP), and organized sustainability discussion forums in both China and India for the local cement industries. The CSI also helps new CSI member companies to implement the CSI Charter commitments, which are required when joining CSI.[114]

By following reporting protocols and adopting technologies such as those available through CSI, the Ethiopian cement industry can develop policies to realize cost savings, improve competitiveness and achieve emissions and other green manufacturing goals.

Key Concepts

- Given the multitude of green manufacturing challenges in each subsector, collaborative efforts are needed between the public and private sector, locally and in target markets, to establish common standards and practices by subsector, provide a framework for financing improvements, enable training and monitor compliance.
- Public and private sector guidance for subsectors is available from organizations such as the Leather Working Group (LWG), the Sustainable Apparel Coalition (SAC), the Global Ecolabeling Network (GEN), and the Cement Sustainability Initiative (CSI), which are multi-stakeholder coalitions that align goals and promote best practices globally.
- Governments can establish national certification programs to target key issues pertinent to the local operating environment; if doing so, it is advisable to do so proactively to maintain a country's reputation as a trusted supplier and help manufacturers navigate evolving standards.
- By standardizing, collecting and making public manufacturers' environmental data, a government can raise awareness of the impacts of manufacturing on the environment, create an accountability mechanism to maintain positive performance and speed response time to address issues as they arise.
- Requirements for target export markets and buyers are continually evolving; governments can help manufacturers, especially SMEs, understand requirements and develop pathways to achieve national and global standards compliance.

[114] Emerging Economies, Cement Sustainability Initiative (CSI), http://wbcsdcement.org/index.php/about-cement/emerging-economies

6 Green Manufacturing Strategy Development

6.1 Vision Statement

Ethiopia is committed to follow a green development pathway and has the plan of attaining middle-income status by year 2025. The GoE formulated a Climate-Resilient Green Economy (CRGE) strategy that all sectors of the economy are implementing. Accordingly, MoTI, along with IPDC, is leading the industrialization of the country within the context of the Growth and Transformation Plans that foresees a dominant role for the industrial sector in the country's economy. Regional Governments and other private IP developers are also playing crucial roles in contributing toward the industrialization of the country.

The industrial development vision of MoTI is, ***"Building an industrial sector with the highest manufacturing capability in Africa, which is diversified, globally competitive, environmentally-friendly, and capable of significantly improving the living standards of the Ethiopian people by the year 2025."***[115]

MoTI gives high priority for the manufacturing sector in industrial development. The vision of industrial development emphasizes the building of an *environmentally friendly* industry for achieving global competitiveness. Thus, greening the manufacturing sector dovetails with the CRGE and the vision of industrial development. Accordingly, the vision statement of green manufacturing is:

> ***"For Ethiopia to achieve, maintain and be globally recognized for environmentally and socially conscience green manufacturing on a national scale that will increase competitiveness to open new markets abroad and increase the national export volume and value of manufactured goods, thus support Ethiopia to achieve and maintain middle-income status and preserve the integrity of its environment and the health of its inhabitants for future generations."***

6.2 Objectives of Green Manufacturing

Based on the vision for greening the manufacturing sector stated above, the following major objectives are set.

1. By 2020, at least 75% of existing manufacturing companies that were established before 2018 will be compliant with Ethiopian environmental & social standards (and meet compliance standards required in strategy export markets) and 100% will be compliant by 2025.[116]

[115] Ethiopian Industry Development Strategic Plan (2013-2025), April 2014.

[116] The year 2020 was set in consultation with EFCCC in 2nd quarter 2018 and was based on the progress being made by industries to achieve environmental compliance. In fact, many leather sector factories, which were the most

2. As of 2019, 100% of newly established manufacturing companies will be compliant with existing Ethiopian environmental and social standards.

3. Ethiopia will construct at least one industrial waste landfill (i.e., capable of handling hazardous and inert industrial waste including sludge) built to internationally recognized standards by 2025.[117]

4. To fulfill environmental requirements and provide decent social working conditions acknowledging worker health and safety, a minimum of 50% of manufacturing companies will be implementing resource efficient and cleaner production (RECP) by 2025 and at least 75% of companies will be implementing RECP by 2030.

5. By 2020, 100% of companies discharging environmentally unsafe effluents will have installed effluent treatment plant (ETP) systems – to be in continuous operation during production activity – and will ensure that end-of-pipe discharge will be compliant with the Ethiopian effluent discharge standards, and standards required in strategic export markets and be in continuous operation. Companies with existing but inadequate ETP – e.g., end-of-pipe discharge does not meet Ethiopian effluent discharge standards – will be required to upgrade by 2020 to ensure end-of-pipe discharge is compliant with Ethiopian effluent discharge standards.

6. By 2025, at least 50% of manufacturing companies will have an energy management system, will have conducted a comprehensive energy audit and will have established and recorded baseline data; 95% of companies will have done so by 2030.

7. By 2025, manufactured goods exports will increase at least 50% by volume and at least 75% by value.

8. In accordance with CRGE national strategy, by 2030, the manufacturing sector will achieve its GHG emissions target of 20 MT CO_2e.

6.3 SWOT Analysis and Strategic Issues

The SWOT analysis identifies major impediments to greening the manufacturing sector in Ethiopia. There are some strengths in the manufacturing sector that enable the greening of the sector to ensure its competitiveness. On the other hand, the sector has many weaknesses to overcome, namely, meeting environmental standards and compliance to environmental laws and

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polluting, have already built secondary treatment plants. Certain timelines, however, may be adjusted depending on when implementation commences.

[117] IPDC has started construction of one landfill for sludge in Hawassa, but this facility will serve Hawassa industrial park only and has an expected useful life of 20 years. A facility (or facilities) large enough to accommodate all of Ethiopia's industrial waste is necessary.

regulations. These weaknesses could be stumbling blocks for meeting international environmental and social requirements for trading competitively in the global markets.

The manufacturing sector perceives opportunities in the commitment of the country to follow a green development pathway for green manufacturing with policy support for exporting and the existence of recipient markets for products that are produced in environmentally friendly processes. If the opportunities are not adequately managed, some might be potential threats to the greening of the manufacturing sector (Table 11).

Table 11: SWOT Analysis

Strengths	Weaknesses
• Sustained overall growth of the industrial sector. • Government commitment to expand the manufacturing sector. • Government commitment to green economic development pathway. • Existence of environmental rules, regulations and standards. • Conducive environment for investment and availability of incentives to attract local and foreign investment. • Existence of low-cost, trainable workforce. • Wide range of incentives offered to investors and exporters. • Existence of institutional quality infrastructure providing support services to the manufacturing sector (accreditation, metrology, quality management standards). • Existence of technical assistance to implement Cleaner Production practices in enterprises. • Ongoing construction of industrial parks & integrated agro-industrial parks (IAIPs) with adequate infrastructure for expediting establishment of light manufacturing enterprises. • Very high concern for GHG emission reduction. • Higher education policy on enrollment of 70% students to natural science and technology fields. • Policy support for duty-free import of pollution prevention/ abatement equipment. • Existence of social policy on persons with disabilities (PwDs).	• Limited FDI flow as compared to the need for industrialization. • Weak transport and logistics services. • Low-level ranking of the country at ease of doing business compared to competitor countries. • Low level of enforcement of environmental rules and regulations and social standards. • Poor alignment of training systems to meet demands of the manufacturing sector. • Weak technical and managerial skills and competencies. • Poor infrastructure (roads, railways, water supply, electric power supply, telecommunications) and management of logistics. • Lack of input/output quality and standardization control capacity. • Low productivity levels in the manufacturing sector leading to uncompetitive pricing. • Limited concern for efficient utilization of resources (raw material, water, energy) resulting in increased waste generation. • Limited awareness of environmental management system and cleaner production practices and social factors. • Limited awareness of the benefit of certification. • Lack of adequate infrastructure for certification for EMS (public or private certifying bodies). • Lack of facilities in enterprises as well as regulatory bodies to monitor environmental performance. • Lack of concern for pollution prevention and control and waste minimization. • Lack of capacity for inspection and monitoring environmental and social performance of enterprises (safety and working environment). • Lack of capacity for installing or incorporating abatement measures (human, financial and technical) in manufacturing enterprises.
Opportunities	**Threats**
• Vast international and preferential market access to EU, USA and regional markets, and relatively large domestic market for the manufacturing sector. • Existence of technical support on pollution prevention and waste management provided by international agencies (UNEP, UNIDO) through environmental bodies and National Cleaner Production Centers. • Increasing ongoing and envisaged installations of renewable energy sources (hydroelectric power, wind, solar and geothermal electric power) will reduce GHG and enhance green manufacturing. • Construction of environmentally-friendly IPs and IAIPs will strengthen green manufacturing in Ethiopia. • Increasing environmental law enforcement and regulations will advance adoption of green manufacturing by all new enterprises. • Strengthening the Cleaner Production Directorate under the Ethiopian Standards Agency (ESA) and its readiness to provide technical support for implementing CP and EMS.	• Stricter non-tariff barriers to export goods that do not meet environmental and social requirements. • Closure of existing manufacturing enterprises that pollute the environment unless the enterprises install abatement plants to meet environmental standards. • Increased environmental liabilities for polluting manufacturing enterprises. • Increased penalties for polluting manufacturing enterprises. • Absence of compliance to environmental laws and regulations deter quality foreign investors.

Source: Global Development Solutions, LLC

Based on the review of the existing strategies, international best practices and the SWOT analysis, the following strategic issues are identified and categorized for greening the manufacturing sector in Ethiopia:

Communication & cooperation

1. Lack of coordination stemming from conflicting goals among the various ministries and government entities inhibits the adoption of green manufacturing and has led to extensive

delays in enforcing *Pollution Prevention and Control, Regulation No. 159/2008*, thereby undermining the authority of the regulatory bodies and empowering companies to ignore current and perhaps future statutes.

As reported above in Section 3.2.1, enforcement of environmental regulations is complicated by prioritization of near-term exports and foreign currency over long-term sustainability of the manufacturing sector. Long grace periods for compliance to Proclamation 300/2002 for Pollution Prevention and Control allow companies to continue to discharge untreated effluent into water bodies. On April 30, 2018, however, the most recent grace period will end and, unless a new one is granted, companies that do not meet the Ethiopian effluent standard will be shut down until they can comply with the standard. This is an example, however, of an extenuating circumstance requiring discussion and consensus to resolve. There are 14 tanneries in Modjo (leather city) and six more from Addis Ababa planning to relocate to take advantage of a planned regional ETP. The tanneries have been contributing monthly fees toward constructing the ETP, yet only half the necessary funds have been raised. As such, the ETP is still well more than a year from reality. To avoid being shut down due to non-compliance at the end of the grace period (April 30, 2018) all 20 tanneries will be required to install ETP at their respective facilities. The tanneries will therefore be subject to paying twice for ETP (for their respective facilities and for the shared facility) and, if all tanneries will have already installed ETP, there will be no point of constructing the common ETP. This time-sensitive scenario provides an example of the need for coordination by all parties.

2. Weak communication network regarding environmental issues between 1) Subsector institutes and ministries, 2) IPDC, MoTI and EFCCC, 3) Regional states (Bureau of Industry), and 4) Among subsector institutes.

