



Technical Report

GREEN GROWTH INDEX 2023 GHANA

December 2023



Green Growth Index

STAKEHOLDERS



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A collaborative project between the National Treasury and the Global Green Growth Institute (GGGI)

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Foreword

Ghana is a signatory to several multinational agreements, including the Paris Agreement. The country has taken steps to develop many policies and strategies and is in the process of implementing them to achieve green and inclusive growth. Ghana's approach to transitioning to a green economy and implementing the Ghana@2057 Development Framework in pursuit of Sustainable Development Goals (SDGs) requires a critical gap analysis of existing policy frameworks. The Government of Ghana, through the Ministry of Environment, Science, Technology and Innovation (MESTI), in collaboration with the Global Green Growth Institute (GGGI), has carried out such an analysis to benchmark Ghana's green growth performance and achievements in pursuit of the SDGs.

The methodology that was adopted depended largely on data and information provided by local experts with extensive background and knowledge on the selected indicators for the four dimensions of the green growth index. The experts were drawn from Government Ministries, Departments and Agencies, the academic community, local and international Non-Governmental Organizations (NGOs), and the private sector. First, there was a stepwise scientific approach to apply the framework of the Green Growth Index in selecting the green growth indicators, followed by a consultative process involving experts and stakeholders to assess the policy relevance of the indicators. The first step involved rigorous research to understand the complexity and multi-dimensionality of green growth, while the second entailed consultations to understand the national and regional contexts that influence green growth policies and the relevance of the indicators to the country.

The report identified priority areas that present the greatest opportunities for Ghana to transition to a green economy using the Green Growth Index Framework, which GGGI applies to measure a country's performance in the green growth transition. The assessment output has provided the baseline data to benchmark green growth performance and information for greening national development policy frameworks that are yet to be developed. The national experts participating in the design process of the Ghana Green Growth Index selected a total of 80 indicators for the Index's four green growth dimensions - Efficient and Sustainable Resource Use, Natural Capital Protection, Green Economic Opportunities, and Social Inclusion.

Ghana's Green Growth Index score from the assessment is 40.7. The country has done well in the Natural Capital Protection and Social Inclusion dimensions. However, Ghana is expected to focus more on green investments to create more sustainable and green jobs for the teeming youth and to address the human resource capacity for green employment. There is also the need to improve access to social services as well as land and material resource use to transition to green growth. All information related to the assessment and the scores are available on this link (<https://ghana-greengrowthindex-8af980b05521.herokuapp.com>), designed to share knowledge on the Green Growth Index. The website is a major output of the project and will be updated annually to provide current information for stakeholders.

It is hoped that Ghana will take advantage of existing and emerging climate change and green-related funds to develop bankable projects and improve its performance toward green growth. The document will also provide areas that need to be prioritized for implementation, in order to achieve the SDG targets for sustainable growth.



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Acknowledgments

The National Green Growth Index emerges from Ghana's commitment to addressing climate change issues while ensuring sustainable development of all sectors of the economy toward a green economy. The Green Growth Index was developed through the collaboration between Ghana and the Global Green Growth Institute (GGGI). The success was a result of a unified dedication and commitment from key stakeholders from both the public and private sectors, who played different and integrative roles to ensure project completion on schedule.

We acknowledge the valuable contribution, direction, and leading role throughout the assignment by the representatives of the Ministry of Environment, Science, Technology and Innovation (MESTI) through the Directorate of Environment, Ministry of Local Government, Decentralisation and Rural Development (MLGDRD), Ministry of Tourism Art and Culture (MoTAC), Ministry of Sanitation and Water Resources (MSWR), Ministry of Roads and Highways (MRH), Ministry of Works and Housing (MWH), National Development Planning Commission (NDPC), the SDGs Advisory Unit at the Presidency, National Cleaner Production Centre (CPC), Ghana Standard Authority and many other government agencies.

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We also want to appreciate the role of the GGGI Technical Team, who worked from different countries to contribute to a successful Green Growth Index development for Ghana. We look forward to working together towards realising our vision of Ghana taking the lead in transitioning to the green economy, addressing climate change concerns, and fostering a sustainable and prosperous future for our beloved nation.



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Contents

Foreword	VI	2. Design process	5	4. Green growth indicators for Ghana	33	6. Green Growth Transition	79
Acknowledgments	VII	2.1 The National Experts	6	4.1 Indicator checklist	34	6.1 Challenges and opportunities	80
List of Figures	X	2.2 Participatory Activities	7	4.1.1 Efficient and sustainable resource use	38	6.2 Policy recommendations	80
List of Tables	XI	2.3 Stepwise Analytical Approach	15	4.1.2 Natural capital protection	39	6.3 Next steps forward	82
Acronyms and Abbreviations	XII	2.3.1 Concept	17	4.1.3 Green economic opportunities	39	7. Statistical Tables	83
1. Introduction	1	2.3.2 Data preparation	17	4.1.4 Social inclusion	40	7.1 Normalized scores for the green growth indicators	84
1.1 About the Green Growth Index	2	2.3.3 Data analysis	18	4.2 Data availability	34	7.2 Aggregated scores for pillars, dimensions, and Green Growth Index	86
1.2 Purpose for developing the Index	3	3. Green Growth in Ghana	21	4.2.1 Green growth indicators and proxy variables	51	Annexes	87
1.3 Structure of the report	4	3.1 Green Growth contexts	22	4.2.2 Robustness check	56	Annex 1 Results of the first online survey with national experts	88
		3.1.1 Economy	22	5. Ghana's Green Growth Index	57	Annex 2 Results of Mentimeter votes from first participatory workshop	103
		3.1.2 Society	23	5.1 Overall green growth performance	58	Annex 3 Results of the second online survey with international experts	117
		3.1.3 Environment	24	5.1.1 Distance to sustainability targets	58	Annex 4 List of the Ghana experts	121
		3.2 Ghana institutional frameworks	24	5.1.2 Performance dashboards	59	Annex 5 List of reviewers	123
		3.2.1 National Policies and Plans	24	5.1.3 Green growth trends	60	Annex 6 GGGI/GGPM Team	124
		3.2.2 Sectoral Programs	26	5.2 Green growth indicators	62	Notes and references	125
		3.2.3 Development priorities	28	5.2.1 Efficient and sustainable resource use	62		
		3.3.1 Natural resource management	29	5.2.2 Natural capital protection	66		
		3.3.2 Energy, industrial and infrastructural development	29	5.2.3 Green economic opportunities	70		
		3.3.3 Disaster preparedness and response	29	5.2.4 Social inclusion	73		
		3.3.4 Agriculture and food security	30	5.2 Green growth indicators	77		
		3.3.5 Equitable social development	30				



Figures



Tables

Figure 1	Framework for the Green Growth Index	2	Figure 12	Stepwise approach to develop the Ghana Green Growth Index	16
Figure 2	Selected photos of the participants during the first (top) and second (bottom) participatory workshops	7	Figure 13	Conceptualization of green growth	22
Figure 3	Design process for the Ghana Green Growth Index	7	Figure 14	Data preparation of green growth indicators	22
Figure 4	Activity 1 (A1) – Webinar 1 on green growth framework	8	Figure 15	Results of the Monte Carlo analysis to check sensitivity of the Index scores	55
Figure 5	Activity 2 (A2) – Example of questions in the 1st Online survey on the green growth indicators	9	Figure 16	Data analysis of the green growth indicators	50
Figure 6	Activity 3 (A3) – Structure of activities during the 1st Participatory workshop survey	10	Figure 17	Distance to sustainability targets by pillar	58
Figure 7	Activity 4 (A4) – Dissemination of the Ghana Green Growth Index during the Global Green Growth Week	11	Figure 18	Performance dashboard by pillars	60
Figure 8	Activity 4 (A4) – Webinar 2 presentation of the preliminary Ghana Green Growth Index scores	12	Figure 19	Trend in the Green Growth Index in Ghana, 2010-2022	61
Figure 9	Activity 6 (A6) – Examples of questions to interpret the scores during the second participatory workshop (Ruben uploaded to folder, Activity 6 (A6) – Examples of questions to interpret the scores)	13	Figure 20	Trend in the green growth dimensions in Ghana, 2010-2022	61
Figure 10	Activity 6 (A6) – Sharing experience from Kenya Green Growth Index during the second participatory workshop	14	Figure 21	Scores for indicators in the efficient and sustainable resource use dimension	62
Figure 11	Activity 9 (A9) – Example of questions for the international experts in the second online survey	15	Figure 22	Scores for indicators in the natural capital protection dimension	66
			Figure 23	Scores for indicators in the green economic opportunities dimension	70
			Figure 24	Scores for indicators in the social inclusion dimension	74
			Figure 25	Results of the Monte Carlo analysis to check the sensitivity of the Green Growth Index scores	77

Table 1	Participants in the design process of the Ghana Green Growth Index	6	Table 6	Checklist for the green growth indicators in green economic opportunities	48
Table 2	Checklist for the green growth indicators in efficient and sustainable energy	18	Table 7	Checklist for the green growth indicators in social inclusion	49
Table 3	Green growth indicators selected by the Ghanaians participants for the Green Growth Index, by dimensions and pillars	35	Table 8	Data availability and sources of the green growth indicators	52
Table 4	Checklist for the green growth indicators in efficient and sustainable resource use	44	Table 9	Proxy variables for green growth indicators with insufficient data	56
Table 5	Checklist for the green growth indicators in natural capital protection	45	Table 10	Results of the regression analysis of pillar and dimension scores	78

Acronyms and Abbreviations

ACA	Academic institution	DMC	Domestic Material Consumption	HDI	Human Development Index	MDAs	Ministries, Departments and Agencies
ADB	Asian Development Bank	EEA	European Environment Agency	HIV	Human Immunodeficiency Virus	MEA	Multilateral Environmental Agreements
AFOLU	Agriculture, Forestry, and Other Land Use	EIA	U.S. Energy Information Administration	ICT	Information Communications Technology	MESTI	Ministry of Environment, Science, Technology & Innovation
AIDS	Acquired Immunodeficiency Syndrome	ESPA	Environnemental Services Providers Association	IEA	International Energy Agency	MF	Material Footprint
ASAL	Arid and Semi-Arid Lands	EV	Electric Vehicle	IHME	Institute for Health Metrics and Evaluation	MJ	Megajoule
BAU	Business-as-usual	FAO	Food and Agriculture Organization of the United Nations	ILO	The International Labour Organization	MITI	Climate Mitigation
BP	The British Petroleum Company plc	FAOSTAT	Food and Agriculture Organization Statistics	IMF	The International Monetary Fund	MLGDRD	Ministry of Local Government, Decentralization and Rural Development
CAID	Climate Action and Inclusive Development	FES	Friedrich-Ebert-Stiftung, Ghana office	INFR	sustainable infrastructure	MRH	Ministry of Roads and Highways, Accra
CAIT	Climate Analysis Indicators Tool	FSC	Forest Certification Organizations	IP	Investment Prospectus	MTAC	Ministry Of Tourism, Arts and Culture
CBD	Convention on Biological Diversity	FPMRA	Federation of Plastics Manufacturers Recyclers Association, Ghana	IQR	Interquartile Range	MSWR	Ministry of Sanitation and Water Resources
CSIR-STEPRI	Council For Scientific and Industrial Research- Science and Technology Policy Research Institute	GCP	Global Carbon Project	IRENA	International Renewable Energy Agency	MSWR-GASSLIP	Ministry of Sanitation and Water Resources
CEIA	Centre For Environmental Impact Analysis	GDP	Gross Domestic Product	ISO	International Organization for Standardization	MT	Metric ton
CWSA	Community Water & Sanitation Agency	GER	Gross Enrollment Ratio	IUCN	International Union for Conservation of Nature	MWSL	Medical Waste Services Limited
COVID-19	Coronavirus disease	GESIP	Green Economy Strategy and Implementation Plan	GCIC	Ghana Climate Innovation Centre	MWH	Ministry Of Works and Housing
CPF	Country Programme Framework	GEU	Green Economy Unit	GNCPC-EPA	Ghana National Cleaner Production Centre	MSW	Municipal Solid Waste
CW	ClimateWatch	GGGI	Global Green Growth Institute	GSA	Ghana Standards Authority	NBSAP	National Biodiversity Strategy and Action Plan
CH4	Methane	GGPM	Green Growth Performance Measurement	GSS	Ghana Statistical Service	NCCAP	National Climate Change Action Plan
CO2	Carbon Dioxide	GHG	Greenhouse Gas	GREDA	Ghana Real Estate Developers Association	NDCs	Nationally Determined Contributions
CO2eq	Carbon Dioxide equivalent	GOVT	Government	LCI	Lion Clubs International	NDCsP	National Council for Population and Development
DALY	Disability-Adjusted Life Year	GVC	Global Value Chains	KNUST	Kwame Nkrumah University of Science and Technology	NDPC	National Development Planning Commission

Acronyms and Abbreviations

NEMA	National Environment Management Authority	SDG	Sustainable Development Goals	UN	United Nations	UNODC	United Nations Office on Drugs and Crime
NGO	Non-government institution	SDG AU-OP	SDG Advisory Unit, Office of the President	UN-Habitat	United Nations Human Settlements Programme	UNSD	United Nations Statistics Division
N ₂ O	Nitrous Oxide	SDHUD	State Department of Housing and Urban Development	UNCTAD	United Nations Conference on Trade and Development	UNSTATS	United Nations Statistics Division
ODA	Official development assistance	SDIDE	State Department for ICT & Digital Economy	UNDP	United Nations Development Programme	USAID	United States Agency for International Development
OECD	Organization for Economic Co-operation and Development	SDT	State Department for Transport	UNEP	United Nations Environment Programme	USD	United States Dollar
PAP	Policy Action Plan	SEL	Stark Energy Ltd	UNEP-WCMC	UN Environment Programme World Conservation Monitoring Centre	USDA	United States Department of Agriculture
PM _{2.5}	Particulate matter with a diameter of less than 2.5 micrometers	SE4ALL	Sustainable Energy for All	UNESCO	United Nations Educational, Scientific and Cultural Organization	WB	World Bank
REDD	Reducing Emissions from Deforestation and forest Degradation	SOCI	Social Inclusion and Sustainable Livelihoods	UNFCCC	United Nations Framework Convention on Climate Change	WDPA	World Database on Protected Areas
RESI	Resilience building	STI	Science, Technology, and Innovation	UNICEF	United Nations International Children's Emergency Fund	WECFEL	World Energy Council's Future Energy Leaders
RESO	Resource efficiency	TB	Tuberculosis	UNIDO	United Nations Industrial Development Organization	WHO	World Health Organization
RVC	Regional Value Chains	TGE	Total Government Expenditure	UNISDR	United Nations Office for Disaster Risk Reduction	WIPO	World Intellectual Property Organization
R&D	Research and Development	UENR	University of Energy and Natural Resources			WTTC	World Travel and Tourism Council
SDBE	State Department for Blue Economy and Fisheries	UESD	University of Environment and Sustainable Development			ZGL	Zoomlion Ghana Limited
SDEP	State Department for Economic Planning	UHC	Universal Health Coverage				

1.1 About the Green Growth Index

The Global Green Growth Institute (GGGI) developed the Green Growth Index to provide its Members and Partners with a practical and explicit policy tool to measure their green growth performance and track their green growth transition. The Green Growth Index framework consists of four dimensions, including efficient and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion (Figure 1). It emphasizes that efficient and sustainable use of natural resources will produce more goods and services with fewer resources. This will, in turn, protect natural capital, including water, energy, land, and materials, as well as the ecosystem services they provide. A healthy ecosystem characterized by, for example, fertile soil, multifunctional forests, productive land and seas, good quality freshwater and clean air, and pollination increases economic productivity and creates new economic opportunities. The green growth framework also highlights the importance of protecting natural capital, which provides sources of economic growth such as green jobs, trade, and investment. Finally, social inclusion is considered a key mechanism to both the achievement and distribution of gains from green growth, where people are not only beneficiaries of economic growth but also contributors to creating economic opportunities. The Green Growth Index framework builds on GGGI's definition of green growth:

"...a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. It seeks opportunities for economic growth that are low-carbon and climate resilient, prevent or remediate pollution, maintain healthy and productive ecosystems, and create green jobs, reduce poverty and enhance social inclusion." (GGGI Refreshed Strategic Plan 2015-2020, (GGGI, 2017:p.12) ¹

The framework, underpinned by four sustainability concepts – low carbon economy, ecosystem health, inclusive growth, and resilient society,² guides the development of the Green Growth Index at the global, regional, and national levels. The Global Green Growth Indexⁱⁱ compares the performance of 157 countries in achieving sustainability targets of the Sustainable Development Goals (SDGs), the Paris Climate Agreement, and Aichi Biodiversity Targets. The 2023 Global Green Growth Index consists of 48 indicators selected and reviewed by experts worldwide starting in 2019. The Regional Green Growth Index emphasizes diversities in green growth performance while considering common economic, social, and environmental contexts within a region. Examples of the Green Growth Index at the regional level include the Green-Blue Growth Index for the OECS and the Green and Inclusive Green Growth for the Central Asian Countries. The National Green Growth Index supports the identification of green growth indicators relevant to the country's policy and planning, for example, guiding the development of national green growth strategies, enhancing the greenness of national development plans, and assessing SDG alignment of national and sectoral policies.

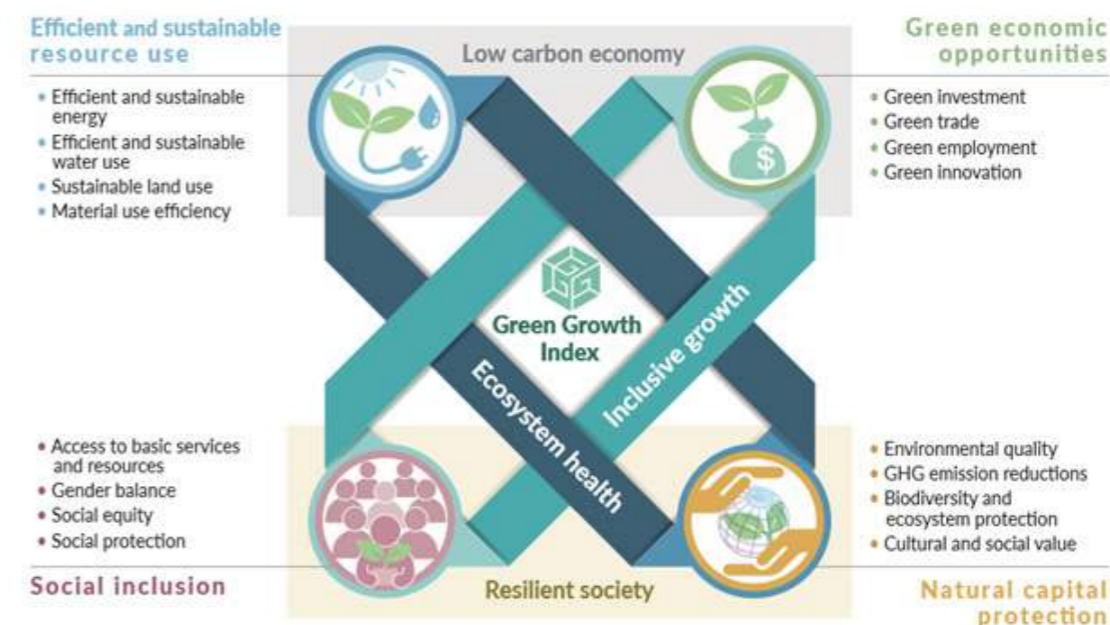
This technical report presents the design process and scores for Ghana's National Green Growth Index, developed through close collaboration between the Ministry of Environment, Science, Technology and Innovation (MESTI) and GGGI in 2023. The policy relevance of the green growth indicators is ensured through the participatory design process led by MESTI, and the robustness of the Green Growth Index scores is validated through the stepwise analytical approach through GGGI's technical support.



Introduction

1.1 About the Green Growth Index	2
1.2 Purpose for developing the Index	3
1.3 Structure of the report	4

Figure 1 Framework for the Green Growth Index



1.2 Purpose for Developing the Index

Ghana was amongst the world's ten fastest-growing economies in 2019, driven by growth in the mining and petroleum sectors and strong agricultural output. The COVID-19 outbreak, the March 2020 shutdown, and a dramatic decrease in commodities exports ended Ghana's fast development (7 percent per year in 2017-2019). The economic downturn significantly impacted households. According to estimates, the poverty rate climbed slightly in 2020, rising from 25 to 25.5 percent. Despite falling to 0.5 percent in 2020, the brisk agriculture and services sectors helped growth bounce back to 5.4 percent in 2021. The outlook remains positive, with projected GDP growth of 5.3 and 5.1 percent in 2022 and 2023 supported by the Ghana COVID-19 Alleviation and Revitalization. However, the impacts of climate change put Ghana's economic and human development at risk. Approximately 45,000 Ghanaians are affected by flooding annually on average, and the country's coastline is at risk of erosion and flooding due to rising sea levels. Inaction increases heat stress, reduces agricultural and worker production, and damages infrastructure from irregular rainfall patterns. Environmental degradation, water scarcity, and regional air pollution will also hamper human capital and productivity.

Ghana has developed several key policies and strategic documents to ensure climate resilience and integration of adaptation measures into all facets of national development planning, namely:

- National Climate Change Adaptation Strategy (NCCAS) to ensure a consistent, comprehensive, and targeted approach to increasing climate resilience and decreasing the vulnerability of the population, deepen awareness and sensitization for the general populace, particularly policymakers, about the critical role of adaptation in national development efforts, and position Ghana to draw funding for meeting its national adaptation needs, strengthen international recognition to facilitate action, and promote the mainstreaming of climate change and disaster risk reduction into national development.
- National Climate Change Policy (NCCP), 2013, to provide a clearly defined pathway for dealing with the challenges of climate change within the current socio-economic context of

Ghana and look ahead to the opportunities and benefits of a green economy. Four subject areas have been determined to address the adaptation challenges in Ghana, including disaster preparedness and response, agriculture and food security, natural resource management, energy and infrastructure, and natural resources management.

- Ghana National Climate Change Master Plan identified ten program areas for 2015-2020, including reducing greenhouse gas emissions and increasing carbon sinks. The other eight program areas are focused on adaptation and climate resilience.⁴
- Medium-Term Development Plan (MTDP), 2018-2021, focuses on various issues, including adaptation and mitigation priorities, and refers to Ghana's Nationally Determined Contribution (NDCs) targets.⁵ The National Development Planning Commission (NPDC) prepared the MTDP for the 2022-2025.

Ghana has revised its NDCs under the Paris Agreement (2020-2030), aiming to reduce emissions by 15-45 percent below business-as-usual (BAU) and strengthen climate resilience closely aligned with its development priorities. Twenty (20) mitigation and 11 adaptation actions in seven priority economic sectors have been committed for implementation in the next 10-year period (2020-2030). To update the NDCs in 2021-30, the government will need to spend 9.3 billion USD. Given its limited financial resources, the government is looking into more results-based climate funding options, including carbon markets, climate impact bonds, and leveraged private participation.

Ghana still needs to develop long-term contingency plans for dealing with climate change, as local managers tend to have an inadequate perception of the costs of dealing with such crises. Its low-carbon development strategy focuses on the period until 2030. Ghana wants to review progress towards meeting its NDCs in 2025; however, very few details about the modalities of this process are currently available. For this review to be effective, the country requires more technical support in tracking the NDCs progress and other climate goals, especially in aggregating the cumulative effects of individual mitigation actions.⁶

In this light, Ghana requested support from GGGI to develop its National Green Growth Strategy (NGGS). The National Green Growth Index for Ghana will guide the NGGS development by identifying its green growth priorities and measuring its performance in achieving sustainability targets for the four green growth dimensions: efficient

and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion. Through the Ghana Green Growth Index, the NGGS processes will aim to set the pace and tools needed to support the Government of Ghana in unlocking access to climate finance through developing pipelines of projects.

1.3 Structure of the Report

Chapter 1 introduces the Green Growth Index, briefly explains the purpose of developing the Index for Ghana, and presents the structure of this technical report.

Chapter 2 describes the detailed process for designing the Ghana Green Growth Index. First, it describes the national experts participating in the design process. Second, it discusses the participatory activities to capacitate the participants in identifying green growth indicators most relevant to Ghana's economic, social, and economic contexts and interpreting the challenges and opportunities for green growth transition based on the Index scores. Moreover, the participants' roles and the purpose of the various activities are explained. Finally, the chapter presents the stepwise analytical approach complementing the participatory process.

Chapter 3 discusses Ghana's contexts, policies, and priorities for green growth. The contexts include social, economic, and environmental issues that pose policy challenges and create economic and societal opportunities during the green growth transition. The chapter introduces the national policies and sectoral programs supporting Ghana's green growth. Finally, the five development priorities emphasized in Ghana's National Climate Change Policy (2013) are briefly discussed in this chapter. These priorities include agriculture and food security, disaster preparedness and response, natural resource management, equitable social development, and energy, industrial and infrastructural development. The chapter corresponds to Step 1 of the analytical approach presented in Chapter 2.

Chapter 4 presents the 80 green growth indicators selected by the national experts from the participatory process for designing the Ghana Green Growth Index. Using checklist tables, the chapter

identifies the links of the indicators to the issues being addressed in national policies and sectoral programs and their relevance to the development priorities. The significance of the indicators to the SDGs and Global Green Growth Index is also discussed in this chapter. The computation of the Green Growth Index involves benchmarking against sustainability targets. This chapter introduces the sustainability targets used for each green growth indicator. Finally, proxy variables, which temporarily replaced indicators with insufficient data, are presented in this chapter. The chapter corresponds to Step 2 of the analytical approach presented in Chapter 2.

Chapter 5 presents the scores for the Ghana Green Growth Index. First, it discusses the overall green growth performance at the pillar and dimension levels of the Index by looking at the distance to sustainability targets and performance dashboards. The trend in green growth performance at these levels of score aggregation is also presented for the period 2010-2022. Second, the chapter presents the scores for the 80 green growth indicators and discusses the challenges and opportunities identified by the participants in improving performance in these indicators. It also discusses how different national and sectoral policies could further enhance the performance of the green growth indicators. Third, the chapter briefly presents the results of the Monte Carlo analysis to validate the scores and check the robustness of the Ghana Green Growth Index. The chapter corresponds to Step 3 of the analytical approach presented in Chapter 2.

Chapter 6 provides the summary and conclusions of the report for the following topics: (i) challenges and opportunities for green growth transition based on the discussion in Chapter 5, (ii) policy recommendations based on the national experts' assessments of the challenges and opportunities, (iii) next steps to improve and update the green growth indicators in the Ghana Green Growth Index in the following years.

Chapter 7 presents the normalized scores for the 80 green growth indicators and aggregated scores for pillars, dimensions, and the Green Growth Index from 2011 to 2022. The former scores were computed from the normalization and benchmarking methods, and the latter from aggregating the normalized and benchmarked scores of the green growth indicators.



2.1 The National Experts

The Ghana Green Growth Index project kicked off on the 11th of May 2023 with the meeting between GGGI and MESTI, during which the latter institution agreed to take over the critical role of selecting and mobilizing the national experts to participate in various activities for the design process. Thirty-nine (39) experts from 30 institutions in Ghana actively participated in webinars, online surveys, participatory workshops, and targeted consultations, leading to the selection of the

80 most policy-relevant green growth indicators. The participatory activities ensured that experts' capacities were built, and their expertise contributed to developing the Ghana Green Growth Index. Table 1 lists the national experts from 14 government agencies, 13 non-governmental and private organizations, and 3 academic institutions. They represent interdisciplinary expertise covering the four green growth dimensions – efficient and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion.

Table 1 Participants in the design process of the Ghana Green Growth Index

Ministries/Institutions	Sector	Number of participants	Number of activities participated
Ministry of Environment, Science, Technology & Innovation (MESTI)	GOV	4	5
SDG Advisory Unit, Office of the President (SDGAU-OP)	GOV	1	2
National Development Planning Commission (NDPC)	GOV	2	5
Ministry of Sanitation and Water Resources (MSWR-GASSLIP)	GOV	1	1
Ministry of Sanitation and Water Resources (MSWR)	GOV	1	3
Ghana National Cleaner Production Centre (GNPCPC-EPA)	GOV	2	4
Ministry Of Works and Housing (MWH)	GOV	1	3
Ghana Standards Authority (GSA)	GOV	1	3
Ministry Of Tourism, Arts and Culture (MTAC)	GOV	1	3
Council For Scientific and Industrial Research- Science and Technology Policy Research Institute (CSIR-STEPRI)	GOV	2	2
Community Water & Sanitation Agency (CWSA)	GOV	1	2
Ministry of Roads and Highways, Accra (MRH)	GOV	1	4
Ministry of Local Government, Decentralization and Rural Development (MLGDRD)	GOV	1	4
Ghana Statistical Service (GSS)	GOV	1	2
Centre For Environmental Impact Analysis (CEIA)	NGO	1	5
Ghana Climate Innovation Centre (GCIC)	NGO	3	4
Lion Clubs International (LCI)	NGO	1	2
Friedrich-Ebert-Stiftung, Ghana office (FES)	NGO	1	4
Environnemental Services Providers Association (ESPA)	NGO	1	2
World Energy Council's Future Energy Leaders (WECFEL)	NGO	1	5
A Rocha Ghana	NGO	1	4
Federation of Plastics Manufacturers Recyclers Association, Ghana (FPMRA)	NGO	1	2
Kwame Nkrumah University of Science and Technology (KNUST)	ACA	1	1
University of Energy and Natural Resources (UENR)	ACA	1	3
University of Environment and Sustainable Development (UESD)	ACA	1	1
Africa Environmental Sanitation Consult (AESC)	PRI	1	5
Stark Energy Ltd (SEL)	PRI	1	5
Medical Waste Services Limited (MWSL-Jospong Group)	PRI	1	5
Ghana Real Estate Developers Association (GREDA)	PRI	2	4
Zoomlion Ghana Limited (ZGL)	PRI	1	2
Total	30	39	

Note: GOVT – government, NGO – non-government, and ACA – academic institutions. The activities are described in section 2.2 Participatory Activities.

2

Design process

2.1	The National Experts	6
2.2	Participatory Activities	7
2.3	Stepwise Analytical Approach	15
2.3.1	Concept	17
2.3.2	Data preparation	17



2.2 Participatory Activities

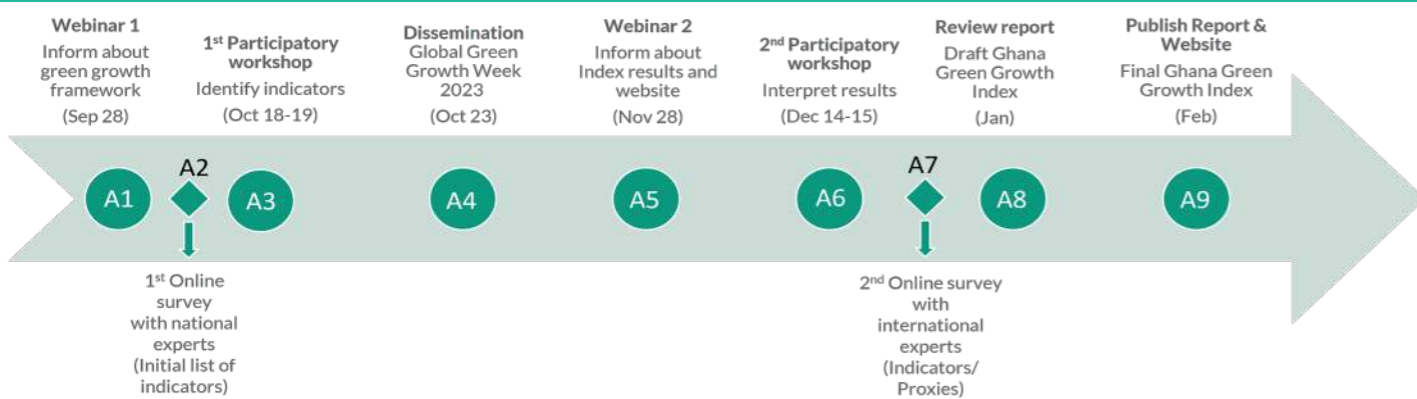
The process for developing the Ghana Green Growth Index followed systematic and participatory approaches, facilitating the capacity building of the national experts (Figure 2). The approach is systematic, with the output from each activity feeds in as input into the following activity, and participatory, with the national experts not only receiving but also sharing knowledge for developing the Index. Throughout the design process, the national experts discussed, suggested, and selected the indicators that are policy

relevant and the GGGI provided technical support and expertise on developing the Green Growth Index (see section 2.3). The participatory activities combined different forms and mediums to allow interactive participation with and among the national experts, including webinars, workshops, online surveys, targeted consultations, and dissemination (e.g., global conference). Figure 3 shows the chronology of the ten participatory activities to develop the Ghana Green Growth Index from August 2023 to January 2024. The participatory activities were complemented by the technical support of GGGI's Green Growth Performance Measurement (GGPM) team, which is described in section 2.3. Details on each participatory activity are discussed below.

Figure 2 Selected photos of the participants during the first (top) and second (bottom) participatory workshops



Figure 3 Design process for the Ghana Green Growth Index



Activity 1 (A1) – Webinar 1 on green growth framework

Objective: Inform the participants about the concepts and applications of the Green Growth Index.

Output: Created knowledge among participants on the different green growth indicators for the dimensions and pillars of the Green Growth Index, enabling them to respond to the questions in the 1st online survey.

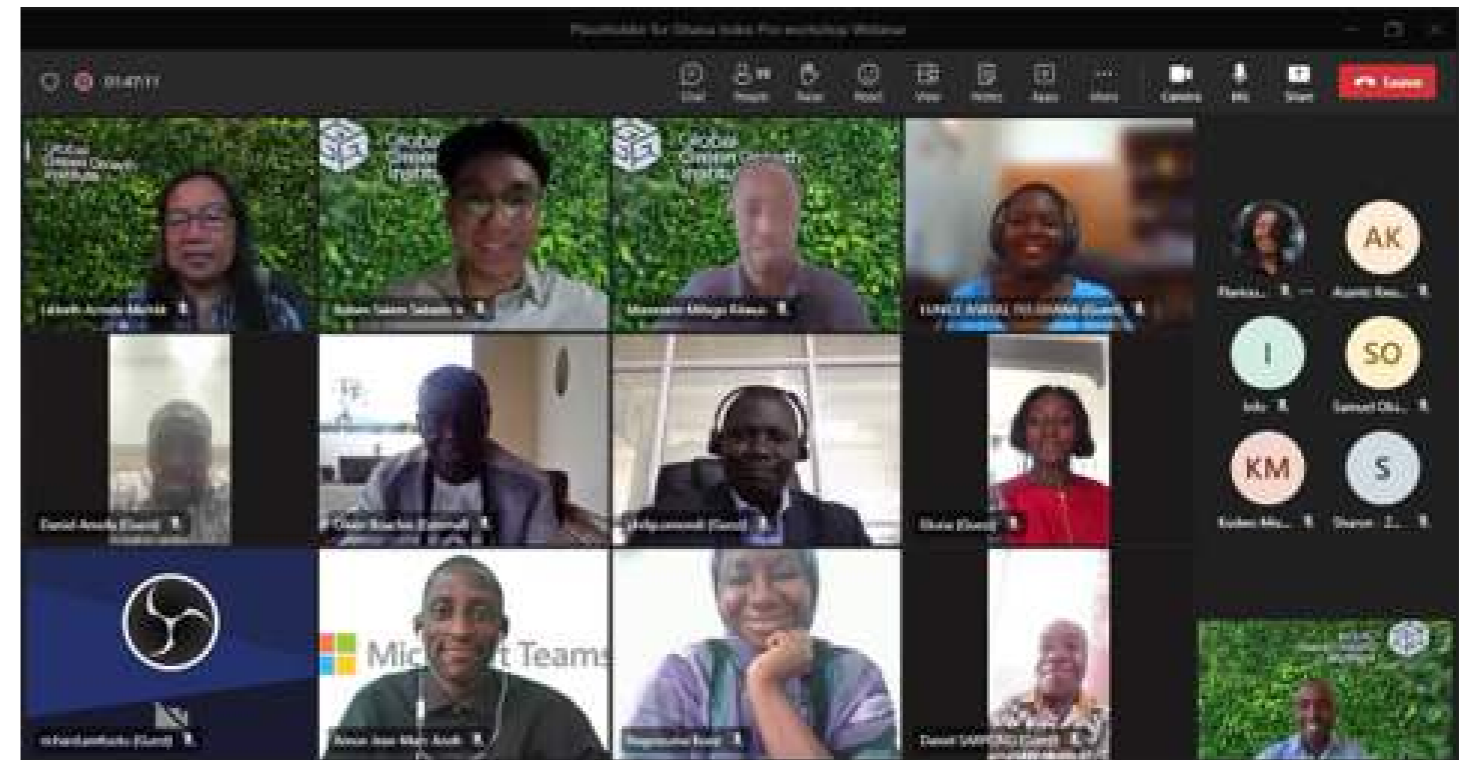
Highlights: MESTI appreciated the usefulness of the Ghana Green Growth Index in guiding the development of Ghana's National Green Growth Strategy.

The webinar on the green growth framework was held in Accra on September 28, 2023 (Figure 3). The GGPM team presented the framework for the Green Growth Index (Figure 4). Dr. Lilibeth Acosta, Program Manager for GGGI's Green Growth Performance Measurement, emphasized the framework's usefulness in selecting

green growth indicators for the Ghana Green Growth Index. Each of the four dimensions of the Green Growth Index consists of four

sustainability pillars, which support the transition to green growth. During the first participatory workshop, national experts will select five green growth indicators for each pillar.

Figure 4 Activity 1 (A1) – Webinar 1 on green growth framework



Dr. Lilibeth Acosta, Program Manager for GGGI's Green Growth Performance Measurement presenting the concept and applications of the Green Growth Index to the national experts during Webinar 1 on the 28th September 2023.

Activity 2 (A2) – First online survey on the green growth indicators

Objectives: (i) Familiarize the national experts with the potential indicators for the different green growth dimensions; (ii) Build their capacity to assess the policy relevance of the green growth indicators to Ghana's economic, social, and environmental contexts; and (iii) Train them on how to use the online survey form which will be used during 1st participatory workshop.

Output: Created knowledge among participants on the policy relevance of the green growth indicators, which was necessary for the discussion during the 1st participatory workshop and selection of indicators for the Ghana Green Growth Index.

Highlights: Out of more than 200 potential green growth indicators, the national experts selected the 80 most policy-relevant indicators for the Ghana Green Growth Index. Twenty-six (26) experts participated in the online survey, and the results of their ratings are presented in Annex 1.

The first online survey was conducted from September 28 to October 17, 2023. The survey consisted of a semi-structured questionnaire suggesting five potential green growth indicators and other alternative indicators for each pillar, which the participants rated according to the policy relevance to Ghana's economic, social, and environmental contexts (Figure 5). The ratings are very high, high, moderate, low, very low, and not relevant. The participants provided ratings based on their fields of expertise and/or expert judgments. They were asked to explain the ratings they gave to the green growth indicators in each pillar. If the participants gave a very low or not relevant rating, they were asked to suggest alternative indicators and provide information on the data sources. The alternative indicators can come from the survey's list or the participants' knowledge.

The GGPM team identified the green growth indicators presented in the first online survey by assessing Ghana's policy frameworks and development priorities discussed in Chapter 3. Based on this assessment, the team created checklist criteria to determine the policy relevance of the suggested green growth indicators. The criteria are described in section 2.3.2. The GGPM team also checked the suggested indicators' online sources and data availability. When the data were unavailable online, the participants were requested to propose possible data sources from national databases or statistics.

Figure 5 Activity 2 (A2) – Example of questions in the 1st Online survey on the green growth indicators

Ghana National Green Growth Index

Rate initial 5 indicators for efficient and sustainable energy (EE)

EE1: rate the indicator on energy efficiency
Please rate the policy relevance of the first indicator for efficient and sustainable energy below. Should you rate it "Very low" or "Not relevant", please (i) explain the reason for this rating and (ii) suggest an alternative indicator in the next page.

EE1. Ratio of total primary energy supply to GDP, or energy intensity level of primary energy [UNSTATS, IEA] (2000-2020) *
Definition: Energy intensity is the energy provided to the economy to create a unit of economic output.

Very High
 High
 Moderate
 Low
 Very Low
 Not relevant

EE1: suggest new indicator on energy efficiency

Kindly provide a reason for saying that the indicator has "Very low" or "Not relevant" rating *

Since you have answered "Very low" or "Not relevant", kindly provide an indicator to replace it *

- Energy intensity of the industry sector [World Bank, IEA] (1960-2021)
- Number of energy efficient technology developed (To check for local data)
- Number of energy efficient and conservation programmes implemented (To check for local data)
- Proportion of businesses using green/ sustainable energy initiatives (To check for local data)
- Other: _____

In cases where the indicator you selected have "No data" or "To check for local data", do you know the responsible institution/ source that is publishing the data? *

Yes
 No

Activity 3(A3) –First participatory workshop

Objectives: (i) Allow national experts to discuss with each other the policy relevance of the green growth indicators and (ii) Allow them to rate and vote on the green growth indicators with the highest policy relevance to Ghana's economic, social, and environmental contexts.