3. General lack of capacity in terms of knowledge and skills concerning environmental issues across MoTI, subsector institutes, IPDC and EFCCC.

   The people in the environmental directorates are committed, keenly aware of the issues and eager to achieve green manufacturing in the country. Lacking, however, is industry knowledge regarding how specific initiatives are handled in industry. For example, since municipal waste disposal facilities will not accept industrial waste, sludge from ETPs, slag and scale from metal processing, and other solid wastes are being stockpiled at companies' sites. There is little knowledge of how to reduce the potential for waste or how to reuse or recycle unavoidable byproducts. Although an industrial waste landfill is part of Ethiopia's green manufacturing strategy, to attain a holistic industrial ecological approach, knowledge of how to implement state-of-the-art environmental initiates is required but will likely best be served through external communication. Training modules can be developed and delivered but beyond these, external support networks will serve to keep Ethiopia well-informed with cutting edge solutions. Example programs include WWF's Climatesolver initiative (www.climatesolver.org - "a climate innovations portal developed by WWF in order to strengthen the development and widespread use of technologies that can dramatically reduce carbon-dioxide emissions"), and Yale University's Center for Industrial Ecology which provides direct environmental

assistance to India and China. Establishing lines of communication with an institution such as Yale will provide an exceptional opportunity for Ethiopia to advance its green manufacturing program.

Opportunities also exist in global alliance networks that provide forums for idea exchange and learning opportunities on a global participatory scale. Alliances can be subsector-specific or all encompassing. Ethiopia should also choose to initiate a regional alliance of governmental environmental organizations.

Standards

4. Ethiopia environmental standards, which exhibit some inconsistencies, were collated and published more than ten years ago and were not based on Ethiopia's environmental carrying capacity; furthermore, several critical standards are nonexistent including, but not limited to, an industrial solid waste standard and an electronic waste standard.

   The Environmental Standards for Industrial Pollution Control in Ethiopia was prepared by a team of international consultants together with Ethiopian experts who are pertinent to the subject. In the preparation of the Ethiopia standards, standards from the following countries were consulted: Bangladesh, Pakistan, India, Jamaica, China, Thailand, Uganda, Nigeria, Zambia, and Kenya. Information was also obtained from development agencies including The World Bank, United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), and from other information sources such as the European Union and the United States Environmental Protection Agency. Not all elements of waste and pollution were covered, however. For example, there is neither a standard for solid waste nor a standard for electrical waste.

   Standards deemed relevant and appropriate for Ethiopian conditions were adopted directly, whereas standards deemed inappropriate were modified based on practical Ethiopian experience. The standards were written as national minimum thresholds. Regional states are free to establish more stringent standards, but the national standards are the minimum requirements.

   An example inconsistency in the Environmental Standards for Industrial Pollution Control in Ethiopia, for tanning and leather finishing, to achieve 30 mg per liter of total ammonia (as N) with the BOD5 at 20 degrees Centigrade, the limit value of water discharge should be 250 mg per liter, however, the Ethiopian standard states 200 mg per liter.

5. Lack of monitoring and reporting system to track compliance with environmental standards, except an MRV system designed for climate change which is not being implemented; without appropriate systems in place, standards will not be met nor enforced, thus preventing baseline data from being developed and monitored for change.

6. Lack of infrastructure to monitor and record non-GHG emissions – i.e., air pollutants – that are harmful to the environment and humans.

The focus in Ethiopia is on greenhouse gas emissions while emissions responsible for air pollution are largely ignored. The United States Environmental Protection Agency, for example, specifies the following six air emissions by pollutant:

- *ground-level Ozone Precursor: Volatile Organic Compounds (VOCs);*
- *ground-level Ozone Precursor: Nitrogen Oxides (NOx);*
- *sulfur dioxide (SO2);*
- *particulate matter (PM);*
- *carbon monoxide (CO); and*
- *lead (Pb).*

Breathing polluted air increases the risk for asthma and other respiratory diseases. Ozone, particulate and harmful gases can damage lungs, heart, and overall health and can cause coughing, burning eyes, and breathing problems. Extreme cases of air pollution can, and has, result in death. Breathing small amounts of air pollution over many years is also considered dangerous and may contribute to cancer.

7. General lack of industrial park frameworks and guidelines for converting IPs to EIPs and for establishing new EIPs.

Company specific

8. In the absence of a sanitary and environmentally acceptable solid waste disposal option, companies are stockpiling potentially contaminated solid waste and effluent residue onsite causing two major concerns: 1) susceptibility to airborne diseases in humans and leachate and run off that can contaminate soil and, eventually, groundwater and public water bodies; and 2) companies lack options for disposing solid waste once onsite space is no longer available.

9. Awareness regarding the benefits of RECP & EMS (ISO 14001) and ISO 26000 (environmentally and socially beneficial systems) and ISO 50001 or EN 16001 energy standard is low, causing manufacturers to consider the systems as costs as opposed to investments, which results in slow adoption/implementation.

10. Weak infrastructure available to companies to implement RECP and EMS.

The former CP Center provided technical support to manufacturing enterprises to develop and implement RECP practices as well as EMS implementation. Unfortunately, due to a government reorganization, funding for the CP Center was eliminated and the institution was subsumed into the ESA as a unit, recently elevated to a directorate level. The Center is needed to provide the environmental extension service regarding environmentally sound technologies (ESTs) which is missing in the manufacturing sector at present. Moreover, the CP Center can exploit the knowledge base from the RECP-Net platform operated jointly by UNEP and UNIDO. The Center has experience in implementing RECP and EMS gaining credibility and visibility. The existing CP directorate can be strengthened to regain its vitality and start providing services shortly.

11. Non-exporting companies – and some exporting companies – do not meet Ethiopian social compliance; companies do not invest in worker safety training nor is protective clothing always issued in factories.

12. Lack of facilities in enterprises to monitor environmental and social performance resulting in inability to create baseline data.

13. Frequent power interruptions caused by inadequate electricity generation and transmission leads manufacturing companies to prefer equipment powered by high GHG-emitting fossil fuels to generate heat and steam required for converting input materials into finished products.

14. Companies lack general environmental knowledge regarding input selection, materials storage, and management (particularly for chemicals); moreover, materials safety data sheets (MSDS) are not always provided by chemical suppliers.

Lack of capacity in institutes responsible to green the sector

15. Subsector institutes have independent labs resulting in equipment redundancy but are often unable to afford subsector-specific equipment needed to test compliance with subsector-specific standards.

16. Lack of capacity in the subsector institutes to inspect and test environmental performance of manufacturing enterprises.

Financing for green manufacturing

17. Lack of funding facilities and mechanisms for providing support and incentives to manufacturing enterprises undertaking investments and improvement measures to protect the environment and build social infrastructures.

Compliance enforcement

18. There is no link between environmental compliance and business license renewal (environmental clearance letters are valid for the life of a company).

19. Compliance to environmental standards is driven by penalties and GoE offers no positive incentives to encourage manufacturers to meet compliance.

20. Locally developed innovations need more support in bringing them to the market.

Social

21. There is no legal and social performance implementation framework in Ethiopia. Enforcement of regulations and social standards/safeguards is limited and not consistent

with the Constitution, existing national policy, laws, regulations or ratified international instruments.

The absence of a legal and social performance framework gives rise to a variety of issues preventing consistent social justice throughout the manufacturing environment. Indications include:

- *Manufacturers' poor adherence to social and OHS guidelines and existing provisions exacerbated by insignificant maximum penalty for non-complying companies;*
- *Health and Safety Committees are voluntary and lack training and awareness on how to implement workplace OHS;*
- *MoLSA lacks resources to measure and enforce enterprise compliance against standards;*
- *Lack of resources limits technical service (training, awareness raising, RECP exercises, etc.) provided by Occupational Safety, Health and Working Environment of the Harmonious Industrial Relation Directorate (MoLSA).*

22. There is lack of awareness among – and little to no priority given by – employers and workers regarding 1) prevention and control of occupational accidents, 2) work-related hazards and 3) provision of medical treatment, care and support services for victims of occupational injuries, nor are there data available to analyze work-related accidents, occupational diseases, absenteeism, work-related fatalities, loss of productivity, etc. in the Ethiopian manufacturing sector. Furthermore, there is lack of in-house social and environmental policy guidelines in manufacturing enterprises and there are neither local technical service providers for assisting enterprises in developing and implementing OHSAS 18001:2007 social management systems nor accredited bodies to certifying enterprises for OHSAS 18001:2007.

23. There is limited awareness of managing OHS issues and lack of primary social infrastructure (separate toilets for men and women, amenities for persons with disabilities (PwD), drinking water faucets, etc.) in relation to vulnerable groups of workers such as women, youth, PwD, workers with HIV and other marginalized groups.

24. Manufacturers are not being encouraged to engage in, nor are they understanding the benefits associated with, community dialogue, performing community outreach activities, public service activities or investing in socio-economic and/or physical infrastructure in their respective communities as part of corporate social responsibility. Further, there are no public or private Ethiopian entities to provide ISO 26000-based technical support for CSR implementation.

6.4 Strategies and Action Plan

The following issues, strategies and corresponding actions in the action plan for Ethiopia's green manufacturing strategy below have been developed in consultation with industry stakeholders (government ministries, subsector institutes, industry associations) and local experts. After developing the fundamentals of the plan with local stakeholders and experts, the plan was transcribed and presented for stakeholder review. Adjustments were made according to input

received during the review, after which, the plan was redistributed to several stakeholders and further consultations took place. The plan was further elaborated in correspondence with international industry experts. The plan was subsequently bolstered by adding details regarding social issues including occupational health and safety and corporate social responsibility, based on consultations with MoLSA, MoTI and its subsector institutes, industry associations and local and international industry experts.

With regard to eco-industrial park development under the umbrella of green manufacturing, MoTI, IPDC and other IP developers will need to devise an operational framework that incorporates the green manufacturing strategies herein to manage the IPs based on international standards prepared by UNIDO, WB and GIZ.[118] Moreover, MoTI and the IPDC et al., will need to develop:
1) A general IP management framework based on international standard (responsibility of MoTI), and
2) Policy unique to the industries operating within the respective IP that would serve as a guideline for formulating the contractual agreements between the IP administration and the tenants in which the obligations of the parties are specified in connection with the environmental, economic, social and administrative performances (responsibility of IPDC and other IP developers, subject to approval of MoTI).

The following are essential elements when transforming industrial parks into eco-industrial parks.

1. The standards to be fulfilled by eco-industrial parks are not only national but also international in nature, thus enabling firms operating in the parks to export their goods competitively to the global market and in a sustainable manner.
2. There is need to develop and operationalize private-sector-friendly, competitiveness-focused IPs with defined managerial, environmental, social and economic performance frameworks to ensure sustainability and attractiveness of industrial subsectors for investment based on international best practices and local conditions.
3. The "International Framework on Eco-Industrial Parks" can be adopted for the operationalization of environmental and social performance mechanisms of eco-industrial parks.

The abovementioned UNIDO/WBG/GIZ International Framework on EIPs, as tailored to Ethiopian conditions, should be applied by IP developers when converting existing IPs into EIPs and establishing new EIPs.

[118] "An International Framework for Eco-Industrial Parks", United Nations Industrial Development Organization (UNIDO), the World Bank Group, and Deutsche Gesellschaft fur Internationale Zusammenarbeit (German Development Cooperation) (GIZ) GmbH, December 2017.

Issue 1: Lack of coordination stemming from conflicting goals among the various ministries and government entities inhibits the adoption of green manufacturing and has led to extensive delays in enforcing *Pollution Prevention and Control, Regulation No. 159/2008,* thereby undermining the authority of the regulatory bodies and empowering companies to ignore current and perhaps future statutes.

Strategy 1.1: Enhance cooperation, set consensus goals and priorities, and establish a coordinated approach to green manufacturing among relevant government institutions.

Actions	2017/20	2020/25	2025/30	Responsibility
1.1.1 Establish a forum for Ministry of Trade and Industry (MoTI), Ministry of Environmental, Forestry and Climate Change (EFCCC), Ministry of Labor and Social Affairs (MoLSA), Ethiopian Investment Commission (EIC), Ministry of Science & Technology (MoST), Ministry of Agriculture and Natural Resource (MoANR), Ministry of Water, Irrigation and Energy (MoWIE) decision makers (minister level or directorate level) as well as Industrial Parks Development Corporation (IPDC), Ethiopian Chamber of Commerce and Sectoral Associations (CCSA) and Ethiopian Standard Agency (ESA) to discuss key issues. Including subsector association leaders to ensure insight on the most current private sector issues, activities and limitations.	X			MoTI, IPDC, EFCCC, MoLSA, EIC, MoST, MoANR, MoWIE, ESA, ECCSA (plus subsector association leaders)
1.1.2 To enhance cooperation and set consensus goals and priorities among and between government organizations, convene the forum in regular quarterly or biannual meetings during which intra-governmental conflicts can be resolved and goals and priorities aligned among the government bodies.	X	X	X	MoTI
1.1.3 All forum participants will ensure information is disseminated throughout their respective organizations.	X	X	X	All forum participants

Issue 2: Weak communication network regarding environmental issues between 1) Subsector institutes and ministries, 2) IPDC, MoTI and EFCCC, 3) Regional states (Bureau of Industry) and 3) Among subsector institutes.

Strategy 2.1: Institutionalize communication channels between subsector institutes and MoTI to enable the environmental directorates/departments to work with MoTI to solve issues together through knowledge sharing, financial planning and general capacity building, including contracting external assistance.

Actions	2017/20	2020/25	2025/30	Responsibility
2.1.1 Establish a regularly scheduled management meeting between MoTI and institutes' environmental directorates, similar to current management meetings already in place between MoTI and other institute directorates. • Meetings will be coordinated at the highest level of MoTI and with a focal person appointed for facilitation • Provide opportunity to discuss issues in a participatory manner, report on the previous period's progress/events and plan for the next period	X	X	X	MoTI and Sectoral Env. Directorates
2.1.2 To enhance cooperation and set consensus goals and priorities among and between government organizations, convene the forum in regular quarterly or biannual meetings during which intra-governmental conflicts can be resolved and goals and priorities aligned among the government bodies.	X	X	X	MoTI, EFCCC, IPDC, IPs[1]

[1] *IPs are industrial parks under IPDC, Regional States and private developers*

Issue 2: Weak communication network regarding environmental issues between 1) Subsector institutes and ministries, 2) IPDC, MoTI and EFCCC, 3) Regional states (Bureau of Industry) and 3) Among subsector institutes.

Strategy 2.2: Create a communication platform between subsector environmental directors/department heads.

Actions	2017/20	2020/25	2025/30	Responsibility
2.2.1 Establish a subsector institute working group (IWG) comprised of management level representatives from each subsector institutes' environmental departments.	X			Sectoral Env. Directorates
2.2.2 Schedule a regular monthly meeting of the subsector working group to report on discuss solutions for key issues, and progress made toward meeting environmental standards within their respective subsectors.	X	X	X	Sectoral Env. Directorates

Issue 3: General lack of capacity in terms of knowledge and skills concerning environmental issues across MoTI, subsector institutes, IPDC and EFCCC.

Strategy 3.1: Develop training modules to assist government entities to increase their knowledge and skills to best implement environmental duties and initiatives.

Actions	2017/20	2020/25	2025/30	Responsibility
3.1.1 Conduct gap analyses to identify training needs and capacity deficiencies within each organization.	X			MoTI, IPDC, EFCCC
3.1.2 Identify financial sources to cover the service(s) required to address the identified gaps.	X			MoTI, IPDC, EFCCC
3.1.3 Develop capacity and design a training module/capacity-building program at a local university where relevant government personnel will be trained by university faculty members (and new personnel can be trained in the future). • If necessary, contract an international entity to provide training-of-trainers to university faculty members who will administer the training	X			MoTI, IPDC, EFCCC
3.1.4 University faculty members to provide training to relevant government personnel on an as-needed basis – e.g., new employee training	X			University to be selected

Issue 3: General lack of capacity in terms of knowledge and skills concerning environmental issues across MoTI, subsector institutes, IPDC and EFCCC.

Strategy 3.2: Engage in advisory support networks to build local capacity in subsector institutions.

Actions	2017/20	2020/25	2025/30	Responsibility
3.2.1 Provide budget for subsector institutes to engage in advisory support networking programs between international experts (e.g., leading environmental research organizations, universities or benevolent private sector environmental leaders) that can provide direct, practical advice/technological approach to addressing industry-specific issues.	X	X	X	MoTI, EFCCC
3.2.2 Identify advisory support networks and establish sustainable communication via phone, voice-over internet protocol (VoIP) options, email, web-based training modules, etc.	X	X	X	Subsector Institutes
3.2.3 Conduct research to identify subsector-relevant international alliances and networks (e.g., the Sustainable Apparel Coalition (https://apparelcoalition.org/) appropriate for the textile subsector, the Leather Working Group (https://www.leatherworkinggroup.com/) for leather processing, and the World Council for Sustainable Development's Cement Sustainability Initiative (http://www.wbcsdcement.org/index.php/about-csi/csi-charter)) that provide tools, forums for idea exchange, and opportunities to tackle common issues.	X	X	X	Subsector Institutes, MoTI, IPDC, EFCCC
3.2.4 If an alliance or network exists for a subsector, join, if possible.	X	X	X	Subsector Institutes
3.2.5 Explore the possibility of establishing an East Africa environmental alliance among regional countries to share ideas and solve common problems.	X	X	X	EFCCC, ESA
3.2.6 Design an internet-based platform for communication (chat forum), current environmental events and green initiatives in each country.	X	X	X	EFCCC

Issue 3: General lack of capacity in terms of knowledge and skills concerning environmental issues across MoTI, subsector institutes, IPDC and EFCCC.

Strategy 3.3: Establish a common information clearinghouse accessible to all manufacturing sector stakeholders.

Actions	2017/20	2020/25	2025/30	Responsibility
3.3.1 Add an environmental information clearinghouse section to the existing MoTI library.	X			MoTI
3.3.2 Designate a person within MoTI as an environmental researcher to gather and catalog web-based environmental information as requested by MoTI, EFCCC and subsector institutes.	X	X	X	MoTI
3.3.3 Contributions to the clearinghouse will be made by MoTI, EFCCC, subsector institutes and other institutions that have pertinent environmental information.	X	X	X	MoTI, EFCCC, Subsector Institutes

Issue 4: Ethiopia environmental standards, which exhibit some inconsistencies, were collated and published more than ten years ago and were not based on Ethiopia's environmental carrying capacity; furthermore, several critical standards are nonexistent including, but not limited to, an industrial solid waste standard and an electronic waste standard.

Strategy 4.1: Update the *Ethiopian Environmental Standard for Industrial Pollution Control* based on standards of strategic export markets.

Actions	2017/20	2020/25	2025/30	Responsibility
4.1.1 Include all environmental issues in the standards: emissions, effluents, chemical waste and discharges, liquid waste and discharges, solid waste (esp. hazardous), electronic waste, and other environmentally impactful byproducts and discharges resulting from manufacturing activities as noted in other international environmental standards. • Note that an electronic waste regulation has been drafted but is yet to be ratified by the Council of Ministers. Once ratified, a standard is required.	X			EFCCC
4.1.2 Update the Ethiopian standard to reflect the more stringent standards of strategic export markets (e.g., EU, USA, etc.), while also considering Ethiopia's environmental carrying capacity.	X			EFCCC
4.1.3 For international standards deemed unobtainable for current conditions in Ethiopia, establish a timeline for phase in of the standard. • In the initial phase, establish a more lenient specification for currently unobtainable standards (make companies aware that such specifications will become more stringent over time) • Annually reevaluate each of the less stringent specifications in the standard and tighten as deemed appropriate for conditions at the time of review • Standards should be commensurate with those of the strategic export markets within seven years from the initial writing	X			EFCCC
4.1.4 Conduct an annual review and update Ethiopian standards according to the most up-to-date international standards. • Include the reevaluation of standard specifications as part of each annual review until all specifications are commensurate with those of strategic export markets	X	X		EFCCC
4.1.5 Subsector institutes will ensure that revisions to Ethiopian standards will be disseminated throughout the manufacturing sector via mailing lists and newsletters (addressed in Strategy 8.1).	X	X		Subsector Institutes

Issue 5: Lack of monitoring and reporting system to track compliance with environmental standards, except an MRV system designed for climate change which is not being implemented; without appropriate systems in place, standards will not be met nor enforced, thus preventing baseline data from being developed and monitored for change.

Strategy 5.1: Provide infrastructure and build capacity to implement a comprehensive system for monitoring the environmental and social standards of the manufacturing sector and reporting and storing results.

Actions	2017/20	2020/25	2025/30	Responsibility
5.1.1 Through a collaborative process, develop consensus on where to locate a server to house all reports on environmental and social monitoring data (i.e., MoTI or EFCCC).	X			MoTI, EFCCC
5.1.2 Specify, select, procure and install the required IT network (server, peripherals, redundancies and backup) with enough capacity to accommodate all environmental systems for the manufacturing sector.	X			MoTI, EFCCC
5.1.3 Update existing climate change MRV software and install onto the server.	X	X		MoTI, EFCCC
5.1.4 Ensure that the MRV data feeds into the database for the Ministry of Finance's CRGE system.	X	X		MoTI, EFCCC, MoFEC
5.1.5 Design monitoring and reporting systems for environmental and social concerns not covered by MRV (i.e., systems for non-climate change issues).	X			MoTI, EFCCC
5.1.6 Install all systems onto the server.	X			MoTI
5.1.7 Raise awareness and build capacity of manufacturing subsector institutes, MoTI and EFCCC regarding functionality and implementation of the systems.	X			MoFEC
5.1.8 Raise awareness and build capacity of manufacturing companies through training regarding process and preparation of environmental and social reporting requirements.	X	X	X	MoTI, EFCCC, Subsector Institutes
5.1.9 Create a database of company EIAs on the server to allow convenient access for subsector institutes, EFCCC, MoSA, EIC and other government institutions that need to reference company EIAs (e.g., for testing and monitoring).	X			MoTI
5.1.10 Ensure accessibility of the server data by relevant ministries and institutions.	X			MoTI

Issue 6: Lack of infrastructure to monitor and record non-GHG emissions – i.e., air pollutants – that are harmful to the environment and humans.[2]

Strategy 6.1: Develop infrastructure to monitor and record harmful non-GHG emissions.