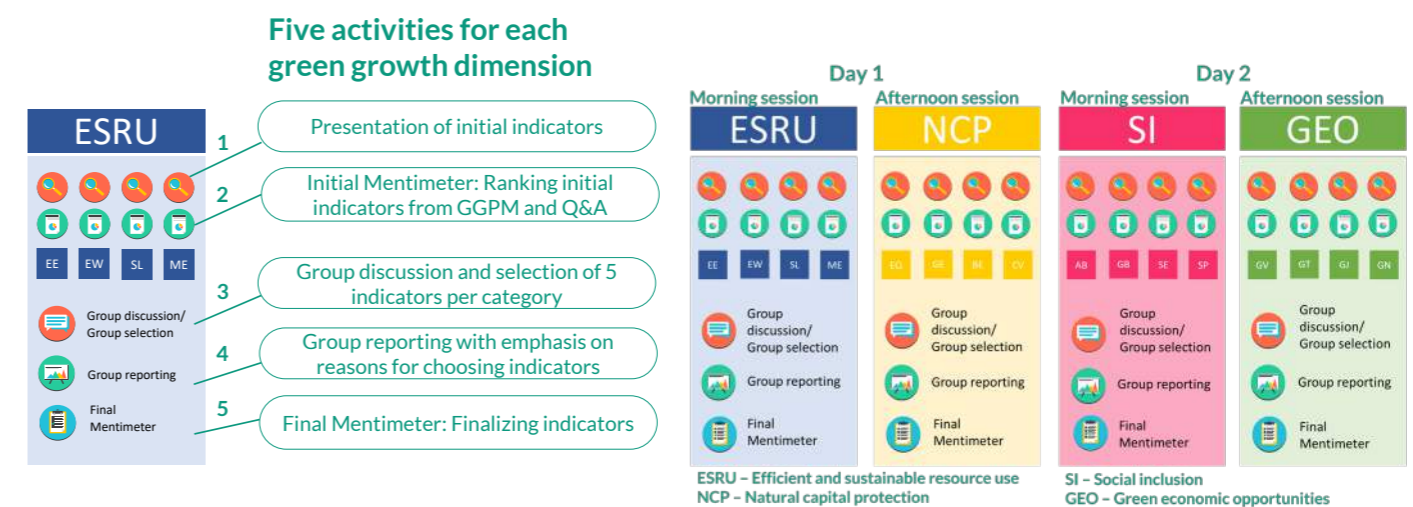
Output: Selected 80 green growth indicators to be included in the Ghana Green Growth Index.

Highlights: The list of 80 green growth indicators was finalized based on the group ratings during the breakout sessions (results are in Annex 1) and the Mentimeter votings during the plenary sessions (results are in Annex 2).

The first participatory workshop was conducted in Accra on October 18-19, 2023. The workshop allowed national experts to discuss together the green growth indicators, which they individually rated in the 1st online survey. It provided well-structured activities to enable them to rate and vote on the green growth indicators before and after the breakout sessions, during which they discussed the policy relevance of the indicators in each dimension (Figure 6). For example, for the efficient and sustainable resource use (ESRU) dimension, the first activity was the GGPM team's presentation of

the five indicators for each pillar; the second activity was the initial individual voting on the indicators for each pillar using Mentimeter software; the third activity allowed the participants to join one of the three breakout groups to discuss the relevance of the indicators and provide agreed ratings using the online survey form; the fourth activity was a reporting from each breakout group on the reasons for the votes given to the indicators; and the fifth activity was final voting on the indicators for each pillar using Mentimeter software. The same structure was followed for all other green growth dimensions.

Figure 6 Activity 3 (A3) – Structure of activities during the 1st Participatory workshop survey



Activity 4 (A4) – Dissemination during the Global Green Growth Week 2023

Objectives: (i) Create awareness of the collaborative project between MESTI and GGGI to develop the Ghana Green Growth Index; (ii) Train government officers who are participating in the development of the Index to disseminate it to the experts globally; and (iii) Inform international organizations on the application of the Global Green Growth Index at the national level.

Output: Dissemination of the Ghana Green Growth Index during the Global Green Growth Week 2023.

Highlights: The session garnered one of the highest numbers of attendees (106) and livestreamed views (175) in this global conference.

The Ghana Green Growth Index was presented in the session on Green Growth Index - A Policy Tool to Mainstream Green Growth Indicators in Planning Process and Capacity-Building during the Global Green Growth Week, held virtually on October 23-27, 2023 (Figure 7). Dr. Malle Fofana, GGGI's Director and Head of Programs in Africa, gave the welcome remarks, and Dr. Lei Lei Song, Director of Economic Analysis and Operational Support Division at the Asian Development Bank (ADB), gave the opening remarks for this session on October 23, 2023. Dr. Lilibeth Acosta, Deputy Director and GGPM Program Manager at GGGI presented an overview of concepts and applications in Asia and Africa and a comparison of the green growth performance in Azerbaijan and Central Asian countries. Mr. Oliver Boachie, Senior Advisor to the Minister at

MESTI, presented the Ghana Green Growth Index. Mr. Philip Omondi presented the Kenya Green Growth Index on behalf of Mr. Peter Odhengo, Head of Climate, Finance and Green Economy Unit at the National Treasury and Economic Planning. Other National Green Growth Index presentations were given for Ghana and Lao PDR. Mr. Bounma Thor, Program Officer in GGGI Lao PDR Country Office, presented the Lao PDR Green Growth Index on behalf of Ms. Sisavanh Didaravong, Deputy Director General, DRI, Ministry of Planning and Investment. Dr. Aimee Hampel-Milagrosa, Urban Development Specialist in the ADB's Water Supply and Urban Development Sector Group, moderated the presentations during the session. The presentations create awareness among global audiences about the value of the Green Growth Index in tracking performance in the green growth transition.

Other speakers and panelists in the session included the following:

Dr. Lei Lei Song, Director, Economic Analysis and Operational Support Division, ADB Philippines

Mr. Rowan Fraser, Program Officer, Laos Country Program, Lao PDR

Ms. Nagnouma Kone, Senior Regional Business Development Officer, Africa, Côte D'Ivoire

Dr. Sang In Kang, Chief Research Fellow, Korea Environment Institute, Republic of Korea

Dr. Al-Hamndou Dorsouma, Manager, Climate and Green Growth, African Development Bank (AfDB), Côte d'Ivoire

Figure 7 Activity 4 (A4) – Dissemination of the Ghana Green Growth Index during the Global Green Growth Week 2023 (continue)



Mr. Oliver Boachie, Senior Advisor to the Minister at MESTI, presenting the Ghana Green Growth Index.

Activity 5 (A5) – Webinar 2 presentation of the Ghana Green Growth Index website

Objectives: (i) Present the preliminary results of the Ghana Green Growth Index on the interactive website, and (ii) Train the national experts to navigate the website and interpret the scores in preparation for the second participatory workshop.

Output: Ghana Green Growth Index results were presented on an interactive website.

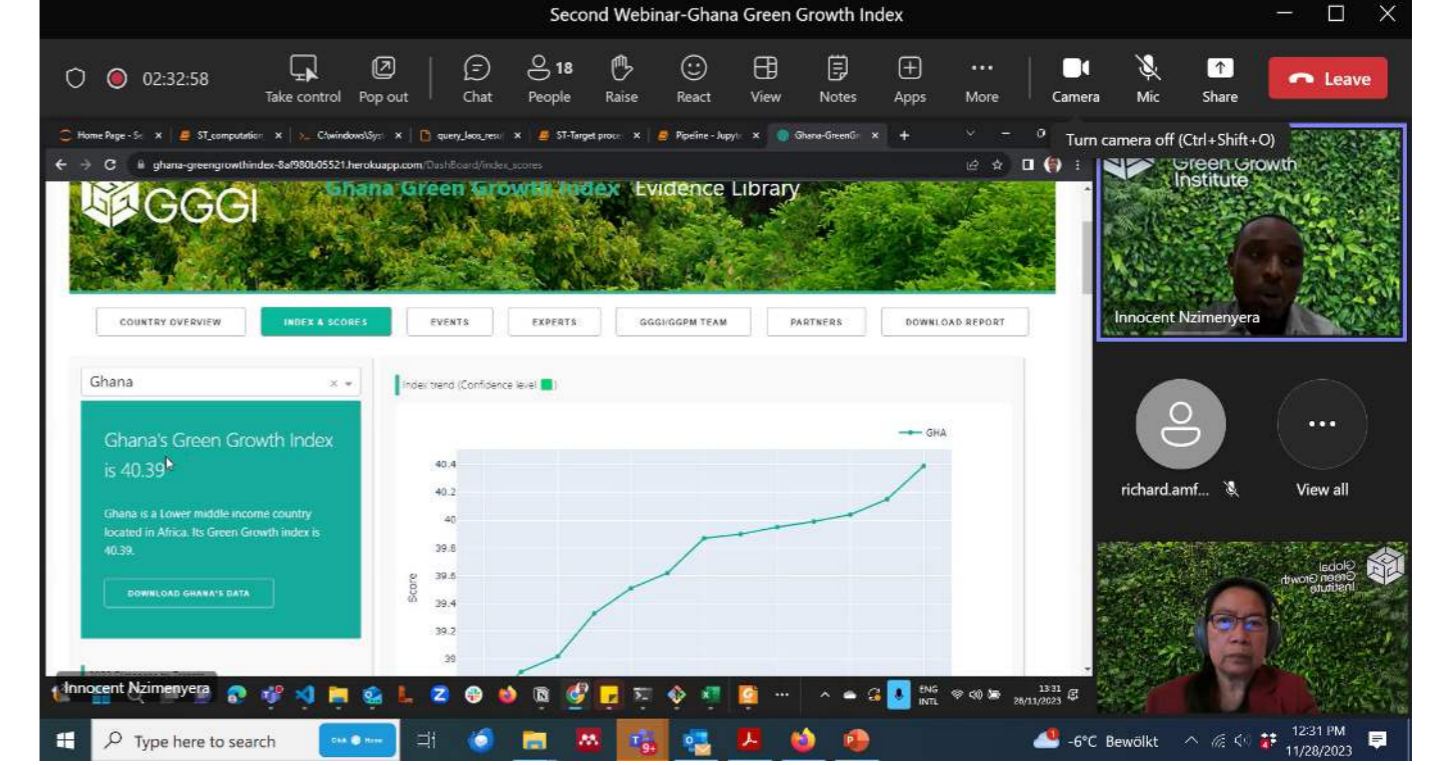
Highlights: The national experts validated the interactive website for the Ghana Green Growth Index.

Webinar 2 was conducted on November 28, 2023, allowing the national experts to access the preliminary scores of the Ghana Green Growth Index from the website (Figure 8). Because the indicators are benchmarked against sustainability targets, the scores measure Ghana's performance in achieving these targets. There are three possible sources of sustainability targets: (1) SDG targets in the case of SDG indicators, (2) national targets for indicators from national databases, and (3) average values of the top 5 performing developing countries for indicators without targets.

Figure 7 Activity 4 (A4) – Dissemination of the Ghana Green Growth Index during the Global Green Growth Week 2023



Figure 8 Activity 5 (A5) – Webinar 2 presentation of the preliminary Ghana Green Growth Index scores



Mr. Innocent Nzimenyera presenting the preliminary Green Growth Index scores during the Webinar 2 on November 28, 2023.

Activity 6 (A6) – Second participatory workshop

Objectives: (i) Allow the national experts to discuss with each other the challenges and opportunities for green growth transition based on the Index scores; and (ii) Build their capacity to interpret the scores of the Ghana Green Growth Index.

Output: (i) Access to the website on the final scores of the Ghana Green Growth Index and (ii) national experts' assessments of the challenges and opportunities in the country's green growth transition.

Highlights: The discussions during the breakout sessions allowed the national experts to contribute to this report's analysis of the Green Growth Index scores. An expert shared experience on the design process of the Ghana Green Growth Index in 2023.

The second participatory workshop was conducted in Accra on December 14-15, 2023, allowing the participants to discuss and interpret the final scores in the Ghana Green Growth Index. It

followed a similar structure as in the first participatory workshop (Figure 6) wherein (1) GGGI presented the Index scores for each pillar in each dimension; (2) participants provided initial votes on green growth pillars that could enhance Ghana's green growth performance; (3) breakout groups discussed the challenges and opportunities to enhance green growth performance based on the Index scores; (4) breakout groups reported on the results of their discussions; and (5) participants provided final votes on green growth pillars. Figure 9 shows examples of questions the participants had to answer during the breakout sessions. The participants discussed and responded to the same questions for all pillars in the three breakout groups. Moreover, during the second participatory workshop on December 15, 2023, Mr. Philip Omondi, speaking on behalf of Mr. Peter Odhengo, Head of the Climate Finance & Green Economy Unit from the National Treasury and Economic Planning, gave an online presentation on Kenya's Green Growth Index, sharing experiences with the national experts on the design process in Ghana in 2023 (Figure 10). Mr. Peter Odhengo led the 54 national experts from 24 institutions who participated in developing the Green Growth Index, which informed the development of green project pipelines for Kenya.

Figure 9 Activity 6 (A6) – Examples of questions to interpret the scores during the second participatory workshop

Analysis of indicator scores for efficient and sustainable energy (EE)

Based on the Index scores, how will you rate the opportunities for improving Ghana's green growth performance in efficient and sustainable energy? *

Very High
 High
 Moderate
 Low
 Very Low

Please explain the rating you have given to the indicator category. *

Your answer _____

Analysis of the indicator scores for efficient and sustainable energy (EE)

Based on the Index scores, which of the five indicators for EE provides the best opportunity to improve Ghana's green growth performance? *

Note: Please choose only 1-2 indicators

EE1 - Ratio of total primary energy supply to GDP (Energy intensity)
 EE2 - Share of renewable to total final energy consumption
 EE3 - Logistics performance index: Quality of trade and transport-related infrastructure
 EE4 - Electricity generation from renewables
 EE5 - Electric power transmission and distribution losses

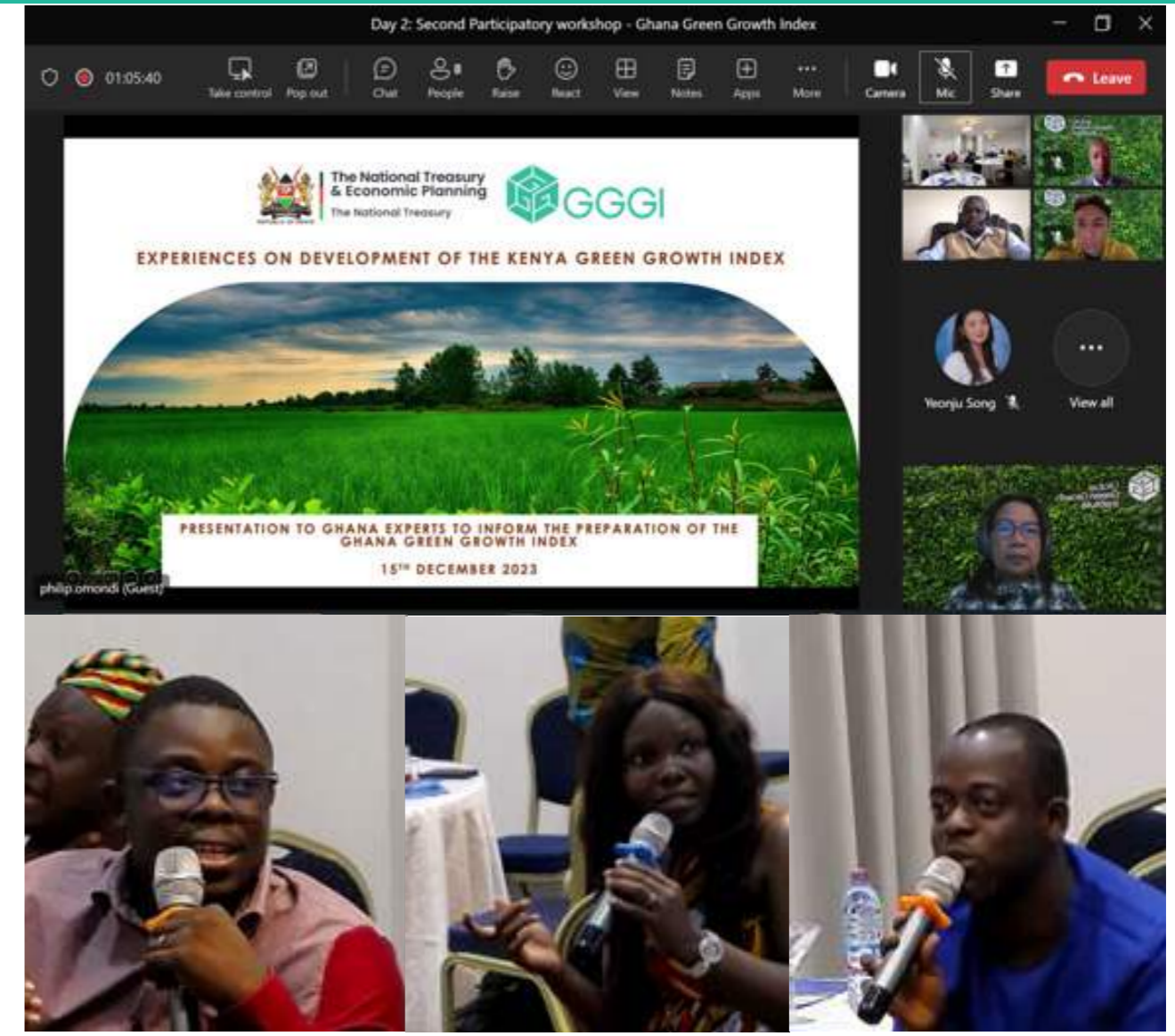
Please explain the reason for choosing the indicator(s). *

Your answer _____

What are the challenges to further improving the Index scores for the chosen indicator(s)? Challenges can include policy priorities, implementation and management, financing, public acceptability, resource constraints, cultural values, etc. You can also provide specific examples on these challenges. *

Your answer _____

Figure 10 AActivity 6 (A6) – Sharing experience from Kenya Green Growth Index during the second participatory workshop



Mr. Philip Omondi presenting on behalf of Mr. Peter Odhengo, Head of the Climate Finance & Green Economy Unit from the Kenya National Treasury and Economic Planning the Kenya Green Growth Index and sharing experience on its design process to the Ghanaian national experts.

Activity 7 (A7) – Second online survey

Objectives: (i) Inform the international experts on the first application of the Green Growth Index at the national level and (ii) Collect feedback on the policy relevance of the indicators selected by the national experts for the Ghana Green Growth Index.

Output: International experts' ratings on the relevance of the indicators to policy decision-making and development contexts in Ghana or, in general, African countries.

The second online survey was conducted in December 2023. It consisted of a semi-structured questionnaire for the international experts to review the relevance of the green growth indicators to policy decision-making and development contexts in Ghana or, in general, African countries. Since 2019, at least 100 experts have

been participating worldwide in the annual review of the green growth indicators in the Global Green Growth Index reports. The GGPM team continues to review the indicators and update the index to replace proxy variables with SDG indicators when their data availability improves. Because the Ghana Green Growth Index was featured in the 2023 Global Green Growth Index report, international experts were also requested to review the indicators in the former. The GGPM team designed the survey with an "adaptive" questionnaire so that the international experts could only provide feedback on the indicators in their field(s) of expertise (Figure 11). The feedback from the international experts would help update the Ghana Green Growth Index next year and assess green growth indicators to be considered in the National Green Growth Strategy. Overall, the online survey results show that the international experts agree with the green growth indicators selected for the Ghana Green Growth Index (Annex 3).

Figure 11 Activity 7 (A7) – Example of questions for the international experts in the second online survey

PART 2 Efficient and sustainable resource use (ESRU) - energy

The first category in the ESRU dimension is efficient and sustainable energy, which refers to delivering more services or products per unit of energy used and meeting present needs by using renewable sources to ensure sustainability of energy for future use (IRENA & C2E2, 2015; Kutscher, Milford, & Keith, 2018).

Is energy your field of expertise? Or, do you have knowledge on energy efficiency? *

Yes
 No

Efficient and sustainable energy (EE)

Below are the five indicators selected by the government experts for this category. In addition to the units of measurement, information is provided whether it is an SDG indicator. You will find at the bottom of the page the ratings provided by the Ghana government experts on these indicators.

EE1 - Energy intensity level of primary energy (Mj per constant 2017 PPP GDP), SDG indicator
EE2 - Renewable energy share in the total final energy consumption (Percent), SDG indicator
EE3 - Logistics Performance Index: Quality of trade and transport-related infrastructure (Score)
EE4 - Electricity generation from renewables (Terawatt-hours)
EE5 - Electric power transmission and distribution losses (Percent of output)

Please rate the indicators described above based on their relevance to policy decision-making and development contexts in Ghana or, in general, African countries. *

	Very high	High	Moderate	Low	Very low	Not relevant
EE1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EE2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EE3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EE4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EE5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If your answer to one of the indicators is "Not relevant" or "Very low", please provide a brief explanation.

Your answer

Activities 8-9 (A8-9) – Review and publication of the Ghana Green Growth Index

Objectives: (i) Inform the national experts of the contents of the Ghana Green Growth Index; and (ii) Allow them to review the 2023 Ghana Green Growth Index report before its publication.