Actions	2017/20	2020/25	2025/30	Responsibility
6.1.1 Establish a laboratory with appropriate facilities at the EFCCC and procure measurement toolkits.	X			EFCCC
6.1.2 Develop capacity and design a training module to be administered by faculty member(s) at a local university (use external sources for training-of-trainers, if necessary) where relevant government personnel will be trained in: • Means of data collection and reporting • Data quality management • Data interpretation • Mitigation technologies • Occupational health and safety	X			University to be selected by EFCCC
6.1.3 Provide training to relevant government personnel responsible for monitoring and recording harmful non-GHG emissions data.	X	X	X	Selected university
6.1.4 Contract a system software expert to design and develop system software for monitoring and reporting and install the database on the shared server hosting the other environmental monitoring databases.	X			MoTI
6.1.5 Monitor emissions at least biannually.	X	X	X	EFCCC
6.1.6 If emissions are not compliant with standards, require the company to update technology (equipment and practices) that will enable the company to comply with emissions standards.	X	X	X	EFCCC
6.1.7 Refer to international best practices to determine means by which harmful pollutants can be reduced or eliminated.	X	X	X	MoTI, Subsector Institutes
6.1.8 Strengthen university-industry linkages and support R&D activities related to resource efficiency, GHG reduction and climate change adaptability as they apply to manufacturing enterprises.	X	X	X	MoTI, Selected university

Issue 7: General lack of industrial park frameworks and guidelines for converting IPs to EIPs and for establishing new EIPs.

Strategy 7.1: Develop an industrial park operational framework that incorporates the green manufacturing practices presented in this Green Manufacturing Strategy for Ethiopia and this accompanying Action Plan based in the IPs according to requirements stipulated in the International Framework on Eco-Industrial Parks prepared by UNIDO, WB and GIZ.[1]

Actions	2017/20	2020/25	2025/30	Responsibility
7.1.1 Develop a general IP framework by tailoring adopting the International Framework for Eco-Industrial Parks contextualized to local conditions. • Tailor framework to provide basis for defining and setting prerequisites and performance requirements in alignment with applicable national norms and regulations and in alignment with international standards for EIPs • As per the International Framework, the performance requirements for EIPs are defined so that the environmental and social impacts go beyond regulatory requirements	X			MoTI
7.1.2 Prepare IP- specific policy and guidelines that serves as a basis for formulating the contractual agreements between the IP administration and the tenants in which the obligations of the parties are specified in connection with the environmental, economic, social and administrative performances.	X	X	X	IP developers

[1] *The International Framework is found at: https://openknowledge.worldbank.org/bitstream/handle/10986/29110/122179-WP-PUBLIC-AnInternationalFrameworkforEcoIndustrialParks.pdf?sequence=1&isAllowed=y*

Issue 8: In the absence of a sanitary and environmentally acceptable solid waste disposal option, companies are stockpiling potentially contaminated solid waste and effluent residue onsite causing two major concerns: 1) susceptibility to airborne diseases in humans and leachate and run off that can contaminate soil and, eventually, groundwater and public water bodies, and 2) companies lack options for disposing solid waste once onsite space is no longer available.

Strategy 8.1: Implement comprehensive reduce, reuse, recycle programs in manufacturing factories.

Actions	2017/20	2020/25	2025/30	Responsibility
8.1.1 Acquire technical knowledge regarding comprehensive reduce, reuse, recycle programs applicable to manufacturing through assistance of subsector institutes.	X			MoTI, Subsector Institutes
8.1.2 Subsector institutes will demonstrate how to implement programs within companies to gather recyclable office waste (e.g., paper) and consumer waste (plastic, glass, metal and aluminum cans). • Acquire list of materials recycled locally • Train workers regarding how to separate their personal recyclables from non-recyclable waste, including avoidance of contamination to recyclables (e.g., paper or foil with food residue is not recyclable) • Introduce recycling awareness training as a part of a broader company level worker training program	X			MoTI, Subsector Institutes
8.1.3 To change the mindset/behavior of companies, offer a tax deduction for sorting and separating as an incentive, while at the same time, helping to reduce the cost of operating local recycling centers.	X			MoTI
8.1.4 Once there is high level of compliance, phase out the tax incentive.			X	MoTI
8.1.5 Subsector institutes to compile a list of recycling centers and collectors and make available to all companies to identify their nearest facility or collector.	X	X	X	Subsector Institutes
8.1.6 Each manufacturing company will contract with a local recycling center or a recyclable waste hauler to remove the recyclables from its premises.		X	X	Subsector Institutes

Issue 8: In the absence of a sanitary and environmentally acceptable solid waste disposal option, companies are stockpiling potentially contaminated solid waste and effluent residue onsite causing two major concerns: 1) susceptibility to airborne diseases in humans and leachate and run off that can contaminate soil and, eventually, groundwater and public water bodies, and 2) companies lack options for disposing solid waste once onsite space is no longer available.

Strategy 8.2: Invest in appropriate facilities to collect, process and dispose of non-hazardous and hazardous industrial waste.

Actions	2017/20	2020/25	2025/30	Responsibility
8.2.1 Conduct a study to determine international best practice to handle non-hazardous and hazardous industrial waste. • In addition to the reduce, reuse, recycle technologies and processes listed in the above strategy, list and prioritize any other maximum waste reduction technologies and processes available globally and feasible for Ethiopia • Based on maximum waste reduction, consider volume of remaining industrial waste stream destined for landfill	X			MoTI
8.2.2 Considering the volume of waste that cannot be diverted from landfills, conduct a feasibility study to determine: • Most strategic location to site an industrial solid waste disposal site considering accessibility and community in which it will reside • Most efficient and hygienic collection infrastructure, including placement of transfer stations and road networks, to haul waste from factories to the facility • Develop projections of the anticipated volume and type of solid waste to be disposed of at the proposed site • Based on international standards, define a design and material use requirement to house waste at the proposed site • Estimate cost to build and operate the proposed site according to international standards • Worker skills required	X			MoTI
8.2.3 Conduct environmental and social impact assessment for siting and constructing the facility.	X			MoTI
8.2.4 Solicit cost estimates from international construction firms specializing in industrial landfill design and construction. • Proposals will be made in partnership with a local Ethiopian engineering and construction firm as a way of building local capacity	X			MoTI

Actions (continued)	2017/20	2020/25	2025/30	Responsibility
8.2.5 Select the contractor and construct the landfill in collaboration with the local Ethiopian engineering and construction firm to ensure technology transfer in anticipation of constructing future sites.		X		MoTI
8.2.6 Test and commission the landfill.		X		MoTI
8.2.7 Based on research of international best practice, devise the user service fee (fee to companies disposing their waste in the facility) and/or user payment modalities.		X		MoTI

Issue 8: In the absence of a sanitary and environmentally acceptable solid waste disposal option, companies are stockpiling potentially contaminated solid waste and effluent residue onsite causing two major concerns: 1) susceptibility to airborne diseases in humans and leachate and run off that can contaminate soil and, eventually, groundwater and public water bodies, and 2) companies lack options for disposing solid waste once onsite space is no longer available.

Strategy 8.3: Determine a solution for safely processing (oxidizing, neutralizing) hazardous waste.

Actions	2017/20	2020/25	2025/30	Responsibility
8.3.1 Conduct a study to determine the feasibility of establishing an East African regional hazardous liquid and chemical waste neutralization and/or oxidation facility at the landfill site. • Prepare a brief concept note to solicit interest among development partners to help finance and act as a neutral third party to assess the viability of establishing a regional facility in Ethiopia • Feasibility assessment to include necessary safeguard provisions to ensure no environmental/social impacts will result from the existence of the facility		X		MoTI, EFCCC
8.3.2 If the project is feasible, leverage international environmental funds and international financial institutions (e.g., World Bank Group, African Development Bank) to help finance the project.		X		MoTI, EFCCC, MoFEC
8.3.3 Develop stringent regulations/laws regarding handling, transporting and storing waste prior to processing.		X		MoTI, EFCCC
8.3.4 Establish fees based on international prices of facilities currently used by East African countries, i.e., European facilities.			X	MoTI, EFCCC, MoFEC
8.3.5 Advertise the project regionally to entice East African countries to send waste destined for neutralization to the Ethiopian facility.			X	MoTI, EFCCC, MoFEC

Issue 8: In the absence of a sanitary and environmentally acceptable solid waste disposal option, companies are stockpiling potentially contaminated solid waste and effluent residue onsite causing two major concerns: 1) susceptibility to airborne diseases in humans and leachate and run off that can contaminate soil and, eventually, groundwater and public water bodies, and 2) companies lack options for disposing solid waste once onsite space is no longer available.

Strategy 8.4: Conduct a study to determine feasibility of constructing a waste-to-energy facility to divert the non-reusable, non-recyclable, combustible portion of industrial waste from landfills.

Actions	2017/20	2020/25	2025/30	Responsibility
8.4.1 Conduct a waste stream analysis of manufacturing waste to determine the non-reusable, non-recyclable, combustible content of the waste.	X			Subsector Institutes
8.4.2 Estimate the cost to design, construct and operate a waste-to-energy facility. • Based on the volume of non-reusable, non-recyclable combustible waste, solicit cost estimates for designing and constructing an appropriately sized facility • Estimate operating costs based on data from the Reppie waste-to-energy facility • Given the above cost estimates, determine if constructing a waste-to-energy is financially viable (conduct breakeven and ROI)	X			MoTI, EFCCC, MoFEC
8.4.3 If the project is deemed financially viable, conduct a feasibility study to determine: • Most strategic location to site a waste-to-energy facility considering accessibility and community in which it will reside • Most efficient and hygienic collection infrastructure, including placement of transfer stations and road networks, to haul waste from factories to the facility • Based on international standards, define a design and material use requirement to handle waste and at the proposed site • Worker skills required	X			MoTI, EFCCC, MoFEC

Actions (continued)	2017/20	2020/25	2025/30	Responsibility
8.4.4 If the waste-to-energy is deemed financially viable, commission a study to determine the most efficient solution: • Haul bulk waste to the incinerator and have a waste separation operation at the incinerator o Non-combustible waste will need to be rerouted to an industrial waste facility (once operational) • Separate waste at each company and haul only non-reusable, non-recyclable combustibles to the incinerator o Will require waste separation knowledge at companies, capacity (human resource), and willingness (which will likely require an incentive) o Combustibles may need to be stockpiled at the company until a critical mass is gathered necessary to make hauling efficient • Other possibility	X			MoTI
8.4.5 Conduct an environmental and social impact assessment for siting and constructing the facility.	X			MoTI
8.4.6 Solicit cost estimates from international construction firms specializing in waste-to-energy design and construction. • Proposals will be made in partnership with a local Ethiopian engineering and construction firm as a way of building local capacity	X			MoTI
8.4.7 Select the contractor and construct the waste-to-energy facility – and, if required, a waste separation facility – in collaboration with the local Ethiopian engineering and construction firm to ensure technology transfer in anticipation of constructing future sites.		X		MoTI
8.4.8 Test and commission the facility.		X		MoTI

Issue 9: Awareness regarding the benefits of RECP & EMS (ISO 14001), ISO 26000 (environmentally and socially beneficial systems) and ISO 50001 or EN 16001 energy standard is low, causing manufacturers to consider the systems as costs as opposed to investments, which results in slow adoption/implementation.

Strategy 9.1: Establish awareness mechanisms that will be evaluated for effectiveness and continually adapted to stay abreast of global environmental concerns and trends.

Actions	2017/20	2020/25	2025/30	Responsibility
9.1.1 Identify two or three companies that have achieved significant success in return on investment (ROI) from implementing RECP and EMS (e.g., Meta and Harar breweries and Kombolcha Textile Factory).	X			MoTI, Subsector Institutes
9.1.2 Obtain permission from the companies identified above to develop case studies highlighting their financial investment in RECP and/or EMS, resulting in direct operational cost savings, investment payback (breakeven) period, etc., in addition to benefits related to increased market exposure and social impact on workers (attitudes, productivity, safety, etc.).	X			MoTI, Subsector Institutes
9.1.3 Subsector institutes will present the case studies during one of their periodic meetings with their constituent manufacturing enterprises.	X	X		MoTI, EFCCC

Actions (continued)	2017/20	2020/25	2025/30	Responsibility
9.1.4 The subsector institute working group (IWG) will create a quarterly environmental newsletter; topics will include (among others): • To create awareness and gain momentum for adopting relevant environmental and social programs and certifications, companies having initiated RECP and EMS implementation (or other relevant environmental and/or social certification) processes during the previous quarter as well as companies having achieved full implementation during the quarter • Anonymous pass/fail statistics regarding energy audit results during the previous quarter and measures taken to improve energy use efficiency • General health of Ethiopian environment and changes made (better or worse) in the previous quarter • Environmental innovations implemented by local manufacturing companies in the previous quarter • Worker accident report (number of accidents) in the previous quarter • Any hot topics discussed (issues, solutions or other) in the quarter's IWG meetings • Short informative articles describing international best practices for environmental solutions (e.g., new input reduction and reuse concepts/ideas, new innovative recycling practices/technologies, etc.) • Other pertinent environmental updates and information from the previous quarter	X	X		MoTI, Subsector Institutes
9.1.5 Each institute will compile an emailing list of manufacturing companies in its respective subsector (if lists do not already exist).	X			Subsector Institutes
9.1.6 Distribute the newsletter to the mailing list each quarter.	X	X	X	Subsector Institutes
9.1.7 Conduct annual customer satisfaction poll to determine if the newsletter is delivering relevant information useful to the manufacturers.	X	X	X	Subsector Institutes
9.1.8 Adjust newsletter format as deemed necessary considering user feedback from the poll.	X	X	X	Subsector Institutes
9.1.9 Commission market research on the effectiveness of the current environmental daily radio message.	X	X	X	MoTI
9.1.10 If the market research indicates that messages are ineffective, determine ways to revise the platform or advertise its existence.	X	X	X	MoTI

Issue 10: Weak infrastructure available to companies to implement RECP and EMS.

Strategy 10.1: Establish infrastructure to encourage and assist manufacturing enterprises to implement/achieve RECP, EMS, ISO 50001 Energy Management Standard and other international environmental and/or social certifications.

Actions	2017/20	2020/25	2025/30	Responsibility
10.1.1 Fast track reestablishment of RECP Institute.	X			MoTI, MoST, ESA
10.1.2 Government of Ethiopia to investigate establishing a local private or public EMS audit firm or incentive options to entice a 3rd-party certifier to establish a permanent local presence in Ethiopia.	X			MoTI, MoST, ESA
10.1.3 Compile list of national pre-preparation consultants for RECP, ISO 14001-based EMS and ISO 50001 Energy Management Standard and make available to manufacturing enterprises via the clearinghouse and by request.	X			MoTI, EFCCC

Issue 11: Non-exporting companies – and some exporting companies – do not meet Ethiopian social compliance; companies do not invest in worker safety training nor is protective clothing always issued in factories.

Strategy 11.1: Monitor social compliance concurrently with environmental compliance.

Actions	2017/20	2020/25	2025/30	Responsibility
11.1.1 Create a checklist consistent with Ethiopian social compliance standards.	X			EFCCC, MoLSA
11.1.2 Include social compliance requirements in capacity building and awareness training sessions regarding environmental compliance.	X			MoTI, MoLSA, EFCCC
11.1.3 Present company with its social performance results indicating points of non-compliance and necessary improvements.	X			MoLSA
11.1.4 Use company's previous performance review as a benchmark for company's subsequent review to measure improvements.	X			MoLSA
11.1.5 Store companies' social performance results on the same server as environmental monitoring databases.	X			MoTI, MoLSA
11.1.6 Present social compliance results alongside environmental monitoring results.	X			EFCCC, MoLSA
11.1.7 Raise awareness and advertise advantages of ISO 26000 certification.	X			MoTI, Subsector Institutes, MoLSA
11.1.8 Offer a lending mechanism for companies seeking ISO 26000 (e.g., loan guarantee, low interest, favorable terms, etc.).	X	X	X	MoTI

Issue 12: Lack of facilities in enterprises to monitor environmental and social performance resulting in inability to create baseline data.

Strategy 12.1: Raise awareness of the benefits to, and provide incentives for, companies measuring and recording input consumption, company waste generation and effluent discharge as well as social data and establish baseline data for environmental and social monitoring.

Actions	2017/20	2020/25	2025/30	Responsibility
12.1.1 Through subsector institutions, raise awareness of the benefits to the company of appointing (or hiring) a person responsible for company environmental and social compliance.	X			MoTI, Subsector Institutes
12.1.2 Present the benefits to the company for supporting a mini testing lab for its own purposes of environmental testing.	X			Subsector Institutes
12.1.3 Through subsector institutions, indicate recommended instruments for a mini lab suitable for company size and subsector.	X			Subsector Institutes
12.1.4 Provide training to companies regarding the use of the lab equipment and data recording/record keeping.	X			Subsector Institutes
12.1.5 For companies drawing water from boreholes, install flowmeters to measure water use and maintain a water use log.	X			Subsector Institutes, Manufacturing enterprises
12.1.6 Create and maintain a fuel use log.	X			Subsector Institutes, Manufacturing enterprises
12.1.7 Require companies to measure effluent (m^3) and sludge (kg) generation and maintain a log.	X			Subsector Institutes, Manufacturing enterprises
12.1.8 Maintain worker accident report, absenteeism and other pertinent social monitoring logs.	X			Subsector Institutes, Manufacturing enterprises
12.1.9 Measure quantity and maintain log of waste materials sent to landfill.	X			Subsector Institutes, Manufacturing enterprises
12.1.10 Train companies regarding the concept of continuous improvement and charting changes over time.	X			Subsector Institutes, Manufacturing enterprises
12.1.11 Government to offer no-tax for purchase of select testing equipment.	X			MoTI, MoFEC
12.1.12 Government to develop a list of test equipment that will qualify for zero-tax rating.	X			MoTI, MoFEC

Issue 13: Frequent power interruptions caused by inadequate electricity generation and transmission leads manufacturing companies to prefer equipment powered by high GHG-emitting fossil fuels to generate heat and steam required for converting input materials into finished products.

Strategy 13.1: Apply energy efficiency measures and alternative production processes in process and engineering industries to reduce GHG emissions and meet SDG targets by 2030.

Actions	2017/20	2020/25	2025/30	Responsibility
13.1.1 To increase efficiency, select and install suitable energy-efficient technologies, including retrofitting factories with modern production technologies, improving insulation, recovering waste heat, and using cogeneration.	X			Subsector Institutes, Manufacturing enterprises
13.1.2 Require that all industrial facilities utilize technologies such as a) LED or high efficiency lighting systems, b) heat recovery systems, c) variable frequency drives and motors, as well as incorporate appropriate levels of insulation, glazing and cold storage sealing for rooms and walk-in freezers and refrigerators, etc. will be implemented by June 2018, in line with the Energy Management Strategy of the MoTI issued in 2018.	X			Subsector Institutes, Manufacturing enterprises
13.1.3 Conduct secondary research to determine alternative production processes and compile a list of enzymes that can potentially replace chemicals.	X			Subsector Institutes, Manufacturing enterprises
13.1.4 Conduct feasibility assessments of alternative production processes such as replacing chemicals with enzymes and, for cement production, substitute clinker with other cementitious materials, such as coal fly ash or blast furnace slag.	X			Subsector Institutes, Manufacturing enterprises
13.1.5 Make the master chemical-enzyme swap list readily available to all companies and consultants via the clearinghouse or direct request, along with documentation of feasibility assessment results, as they become available. • Note that switching from traditional chemical processes to industrial biotechnology processes (enzyme-based), existing facilities may not be appropriate. New facilities/processes are needed. It is likely, however, that industrial biotechnology could be done at smaller scale than traditional chemistry since it is more modular, and bioreactors can be small in scale. Research would be needed to determine feasibility.	X			MoTI, ETIDI, Manufacturing enterprises
13.1.6 If alternative processes are feasible, create incentives (tax-free import of required equipment, soft bank loans) for companies to switch processes to more environmentally friendly alternatives.	X			MoTI, EFCCC, MoFEC

Actions	2017/20	2020/25	2025/30	Responsibility
13.1.7 Provide incentives (tax-free import of required equipment, concessionary bank loans) for companies to develop/engage alternative energy sources in process industries by replacing fossil fuel-powered generation with renewable energy sources – e.g., solar, biomass, biofuels, wind reducing the application of fossil fuels.	X			MoTI, EFCCC, MoFEC
13.1.8 Introduce "Green Procurement" to the federal government – i.e., government purchasing prioritizes local suppliers based on environmental and social performance • As an example, government would procure cement from companies that have signed the CSI charter		X	X	Subsector Institutes
13.1.9 Make technology choices from among existing alternative technologies for achieving resource efficiency, energy efficiency and higher environmental performance to ensure sustainability of procured installations based on set criteria.	X	X	X	Subsector Institutes, Manufacturing enterprises

Issue 13: Frequent power interruptions caused by inadequate electricity generation and transmission leads manufacturing companies to prefer equipment powered by high GHG-emitting fossil fuels to generate heat and steam required for converting input materials into finished products.

Strategy 13.2: When Ethiopia's imminent electricity infrastructure upgrade is complete, companies will be required to substitute fossil fuel-powered equipment with renewable energy-powered equipment – e.g., on-grid electricity or company-generated renewable energy (biomass, solar, wind).

Actions	2017/20	2020/25	2025/30	Responsibility
13.2.1 With completion of the electricity infrastructure upgrade, existing companies will be given a grace period (length to be determined by decision makers, e.g., Council of Ministers) to convert from fossil fuel power to electric power (on-grid or other means of renewable energy). • Offer tax incentives to companies generating their own renewable energy		X		MoTI, CoM
13.2.2 Newly established companies will be restricted from using non-renewable energy-powered equipment for their factories.		X		MoTI, IPDC, EIC

Issue 14: Companies lack general environmental knowledge regarding input selection, materials storage, and management (particularly for chemicals); moreover, materials safety data sheets (MSDS) are not always provided by chemical suppliers.