Output: The first version of the Green Growth Index published on the Ghana Green Growth Index website: <https://ghana-greengrowthindex-8af980b05521.herokuapp.com/>

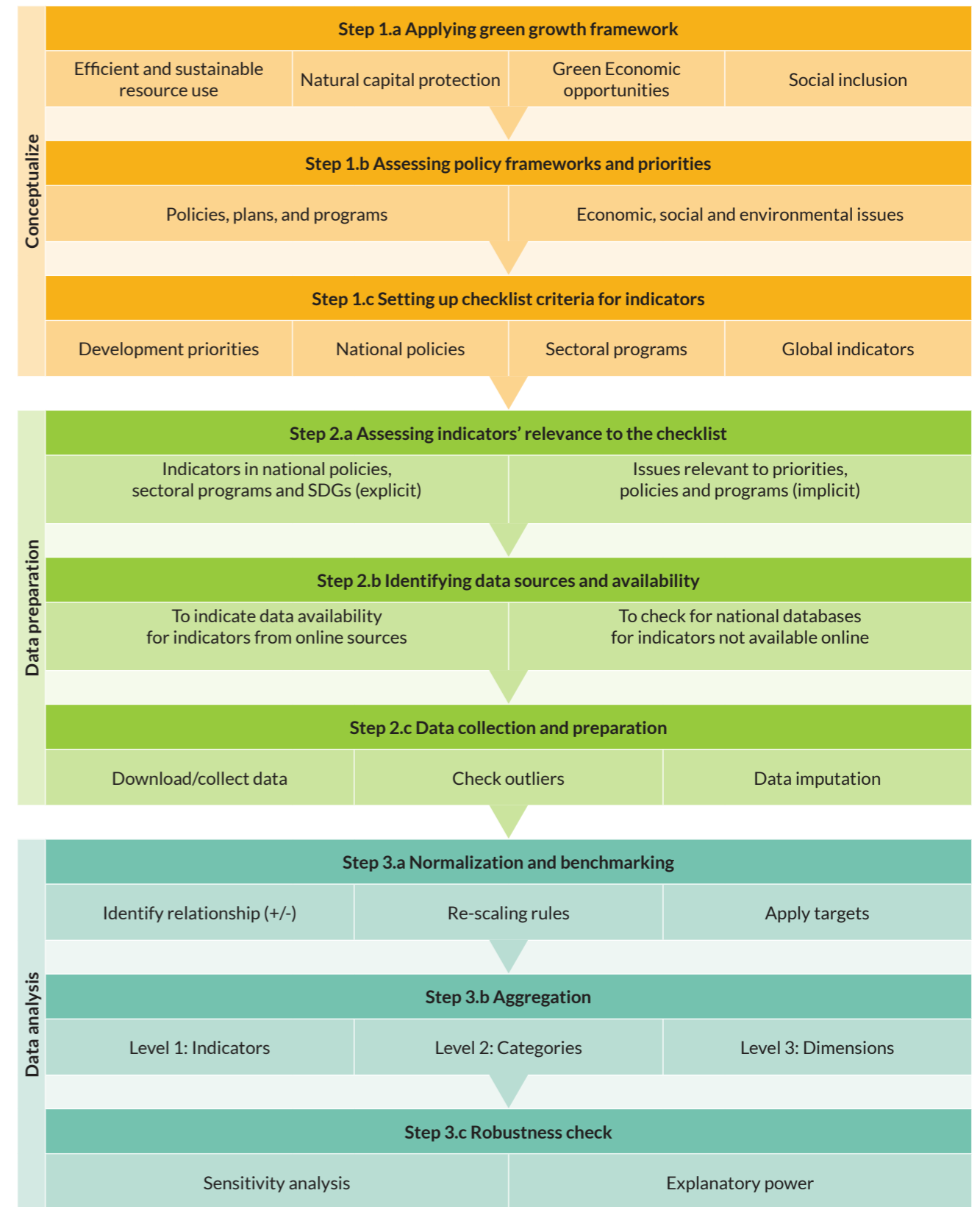
The last activity before the publication of the Ghana Green Growth Index report was the national experts' review of the draft report in January 2024. The comments and suggestions were considered in the published version of the report.

2.3 Stepwise Analytical Approach

The methods applied in the report have three components – concept, data preparation, and data analysis (Figure 12). Each component consists of three steps, which are described below.

The steps for the concept include applying the framework (Step 1.a), assessing policy frameworks and priorities (Step 1.b), and setting up checklist criteria for the indicators (Step 1.c). In Step 1.a, the framework for the Green Growth Index, discussed in Chapter 1 (Figure 1), was applied to guide the selection of the indicators and to organize the indicator selection systematically. In Step 1.b, policy frameworks and priorities in Ghana were identified by assessing policy documents, sectoral programs, and relevant literature. The assessment results, providing useful knowledge to form the criteria for the next step, are presented in Chapter 3. In Step 1.c, the checklist criteria were set up to guide the selection of the green growth indicators.

Figure 12 Stepwise approach to develop the Ghana Green Growth Index



The steps for the data preparation include assessing indicators' relevance to the checklist (Step 2.a), identifying data sources and availability (Step 2.b), and collecting and preparing data (Step 2.c). Step 2.a dealt with assessing the green growth indicators, whether directly or indirectly linked to the checklist criteria. The assessment results are presented in Chapter 4. Step 2.b focused on finding data for the green growth indicators previously identified in Step 1. The results on the inventory of data sources and availability are presented in Chapter 4. Step 2.c is essential before the data analysis because checking for outliers ensures that data is accurate, and imputing data corrects for data gaps. Inaccuracy and gaps in data will affect the aggregated scores of the indicators.

The steps for the data analysis include normalization and benchmarking of data (Step 3.a), aggregation of normalized indicators (Step 3.b), and robustness check of the scores (Step 3.c). In Step 3.a, data were normalized to transform the units of the indicators into the same numerical scale, i.e., 1-100. Benchmarking integrates sustainability targets in the normalized scores, allowing interpretation of distance to targets, i.e., a score of 100 implies the targets have been achieved for the indicators. Step 3.b follows the aggregation of normalized indicators at different levels to facilitate interpretability of results, e.g., at the pillar, dimension, and overall scores. Step 3.c is essential to check the robustness of the selected indicators and the relevance of the results to green growth.

2.3.1. Concept

Step 1.a Green growth framework

The objective in Step 1.a is to use the Green Growth Index framework to guide the selection of green growth indicators. Without a framework, the indicators may not be aligned with the challenges and opportunities for green growth transition. The framework for the Green Growth Index consists of four dimensions – efficient and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion (Figure 1). Each dimension in the green growth framework is represented by four sustainability pillars, which are essential considerations for transitioning to green growth pathways. The efficient and sustainable resource use dimension covers energy, water, land use, and waste and material use. The natural capital protection dimension includes improving environmental quality, reducing GHG emissions, protecting biodiversity and ecosystem, and preserving cultural and social value. The green economic opportunities dimension includes investment, trade, innovation, and employment. The social inclusion dimension includes access to basic services and resources, gender balance, social equity, and social protection.

Step 1.b Policy frameworks and priorities

The objective in Step 1.b is to identify green growth indicators that are emphasized in documents published by the government and issues that indicate priorities as well as challenges and opportunities for sustainable development in Ghana. The policy documents reviewed in this step include the Long-term National Development Plan 2018-2057 (LTNDP), National Medium-term Development Policy Framework 2022-2025 (MTNDPF), Updated Nationally Determined Contribution under the Paris Agreement 2020-2030 (NDCs), National Biodiversity Strategy and Action Plan

2016 (NBSAP), Ghana National Climate Change Master Plan Action Programmes for Implementation 2015-2020 (NCCAS), and National Climate Change Policy 2013 (NCCP). Development priorities can also provide knowledge on the green growth indicators that must be considered when assessing green growth transition. In addition to the policy documents, relevant literature was reviewed to understand the social, economic, and environmental contexts that underpin challenges and opportunities for sustainable development in Ghana.

Step 1.c Checklist criteria

The objective in Step 1.c is to set up checklist criteria based on the knowledge generated from the assessment of policy frameworks and development priorities. Five checklists were identified and provided the rationale for selecting the green growth indicators.

Checklist 1: Policies relevant to economic development and climate actions provide information on the goals and targets of the government to overcome challenges and maximize opportunities, including those mentioned in the national policy documents (i.e., LTNDP, MTNDPF, NDCs, NBSAP, NCCAS, and NCCP).

Checklist 2: Programs and strategies implemented for different sectors to support the achievement of national goals and targets, including National Policy on Environment (2012), National Green Jobs Strategy (2013), National Forestry and Wildlife Policy (2014), Health National Policy (2020), National Gender Policy (2015), Ghana National Social Protection Policy, National Energy Transition Framework (2020-2070), National Transport Policy (2008), National Ageing Policy 'Ageing With Security and Dignity' (2010), National Health Policy (2020), National Environmental Sanitation Policy (2010), National Water Policy (2007), Education Strategic Plan (2018-2030), MSME & Entrepreneurship Policy, and National Housing Policy (2015).

Checklist 3: National issues considered priorities for sustainable development in Ghana include agriculture and food security, disaster preparedness and response, natural resource management, equitable social development, and energy, industrial and infrastructural development.



Checklist 4: Climate actions can be aimed at reducing GHG emissions through mitigation or increasing the resilience of the society and ecosystem through adaptation.

Checklist 5: Global issues that UN Member Countries commit to address, particularly those in the Sustainable Development Goals (SDGs). Due to the lack of indicators for green economic opportunities in the SDGs, the Global Green Growth Index was also considered in the list of criteria to address this gap in green growth indicators.

2.3.2 Data preparation














Step 2.a Relevance to the checklist



The objective in Step 2.a is to create a checklist table informing about the relevance of the green growth indicators to the criteria (Table 2). The two categories for relevance are direct and indirect.

Direct relevance, represented by the icon  in the checklist table, indicates that the indicators directly correspond to the criteria, i.e., with the same names and measurement units as mentioned in the documents. Indirect relevance, represented by the icon , indicates that indicators have been implied from the documents

without mentioning names and measurement units. In the case of indirect relevance, the selected indicators were based on expert judgment. Table 2 provides an example of the checklist table for the five efficient and sustainable energy indicators. It summarizes the indicators' presence and level of relevance to the five criteria described in Step 1.c.

Table 2 Checklist for the green growth indicators in efficient and sustainable energy

Indicator code	National Policies						Sectoral programs*	Development Priorities					Climate action		Global issues	
	LTNDP	MTND-PF	NCCAS	NCCP	NCP	NBSAP		FOOD	RESP	NATU	SOCI	INFR	MITI	ADAP	GG Index	SDG
EE1																
EE2																
EE3																
EE4																
EE5																

Legend:  direct relevance, explicit mention of the indicator with the same measurement unit  indirect relevance, implicit mention of the indicator with no relevant unit

Notes: FOOD – Agriculture and Food Security, RESP – Disaster preparedness and response, NATU – Natural resource management, SOCI – Social development, and INFR – Energy and Infrastructure
MITI – climate mitigation, ADAP – climate adaptation, GG Index – Green Growth Index, SDG – Sustainable Development Goals

Step 2.b Data sources and availability

The objective in Step 2.b is to identify sources of data for the green growth indicators and make an inventory of the availability of time-series data. The data from the SDG database was prioritized before checking other online databases published by international organizations. Online databases are preferred to increase transparency and allow replicability of the results applied in the report. Information on data sources and availability is presented in section 4.2.

Step 2.c Collected and validated database

The objective in Step 2.c is to prepare and validate the data collected from different sources. Scaling and imputation are the most important methods to prepare the data and improve the comparability of the indicators. Scaling the data by an appropriate denominator (e.g., population, GDP, land area, etc.) allows an objective comparison across countries. Although the assessment focused on Ghana, normalization and benchmarking required global data. Imputing data based on available time-series data helps improve the country's coverage of the indicators. To minimize the effects of imputation on data uncertainty, the simple method of imputing data from the closest years was applied. The most essential methods to validate the indicator data's statistical appropriateness are checking for outliers and correlation. Since outliers can distort the indicators' statistical properties and normalized values, they were capped using lower or upper fences based on the interquartile range (IQR) from the 75th and 25th percentiles. The correlation analysis aims to identify redundant indicators with very strong correlations to improve the explanatory power of the indicators and verify whether indicators have acceptable levels of association in their respective dimensions.

2.3.3. Data analysis

Step 3.a Normalization and benchmarking

The objective in Step 3.a is to transform the data so that the indicators have the same units of measurement and facilitate the interpretation of the results. It is necessary to apply a normalization method to translate the indicators with different units into a standard scale. Normalization allows the indicator values measured in different units to be adjusted to a single scale to make the data comparable across the indicators. The re-scaling method (min-max transformation) for normalization was applied for the following reasons: it is the simplest and most widely used method that will facilitate ease of comprehensibility and replication; using upper and lower bounds will reduce issues related to outliers; and integrating targets will allow benchmarking against sustainability targets. Through benchmarking, the indicators are assigned values between 1 and 100, where a score of 100 implies that the target for a given indicator has been achieved. For the SDG indicators, sustainability targets are based on explicit or implicit SDG targets. For non-SDG indicators, sustainability targets are represented by the average values of the top five performing developing countries.

Step 3.b Aggregation of normalized indicators

The objective in Step 3.b is to aggregate the indicators' scores to provide an overall score for the four green growth dimensions – efficient and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion. The two most common and straightforward aggregation methods include linear aggregation using arithmetic mean and geometric aggregation using geometric mean. These two methods have different

underlying assumptions. Linear aggregation allows full and constant compensability, i.e., low values in one indicator can be traded off (substituted) by high values in another. On the other hand, geometric aggregation allows only partial compensability, limiting the ability of the indicators with very low scores to be fully compensated by indicators with high scores. The two methods were applied in the different aggregation models so that, as the level of aggregation increases, the level of substitutability decreases:

Level 1: Arithmetic mean was applied to linearly aggregate the normalized indicators, allowing compensability of the individual indicators in each pillar.

Level 2: Geometric aggregation was applied to the pillars to allow only partial compensability between indicators in each dimension.

Level 3: Geometric aggregation was applied to the dimensions. No dimension was allowed to substitute the other dimensions.

Step 3.c Robustness check

The objective in Step 3.b is to evaluate the confidence level of the scores. Composite indices often face criticism because they can be misleading if poorly constructed and interpreted. Thus, the final critical step in developing a composite index is evaluating

the confidence in the model and its underlying assumptions (i.e., robustness check). Two methods were applied: First, to check the sensitivity of the aggregated scores to changes in the input variables of the aggregation models. Monte Carlo methods, an easy and efficient class of algorithms often used for sensitivity analysis, were used to simulate perturbations to the Ghana Green Growth Index, estimating its sensitivity to the changes in the values and missing

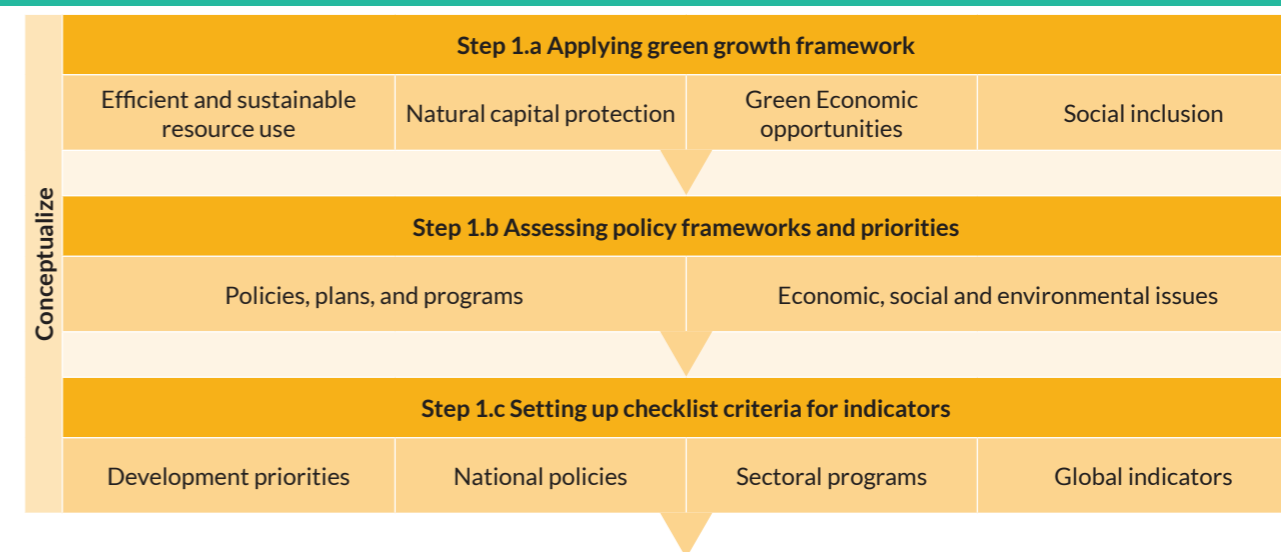
values of the indicators. Each simulation is run 1000 times, and each run's number was determined empirically. Second, to check the explanatory power, regression models are applied to analyze the ability of the indicators to explain the structure of dimension scores. The regression analysis was conducted to identify the extent to which the indicators' variance explains the Green Growth Index scores.



This chapter assesses the green growth contexts, national and sectoral policies, and development priorities in Ghana. The assessment results inform how they are aligned with the green growth indicators, which were selected by the national experts during the first participatory workshop. The knowledge presented

here is the outcome of Step 1 of the analytical methods, providing the rationale for including the selected 80 green growth indicators in the Ghana Green Growth Index (Figure 13). The assessment results supported the structure of the checklist criteria for the green growth indicators (see Chapter 4).

Figure 13 Conceptualization of green growth



Note: Complete diagram and description of analytical methods are in Annex 1.

3 Green growth in Ghana

3.1	Green Growth contexts	22
3.1.1	Economy	22
3.1.2	Society	23
3.1.3	Environment	24
3.2	Ghana institutional frameworks	24
3.2.1	National Policies and Plans	24
3.2.2	Sectoral Programs	26
3.3	Development priorities	28
3.3.1	Sustainable infrastructure	29
3.3.2	Building resilience	29
3.3.3	Resource efficiency	29
3.3.4	Social inclusion and sustainable livelihoods	30
3.3.5	Equitable social development	30

3.1 Green growth contexts

This section provides an overview of the economic, social, and environmental issues influencing Ghana's performance and transition to green growth. These issues are related to the national and sectoral policies which the Government of Ghana implements to overcome development challenges and create socioeconomic opportunities for sustainable growth.

3.1.1 Economy

Ghana's economic growth is anchored on agriculture, industry, and service sectors. Agriculture, historically a central sector of Ghana's economy, has been a major employer, absorbing a substantial portion of the workforce. As of 2021, the sector contributed significantly to the country's Gross Domestic Product (GDP), accounting for nearly one-fifth (19.7 percent). Despite its pivotal role, providing food, feed, and fuel to meet the demands of the growing population is a huge challenge for the agricultural sector. The agriculture sector employs 52 percent of the labor force, with women constituting approximately 39 percent of the farm labor force. In rural areas, it remains the primary source of income and employment for both women and men. Recognizing the intrinsic link between agricultural productivity and the population's well-being, it is imperative to address the challenges faced by the sector to ensure sustainable growth and food security in Ghana.

The mining sector, particularly gold, bauxite, and manganese mining, contributes significantly to Ghana's industrial growth, offering considerable potential for aluminum smelting. The country's rich subsoil resources underpin its position as a key player in the global market. Ghana's automotive industry further enhances its industrial profile by exporting cars to various African regions. The advent of oil production and the upswing in commodity prices have propelled the mining sector's direct contribution to total value-added. The share of mining in the overall value-added increased from 3 percent in 2010 to 12 percent in 2018, marking a significant uptrend in the country's industry. Although nearly 20 percent of the GDP growth was directly attributable to the mining sector between 2013 and 2019, employment in the sector decreased. In 2019, oil and gold contributed 11 percent of Ghana's GDP. Between 2000 and 2020, Ghana experienced a substantial economic transformation, marked by a nearly doubled per capita GDP. It recorded an impressive annual growth rate of 6.1 percent from 2017 to 2019, positioning it as one of the fastest-growing economies in Sub-Saharan Africa (SSA). The expansion not only in the oil but also in the gas sector significantly influenced this economic upswing. Moreover, the manufacturing sector witnessed significant growth, contributing to increased employment rates.

The services exports also exhibited a remarkable fivefold growth between 2014 and 2018. The country's infrastructural landscape saw notable advancements, encompassing both physical and digital domains. Ghana attracted a substantial influx of foreign direct investment (FDI), underlining its appeal as an attractive investment destination. Ghana was chosen as the Secretariat for

the African Continental Free Trade Area (AfCFTA), unleashing many new opportunities. This development positioned Ghana at the forefront of regional economic integration and cooperation. Despite these strides, agriculture remains the primary source of income and employment for women and men in rural areas, significantly contributing to the livelihoods in certain parts of the country.