Strategy 14.1: Improve companies' materials selection, storage and management practices.

Actions	2017/20	2020/25	2025/30	Responsibility
14.1.1 To reduce the incidence of expired chemicals, disallow importation of chemicals with less than 50% of remaining shelf life.	X			ESA
14.1.2 Build company capacity regarding materials handling through institutes' training and awareness programs.	X			Subsector Institutes, Manufacturing enterprises
14.1.3 Create a master list of less environmentally damaging alternatives to harsh chemicals and materials.	X			Subsector Institutes, Manufacturing enterprises
14.1.4 Make the master list readily available to all companies and consultants via the clearinghouse or direct request.	X			MoTI, Subsector Institutes, Manufacturing enterprises
14.1.5 Restrict import of chemicals without accompanying MSDS.	X			ERCA, MoTI, ESA
14.1.6 Require all companies producing chemicals domestically to provide MSDS with all chemical sales.	X			Subsector Institutes, Manufacturing enterprises

Issue 15: Subsector institutes have independent labs resulting in equipment redundancy but are often unable to afford subsector-specific equipment needed to test compliance with subsector-specific standards.

Strategy 15.1: Develop a common test facility for all subsector institutes.

Actions	2017/20	2020/25	2025/30	Responsibility
15.1.1 All common testing and assessment equipment will be made available through a common test facility, while subsector-specific testing equipment will remain in existing subsector labs.	X			MoTI, Subsector Institutes
15.1.2 Enhance the common facility by procuring portable equipment and analytical instruments available to all subsector institutes to conduct on-site company inspections and on-the-spot tests.	X			MoTI, Subsector Institutes
15.1.3 Ensure continuous availability of required reagents in the common facility.	X	X	X	MoTI, Subsector Institutes
15.1.4 Conduct a study to determine location, required personnel, construction cost and operating budget of the common facility.	X			MoTI, Subsector Institutes
15.1.5 Revise current subsector institute lab budget to reflect cost savings from the introduction of a common facility.	X			MoTI, Subsector Institutes
15.1.6 Savings from the introduction of a common facility will be dedicated towards subsector-specific testing equipment.	X			MoTI, Subsector Institutes

Issue 16: Lack of capacity in the subsector institutes to inspect and test environmental performance of manufacturing enterprises.

Strategy 16.1: Conduct capacity building of experts in the subsector institutes regarding enterprise-level environmental performance testing.

Actions	2017/20	2020/25	2025/30	Responsibility
16.1.1 Recruit and hire trainable personnel (e.g., lab technicians) for undertaking inspections and laboratory tests.	X	X		Subsector Institutes
16.1.2 Train the personnel to upgrade their skills.	X	X		Subsector Institutes
16.1.3 For record-keeping purposes, each subsector institute will design, implement and maintain a database where company inspection and testing data will be stored.	X	X		Subsector Institutes
16.1.4 Establish a laboratory in each sector institute to serve the requirements of the manufacturing enterprises.	X	X		Subsector Institutes

Issue 17: Lack of funding facilities and mechanisms for providing support and incentives to manufacturing enterprises undertaking investments and improvement measures to protect the environment and build social infrastructures.

Strategy 17.1: Develop and implement a green manufacturing policy framework that will include mechanisms and instruments to create incentives and support services to green manufacturers and establish MoTI's involvement in designing appropriate green financing mechanisms targeting the manufacturing sector.

Actions	2017/20	2020/25	2025/30	Responsibility
17.1.1 MoTI will author and propose policy to provide for requisite instruments and mechanisms relevant to greening the manufacturing sector. • Should MoTI lack internal capacity to draft appropriate policies relevant to introducing green financing mechanisms, MoTI should appropriate an international consultant to assist MoTI prepare and build internal capacity to prepare such policies.	X			MoTI
17.1.2 Council of Ministers approves MoTI's proposed policy.	X			CoM
17.1.3 Ministry of Finance to allocate budget to MoTI to implement the newly created policies - i.e., define terms and conditions of green manufacturing incentives, engage local and international financial institutions to explore options and conditions for partial or full private sector participation offering green financing, create incentive packages to encourage private sector service industries to develop support services to assist companies in complying with conditions required to qualify for green financing and gain/maintain credential for green manufacturing status.	X	X		MoTI

Issue 17: Lack of funding facilities and mechanisms for providing support and incentives to manufacturing enterprises undertaking investments and improvement measures to protect the environment and build social infrastructures.

Strategy 17.2: Develop and introduce diverse forms of green funding mechanisms and types of incentives/supports to finance and promote green manufacturing practices in Ethiopia.

Actions	2017/20	2020/25	2025/30	Responsibility
17.2.1 Appoint a steering committee – led by representatives from MoTI and including MoFEC, EFCCC, EIC, MoWIE, MoLSA and MInT – that identifies and recommends to the government the setting up of green funds – i.e., an Ethiopian Green Industry Fund (EGIF)[3] – along with appropriate funding mechanisms and modalities for providing support and incentives for greening the manufacturing sector.		X		CoM
17.2.2 MoTI, MoFEC and EFCCC mobilize international and domestic resources for implementing setting up the potential EGIF and its operational procedures.		X		MoTI
17.2.3 Set criteria for prioritizing and selecting projects eligible for green financing from the green fund.		X		Steering Committee
17.2.4 Determine and set the type and amount of incentives/support under pertinent categories (e.g., clean energy, pollution control and waste reduction, water consumption reduction and OHS and social infrastructure) for the selected projects.		X		Steering Committee
17.2.5 Establish a technical evaluation committee to select and recommend for approval of the steering committee projects having the highest environmental, social and economic impacts to be considered for green financing.		X		Steering Committee

[3] *"Ethiopian Green Industry Fund" is a suggested title for the fund.*

Issue 18: There is no link between environmental compliance and business license renewal (environmental clearance letters are valid for the life of a company).

Strategy 18.1: Develop a clear link between business license renewal and environmental compliance based on environmental clearance letters.

Actions	2017/20	2020/25	2025/30	Responsibility
18.1.1 All new companies will be required to have conduct an ESIA; existing companies – regardless of whether the company has conducted an ESIA – will be required to prepare and regularly update an ESMP.	X	X	X	EFCCC
18.1.2 Limit environmental clearance letters to a finite lifespan (three years, for example).	X			EFCCC
18.1.3 Companies will be required to hire an independent, certified consultant to conduct an environmental audit prior to the expiration of its environmental clear letter.	X	X	X	Manufacturing enterprises
18.1.4 If the company passes the environmental audit, EFCCC will issue a clearance letter valid for the next three-year period.	X			EFCCC
18.1.5 The company will use the clearance letter to renew its business license.	X			MoTI
18.1.6 If the company does not pass the environmental audit (does not meet the requirements of the environmental standard), EFCCC will instruct the company to undertake improvement measures.	X			EFCCC
18.1.7 The company will make necessary improvement measures according to the recommendations of the environmental audit, or the recommendations of the EFCCC, and retest for the failed parameter(s) to obtain environmental clearance.	X			EFCCC, Manufacturing enterprises
18.1.8 When the company passes the audit, EFCCC will issue a clearance letter valid for the next three-year period and this letter will be used to renew the business license.	X			EFCCC, Manufacturing enterprises

Issue 19: Compliance to environmental standards is driven by penalties and GoE offers no positive incentives to encourage manufacturers to meet compliance.

Strategy 19.1: GoE to offer financial incentives and green funds.

Actions	2017/20	2020/25	2025/30	Responsibility
19.1.1 Determine optimal loan guarantee terms for projects that have no demonstrable ROI (e.g., ETP projects).	X			MoTI
19.1.2 Design a green funding mechanism for green manufacturing based on the model used for CRGE.	X			MoTI, MoFEC

Issue 19: Compliance to environmental standards is driven by penalties and GoE offers no positive incentives to encourage manufacturers to meet compliance.

Strategy 19.2: GoE to develop eco-labeling for manufactured products.

Actions	2017/20	2020/25	2025/30	Responsibility
19.2.1 Design a logo for an Ethiopia mark. • The Global Ecolabeling Network provides useful guidelines for this process: https://globalecolabelling.net/what-is-eco-labelling/	X			ESA, MoTI
19.2.2 Applicable to manufactured products that can demonstrate environmental compliance.	X	X	X	ESA, MoTI

Issue 20: Locally developed innovations need more support in bringing them to the market.

Strategy 20.1: Support development of environmentally friendly technologies.

Actions	2017/20	2020/25	2025/30	Responsibility
20.1.1 Simplify access to finance for entrepreneurs engaging in the development of environmental technology.	X	X	X	MoTI, MoST
20.1.2 Sponsor awareness campaigns within the manufacturing sector via subsector institutes.	X	X	X	MoTI, MoST
20.1.3 Provide a platform – i.e., well-publicized large-scale demonstration(s) – for environmentally friendly technologies from which the inventor/entrepreneur can demonstrate proof-of-concept.	X	X	X	MoTI, MoST
20.1.4 If demonstrations prove successful, provide encouragement and support (e.g., loan guarantees or tax incentives) to early adaptors of the technology.	X	X	X	MoTI, MoST, MoFEC
20.1.5 Assist entrepreneur to gain international exposure.	X	X	X	MoTI, MoST

Issue 21: There is no legal and social performance implementation framework in Ethiopia. Enforcement of regulations and social standards/safeguards is limited and not consistent with the Constitution, existing national policy, laws, regulations or ratified international instruments.

Strategy 21.1: Strengthen the social performance implementation framework by adopting and implementing legislation and standards that will guide occupational health and safety services.

Actions	2017/20	2020/25	2025/30	Responsibility
21.1.1 Establish a prevention-oriented, accessible, efficient and effective labor inspection system that specifies clear mandates for government agencies involved with the processes, ensuring there are no overlapping mandates among different government entities.	X			MoLSA, MoTI,[4] IPDC, EFCCC, EIC (plus subsector association leaders)[5]
21.1.2 Develop, implement and periodically review national laws and standards related to occupational health and safety in line with the labor proclamation and ILO conventions.	X			MoLSA, MoTI
21.1.3 Mainstream OHS issues in all national development plans and programs and implement accordingly.	X	X		MoLSA, MoTI, EFCCC, EIC, IPs
21.1.4 Establish an effective regulatory system to ensure machinery, raw materials and chemical substances are safe and without risks to workers and work environments while importing, in usage and upon disposal. • Require documentation regarding safe handling of machinery, raw materials and chemical substances be displayed for easy reference during transport (e.g., importing), usage and disposal. For example, require access to MSDS for chemicals during transport, usage and disposal.	X	X		MoLSA, MoTI,[4] IPDC, EFCCC, EIC (plus subsector association leaders)[5]
21.1.5 Establish a system that facilitates participation of the private sector in delivering occupational health and safety services.	X			MoTI, IPs, EFCCC, MoLSA, EIC

[4] *MoTI includes the subsector institutes under its jurisdiction.*

[5] *Chamber of Ethiopia, Sectoral Associations.*

Issue 21: There is no legal and social performance implementation framework in Ethiopia. Enforcement of regulations and social standards/safeguards is limited and not consistent with the Constitution, existing national policy, laws, regulations or ratified international instruments.

Strategy 21.2: Strengthen and create enabling mechanisms for law enforcement and compliance with social standards.

Actions	2017/20	2020/25	2025/30	Responsibility
21.2.1 Create a platform for clarification of mandates among MoLSA, EIC, IPDC and MoTI with regard to inspections to check compliance with laws and social standards in manufacturing enterprises.	X			MoLSA, MoTI, IPDC, EIC
21.2.2 Increase the number, capacity, and capabilities of inspectors and enforcement officers to gain wider and more comprehensive coverage of all manufacturing entities throughout the country. • Recruit personnel to be trained in OHS inspection and enforcement. • In cooperation with a local training institute, develop curricula for training personnel in comprehensive inspection. • Include training on processes for effectively citing violators and how to commence legal action.	X			MoLSA
21.2.3 Ensure freedom of association and collective bargaining by workers in compliance with labor laws and related international conventions by MoLSA, bringing together the two parties, labor representatives and management of manufacturing enterprises.	X	X		MoLSA, Manufacturing enterprises
21.2.4 Reduce the incidence of low wage payments due to labor outsourcing through prevention of (i.e., make punishable by law) the outsourcing practice for permanent job positions.	X			MoLSA, Manufacturing enterprises
21.2.5 Establish grievance mechanisms in each manufacturing enterprise to provide feedback to the management regarding workplace problems.	X	X	X	MoLSA, Manufacturing enterprises

Issue 22: There is lack of awareness among – and little to no priority given by – employers and workers regarding 1) prevention and control of occupational accidents, 2) work-related hazards and 3) provision of medical treatment, care and support services for victims of occupational injuries, nor are there data available to analyze work-related accidents, occupational diseases, absenteeism, work-related fatalities, loss of productivity, etc. in the Ethiopian manufacturing sector. Furthermore, there is lack of in-house social and environmental policy guidelines in manufacturing enterprises and there are neither local technical service providers for assisting enterprises in developing and implementing OHSAS 18001:2007 social management systems nor accredited bodies to certifying enterprises for OHSAS 18001:2007.

Strategy 22.1: Strengthen institutional capacity through the provision of adequate instruments (laboratory testing equipment, re-agents, kits, etc.) and deployment of trained human resources.

Actions	2017/20	2020/25	2025/30	Responsibility
22.1.1 In coordination with relevant stakeholders (sector institutions, professional associations and the private sector), improve access to occupational health and safety services by establishing extension services in MoLSA.	X			MoLSA, Sectoral OHS units
22.1.2 Establish an OHS management system to strengthen the provision of occupational health and safety advisory and technical support services to manufacturing enterprises.	X			MoLSA, MoTI, EFCCC
22.1.3 Support the establishment of professional associations in the field of occupational health and safety that will promote and develop OHS support activities and capacity building.	X	X	X	MoLSA, MoTI, EFCCC, Sectoral OHS units
22.1.4 Carry out continuous awareness-raising activities via mass media channels (print, radio, television) regarding occupational health and safety to raise the awareness of workers, employers and the public at large.	X	X	X	MoLSA, MoTI, EFCCC, Sectoral OHS units
22.1.5 Provide prevention-specific awareness raising and advisory support to all manufacturing entities, including the informal economy.	X	X	X	MoLSA, MoTI, EFCCC, Sectoral OHS units
22.1.6 Design at various levels education (e.g., diploma, BA and MA degrees) and training programs for the private and public sectors that address human resource development in the field of occupational health and safety.	X	X		MoLSA
22.1.7 Provide technical assistance (e.g., secretarial, office provision, workshop sponsorship, etc.) to establish local organizations that provide technical services in undertaking OHSAS 18001:2007 standard and OHS management system. Enable such entities to build capacity and capability to be accredited and able to certify manufacturing enterprises with social management systems.	X	X	X	MoLSA, EFCCC, EIC, MoTI

Issue 22: There is lack of awareness among – and little to no priority given by – employers and workers regarding 1) prevention and control of occupational accidents, 2) work-related hazards and 3) provision of medical treatment, care and support services for victims of occupational injuries, nor are there data available to analyze work-related accidents, occupational diseases, absenteeism, work-related fatalities, loss of productivity, etc. in the Ethiopian manufacturing sector. Furthermore, there is lack of in-house social and environmental policy guidelines in manufacturing enterprises and there are neither local technical service providers for assisting enterprises in developing and implementing OHSAS 18001:2007 social management systems nor accredited bodies to certifying enterprises for OHSAS 18001:2007.

Strategy 22.2: Build the implementation capacity of occupational health and safety through strengthening national collaboration and cooperation between MOLSA, MoTI and professional associations.

Actions	2017/20	2020/25	2025/30	Responsibility
22.2.1 Identify/recruit local private-sector entities to provide technical services to local manufacturers for developing and implementing OHSAS 18001:2007 social management systems.	X	X	X	MoLSA, MoTI
22.2.2 Seek assistance from development partners and co-sponsor the provision of a training-of-trainers program to train local entities to deliver technical support services regarding OHSAS 18001:2007 social management systems.		X	X	MoLSA, MoTI
22.2.3 Establish and operate a functional management information system, including occupational health and safety management, designed for manufacturing enterprises that enables enterprises to organize information on occupational injuries.	X			MoLSA, MoTI, EFCCC, Sectoral OHS units
22.2.4 Institute mandatory reporting requirements/guidelines for annual submission of OHS-relevant data by manufacturing enterprises into a central government repository.	X			MoLSA, MoTI
22.2.5 Design and implement a data analysis format for health and safety management data; update and make publicly available the analysis after each reporting period.	X	X	X	MoLSA, MoTI
22.2.6 Establish an occupational health and injury compensation system (workers' compensation) equitable with occurring disablements as defined by insurance agencies. External consultants may be required to establish the framework for an effective and efficient system which includes, but is not limited to, components such as: • Establish a legal system to determine fault. • Determine cost of time lost. • Determine cost of additional health care (short- and long-term) and install cost verification mechanism to prevent fraud.	X			MoLSA, Sectoral OHS units

Actions (continued)	2017/20	2020/25	2025/30	Responsibility
22.2.7 Strengthen stakeholder collaboration and consultation mechanisms to jointly prevent occupational accident and work-related diseases.	X	X		MoLSA, MoTI, EFCCC, Sectoral OHS units
22.2.8 Establish collaboration and cooperation system with insurance/social security institutions to increase prevention of occupational accidents and work-related diseases. • Develop an insurance network (via private companies) to cover workers' compensation claims. • Insurance companies determine insurance premiums based on manufacturing entities' compliance with OHS regulations/standards. • Based on an internal risk assessment, develop a premium schedule that reflects the manufacturer's level of compliance.	X			MoLSA, Private-sector insurance companies, Manufacturing enterprises
22.2.9 Establish mandatory first aid services or health care units and help strengthen existing services.	X			MoLSA, EFCCC, EIC, MoTI, IPs
22.2.10 Mandate all manufacturing entities to have available emergency first aid kits (required contents to be established by MoLSA); medium and large manufacturing entities will have available emergency medical treatment and health care services for victims of occupational injuries at workplace.	X	X	X	MoLSA, MoTI
22.2.11 Establish a physical and psychological rehabilitation services facility for victims of occupational injuries.	X	X	X	MoLSA

Issue 23: There is limited awareness of managing OHS issues and lack of primary social infrastructure (separate toilets for men and women, amenities for persons with disabilities (PwD), drinking water faucets, etc.) in relation to vulnerable groups of workers such as women, youth, PwD, workers with HIV and other marginalized groups.

Strategy 23.1: Develop mechanisms/policies for enhancing the social performance of manufacturing enterprises within the workplaces, particularly in regard to vulnerable workers with respect to their physical strength, nature of vulnerability and endurance and immunological capacity against diseases of the workers.

Actions	2017/20	2020/25	2025/30	Responsibility
23.1.1 Through workshops, leaflets, associations, radio and other appropriate media, raise awareness, particularly among company management and workers, regarding OHS issues in relation to vulnerable workers.	X			MoLSA
23.1.2 Devise a mechanism or policy to make the workplace more conducive to women, particularly pregnant women. Refer to international models for examples of how policies are implemented. For example, the Canadian Human Rights Commission has a developed policy and best practice guideline regarding pregnancy and human rights in the workplace (https://www.chrc-ccdp.gc.ca/eng/content/policy-and-best-practices-page-1).	X			MoLSA, MoTI, EFCCC, IPDC, Sectoral OHS units
23.1.3 Devise a mechanism or policy to protect young workers from engaging in jobs that may have detrimental effects on their physical and emotional development.	X	X		MoLSA, MoTI, EFCCC, Sectoral OHS units
23.1.4 Keep confidential the medical records of HIV-positive workers to prevent stigma and discrimination.	X	X	X	MoLSA, MoTI, EFCCC, Sectoral OHS units
23.1.5 Require enhanced accessibility (e.g., ramps) in medium and large manufacturing enterprises to accommodate PwD.	X	X		MoLSA, Manufacturing enterprises

Issue 24: Manufacturers are not being encouraged to engage in, nor are they understanding the benefits associated with, community dialogue, performing community outreach activities, public service activities or investing in socio-economic and/or physical infrastructure in their respective communities as part of corporate social responsibility. Further, there are no public or private Ethiopian entities to provide ISO 26000-based technical support for CSR implementation.

Strategy 24.1: Encourage and motivate manufacturing enterprises to be good corporate citizens by undertaking their corporate social responsibility and adhere to rules and regulations.

Actions	2017/20	2020/25	2025/30	Responsibility
24.1.1 Motivate manufacturing investors and enterprises to undertake CSR activities to create good relationships with the communities in which the manufacturing entities operate. • Through case studies, demonstrate and publicize favorable market response to CSR activities from international buyers. For example, the Kombolcha textile factory created a green park for its host community and this was one of the factors considered by its foreign buyer when choosing the factory as a supplier.	X	X	X	MoLSA, MoTI, EIC, IPs
24.1.2 During negotiations with new investors – particularly for FDI initiatives in which government provides concessions – IPDC/MoTI (as appropriate) will incorporate CSR activities into the contractual agreements with investors.	X	X	X	MoTI, EIC, IPDC
24.1.3 Provide land and basic infrastructure that enables new investors and existing manufacturing enterprises to carry out their corporate social responsibilities.	X	X	X	MoTI, EIC, IPDC
24.1.4 Identify/recruit local private-sector entities to provide ISO 26000-based technical support for CSR implementation.	X	X		MoLSA, MoTI
24.1.5 Seek assistance from development partners and co-sponsor a training-of-trainers program to train local entities to provide ISO 26000-based technical support for CSR implementation.	X	X		MoLSA, MoTI

Annex 1: Potential Contribution of the Manufacturing Sector to the Sustainable Development Goals