However, Ghana's economic progress took a turn with the advent of the COVID-19 crisis, substantially undermining its growth prospects. While Ghana managed to maintain positive economic growth in 2020, a departure from the experiences of many other countries, the growth rate slowed sharply to 0.5 percent compared to 6.5 percent in 2019. External demand weakened, commodity prices, especially for oil, plummeted, and FDI declined. Average inflation rose to 9.9 percent in 2020, nearing the upper limit set by the Central Bank. These challenges emphasize the vulnerability of Ghana's economy to global shocks and the importance of resilient strategies in times of crisis. The COVID-19 crisis has led to a significant fiscal gap in Ghana, primarily from diminished revenues, especially in oil-related sectors, and decreased economic activity. The necessity to augment expenditures, particularly in the health sector, has further widened this gap. In 2022, Ghana faced a severe macroeconomic crisis driven by pre-existing imbalances and external shocks. Mounting financing needs and constrained access to international markets intensified debt sustainability concerns. Large capital outflows and tightening monetary conditions globally pressured the exchange rate and contributed to high inflation. This crisis disrupted the post-COVID-19 recovery, causing GDP growth to decline from 5.1 percent in 2021 to 3.1 percent in 2022. The fiscal deficit for 2022 exceeded the target at 11.8 percent, and public debt surged to over 90 percent of GDP, with debt service-to-revenue reaching 117.6 percent. These challenges emphasize the need for comprehensive measures to address fiscal and debt issues in Ghana's economy.

3.1.2 Society

Over the last three decades, Ghana has witnessed significant improvements in human development indicators, showcasing advancements in average life expectancy, primary and secondary school enrollment, reduction in stunting, and under-5 mortality rates. This remarkable progress can be attributed to sustained political stability, increased investment, enhanced productivity, a substantial expansion in agricultural production, and rapid urbanization. These combined efforts have been pivotal in fostering positive developments in Ghana's human development landscape.

Between 1990 and 2021, Ghana exhibited substantial progress in its Human Development Index (HDI), with a growth from 0.460 to 0.632, marking a 37.4 percent increase. Notable improvements were observed in life expectancy at birth (up by 8.2 years), mean years of schooling (up by 2.8 years), and expected years of schooling (up by 5.3 years). Ghana's Gross National Income (GNI) per capita also experienced a significant change, rising by approximately 142.8 percent during the same period. Despite achieving a medium human development status, the unequal distribution of human development indicators reveals a 27.5 percent loss, resulting in a lower HDI of 0.458 in 2021. Gender inequality remains a persistent challenge in Ghana, ranking 130 out of 170 countries in 2021 on the Gender Inequality Index (GII). The GI value of 0.529 highlights the

considerable gender disparities in achievements between females and males. Addressing these disparities is crucial for enhancing overall human development in the country.

Regarding education, the country has made strides in achieving universal primary education and gender parity. Plans for legislation extending compulsory education to the secondary level were announced in 2019. The Free Compulsory Universal Basic Education Program (fCUBE) launched in 1996 has contributed to a 10 percent increase in primary education enrollments, reaching 4,729,154 pupils by 2023. Primary school enrollment rose from 27 percent in 2019 to 30 percent in 2020. Both private and public sectors have seen growth, but private schooling is expanding faster, highlighting the evolving dynamics in Ghana's education landscape. As of March 2020, 404,856 students benefited from Ghana's free Senior High School (SHS) policy. While 71 percent of children complete primary education, completion rates sharply decline for lower and upper secondary levels, with only 47 percent finishing lower secondary and 35 percent concluding upper secondary education. Educational spending as a share of GDP (2020) is 3.90 percent.

According to the 2021 Population and Housing Census, 87.7 percent of the population currently have access to basic water supply services. While significant progress has been made, one in ten individuals still spends over 30 minutes accessing an improved drinking water source. Moreover, 8 percent of Ghanaian households still depend on unsafe water sources. There is a notable urban-rural disparity, with 96.4 percent of the urban population having access to basic water supply services compared to 74.4 percent in rural areas. Although there is seemingly widespread access to safe water in urban areas, sachet water holds a dominant share at 51.5 percent, while pipe-borne water constitutes only 33.6 percent. The overarching vision is to connect approximately 70 percent of the households in urban and peri-urban areas and 50 percent in rural areas to a piped water network, ensuring the utilization of safely managed water services by 2030. Despite ongoing efforts to establish secure and sustainable water sources, it is still necessary to document and thoroughly analyze the sustainability of these systems and the quality of the water they provide. But still, in achieving basic improved sanitation, it has lagged behind water access. As of 2021, only 25.3 percent of the population had access to improved sanitation, and a concerning 17.7 percent of Ghanaians still practice open defecation. The economic toll of poor sanitation is significant, with Ghana incurring an annual loss of approximately 290 million USD. This amounts to 12 USD per person in Ghana annually, or 1.6 percent of the GDP. Additionally, the country suffers an extra loss of 79 million USD due to the practice of open defecation.

Poverty rates more than halved between 1998 and 2016, and the extreme poverty rate declined from 36.0 percent in 1991 to 8.2 percent in 2016. While the country has dramatically mitigated extreme poverty, the ramifications of service- and resource-led growth are evident in escalating inequality and unemployment. While strides have been taken to alleviate extreme poverty, a study from 2016 highlighted a concerning trend of increasing income inequality since the early 1990s. A recent study in March 2020 revealed the correlation between rising income inequality from 1990 to 2010 and falling shares of manufacturing in total value added and employment. This suggests a potential link between economic shifts and the widening income gap during this period. Stimulating

economic activity and creating jobs in other parts of the country is therefore essential to ensuring equal opportunity across the country and mitigating social tensions.

3.1.3 Environment

Ghana's economy followed a different path, starting with farming and moving to services (i.e., jumping straight from agriculture-led to services-driven). This shift has been supported by the country's abundant natural resources, paving the way for sustainable development. Notably, the extraction of rich mineral resources—including gold, diamonds, manganese, limestone, bauxite, iron ore, and various clays and granite deposits—has driven Ghana's economic growth. These resources have contributed significantly to the economy, accounting for 67 percent of exports and 15.4 percent of GDP. Despite these achievements, there are deficits and gaps in Ghana's natural resources governance performance over time. The susceptibility of critical facets of the country's economy (i.e., energy systems, agriculture, industry, and natural resources) to climate variability poses a significant developmental challenge, which could hinder Ghana's progress toward achieving middle-income status and undermine the modest advancements in economic growth.

Ecologically, Ghana is divided into three primary zones: the high forest zone in the south, covering approximately one-third of the land area with eight million hectares; the savanna zone, predominantly in the north, with 14.7 million hectares; and the transition zone, with 1.1 million hectares. According to a study by the International Tropical Timber Organization (ITTO), the broad forest types are categorized as rainforest (47 percent), moist tropical forest (32 percent), and dry tropical forest (21 percent). The key timber-producing areas are in the deciduous and evergreen forests in the southwest. Key tree crops in Ghana's forest zone include cocoa, oil palm, coffee, and rubber. The depletion of forest resources in Ghana is a pressing concern, with only about 1.6 million hectares remaining from the original 8.2 million hectares at the beginning of the 20th century. The cost of environmental degradation linked to unsustainable land use alone amounted to 2.8 percent of the country's GDP in 2017. According to the Forest Investment Programme (FIP) Ghana Investment Plan, the current deforestation rate is 2.0 percent, resulting in an annual loss of approximately 135,000 hectares. The underlying causes are a complex interplay of demographic, economic, and political factors.

Agricultural production is characterized by mixed or mono-cropping of food crops like sorghum, maize, millet, cowpeas, groundnuts, legumes, cocoyam, and yam, and cash crops like tobacco and cotton. Rice is an important food crop across all zones, contributing to the agricultural diversity of Ghana. The country produces only a fraction of its annual fish requirements, with the sector experiencing a decline in production in recent years. Ghana's fishery resources face serious problems, including severe over-exploitation, unlawful fishing methods, overfishing, inadequate fisheries management systems, and a lack of infrastructure and modernization in the industry. If this trend persists, it threatens to intensify the degradation of the natural resource base, disproportionately affecting the poor and heightening vulnerability to climate risks.

Ghana possesses significant freshwater resources, but the availability varies both seasonally and annually. The distribution of these resources is also uneven, with the southwestern rainforest

zone receiving more precipitation than the coastal and northern savannah regions. Ghana's total renewable freshwater resources are estimated at 53.2 billion cubic meters per year, with 30.3 billion cubic meters generated internally. Notably, the Volta contributes 70 percent, the Southwestern 22 percent, and coastal river systems 8 percent to internal freshwater resources. If properly developed and managed, these resources are sufficient to support domestic, irrigation, and industry. Besides surface water, Ghana possesses groundwater resources, whose availability and distribution are primarily influenced by local geology, topography, and climatic conditions. The average annual groundwater recharge is less than 5 percent in most basins. Efficient management and sustainable surface water and groundwater resource utilization are essential for Ghana's continued development and resilience.

Ghana's water ecosystems are generally in an unhealthy state. In 2013, many rivers were reported to have deteriorated, indicating poor water quality. Although there was a slight improvement in all rivers from 2014 to 2015, the situation remains concerning. In 2015, 60 percent of the 40 river systems monitored nationwide were of poor quality, with 15 percent considered critical. This underscores the ongoing challenges in maintaining and improving the quality of water ecosystems in the country.

3.2 Ghana institutional frameworks

3.2.1 National policies

Six national policies were considered in assessing policy relevance of the green growth indicators, including the Long-term National Development Plan 2018-2057 (LTNDP), National Medium-term Development Policy Framework 2022-2025 (MTNDPF), Updated Nationally Determined Contribution 2020-2030 (NDCs), National Biodiversity Strategy and Adaptation Plan 2016 (NBSAP), Ghana National Climate Change Master Plan Action Programs 2015-2020 (NCCAS), and National Climate Change Policy 2013 (NCCP).

Long-term National Development Plan 2018-2057 (LTNDP)

To achieve incrementally sustained development and growth, long-term policies and plans are necessary catalysts to facilitate Ghana's transformational agenda in economic, social, environmental, and institutional spheres. With the LTNDP, also known as Agenda 2057 or Ghana@100, Ghana envisions its future as a "just, free, prosperous and self-reliant nation that would play a leading and influential role in regional and global affairs". It guides the overall development framework from which successive governments prepare their Coordinated Program of Economic and Social Development Policies and the medium-term policy frameworks to operationalize the Coordinated Program and provide guidelines for implementing a government's manifesto. The transformation agenda has five goals: Build an industrialized, inclusive, and resilient economy; Create an equitable, healthy, and prosperous society; Build safe and well-planned communities while protecting the natural environment; Build effective, efficient, and dynamic institutions for national development; and Strengthen Ghana's role in international affairs. These goals aim to achieve high economic

growth, reduce inequalities and poverty, ensure access to quality education, improve infrastructure, diversify energy sources, create safe and smart communities, empower the youth and women, ensure participation in governance, and achieve self-financing of development interventions. The LTNDP is committed to the “green economy,” minimizing pollution and preserving water resources, lands, forests, air, and biodiversity. The LTNDP goals are critical for Ghana's green transition as it coincides with the 2030 Agenda for Sustainable Development, which aims to end poverty, fight inequality and injustice, and tackle climate change by achieving SDG goals and targets. It also seeks to establish fully integrated and sustainable water and resource management programs.

National Medium-term Development Policy Framework 2022-2025 (MTNDPF)

The MTNDPF, which was informed by national and international development frameworks such as the Sustainable Development Goals (SDGs 2030), Paris Climate Agreement, and Africa Union Agenda 2063, aims to “create an optimistic, self-confident and prosperous nation, through the creative exploitation of our human and natural resources, and operating within a democratic, open and fair society in which mutual trust and economic opportunities exist for all”. The goals include building a prosperous country, creating opportunities for all Ghanaians, safeguarding the natural and built environment, maintaining a stable, united, and safe country, building resilience to withstand threats of different dimensions (including COVID-19), and improving development outcomes at all levels. The main priority has been on economic growth, digitization, science, technology, and innovation, urbanization and infrastructural deficits, youth unemployment, public health, emergency preparedness, the fight against pandemics, and climate change. It adopts a multi-stakeholder participation approach in implementing the framework through the decentralized governance system.

Updated Nationally Determined Contribution 2020-2030 (NDCs)

Ghana's NDCs, which considers various national policies, the African Union's development framework, and international development frameworks, aims at achieving “a resilient and low-carbon society by promoting economic growth, climate protection and air quality benefits, youth and women empowerment and social inclusion in the next decade and beyond”. The NDCs has 19 policy actions in 10 priority areas to achieve nationally determined contribution goals in the next decade. This translates into 13 adaptation and 34 mitigation programs with the potential to maximize the synergies between adaptation and economic diversification, resulting in mitigation co-benefits. This is expected to accelerate sustainable energy transition, build resilient economies and societies, enhance early warning and disaster risk management, enhance landscape restoration, ensure responsible production and consumption, foster social inclusion focusing on youth and women, and provide smart and safe communities. Ghana expects to generate absolute GHG emission reductions of 64 MtCO_{2e}, avoid at least 2,900 premature deaths per year from improved air quality, create over one million decent and green jobs, and benefit cumulatively nearly 38 million people upon successfully implementing the policy actions. This will require between 9.3 and 15.5 billion USD of investment to implement the 47 NDCs measures from 2020 to 2030 successfully.

National Biodiversity Strategy and Action Plan 2016 (NBSAP)

The NBSAP identified the underlying direct causes of biodiversity loss in Ghana, including overexploitation of natural resources, invasive alien species, climate change effects, habitat changes, pollution, poor resource governance, infrastructural development, and urbanization. Indirect causes include neglecting the role of traditional institutions in managing natural resources, duplication of roles and responsibilities without clear direction for biodiversity conservation, weak coordination, especially at the national level, and tree tenure and benefit sharing arrangement. The NBSAP took cognizance of the existing framework of national development agenda and Sustainable Development Goals, among others, to craft its biodiversity vision for an “effective systems to ensure that biodiversity in Ghana is valued, conserved, restored and wisely used to maintain ecosystem services, and sustain life support services for a healthy planet while ensuring continuous and equitable sharing of the costs and benefits arising therefrom, to the well-being, prosperity and security of all Ghanaians by 2030”. Its mission is “to take effective and urgent actions to minimize the loss of biodiversity to ensure that by 2030 ecosystems in Ghana are resilient and continue to provide essential services, thereby securing the country's variety of life, and contribute to human wellbeing, and poverty eradication”. The NBSAP outlines four strategic objectives for pursuing effective policies, regulations, and programs and provides 19 strategies to address the underlying causes of biodiversity loss. The implementation, monitoring, and evaluation framework was covered with responsible institutions or stakeholders identified to lead the various actions. The policy implementation was expected to be for about 25 years, with short-term (2016-2020), medium-term (2021-2030), and long-term (2031-2040) implementation plans.

Ghana National Climate Change Master Plan Action Programs 2015-2020 (NCCAS)

The NCCAS provides the blueprint for the implementation of 10 policy focus areas identified in the NCCP, including developing climate-resilient agriculture and food security systems, building climate-resilient infrastructure, increasing the resilience of vulnerable communities to climate-related risks, increasing carbon sinks, improving management and resilience of terrestrial, aquatic, and marine ecosystems, addressing the impact of climate change on human health, minimizing the impact of climate change on access to water and sanitation, considering gender issues in climate change, tackling climate change and migration, and reducing GHG emissions. Nine programs with 24 actions have been identified to develop climate-resilient agriculture and food security systems, considering the critical role of the agriculture sector in Ghana's economy. Seven programs with 24 actions have been considered to build a climate-resilient infrastructure that will protect Ghana's life, properties, and livelihoods, including coastal resource and community protection and flood prevention. Eight programs with 11 actions have been planned for implementation to address the impact of climate change on human health, including the strengthening of climate-sensitive disease surveillance and response systems and building capacity of health providers and groups associated with climate change. Programs and actions have also been identified for the other policy focus areas to support the mainstreaming process, including the estimated cost for each sector, the system for monitoring and evaluation, and financing mechanisms and strategies for effective implementation.

3.2.2 Sectoral programs

Several sectoral policies relevant to the green growth indicators are discussed briefly below, including National Environmental Policy (2012), Ghana Forest and Wildlife Policy (2012), National Energy Transition Framework (2022-2070), National Transport Policy (2008), National Green Jobs Strategy (2021-2025), National Gender Policy (2015), National Ageing Policy 'Ageing with Security and Dignity' (2010), Ghana National Social Protection Policy (2015), National Health Policy (2020), National Environmental Sanitation Policy (2010), National Water Policy (2007), Education Strategic Plan (2018-2030), Micro, Small & Medium Enterprises (MSME) & Entrepreneurship Policy, and National Housing Policy (2015).

National Environmental Policy (2012)

The physical environment is important in national development discourse as it provides the natural resources for socio-economic development. With its rich natural resources, Ghana is committed to protecting the environment. Through its participation in the Stockholm Conference in 1972, concerted and conscious efforts were made to manage the environment safely. Ghana revised its 1995 National Environmental Policy in 2012 with the vision of managing the environment to sustain society by ensuring that citizens have access to sufficient and wholesome food, clean air and water, decent housing, and other necessities of life. The policy focuses on an integrated environmental management approach to address all sectoral issues, including pollution control and waste management, environmental education and awareness creation of all members of society with law enforcement, and using economic instruments to raise funds to facilitate environmental protection. Some actions are related to environmental protection and sustainable utilization of renewable energy resources while reducing dependence on fossil fuel, which aligns with Ghana's Energy Transition Framework (2022-2070). Other areas covered in the National Environmental Policy include restoring mining areas, educating members of the mining community for their effective and sustainable participation, addressing social and gender concerns relating to water access, promoting sustainable agriculture, conserving ecosystem and biodiversity, protecting marine and coastal areas, supporting forest and wildlife conservation, etc.

Ghana Forest and Wildlife Policy (2012)

The Ghana Forest and Wildlife Policy is a comprehensive framework developed to ensure the country's conservation and sustainable management of forest and wildlife resources to address the national development agenda and emerging internal development concerns and reverse the deforestation and forest degradation rate. The revised policy emphasizes the non-consumptive values of the forest and creates a balance between timber production and marketing to satisfy domestic wood demands. The policy has five objectives, including the conservation of soil and water resources, biodiversity, and enhancement of carbon stocks for environmental stability; rehabilitation of degraded landscapes through forest plantations, enrichment planting, and community forestry; promotion of viable forest and wildlife-based industries, livelihoods, and value-added processing; promotion of transparent governance and community participation in resource management; and conduct of research that contribute to sustainable forest management. Actions to deal with climate change concerns include enacting legislation to guide the

allocation of carbon rights and related matters, as well as creating awareness of the role of the forest in climate change adaptation and mitigation. The policy emphasizes exploring innovative financing mechanisms for the forestry and wildlife sector to facilitate successful implementation. It aligns with Ghana's long-term development plan objectives (Agenda 2057), focusing on environmental sustainability, economic transformation, social inclusion, and resilience.

National Energy Transition Framework (2022-2070)

Ghana has developed a comprehensive energy transition framework for the next almost 50 years to transition to a net-zero GHG emission, considering that it is a net importer of oil and has the prospects to discover more oil fields. This addresses the potential threat to energy security, reduced funding for fossil-related projects, stranded assets, job losses, royalties, and revenue loss in the oil and gas sector, and access to the global green market. The framework outlines the strategy for decarbonizing the energy sector and reaching net-zero GHG emissions by 2070 while ensuring socio-economic growth and efficient use of Ghana's natural resources. Measures identified to facilitate the decarbonization and transition include using nuclear for power generation, Carbon Capture, Utilization, and Storage (CCUS) technology, compressed natural gas, electric, and hydrogen fuel cell vehicles, sustainable aviation fuel, efficient energy transformation processes, and efficient end-use appliances. The framework identified energy transition targets over the next five decades and projected net cashflows for the oil and gas sectors as 35 billion and 1.3 billion USD, respectively, with electricity sales expected to increase during the transition to account for 16 percent of the country's GDP.

National Transport Policy (2008)

Ghana's Transport Policy, which provides the blueprint for developing the transport sector, was developed through extensive stakeholder consultations and contributions. At the time of its development, global, regional, and national development concerns were the focus of the Millennium Development Goals, Ghana's Growth and Poverty Reduction Strategy (GPRSII, 2005), and broader aspirations for sustainable development. The Transport Policy focuses on road, aviation, rail, marine, and inland water transport, contributing to GHG emissions. It has seven strategic goals for improving the transport sector. Strategic goal six is “ensuring sustainable development in the transport sector,” particularly “Environmental Sustainability, integrate principles of sustainable development into country policies and programs and reverse the loss of environmental resources.” The policy document indicated that the transport sector consumed about 99.7 percent of gasoline and emitted about 60 percent of non-biomass carbon dioxide and over 50 percent of nitrogen oxide. The proposed policy solutions include promoting fuel efficiency, focusing on alternative fuels to control road pollution, and using environmental pollution criteria for road networks. The current move to use electric vehicles to reduce fossil fuel use aligns with the policy of introducing high import duty on vehicles over ten years.