Sustainable Development Goal	How the Manufacturing Sector Can Contribute
1. **End poverty everywhere**	Focus on manufacturing and productive activities that impact job creation, sustainable livelihoods, food security and equitable growth, all key requirements for eradicating poverty
2. **End hunger, improve nutrition and promote sustainable agriculture**	Support value addition in agro-industrial output, while generating job opportunities and increasing food security for rural communities
3. **Attain healthy lives for all**	Support industrial SMEs in the local manufacturing of essential drugs, medical supplies, and optical products
4. **Provide inclusive and equitable quality education and life-long learning opportunities for all**	Develop entrepreneurial culture and skills, as well as young peoples' technical and learning capability, laying the groundwork for private sector development
5. **Achieve gender equality and empower women and girls everywhere**	Create enabling environment for women entrepreneurs, and promote clusters and partnerships that facilitate access to information, technology and markets for women
6. **Ensure availability and sustainable management of water and sanitation for all**	Follow best environmental practices to protect water resources and support the sound management of resource use in industrial activities
7. **Ensure sustainable energy for all**	Promote energy-efficiency policies, technologies and production processes, along with enhanced utilization of renewable energy sources
8. **Promote sustained, inclusive and sustainable economic growth, full and productive employment, decent work for all**	Build capacities of local industries for value addition, economic diversification, export promotion and employment creation
9. **Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation**	Strengthen national capacities at the policy, institutional and enterprise levels in SME and entrepreneurship development, economic diversification, industrial upgrading, technological uptake and trade
10. **Reduce inequality within and among countries**	Support the provision of equitable and decent employment opportunities through substantial increases in industrial output, value-addition, and transition to higher-tech production
11. **Make cities and human settlements inclusive, safe and sustainable**	Promote industrial clusters in urban industrial zones that spur innovation and industrial competitiveness while linking local business with global markets and supply chains
12. **Promote sustainable consumption and production patterns**	Promote green industries and environmental sustainability policies in industrial production and consumption, as well as support implementation of specific industrial waste reduction agreements
13. **Combat climate change and its impacts**	Promote renewable energy and the uptake of energy-efficient technologies in industrial processes
14. **Conserve and sustainably use the oceans, seas and their resources for sustainable development**	Help reduce the degradation of marine and river basins through sound water management methodologies and system introduction, and strategic partnerships

15. **Protect and promote sustainable use of terrestrial ecosystems, sustainable management of forest, and halt and reverse land degradation and biodiversity loss**	Promote biomass for power generation, and support adaptation and adoption of Resource Efficient and Cleaner Production (RECP) methods, technologies and systems by enterprises[119]
16. **Achieve peaceful and inclusive societies, access to justice for all, and effective and capable institutions**	Promote productive rehabilitation and reconstruction of post-conflict countries, and thus build sustainable livelihoods
17. **Strengthen the means of implementation and the global partnership for sustainable development**	Reinforce business partnerships; global trade national capacities, as well as technology exchange mechanisms, technology policy coordination measures and related investment opportunities

Source: Delivering the Sustainable Development Goals: Seizing the Opportunity in Global Manufacturing, PwC, 2017, https://www.pwc.com/m1/en/publications/documents/delivering-sustainable-development-goals.pdf

[119] RECP builds upon cleaner production in accelerating the application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

Annex 2: Activities Timeline

Action plan implementation depends upon funding and capacity of stakeholders, particularly MoTI. To get the ball rolling, it may be best to pick low-hanging fruit. Preliminary thoughts otherwise will be to prioritize strategies and their respective sets of activities according to the following categories:

1. Stakeholder coordination
2. Institutional & Organizational Setup
3. Frameworks, Standards, Policies & Laws
4. System development
5. Awareness Raising & Capacity Building (Institutional & Human)
6. Projects

The following table is taken from the Action Plan and offers a breakdown for implementation of strategies according to the six categories listed above. The responsibilities and the time frames listed for the strategies are commensurate with the responsibilities and time frames of the sets of activities correlated to the respective strategy.

Strategy	Responsibility	Time Frame		
		Short	Medium	Long
Stakeholder Coordination				
Strategy 1.1: Enhance cooperation, set consensus goals and priorities, and establish a coordinated approach to green manufacturing among relevant government institutions.	ECCSA, EFCCC, EIC, ESA, IPDC, MOA, MoLSA, MoST, MoTI, MOWIE, Subsector Association	X	X	X
Institutional & Organizational Setup				
Strategy 2.1: Institutionalize communication channels between subsector institutes and MoTI to enable the environmental directorates/departments to work with MoTI to solve issues together through knowledge sharing, financial planning and general capacity building, including contracting external assistance.	MoTI and Sectoral Env. Directorates, EFCCC, IPDC, IPs	X	X	X
Strategy 2.2: Create a communication platform between subsector environmental directors/department heads.	Sectoral Env. Directorates	X	X	X
Strategy 8.2: Invest in appropriate facilities to collect, process and dispose of non-hazardous and hazardous industrial waste.	MoTI	X	X	
Strategy 15.1: Develop a common test facility for all subsector institutes.	MoTI, Subsector Institutes	X	X	X
Frameworks, Standards, Policies & Laws				
Strategy 4.1: Update the *Ethiopian Environmental Standard for Industrial Pollution Control* based on standards of strategic export markets.	EFCCC, Subsector Institutes	X	X	
Strategy 7.1: Develop an industrial park operational framework that incorporates the green manufacturing practices presented in this Green Manufacturing Strategy for Ethiopia and this accompanying Action Plan based in the IPs according to requirements stipulated in the International Framework on Eco-Industrial Parks prepared by UNIDO, WB and GIZ.	MoTI, IP developers	X	X	X

Strategy	Responsibility	Time Frame		
		Short	Medium	Long
Strategy 17.1: Develop and implement a green manufacturing policy framework that will include mechanisms and instruments to create incentives and support services to green manufacturers and establish MoTI's involvement in designing appropriate green financing mechanisms targeting the manufacturing sector.	MoTI, CoM	X	X	
Strategy 17.2: Develop and introduce diverse forms of green funding mechanisms and types of incentives/supports to finance and promote green manufacturing practices in Ethiopia.	MoTI, CoM, Steering Committee		X	
Strategy 18.1: Develop a clear link between business license renewal and environmental compliance based on environmental clearance letters.	EFCCC, Manufacturing enterprises, MoTI	X	X	X
Strategy 19.1: GoE to offer financial incentives and green funds.	MoTI, MoFEC	X		
Strategy 19.2: GoE to develop eco-labeling for manufactured products.	ESA, MoTI	X	X	X
Strategy 21.1: Strengthen the social performance implementation framework by adopting and implementing legislation and standards that will guide occupational health and safety services.	MoLSA, MoTI, IPDC, EFCCC, IPs, EIC, (plus subsector association leaders)	X	X	
Strategy 21.2: Strengthen and create enabling mechanisms for law enforcement and compliance with social standards.	MoLSA, MoTI, IPDC, EIC, Manufacturing enterprises	X	X	X
Strategy 23.1: Develop mechanisms/policies for enhancing the social performance of manufacturing enterprises within the workplaces, particularly in regard to vulnerable workers with respect to their physical strength, nature of vulnerability and endurance and immunological capacity against diseases of the workers.	MoLSA, MoTI, EFCCC, IPDC, Sectoral OHS units, Manufacturing enterprises	X	X	X
System Development				
Strategy 3.3: Establish a common information clearinghouse accessible to all manufacturing sector stakeholders.	MoTI, EFCCC, Subsector Institutes	X	X	X
Strategy 5.1: Provide infrastructure and build capacity to implement a comprehensive system for monitoring the environmental and social standards of the manufacturing sector and reporting and storing results	MoTI, EFCCC, MoFEC	X	X	X

Strategy	Responsibility	Time Frame		
		Short	Medium	Long
Strategy 6.1: Develop infrastructure to monitor and record harmful non-GHG emissions.	University to be selected by EFCCC, EFCCC, MoTI, Subsector Institutes	X	X	X
Strategy 8.1: Implement comprehensive reduce, reuse, recycle programs in manufacturing factories.	MoTI, Subsector Institutes	X	X	X
Strategy 11.1: Monitor social compliance concurrently with environmental compliance.	MoTI, MoLSA, EFCCC, Subsector Institutes	X	X	X
Strategy 20.1: Support development of environmentally friendly technologies.	MoTI, MoST, MoFEC	X	X	X
Awareness Raising & Capacity Building (Institutional & Human)				
Strategy 3.1: Develop training modules to assist government entities to increase their knowledge and skills to best implement environmental duties and initiatives	MoTI, IPDC, EFCCC, University to be selected	X		
Strategy 3.2: Engage in advisory support networks to build local capacity in subsector institutions.	Subsector Institutes, MoTI, IPDC, EFCCC, ESA	X	X	X
Strategy 9.1: Establish awareness mechanisms that will be evaluated for effectiveness and continually adapted to stay abreast of global environmental concerns and trends.	MoTI, Subsector Institutes, EFCCC	X	X	X
Strategy 12.1: Raise awareness of the benefits to, and provide incentives for, companies measuring and recording input consumption, company waste generation and effluent discharge as well as social data and establish baseline data for environmental and social monitoring.	Subsector Institutes, Manufacturing enterprises, MoTI, MoFEC	X		
Strategy 14.1: Improve companies' materials selection, storage and management practices.	MoTI, Subsector Institutes, Manufacturing enterprises, ESA, ERCA	X		
Strategy 16.1: Conduct capacity building of experts in the subsector institutes regarding enterprise-level environmental performance testing.	Subsector Institutes	X	X	
Strategy 22.1: Strengthen institutional capacity through the provision of adequate instruments (laboratory testing equipment, re-agents, kits, etc.) and deployment of trained human resources.	MoLSA, MoTI, EFCCC, Sectoral OHS units, EIC	X	X	X

Strategy	Responsibility	Time Frame		
		Short	Medium	Long
Strategy 22.2: Build the implementation capacity of occupational health and safety through strengthening national collaboration and cooperation between MOLSA, MoTI and professional associations.	MoLSA, MoTI, EFCCC, Sectoral OHS units, EIC, IPs	X	X	X
Strategy 24.1: Encourage and motivate manufacturing enterprises to be good corporate citizens by undertaking their corporate social responsibility and adhere to rules and regulations.	MoLSA, MoTI, EIC, IPs, IPDC	X	X	X
Projects				
Strategy 8.3: Determine a solution for safely processing (oxidizing, neutralizing) hazardous waste.	MoTI, EFCCC, MoFEC		X	X
Strategy 8.4: Conduct a study to determine feasibility of constructing a waste-to-energy facility to divert the non-reusable, non-recyclable, combustible portion of industrial waste from landfills.	MoTI, EFCCC, MoFEC, Subsector Institutes	X	X	
Strategy 10.1: Establish infrastructure to encourage and assist manufacturing enterprises to implement/achieve RECP, EMS, ISO 50001 Energy Management Standard and other international environmental and/or social certifications.	MoTI, MoST, ESA, EFCCC, MoFEC	X		
Strategy 13.1: Apply energy efficiency measures and alternative production processes in process and engineering industries to reduce GHG emissions and meet SDG targets by 2030.	Subsector Institutes, Manufacturing enterprises, MoTI, EFCCC, MoFEC, ETIDI	X	X	X
Strategy 13.2: When Ethiopia's imminent electricity infrastructure upgrade is complete, companies will be required to substitute fossil fuel-powered equipment with renewable energy-powered equipment – e.g., on-grid electricity or company-generated renewable energy (biomass, solar, wind).	MoTI, IPDC, EIC, CoM		X	