National Green Jobs Strategy (2021-2025)

Ghana developed a five-year green jobs strategy to deal with the challenges and pressure emerging from global, regional, and national efforts to adopt environmentally friendly development pathways for labor. Climate actions require a shift in workers' skill sets in

adopting new technologies and innovations in production. The strategy presents the roadmap for transitioning Ghana towards a green economy, potentially creating jobs, enhancing livelihoods, and protecting the environment. It aims to ensure that “the transition in Ghana does not negatively impact on the livelihoods of workers and the labor force is adequately prepared to take advantage of the enormous decent job creation potentials of the green or circular economy”. The strategy’s main objective is to “support the creation of green jobs through coherent and effective policy coordination of sectoral approaches”, while the four specific objectives include maximizing green jobs through policy alignment, coherence, and coordination; developing youth, women and PWDs skills for existing and emerging green jobs; promoting sustainable and competitive green enterprises and markets to create green jobs; and providing access to sustainable financing for green enterprises. Ghana adopted a multi-sectoral approach in formulating, implementing, monitoring, and evaluating the strategy by prioritizing five sectors to create green jobs, including renewable energy, agriculture, waste management and recycling, construction, ecotourism, and nature-based tourism. The strategy is aligned with the updated NDCs to mobilize resources for implementation through public-private partnerships, green bonds, and carbon markets to support green job creation.

National Gender Policy (2015)

The Gender Policy’s theme is “Mainstreaming Gender Equality and Women’s Empowerment into Ghana’s Development Efforts”. The policy demonstrates Ghana’s commitment to gender equality and women empowerment in accordance with the national constitution, the targets in the National Development Framework, international frameworks, and instruments on human rights, social protection, good governance, and accountability for development with emphasis on the rights of women, men, and children. The five policy objectives include women’s empowerment and livelihood, women’s leadership and accountable governance, women’s rights and access to justice, economic opportunities for women, and gender roles and relations. The Ministry of Gender, Children and Social Protection (MoGCSP) has been set up to handle social protection and welfare issues together with gender equality and women empowerment. Most Ministries, Departments and Agencies (MDAs) have gender desks to address gender concerns due to their cross-cutting nature. An affirmative action policy was developed, which has influenced gender discussions in the country and led to the preparation of a bill to be considered by the parliament of Ghana to pass as legislation. Many other efforts have been made to mainstream gender into development programs, including the Women’s Manifesto of Ghana (ABANTU, 2004) project to ensure adequate women’s representation and involvement in decision-making on lands. The document proposed at least 40 percent women’s representation in politics, on Boards, and at all levels of decision-making.

National Ageing Policy ‘Ageing with Security and Dignity’ (2010)

Ageing is an inevitable natural process that every growing person experiences and aspires for; therefore, it is critical to provide a framework to safeguard their right, address aging challenges, and enhance access to basic services and economic support for a vibrant life. Ghana’s 2003 national policy on ageing was reviewed to demonstrate the commitment of the Government of Ghana to

the Declarations of the Second World Assembly on Ageing and the Madrid International Plan of Action on Ageing through comprehensive stakeholder participation. This included older persons’ government institutions and policymakers, social partners, the private sector, civil society, and development partners from national and district levels, including representatives of communities. The revised National Ageing Policy seeks to achieve the overall social, economic, and cultural re-integration of older persons into mainstream society to enable them, as far as practicable, to participate fully in the national development process. It envisions respecting the rights of older people, providing economic opportunities, health care services, poverty eradication, and economic empowerment, including financial support, social protection, and violence against aged people. This resonates well with the SDG slogan of leaving no one behind and aligns with Ghana’s medium- and long-term development plan. For instance, the National Health Insurance Authority is implementing free health care for people aged 70 years and above.

Ghana National Social Protection Policy (2015)

Vulnerable groups are in every country; therefore, providing a safety net to support their livelihood and existence has become a priority for countries with growing economies. Ghana has implemented several programs to deal with poverty reduction and the protection of socially vulnerable groups. A National Social Protection Strategy framework was developed in 2007, revised in 2012, and upgraded to the National Social Protection Policy. The Policy provides the blueprint for effective, efficient, holistic, and targeted social protection. The policy aims to provide income support, livelihood empowerment, and improved access to basic services to enable people to live dignified lives. It targets reducing poverty by half through increased and enhanced social assistance and social security and creating employment opportunities for poor and vulnerable Ghanaians by 2031. The policy aligns with Ghana’s long-term development plan and the SDG for poverty eradication.

National Health Policy (2020)

Access to Health is a common and basic human right issue that countries make significant efforts to provide, promote, and protect. Ghana’s Health Policy - “Ensuring healthy lives for all” - was developed to align with the Medium-Term Development Framework, Coordinated Programme of Economic and Social Development Policies (2017-2024), African Union (AU) Vision 2063: “The Africa We Want”, the ECOWAS Vision 2020, the African Health Strategy (2016-2030), the SDGs, and other international frameworks on health. The goal is to promote, restore, and maintain good health for all people living in Ghana. The five policy objectives are to strengthen the healthcare delivery system to be resilient, encourage the adoption of healthy lifestyles, improve the physical environment, improve the socio-economic status of the population, and ensure sustainable financing for health. The document outlines strategies for achieving each objective. For instance, measures to improve the physical environment include improving access to potable water, sanitation, and hygiene; reducing the harmful effects of air, noise, and hazardous substances; improving human settlements and housing; and ensuring a safer transportation system. Strategies to protect women, children, and socially vulnerable groups have been outlined. The implementation strategy is anchored on a multi-stakeholder participation approach with clearly defined roles and responsibilities.

National Environmental Sanitation Policy (2010)

Environmental sanitation, as a component of public health and sustainable environmental management, is one of the powerful drivers of human development and reflects people’s quality of life and value for the environment. The Environmental Sanitation Policy of 1999 was reviewed in 2010. The policy responded to the sector’s international, regional, and national development needs and challenges at the time. Critically, the policy was to help view environmental sanitation as an essential social service and a significant determinant for improving Ghana’s health and quality of life. The policy ensures efficient and effective management of flood control and drainage systems, promotes private sector participation in waste management and coastal protection and supports waste reduction, reuse, recycling, and recovery. It promotes the philosophy of waste as ‘Materials in Transition (MINT)’.

National Water Policy (2007)

Water is one of the essential resources, and lack of access to potable water for whatever reasons expose people, especially women, and children, to water-borne and sanitation-related diseases, hence the UN declaration of access to water and sanitation as a human right issue. Ghana developed the National Water Policy in 2007 to “achieve sustainable development, management and use of Ghana’s water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations”. The policy focuses on issues related to water resources management, urban water supply, and community water and sanitation, with policy actions under about eleven (11) focal areas to be implemented to achieve the overall goal of the policy. Critical among them is the protection of water resources for consumptive and non-consumptive use in the various sectors of the economy, protection against pollution, climate and resilient strategies, water and food security, and water access for all, including poor people. These align with the current global SDGs and regional and national development agenda to conserve water use.

Education Strategic Plan (2018 – 2030)

Access to quality basic education is one of the fundamental human rights of every citizen in Ghana. Global changes in knowledge and technology require new skill sets and competencies to be developed by countries considering the era of artificial intelligence (AI). Ghana has had several educational policies and strategies. The most recent Education Strategic Plan revolves around the ambition to improve the quality of education for all in Ghana by improving equitable access to and participation in inclusive education at all levels and the quality of teaching and learning and science, technology, engineering, and mathematics (STEM) at all levels. The plan captures the overall goal of the education sector “to deliver quality education service at all levels that will equip learners in educational institutions with the skills, competencies and awareness that would make them functional citizens who can contribute to the attainment of the national goal”. It aims to improve equitable access to and participation in inclusive quality education at all levels, the quality of teaching and learning and STEM at all levels, and the sustainable and efficient management, financing, and accountability of education service delivery. It makes provision for the disabled and disadvantaged people to access education and for those with technical skills to have equitable access at all levels of the education ladder, particularly to achieve gender parity at senior high school. It indicated the adoption of policies that

foster the expansion of private participation in tertiary education delivery and the establishment of an Open University to provide dedicated open and distance learning programs and promote open education resources in the country.

MSME & Entrepreneurship Policy

Ghana’s economy has been largely informal, with micro, small, and medium Enterprises (MSMEs) contributing to the country’s socioeconomic development. Available data shows that about 90 percent of businesses registered in Ghana are MSMEs. The medium-term development expenditure of Ghana indicates the national policy objectives for the Ministry of Business Development include creating an entrepreneurial culture in Ghana, targeting especially start-ups and youth businesses; improving the operational efficiency and competitiveness of micro and small businesses for job creation; and providing business development services and enhance access to finance for start-ups and small businesses. Planned strategies in the 2018-2021 medium-term plan include establishing Regional Incubation Hubs for the training of MSMEs on how to manage their businesses, providing funding for innovative Youth Start-Up MSMEs to reduce access to financing challenges, and establishing Green House Domes Estates across the country. Most of the activities implemented in 2020-2023 focused on the 2018-2021 medium-term plan, which is critical in addressing unemployment in Ghana, especially for the youth, equipping MSMEs, and promoting green businesses in the sector.

National Housing Policy (2015)

Shelter provision is one of the basic human needs. The National Housing Policy was developed considering Ghana’s commitment to international frameworks, including the Universal Declaration of Human Rights, 1948, and the constitution of Ghana, among others. It provides a strategy to deal with the rising population that needs to be adequately housed. Housing units have been occupied by owners, tenants, employees, and rent-free people. Most housing units are owned by owners or private developers, with minimal government ownership. The national policy made available a framework for ensuring adequate, decent, and affordable housing that is accessible to satisfy the needs of all people living in Ghana; housing is designed and built to sustainable building principles, leading to the creation of green communities; participation of all stakeholders in decision-making on housing development and allocation in their localities; and adequate and sustainable funding for the supply of a diverse mix of housing in all localities. It enables the private sector to deliver housing units for sale and rent. Promoting green buildings, community, and resilient settlement areas, as indicated in the policy, aligns with the medium and long-term development plans of Ghana.

3.3 Development priorities

Ghana has five major development priorities for driving the green growth transition agenda: agriculture and food security, disaster preparedness and response, natural resource management, equitable social development, and energy, industrial and infrastructural development. These were identified priority areas in the NCCP, contributing to the national economy but with the potential for high GHG emissions and, simultaneously, where significant emission reduction can be achieved to transition to a green economy.

3.3.1 Natural resource management

Traditionally, Ghana's economy has depended on exploiting and using its natural capital assets to undertake socio-economic development projects and programs. The exploitation of these resources has increased, with some illegal activities impacting water resources, soil fertility and quality, and forest cover. Harvesting wood fuels is a permanent feature in fringed communities and rural areas. Government plan and commitment to deal with forest and wildlife conservation as indicated in the National Forestry and Wildlife Policy have been on course and very appropriate to reverse the emerging trends of forest degradation, destruction of forest cover, which serves as a carbon sink, illegal mining, and pollution of water resources. For example, the creation of awareness of the importance of forests in rural community programs has the potential to change the mindset and behavior of people who engage in the illegal felling of trees and harvesting of wood for fuel, and shifting their energy needs to liquefied petroleum gas (LPG) and other alternative fuels that are environmentally clean. The government has implemented several projects to improve the forest stock and reduce deforestation.

Ghana has instituted Green Ghana Day, where the citizens, decentralized authorities, and institutions engage in tree-planting activities. In 2022, the government targeted planting 20 million trees nationwide during Green Ghana Day by distributing free tree seedlings to the general public. This is an excellent initiative to contribute to implementing the updated NDCs and reduce deforestation while encouraging urban greening. Moreover, the Forest Landscape Restoration Interventions, with a total area of 27,910.5 hectares, was established in 2022. The National Afforestation/Reforestation Program (NAP), with a module on "Youth in Afforestation/Reforestation Project (YAP)" covering a total area of 3,235.4 hectares of forest plantations, facilitated recruitment of youths to engage in tree planting. The Ghana Cocoa Forest REDD+ Program (GCFRP) under Ghana's REDD+ (Reducing Emissions from Deforestation and Forest Degradation) Strategy has been implemented since 2019 to reduce deforestation and forest degradation from Ghana's cocoa landscapes. Other interventions implemented on coastline protection also help conserve natural resources and manage erosion. As part of the government's effort to control illegal mining and ensure environmentally sustainable mining, policies were developed to diversify and promote the sustainable extraction of industrial minerals, as reported in the Medium-term Development Framework (2022-2025). This is important for enhancing Ghana's drive toward achieving the SDGs, national objectives, and a green economy.

3.3.2 Energy, industrial and infrastructural development

The correlation between energy and infrastructural development for economic growth and poverty reduction is evident and has been the major backbone of most developed countries. Ghana's effort to improve energy stability and sustainability is critical to facilitating socio-economic growth and transition to a green economy. Ghana has initiated several interventions or actions to address climate

change concerns, such as improving energy efficiency and promoting renewable energy. The government has launched the Renewable Energy Master Plan, aiming to increase the share of renewable energy in the country's energy mix to 20 percent by 2030, and launched a National Energy Transition Framework detailing actions to be taken to reduce emissions from the energy sectors and achieve net zero emission by 2070. From 2016, the share of thermal power increased to 65 percent and marginally decreased to 64 percent in 2022, with the share of renewable energy generation gaining 0.70 percent in 2022. The roadmap to facilitate decarbonization, as indicated in the National Energy Transition Framework, will allow Ghana to manage its oil fines sustainably and in an environmentally friendly manner while expanding renewables, green energy, and nuclear power generation. The projected reduction of 34.2 percent of the total national emission by the energy sector by 2030, as indicated in the NDCs, is important to provide the needed space to build capacity and raise the financial resources to facilitate the transition.

There are plans to build infrastructure to protect coastal resources and communities, prevent flooding, and develop climate-resilient infrastructure for key services. Ghana is implementing community-based adaptation projects, aiming to build the resilience of vulnerable communities to climate change. For example, the Greater Accra Resilient and Integrated Development (GARID) Project is being implemented to improve flood risk and solid waste management in the Odaw River basin and improve access to basic infrastructure and services in the targeted flood-prone low-income communities in the Greater Accra region. The Ministry of Works and Housing has been working on beach and coastline protection projects to deal with coastal erosion and its associated impact on coastal communities and the fishing industry. Other projects have been identified, and preparatory work for each project is estimated to cost about 150 million USD. When these are implemented, they will enhance the management of shoreline protection to safeguard lives and existing and future physical and social infrastructural development in these areas. Such interventions have helped reduce urban flooding in the Greater Accra Region, which used to experience consistent flooding, notable amongst them being the June 3, 2015, circle disaster. Ghana has also developed a roadmap for resilient infrastructure for the energy sector to protect energy generation infrastructure, which is a proactive approach to adapt to the changing climate with local solutions for government adoption. Most infrastructure projects in the country are subjected to climate risk assessment to build climate-resilient infrastructure that will serve the country well.

3.3.3 Disaster preparedness and response

Ghana has witnessed several man-made and natural disasters in the past two decades. Natural disasters recorded were mainly related to climate change. As indicated in the Ghana National Climate Change Master Plan Action Programmes (2015-2020), it is imperative that actions are taken to increase the resilience of vulnerable communities to climate-related risks by building a robust system to manage disasters and respond appropriately to minimize such risk and their impacts on society. Several initiatives have been taken to build capacity to manage disaster and respond swiftly to

reduce disaster risks and impacts. The Participatory Assessment of Flood-Related Disaster Prevention and Development of an Adapted Coping System in Ghana (PARADeS) project, sponsored by the Federal Ministry of Education and Research of Germany, aimed at contributing to enhancing the country's flood disaster risk reduction and management strategy. The Government of Ghana received 150 million USD in additional financing for the Greater Accra Resilient and Integrated Development Project (GARID) from the World Bank to improve flood risk management and solid waste management for over 2.5 million people in the Odaw River Basin of the Greater Accra Region 2023.

The SAGABI component "Urban Resilience Infrastructure – Climate Finance Mechanism for Cities, Ghana" (Integrated Disaster Reduction Management (IDRM) project) was jointly implemented by the German Corporation for International Cooperation GmbH (GIZ) and Allianz Re. Accra Metropolitan Assembly, Ga East Municipal Assembly, Ga West Municipal Assembly, as well as the Ghana Meteorological Agency (GMET) collaborated in this project to prepare the grounds for implementing risk-transfer solutions within an IDRM approach for the said municipalities in GAMA, and thereby better understand what cities can achieve in the field of DRM. These are meant to combat the climate-exacerbated flooding episodes in Accra and build institutional capacity, as anticipated in the medium-to-long development plan. The National Disaster Management Organisation (NADMO) has provided disaster response actions such as rescue operations and relief support to affected Ghanaians and prioritized an early warning system to keep informing people in climate-risk-prone areas. This is appropriate as it is part of the strategies in the medium-to-long-term plan of the country to reduce the impact of climate-related risks by providing early warning systems. The GARID project has developed an early warning system for flood-prone communities in the cities. A project funded by the Adaptation Fund and implemented by the World Meteorological Organization (WMO), aiming to improve West African climate adaptation and disaster management by developing region-wide early warning systems, has been implemented since 2019 in Ghana, Mali, and Cote d'Ivoire. Through the Volta River Authority (VRA) project, the VOLTAALARM system is implemented to monitor and forecast severe weather, floods, extreme heat, forest fires, and drought. It can allow 3-10 days lead times to set up emergency measures and minimize impacts on livelihoods and economic losses.

3.3.4 Agriculture and food security

Agriculture has contributed significantly to the country's economic growth and supported many families to meet their basic human needs. It has been reported that food insecurity in Ghana stands at 11.7 percent, implying a food-insecure population of 3.6 million people. Food security is critical to ensure a healthy population, poverty reduction, and reducing malnutrition in society. Although the sector remains heavily dependent on rainfall rather than irrigation systems, some interventions have been implemented to improve the situation and ensure food security. The Medium-Term Development Plan (2022-2025) mentioned the implementation of some initiatives, including the Aquaculture for Food and Jobs (AFJ) Program; expansion of the Agricultural Mechanization Centres and

irrigation facilities; one village, one dam and subsidy programs on retail prices of seeds, fertilizers, and other agrochemicals, which aim to position the country toward achieving self-sufficiency in food production. These initiatives are crucial in dealing with youth unemployment, improved farming, poverty reduction, and food security. The Agricultural Mechanization Centres and irrigation programs as a way to modernize agriculture have a high potential to reduce soil degradation and enhance better adaptation to climate issues due to reliance on rainfall for food production, as well as encourage large-scale production that relies on heavy-duty equipment. Most of these initiatives have been partly done through the Modernization of Agriculture Ghana (MAG) Program, funded by Global Affairs Canada, which was implemented from 2017 to 2023. It aimed to create sustainable jobs that are secure and green, as affirmed by the National Green Jobs Strategy.

Ghana's Climate-Smart Agriculture Investment Plan (CSAIP) ties in well with the National Climate Change Policy and the National Climate Smart Agriculture Food and Security Action Plan to develop a resilient agricultural sector and food systems for all agroecological zones with enhanced human resource capacity and implementation framework. These demonstrate Ghana's commitment to mitigate and adapt to climate change. CSAIP complements and aligns with the NDCs as mutually reinforcing policies driving the country's efforts towards climate-resilient agricultural development while promoting overall emission reduction and adaptation goals in agriculture. Ghana has also built the capacity to handle disaster-related pest attacks on food production to ensure food security. The country was hit by the outbreak of the Fall Armyworm (FAW) in 2017, which destroyed several hectares of farms in the country, especially maize farms. Improved preparedness and response to emergencies, natural disasters, and crises in the agriculture sector was implemented, contributing to sustained food security and strengthening the livelihoods of vulnerable and worst-affected farmers.

3.3.5 Equitable social development

Social development is visible, felt, and experienced by all in society. It is imperative for Ghana to prioritize it to ensure social cohesion and stability for accelerated growth and development. This is especially so as the country recognizes the impact of climate change on people's social lives and livelihood, especially vulnerable communities, women, aged people, children, men, physically challenged persons, farmer groups, and rural dwellers. Therefore, the National Social Protection Policy is key in addressing poverty issues and ensuring Ghana does not leave behind people who are vulnerable to climate change. Supporting vulnerable groups to create sustainable livelihoods is essential based on the Green Job Strategy and the Gender Policy as they align well with this national priority. Women constitute a sizeable number of farmers, and therefore, their participation in climate change discussions is critical to helping them adapt and contribute to mitigation interventions. In the area of energy, women can play a significant role as they are the users of most of the household appliances. The MSME and Entrepreneurship Policy, Gender Policy, and Social Protection

Policy tie in well to ensure equitable social development objectives are realized. Together, they will provide a strong safety net for the vulnerable, help to protect their livelihood assets and enhance their income levels while sustaining their business to build a resilient society for development.

Ghana National Climate Change Master Plan Action Programs ensure the protection of public health from the impact of extreme climate. Climate change is affecting disease patterns, outbreaks of infectious diseases, resistance of some disease pathogens, and complexity in neglected tropical diseases. Improving access to health facilities and services at an affordable rate is vital for achieving national health objectives and SDG 3. This is an essential social service that requires

resilience to continue to serve health seekers. The GARID project has developed an early warning system for flood-prone communities in the cities, providing support to poor urban communities (inner cities), extending social benefits to the poor urban dwellers, and protecting them against the impacts of climate change. The National Water Policy addresses water access and quality concerns, improving water supply to serve diverse communities to ensure their safety and security from water-related diseases.

The Government of Ghana has implemented the Livelihood Empowerment against Poverty (LEAP) program, which has provided financial support to poor, elderly, disabled, and poor households since 2007 as a means of social protection. The program was expanded through the LEAP 1000 pilot program by transferring

cash to pregnant women and mothers with children under one year from poor households, aiming to improve maternal and child health, reduce poverty, and empower women. Pension laws have been amended to allow informal workers to contribute towards their retirement age to benefit from social security payments during their old age per the Social Protection Policy. According to the National Development Planning Commission (NDPC), the number of informal workers contributing towards their pensions increased from 148,000 in 2017 to 315,890 in 2020. Youth entrepreneur programs and funding opportunities have been instituted to address youth unemployment, business development, and innovation and create

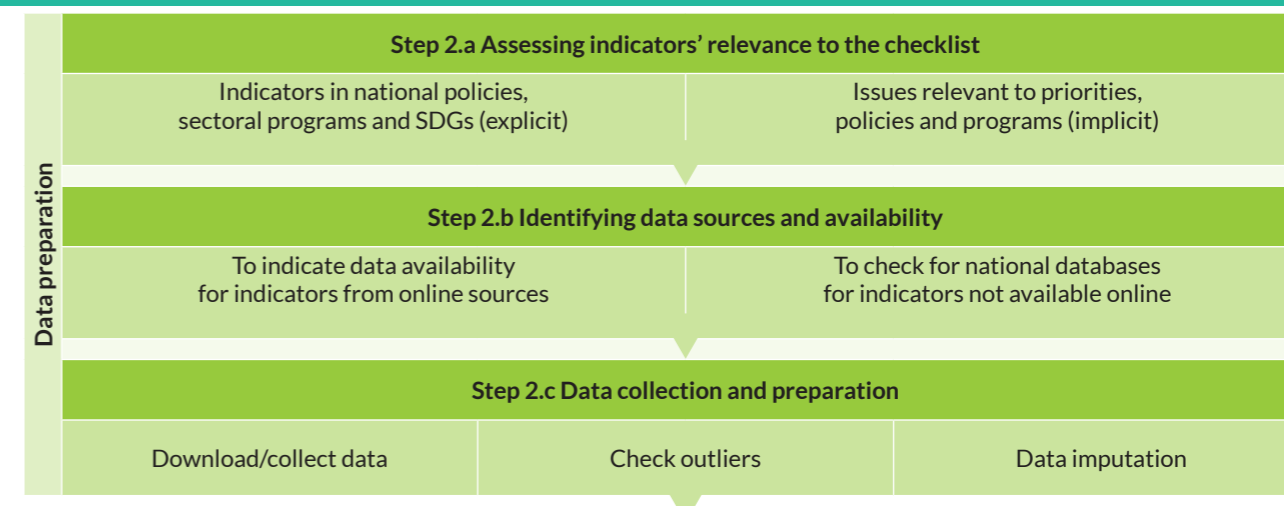
sustainable, decent, green jobs. They provide business development services, startup incubators, and funding for young businesses to enable them to grow and become successful. The Ghana Enterprise Agency (GEA) has been equipped to address entrepreneurs' skills and funding needs, including Junior High School, Senior High School, and University graduates under the Youth Start Project. All these social interventions, including others, are in line with the country's social development priority to build a resilient society, support MSMEs as captured by the MSMEs policy, and build capacity for innovative and green growth.



This chapter applied the checklist criteria to the 80 green growth indicators, assessing their relevance to national policies and sectoral policies, as well as the development priorities in Ghana. The data sources and availability for the indicators and the proxy variables

used to replace those with insufficient data are also discussed in this chapter. The information presented here is the outcome of Step 2 of the analytical methods, dealing with the preparation of the indicators' data before calculating the Ghana Green Growth Index (Figure 14).

Figure 15 Data preparation of green growth indicators



4 Green growth indicators for Ghana

4.1	Indicator checklist	34
4.1.1	Efficient and sustainable resource use	38
4.1.2	Natural capital protection	39
4.1.3	Green economic opportunities	39
4.1.4	Social inclusion	40
4.2	Data availability	34
4.2.1	Green growth indicators and proxy variables	51
4.2.2	Robustness check	56

4.1 Indicator checklists

Applying the checklist criteria for the 80 green growth indicators aims to determine the alignment of the green growth indicators with Ghana's national policies, sectoral programs, and development priorities (see Chapter 3). Table 3 presents the green growth indicators included in the Ghana Green Growth Index. The data for all indicators were developed and published by international organizations, except for the following, which were drawn from Ghana's national databases: EE5 - Electric power transmission and distribution losses and GV2 - Installed renewable energy-generating capacity in developing countries from the Ghana Energy Commission, EQ3 - Proportion of land that is degraded over total land area from the Ministry of Environment, Science, Technology and Innovation, and EQ5 - Proportion of bodies of water with good ambient water quality from the Water Resources Commission. The indicators are valuable tools for monitoring green growth performance and will be helpful to integrate into national policies and sectoral programs.

The green growth indicators are mapped against the criteria in a checklist table (see section 2.3.2). Two colors represent the checks: First, a green check indicates direct relevance, where indicators with their measurement units are explicitly part of the criteria. Second, a yellow check shows only indirect relevance, with no implicit mention of the indicator and its measurement unit. The following provides an interpretation of the checks for the different criteria.

- Criteria 1 (national policies) and 2 (sectoral policies) - The green checks suggest that green and inclusive growth is vigorously pursued in Ghana, where indicators measure performance in achieving green and inclusive growth goals. The yellow

checks indicate that, while issues relevant to the green growth transition are recognized, they are not purposely pursued or addressed. No checks indicate gaps in national policies and sectoral programs, which could slow or hinder the transition.

- Criteria 3 (development priorities) - The checks are used to inform the relevance of the green growth indicators to challenges and opportunities in achieving Ghana's development priorities, including promoting sustainable infrastructure, building resilience, enhancing resource efficiency, and ensuring social inclusion and sustainable livelihoods. Only yellow checks are used in these criteria because the discussion on development priorities focused on highlighting challenges and opportunities.
- Criteria 4 (climate actions) - The green checks inform the significance of the green growth indicators on climate mitigation and adaptation. Mitigation contributes to a low-carbon economy, and adaptation builds a resilient society, enabling a green growth transition. The yellow checks indicate that the green growth indicators are only indirectly relevant to mitigation and/or adaptation.
- Criteria 5 (global issues) - The green checks inform that the green growth indicators are included in the SDGs and Green Growth Index. The yellow checks indicate that, although not in the SDGs and Green Growth Index, the indicators are nonetheless relevant and contribute to sustainable development and green growth.

On the one hand, many checks (particularly the green ones) on Criteria 1 and 2 indicate that Ghana is clearly pursuing green growth. On the other hand, many checks on Criteria 3-5 inform about the value of using the indicators to track progress in the green growth transition.

Table 3 Green growth indicators selected by the Ghanaians participants for the Green Growth Index, by dimensions and pillars

Code	Indicator name	Unit	Publisher
EFFICIENT AND SUSTAINABLE RESOURCE USE			
EE1	Ratio of total primary energy supply to GDP	Megajoules per constant 2017 GDP	IEA
EE2	Share of renewable to total final energy consumption	Percent	IEA
EE3	Logistics performance index: Quality of trade and transport-related infrastructure	Score (1=low to 5=high)	WB
EE4	Electricity generation from renewables	Terawatt-hours	BP, Ember
EE5	Electric power transmission and distribution losses	Percent of output	Ghana Eney commission
EW1	Water use efficiency	United States dollars per cubic meter	FAO
EW2	Share of freshwater withdrawal to available freshwater resources (Level of water stress)	Percent	FAO
EW3	Sustainable fisheries as a proportion of GDP	Percent	UNSD, OECD
EW4	Share of surface irrigation to total irrigation	Percent	FAO
EW5	Renewable internal freshwater resources per capita	Cubic meters	FAO
SL1	Nutrient balance per unit area	kg/ha	FAO
SL2	Share of agriculture organic to total agriculture land area	Percent	FAO
SL3	Share of ruminant livestock population to agricultural area	Livestock units per hectare	FAO
SL4	Agricultural production divided by total area of arable land under crops and pasture	Current thousand USD per hectare	FAO
SL5	Farm machinery per unit of agricultural land	Horsepower per 1000 hectares	USDA
ME1	Total domestic material consumption (DMC) per unit of GDP	Kilograms per GDP	OECD, WB
ME2	Total material footprint (MF) per capita	Tonnes per capita	UNEP
ME3	Average of food loss to production and food waste to consumption	Ratio	FAO
ME4	Municipal solid waste recycled	Percent	FAO
ME5	Ratio treated to not treated municipal wastewater	Ratio	FAO
NATURAL CAPITAL PROTECTION			
EQ1	PM2.5 air pollution, mean annual population-weighted exposure	Micrograms per cubic meter	WHO
EQ2	DALY rate due to unsafe water sources	DALY lost per 100,000 persons	IHME
EQ3	Proportion of land that is degraded over total land area	Percent	MESTI
EQ4	Chlorophyll-a deviations, remote sensing	Percent	UNEP
EQ5	Proportion of bodies of water with good ambient water quality	Percent	Water Resources Commission, Administrative Data, 2017
GE1	Ratio of CO2 emissions to population, including AFOLU	Tonnes per capita	Climate Watch, WB
GE2	Ratio of non-CO2 emissions (CH4, N2O and F-gas) excluding AFOLU to population	CO2eq tons per capita	CAIT, WB
GE3	Ratio of non-CO2 emissions (CH4, N2O and F-gas) in Agriculture and LUCF to population	CO2eq tons per capita	CAIT, WB
GE4	Carbon Intensity of energy production	kilograms of CO2 per kilowatt-hour	GCP, BP
GE5	Carbon dioxide emissions per unit of manufacturing value added	kilogrammes of CO2 per constant 2015 USD	IEA, UNIDO
BE1	Average proportion of Key Biodiversity Areas covered by protected areas	Percent	IUCN, UNEP-WCMC

Table 3 Green growth indicators selected by the Ghanaians participants for the Green Growth Index, by dimensions and pillars (*continued*)

Code	Indicator name	Unit	Publisher
BE2	Share of forest area to total land area	Percent	FAO
BE3	Proportion of forest area within legally established protected areas	Percent	FAO. Global Forest Resources Assessment 2020
BE4	Forest area under an independently verified forest management certification scheme	Thousands of hectares	FSC, PEFC
BE5	Change in the extent of water related ecosystems over time: Lakes and rivers permanent water areas	Percent of total land area	UNEP
CV1	Red list index	Index	BLI and IUCN (2022)
CV2	Share of terrestrial protected areas to total territorial areas	Percent	WDPA
CV3	International tourism, receipts	current US\$	WTO,YTS,CTS
CV4	Plant genetic resources accessions stored ex situ to total agricultural area	Number per hectare	FAO
CV5	Share of exports of cultural goods to exports of total goods	Percent	UNESCO
GREEN ECONOMIC OPPORTUNITIES			
GV1	Adjusted net savings, including particulate emission damage	Percent of GNI, 5 years moving average	WB
GV2	Installed renewable energy-generating capacity in developing countries	Watts per capita	Ghana Eney commission
GV3	International financial flows to developing countries in support of clean energy R&D and renewable energy production	Millions per constant 2020 GDP	OECD, IRENA
GV4	The agriculture orientation index for government expenditures	Percent	IMF, UNSD
GV5	Roads quality	1-7 (best)	UNCTAD
GT1	Share of export of environmental goods (OECD and APEC classifications) to total export	Percent	UNCOMTRADE
GT2	Share of amount of tracked exported Environmentally Sound Technologies to total exports	Percent	UNEP, OECD
GT3	Number of ISO 14001 certificates issued	Number	ISO
GT4	New business density (new registrations per 1,000 people ages 15-64)	Per 1,000 people ages 15-64	WB
GT5	High-technology exports	% of manufactured exports	UN-COMTRADE
GJ1	Share of green employment in total manufacturing employment	Percent	UNIDO
GJ2	Employed population below international poverty line	Percent	ILO
GJ3	Vulnerable employment, total	Percent	ILOSTAT
GJ4	Firms offering formal training	Percent	WB
GJ5	Volume of official development assistance flows for scholarships by sector and type of study	Millions of constant 2021 USD	OECD
GN1	Share of patent publications in environmental technology to total patents	Percent	OECD
GN2	Annual articles published in scientific and technical journals per million people	Number per million people	WB, UN
GN3	Researchers (in full-time equivalent) per million inhabitants	Per 1,000,000 population	UNESCO
GN4	Proportion of medium and high-tech industry value added in total value added	1-7 (best)	UNIDO
GN5	Trademark applications, direct resident	Resident, by count	WIPO
SOCIAL INCLUSION			
AB1	Population with access to safely managed water and sanitation	Percent	WHO/UNICEF

Table 3 Green growth indicators selected by the Ghanaians participants for the Green Growth Index, by dimensions and pillars (*continued*)

Code	Indicator name	Unit	Publisher
AB1_a	Population with access to safely managed water	Percent	WHO/UNICEF
AB1_b	Population with access to safely managed sanitation	Percent	WHO/UNICEF
AB2	Population with access to electricity and clean fuels	Percent	WB, WHO
AB2_a	Population with access to electricity	Percent	WB, WHO
AB2_b	Population with primary reliance on clean fuels and technology	Percent	WB, WHO
AB3	Prevalence of undernourishment	Percent	FAO
AB4	Proportion of population that has convenient access to public transport	Percent	UN-Habitat
AB5	Property rights	Score	Heritage Foundation
GB1	Proportion of seats held by women in national parliaments	Percent	IPU
GB2	Gender ratio of account at a financial institution or mobile-money-service provider	Parity ratio	WB, WHO
GB3	Getting paid, laws and regulations for equal gender pay	Score	WB, WHO
GB4	Proportion of mothers with newborns receiving maternity cash benefits	Percent	KNBS
GB5	School enrollment, primary (gross), gender parity index	Parity ratio	UNESCO
SE1	Inequality in income based on Palma ratio	Ratio	WB, WHO
SE2	Population with access to basic services by urban/rural, i.e. electricity and clean fuels	Ratio	WB, IEA, IRENA, UNSD, WHO
SE2_a	Population with access to electricity by urban/rural	Ratio	WB, IEA, IRENA, UNSD, WHO
SE2_b	Population with access to clean cooking fuel by urban/rural	Ratio	WB, IEA, IRENA, UNSD, WHO
SE3	Disparity of unemployment: Ratio of Youth (15-24 yrs. old) and above 25 yrs. old unemployment	Ratio	ILO
SE4	Age dependency ratio, old	Percent	WB
SE5	Proportion of population with severe disabilities receiving disability cash benefit	Percent	ILO
SP1	Proportion of population above statutory pensionable age receiving a pension	Percent	ILO
SP2	Universal health coverage (UHC) service coverage index	Score	WHO
SP3	Proportion of urban population living in slums	Percent	UN-Habitat
SP4	Number of victims of intentional homicide per 100,000 population	Number per 100,000 population	UNODC
SP5	Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies	Percent	United Nations Office for Disaster Risk Reduction (2023)

Definitions: International Energy Agency (IEA), World Bank (WB), British Petroleum Company plc (BP), Ghana Energy Commission (EC), Food and Agriculture Organization (FAO), United Nations Statistics Division (UNSD), Organization for Economic Cooperation and Development (OECD), United States Department for Agriculture (USDA), United Nations Environment Programme (UNEP), World Health Organization (WHO), Institute for Health Metrics and Evaluation (IHME), Ministry of Environment, Science, Technology and Innovation (MESTI), Water Resources Commission (WRC), Climate Watch (CW), Climate Analysis Indicators Tool (CAIT), Global Carbon Project (GCP), BP and Shift Energy Data Portal (BP), United Nations Industrial Development Organization (UNIDO), International Union for Conservation of Nature (IUCN), UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), Forest Certification Organizations (FSC), Programme for the Endorsement of Forest Certification (PEFC), BirdLife International (BLI), World Database on Protected Areas (WDPA), World Tourism Organization (WTO), Yearbook of Tourism Statistics (YTS), Compendium of Tourism Statistics (CTS), United Nations Educational, Scientific and Cultural Organization (UNESCO), International Renewable Energy Agency (IRENA), International Monetary Fund (IMF), United Nations Conference on Trade and Development (UNCTAD), United Nations Commodity Trade Statistics Database (UN COMTRADE), International Organization for Standardization (ISO), Global Green Growth Institute (GGGI), International Labour Organization (ILO), United Nations (UN), World Intellectual Property Organization (WIPO), United Nations International Children's Emergency Fund (UNICEF), United Nations Human Settlements Programme (UN-Habitat), Inter-Parliamentary Union (IPU), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Office on Drugs and Crime (UNODC), United Nations International Strategy for Disaster Reduction Secretariat (UNISDR)

4.1.1 Efficient and sustainable resource use

Table 4 presents the checklist table for the indicators in the efficient and sustainable resource use pillar, including efficient and sustainable energy, efficient and sustainable water use, sustainable land use, and material use efficiency. This section briefly discusses the relevance of the efficient and sustainable resource use indicators to the criteria in the checklist table.

Efficient and sustainable energy: The five green growth indicators in this pillar include energy intensity (EE1), renewable energy share (EE2), efficient transport (EE3), low-carbon electricity (EE4), and electricity transmission losses (EE5). Across the efficient and sustainable resource use dimension, efficient and sustainable energy indicators are the most frequently mentioned issue in national policies. The five efficient and sustainable energy indicators are discussed in at least one sectoral policy, including Ghana's National Energy Transition Framework, National Environmental Policy, and National Transport Policy. The indicators EE2, EE4, and EE5 are directly mentioned (i.e., with a green check) in the national policies, including LTNDP and MTNDPF. While EE3 is not commonly highlighted, the MTNDPF outlines multiple initiatives to enhance the capacity and efficiency of port operations, encompassing the implementation of integrated systems for truck staging and management, promotion of containerization, particularly in support of intermodal logistics, and the expedited development of projects such as the Boankra Inland Port. In addition, the World Bank's most recent trade analysis for the country suggests that advancements in transportation logistics and increased access to information and communication technology (ICT) infrastructure could facilitate expanded trade, create jobs, and foster economic transformation. Many efficient and sustainable energy indicators align with Ghana's energy and infrastructure development priorities. All five indicators contribute directly (indicated by a green check) to climate mitigation, while certain efficient and sustainable energy indicators can also support climate adaptation efforts. EE1 and EE2 are SDG indicators included in the Global Green Growth Index. The remaining indicators in this pillar drive progress towards specific SDGs, with EE3 contributing to SDG 11.2.1 proportion of the population that has convenient access to public transport by sex, age, and persons with disabilities, EE4 contributing to SDG 7.b.1 Installed renewable energy-generating capacity, and EE5 contributing to SDG 7.1.1 proportion of the population with access to electricity.

Efficient and sustainable water use: The five green growth indicators in this pillar include water use efficiency (EW1), level of water stress (EW2), sustainable fisheries (EW3), share of surface irrigation (EW4), and renewable water resources per capita (EW5). Among the efficient and sustainable water use indicators, only EW5 is explicitly mentioned in MTNDPF. EW4 emerges as the most frequently addressed indicator in national policies, featuring in LTNDP, MTNDPF, NCCAS, and NCCP. Furthermore, the National Water Policy advocates for implementing micro-irrigation and valley-bottom irrigation schemes in rural communities facilitated by district assemblies. This is important since most agricultural activities in Ghana rely on rainfall, as less than one percent of cultivated land is equipped with irrigation. In contrast, EW3 is discussed only in MTNDPF, pushing for sustainable development and management of aquaculture. The efficient and sustainable water use indicators

play a vital role in aligning with Ghana's priorities in agriculture and food security, as well as natural resource management, especially considering that 6.2 percent of the population remained food insecure as of 2021. Each of the five indicators directly contributes to climate adaptation, as indicated by a green check. EW1, EW2, and EW3 are SDG indicators integrated into the Global Green Growth Index. However, while not an SDG indicator, EW4 plays a crucial role in attaining SDG 2.4.1 by assessing the proportion of agricultural land with an acceptable or desirable level of variation in water availability. Moreover, EW5 monitors progress in SDG 6.1.1, focusing on the proportion of the population utilizing safely managed drinking water services.

Sustainable land use: The five green growth indicators in this pillar include soil nutrient balance (SL1), organic agriculture area (SL2), share ruminant livestock (SL3), agricultural productivity (SL4), and farm machinery per unit of land (SL5). SL2 and SL4 are the most frequently discussed indicators in national policies, including the LTNDP, MTNDPF, and NCCP. In contrast, SL3 is only mentioned in the MTNDPF, and SL5 is in NCCAS. SL1 needs attention in the national policies. However, SL1 is mentioned in the National Environmental Policy, which aims to regulate the use of toxic and hazardous chemicals (pesticides, herbicides, and fertilizers) to safeguard human life and the environment. Furthermore, only 57.1 percent (13,628,179 ha) of the land is deemed suitable for agriculture, yet most soils in Ghana exhibit low inherent fertility. Nutrient depletion is pervasive across all agroecological zones, with nitrogen and phosphorus emerging as the most deficient elements. Most sustainable land use indicators are relevant to Ghana's two development priorities, including agriculture and food security, and natural resource management. Many sustainable land use indicators contribute towards climate adaptation, except for SL3, which is more relevant to mitigation. SL4 refers to SDG 2.4.1 proportion of agricultural area under productive and sustainable agriculture, particularly the proportion of agricultural land area that has achieved an acceptable or desirable level of farm output value per hectare. The other sustainable land use indicators have significant contributions to achieving SDGs. SL1 and SL2 play a role in achieving SDG 2.4.1 by focusing on the proportion of agricultural land that has attained an acceptable or desirable level of fertilizer management. Furthermore, SL5 contributes to SDG 2.4.1 by addressing the proportion of agricultural land that has reached an acceptable or desirable level of farm output value per hectare. SL1, SL2, and SL3 are indicators incorporated into the Global Green Growth Index.

Material use efficiency: The five green growth indicators in this pillar include material consumption per GDP (ME1), material footprint (ME2), food loss and food waste (ME3), municipal solid waste recycled (ME4), and ratio treated municipal wastewater (ME5). Compared to the other efficient and sustainable resource use dimension pillars, material use efficiency received the least policy emphasis. Notably, issues and initiatives related to ME3 are mentioned in both the MTNDPF and NCCAS, while ME5 is discussed in the MTNDPF and NCCP. ME4 is the most discussed indicator for ME, featuring in the LTNDP, MTNDPF, NCCP, and the National Environmental Policy. In contrast, ME1 and ME2 did not receive attention in any national and sectoral policies despite their significance as indicators within the circular economy framework. Nevertheless, all material use efficiency is relevant to Ghana's developmental priority on natural resource management. Additionally, many of these indicators have the potential to directly

contribute to climate mitigation and adaptation. Except for ME5, all material use efficiency indicators are aligned with the SDGs. ME5, although not an SDG indicator, contributes to achieving SDG 6.3.1 by addressing the proportion of domestic and industrial wastewater flows that are safely treated. Furthermore, ME1, ME2, and ME3 are part of the Global Green Growth Index.

4.1.2 Natural capital protection

Table 5 presents the checklist table for the indicators in the natural capital protection pillar, including environmental quality, GHG emissions reduction, biodiversity and ecosystem protection, and cultural and social value. This section briefly discusses the relevance of the natural capital protection indicators to the checklist table criteria.

Environmental quality: The five green growth indicators in this pillar include PM2.5 air pollution (EQ1), DALY rate from unsafe water (EQ2), degraded land over the total land area (EQ3), chlorophyll-a deviations (EQ4), and water with good ambient quality (EQ5). Among the environmental quality indicators, EQ5 is the only indicator explicitly mentioned (i.e., with a green check) in the national policy, specifically in the MTNDPF. The indicator relating to air quality (EQ1) was mentioned in the MTNDPF and NDCs, albeit only indirectly (i.e., with a yellow check). EQ4 appeared in the LTNDP, emphasizing incentives for managing coastal and marine areas. The indicator related to degraded land (EQ3) was widely discussed, appearing in all the national policies except NCCAS. Notably, EQ2 was not mentioned in any of the national and sectoral policies. It is crucial to address this gap, particularly considering that 76 percent of households in Ghana face the risk of consuming drinking water contaminated with fecal matter, and microbial contamination such as *Escherichia coli* (*E. coli*) is also prevalent. The five environmental quality indicators are relevant to Ghana's development priority for natural resource management. Additionally, they directly contribute to climate adaptation, with some playing a role in climate mitigation efforts. Except for EQ2, all are SDG indicators. EQ2 only partly contributes to SDG 3.9.2 mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene. EQ1 and EQ2 are part of the Global Green Growth Index.

GHG emissions reduction: This pillar's five green growth indicators include CO2 emissions per capita (GE1), non-CO2 per capita excl. AFOLU (GE2), non-CO2 emissions in AFOLU (GE3), carbon intensity of energy production (GE4), and CO2 emissions per manufacturing value-added (GE5). Except for GE5, all indicators related to reducing different types of GHG emissions were discussed at least once in national policies. Specifically, the LTNDP, MTNDPF, and NDCs discuss GE1, GE2, and GE3. Moreover, GE1 is addressed in the NCCP, attributing the surge in CO2 emissions per capita to the rapid growth of Ghana's energy and transport sector. The primary energy sources in the country are wood fuels, electricity, and oil products. In contrast, GE5 is not discussed in Ghana's key national and sectoral policies despite the expansion of Ghana's industry and construction sectors, increasing the share in the country's total GDP from 18 to 32 percent between 2010 and 2022. The indicators related to reducing GHG emissions are linked to natural resource management and directly contribute to climate mitigation. Except for GE4, all are SDG indicators addressing GHG emissions. Moreover, GE1, GE2, and GE3 are incorporated into the Global Green Growth Index. Although not part of the SDGs, GE4 contributes to achieving SDG

13.2.2 total greenhouse gas emissions per year.

Biodiversity and ecosystem protection: The five green growth indicators in this pillar include protected key biodiversity areas (BE1), share of forest areas (BE2), forest area within legally established PAS (BE3), forest under certification scheme (BE4), and change in extent of water ecosystems (BE5). Only the indicator pertaining to the share of forest land (BE2) is explicitly highlighted (i.e., with a green check) in the LTNDP. BE2 is also implicitly mentioned (i.e., with a yellow check) in other national policies, such as the MTNDPF and NDCs. Moreover, it is referenced in sectoral policies, including the National Environmental Policy and Ghana Forest and Wildlife Policy, where discussions revolve around Ghana's decreasing forest cover. MTNDPF covers both BE1 and BE3, while NCCAS only mentions BE5. BE4 is not discussed in national and sectoral policies, but it is an essential indicator for monitoring the sustainable utilization of forest resources. The biodiversity and ecosystem protection indicators are relevant to Ghana's development priorities on natural resource management. They also directly contribute to climate adaptation and, partly, mitigation. The five indicators measuring biodiversity and ecosystem protection are part of the SDGs, and BE1 and BE2 are included in the Global Green Growth Index.

Cultural and social value: The five green growth indicators in this pillar include the red list index (CV1), terrestrial protected areas (CV2), international tourism receipts (CV3), plant genetic resources accessions (CV4), and share of exports of cultural goods (CV5). Except for CV5, all cultural and social value indicators are mentioned in at least one national policy. CV2, relating to terrestrial protected areas, is explicitly mentioned (i.e., with a green checkmark) in the MTNDPF and NBSAP. CV3 and CV4 are implicitly mentioned (i.e., with a yellow check) in the MTNDPF and NBSAP, respectively. Moreover, CV1 was discussed in the NBSAP and the Ghana Forest and Wildlife Policy. CV5 is the only cultural and social value indicator not mentioned in any of the national and sectoral policies. Many cultural and social value indicators are relevant to Ghana's development priorities on natural resource management and social development. Except for CV3, the indicators support climate adaptation. CV1, CV2, and CV4 are SDG indicators, with CV1 and CV2 being the Global Green Growth Index components. Although CV3 and CV5 are non-SDGs, they contribute to achieving specific SDG indicators. CV3 impacts SDG 8.9.1 tourism direct GDP as a proportion of total GDP and growth rate. CV5 plays a crucial role in advancing the attainment of SDG 11.4.1, focusing on the total per capita expenditure on the preservation, protection, and conservation of all cultural and natural heritage.

4.1.3 Green economic opportunities

Table 6 presents the checklist table for the indicators in the green economics opportunities pillar, including green investment, green trade, green employment, and green innovation. This section briefly discusses the relevance of the green economic opportunities indicators to the checklist table criteria.

Green investment: The five green growth indicators in this pillar include adjusted net savings (GV1), renewable electricity capacity (GV2), financial flows for clean energy R&D (GV3), agriculture orientation index (GV4), and roads quality (GV5). GV1, GV3, and GV4 are not considered in the national and sectoral policies; however, they contribute to climate change mitigation and adaptation. GV2

is explicitly mentioned (i.e., with a green check) in both the LTNDP and MTNDPF. Moreover, it is implicitly mentioned (i.e., with a yellow check) in the NCCAS and the National Energy Transition Framework. GV5 is implicitly mentioned in the MTNDPF and National Transport policy. Green investment indicators are relevant to different development priorities, including agriculture and food security, disaster preparedness and response, and energy and infrastructure. Regarding GV4, agricultural productivity, modernization, and transformation are relevant to Ghana's policy objectives. There is an emphasis on promoting investments in the sector, such as the "Planting for Food and Jobs," alongside other projects like the Ghana Commercial Agricultural Project (GCAP). Ghana has natural conditions favorable to a sustainable energy transition but has faced financing issues to implement it, resulting in a need for significant private capital. Following the National Energy Transition Framework, Ghana released its Energy Transition and Investment Plan, presenting a Net Zero plan by 2060, requiring around 550 billion USD mainly directed towards the power and transport sector. Only GV1 is part of the Green Growth Index, while GV2, GV3, and GV4 are direct SDG indicators. GV5 is closely linked with SDG 9.1.1 proportion of the rural population who live within 2 km of an all-season road.

Green trade: The five green growth indicators in this pillar include exports of environmental goods (GT1), environmental technologies exported (GT2), ISO 14001 certificates issued (GT3), new business density (GT4), and high-technology exports (GT5). None of these indicators is considered in national and sectoral policies. However, the Green Industry and Trade Assessment (2015) suggests measures to enhance green production and trade, for example, strengthening the Ghana Standards Authority's capacity to issue internationally recognized ISO 14001 certificates at a lower cost than counterparts in Europe or North America, supporting the greening of selected supply chains, starting with major wood product exporters and essential oil manufacturers. Furthermore, due to their potential, there is also an ambitious recommendation to export pollution control and renewable energy technologies. Several green trade indicators support Ghana's development priorities. Only GT1 is part of the Green Growth Index, and GT2 is an SDG indicator. The remaining green trade indicators contribute to achieving SDGs: GT2 contributes to SDG 17.7.1 amount of tracked exported Environmentally Sound Technologies; GT3 contributes to SDG 12.6.1 number of companies publishing sustainability reports; GT4 contributes to SDG 9.3.1 proportion of small-scale industries in total industry value added; and GT5 contributes to SDG 9.b.1 proportion of medium and high-tech industry value added in total value added.

Green employment: The five green growth indicators in this pillar include green employment in manufacturing (GJ1), employed below the poverty line (GJ2), vulnerable employment (GJ3), firms offering formal training (GJ4), and ODA flows for scholarships (GJ5). GJ3 is the most frequently mentioned indicator, explicitly (i.e., with a green check) in the LTNDP and MTNDPF, and implicitly (i.e., with a yellow check) in the National Social Protection Policy. GJ2 is explicitly referred to in the MTNDPF, and GJ1 is implicitly mentioned in the NDCs and the Ghana Green Job Strategy. The green employment indicators contribute to social development priorities and climate change adaptation. While Ghana has been experiencing significant economic growth, employment needs to catch up. The working poverty rate is estimated to be around 22 percent as a result of an essential share of workers in the informal sector, and an absence of a living wage. GJ1 is part of the Green Growth Index, while

GJ2 and GJ5 are direct SDG indicators. GJ1 is linked to SDG 9.2.2 manufacturing employment as a proportion of total employment, GJ3 to SDG 8.3.1 proportion of informal employment in total employment, and GJ4 contributes to SDG 4.3.1 participation rate of youth and adults in formal and non-formal education and training.

Green innovation: The five green growth indicators in this pillar include environmental technologies (GN1), scientific and technical journals (GN2), researchers per million inhabitants (GN3), medium/high-tech manufacturing value-added (GN4), trademark applications (GN5). Only GN3 is implicitly mentioned (i.e., with a green check) in a national policy (i.e., LTNDP). No other green innovation indicator is considered in the national and sectoral policies. Kyire et al. (2023) found that in Ghana, sustainability pressures from stakeholders have a significant and positive impact on the green creativity of organizations. In addition, green core competence significantly influences firms' green process and product innovation performance. The indicators are not related to development priorities, but they contribute to climate change mitigation and adaptation. GN1 is part of the Green Growth Index and contributes to SDG 17.7, which promotes the development, transfer, dissemination, and diffusion of environmentally sound technologies, while GN3 and GN4 are direct SDG indicators. GN2 and GN5 are non-SDG indicators with significant links to SDG 9.5.1 research and development expenditure as a proportion of GDP and SDG 9.5.2 researchers (in full-time equivalent) per million inhabitants.

4.1.4 Social inclusion

Table 7 presents the checklist table for the indicators in the social inclusion pillar, including access to basic services and resources, gender balance, social equity, and social protection. This section briefly discusses the relevance of the social inclusion indicators to the criteria in the checklist table.

Access to basic services and resources: The five green growth indicators in this pillar include access to safe water and sanitation (AB1), particularly access to safe water (AB1.a) and access to sanitation (AB1.b); access to electricity and clean fuels (AB2), particularly access to electricity (AB2.a) and access to clean cooking fuels (AB2.b); prevalence of undernourishment (AB3); convenient access to public transport (AB4), and property rights (AB5). AB1 and AB4 are the most frequently mentioned in the national policies (LTNDP, MTNDPF, and NCCP or NDCs); however, only implicitly (i.e., with a yellow check). Only access to safe water (AB1.a) is explicitly mentioned (i.e., with a green check) in the MTNDPF. AB3 is also mentioned explicitly in one national policy (MTNDPF) but not present anywhere else. While the two components of indicator AB2 are mentioned in several national policies (MTNDPF, LTNDP, and NDCs) as well as in the National Energy Transition Framework, AB5 is only implicitly mentioned in the National Social Protection Policy. In several African countries, including Ghana, property ownership is crucial in gaining access to land and water for farming. Many indicators for access to basic services and resources support disaster preparedness and response and social development priorities, with AB4 also contributing to food and agriculture development. All indicators are important to climate adaptation, and AB2 and AB4 also contribute to climate mitigation. AB1 and AB2 are part of the Green Growth Index. Except for AB5, all indicators of access to basic services and resources are part of the SDGs. However, AB5 is essential to achieving SDG 1.4.2 proportion of the total adult

population with secure tenure rights to land.

Gender balance: The five green growth indicators in this pillar include women in national parliaments (GB1), gender account in financial institutions (GB2), equal gender pay (GB3), mothers with maternity cash benefits (GB4), and school enrollment gender parity (GB5). GB1 and GB5 are explicitly mentioned (i.e., with a green check) in the LTNDP and MTNDPF, respectively. In contrast, no national policy mentions GB2, GB3, and GB4. GB3 is, however, mentioned in the National Social Protection Policy, where Ghana aims to achieve full equal pay for work of equal value by 2030. GB4 is not mentioned in this sectoral policy despite its significance in providing household income security while decreasing the likelihood of women prolonging work during pregnancy or returning quickly after childbirth. Progress in the gender balance indicators is critical to the country's disaster preparedness and response and equitable social development priorities as well as climate adaptation strategy. GB1, GB2, and GB4 are direct SDG indicators. Although non-SDG indicators, GB3 and GB5 contribute to achieving SDGs, with the former contributing to SDG 5.1.1 legal frameworks are in place to

promote, enforce, and monitor equality and non-discrimination on the basis of sex and the latter contributing to SDG 4.5.1 adjusted gender parity index for completion rate, by location, wealth quintile and education level. GB1, GB2, and GB3 are part of the Green Growth Index.

Social equity: The five green growth indicators in this pillar include inequality in income (SE1); urban-rural access to electricity and clean fuels (SE2), particularly urban-rural access to electricity (SE2.a) and urban-rural access to clean cooking fuels (SE2.b); youth unemployment disparity (SE3), age dependency ratio (SE4), and cash benefits for people with disabilities (SE5). SE2.a is explicitly mentioned (i.e., with a green check), and SE1 and SE3 are implicitly mentioned (i.e., with a yellow check) in national policies, including the LTNDP and MTNDPF. SE2.b is mentioned in the National Energy Transition Framework, and SE5 in the National Social Protection Policy. In contrast, SE4 is entirely absent from any national or sectoral policy. The age-dependency ratio in Ghana is relatively high (68.05 percent); thus, monitoring the current and projected population structure remains a priority to improve the SE4 indicator.

Moreover, investments in geriatric care services for the elderly are also crucial to improving their quality of life. The social equity indicators are important to disaster preparedness and response as well as social development priorities, with SE3 also contributing to the development priority on food and agriculture. All indicators participate in climate adaptation, with SE2 also relevant to climate mitigation. SE2, SE3, and SE5 are SDG indicators. SE1 and SE4 are non-SDG indicators but contribute to achieving SDG 10.4.2 redistributive impact of fiscal policy and SDG 1.3.1 proportion of the population above statutory pensionable age receiving a pension. SE1 and SE2 are Green Growth Indicators.

Social protection: The five green growth indicators in this pillar include the share of old people receiving a pension (SP1), universal health coverage (SP2), the population living in slums (SP3), victims of intentional homicides (SP4), implementing local disaster risk reduction strategies (SP5). SP3 is explicitly mentioned (i.e., with a

green check) in the MTNDPF. SP5 is implicitly mentioned (i.e., with a yellow check) in four of the six national policies (LTNDP, MTNDPF, NCCAS, and NDCs) and is at the heart of the development priority on disaster preparedness and response. The following social protection indicators are implicitly mentioned in two national policies: SP1 in the LTNDP and MTNDPF, SP2 in the MTNDPF and NCCAS, and SP3 in the LTDNP and MTNDPF. Moreover, they are discussed in the sectoral policies, with the National Ageing Policy discussing SP1 and the National Health Policy discussing SP2 and SP3. SP4 is absent from all national policies but implicitly mentioned in the National Health Policy, highlighting the need for a safe and secure environment where socioeconomic activities will thrive within the confines of the law. Several social protection indicators are relevant to disaster preparedness and response and equitable social development priorities. The social protection indicators, all SDG indicators, support climate adaptation. SP1, SP2, and SP3 are part of the Green Growth Index.



Table 4 Checklist for the green growth indicators in efficient and sustainable resource use

Indicator code	Indicator name	National policies						Sectoral programs*	Development Priorities				Climate action	Global issues		Global issues	
		LTNDP	MTNDPF	NCCAS	NCCP	NDCs	NBSAP		FOOD	RESP	NATU	SOCI	INFR	MITI	ADAP	GG Index	SDG
EE1	Energy intensity	☑	☑		☑	☑		☑					☑	☑		☑	☑
EE2	Renewable energy share	☑	☑		☑	☑		☑					☑	☑		☑	☑
EE3	Efficient transport		☑					☑		☑			☑	☑	☑		☑
EE4	Low-carbon electricity	☑	☑	☑		☑		☑					☑	☑	☑		☑
EE5	Per capita electricity consumption	☑	☑					☑			☑		☑	☑	☑		☑
EW1	Water use efficiency	☑	☑					☑	☑		☑				☑	☑	☑
EW2	Level of water stress	☑	☑						☑	☑	☑				☑	☑	☑
EW3	Capture fisheries		☑					☑	☑		☑				☑	☑	☑
EW4	Agriculture water use efficiency	☑	☑	☑	☑			☑	☑		☑				☑		☑
EW5	Renewable water resources per capita	☑	☑						☑		☑				☑		☑
SL1	Soil nutrient balance							☑	☑		☑				☑	☑	☑
SL2	Organic agriculture area	☑	☑		☑				☑	☑	☑			☑	☑	☑	☑
SL3	Cereal yield		☑						☑					☑		☑	
SL4	Agricultural productivity	☑	☑		☑		☑		☑	☑	☑				☑		☑
SL5	Natural capital productivity			☑					☑		☑				☑		☑
ME1	Domestic material consumption										☑			☑	☑	☑	☑
ME2	Material footprint										☑			☑	☑	☑	☑
ME3	Food loss and food waste		☑	☑					☑		☑			☑	☑	☑	☑
ME4	Sanitation coverage	☑	☑		☑			☑			☑		☑	☑	☑		☑
ME5	Sewer, septic and latrine coverage		☑		☑						☑		☑	☑	☑		☑

Indicators: EE1 - Energy intensity, EE2 - Renewable energy share, EE3 - Efficient transport, EE4 - Low-carbon electricity, EE5 - Electricity transmission losses, EW1 - Water use efficiency, EW2 - Level of water stress, EW3 - Sustainable fisheries, EW4 - Share of surface irrigation, EW5 - Renewable water resources per capita, SL1 - Soil nutrient balance, SL2 - Organic agriculture area, SL3 - Share ruminant livestock, SL4 - Agricultural productivity, SL5 - Farm machinery per unit land, ME1 - Material consumption per GDP, ME2 - Material footprint, ME3 - Food loss and food waste, ME4 - Municipal solid waste recycled, ME5 - Ratio treated municipal wastewater

Legend: ☑ direct relevance, explicit mention of the indicator with the same measurement unit ☐ indirect relevance, implicit mention of the indicator with no relevant unit

Notes: * National Environmental Sanitation Policy, National Environmental Policy, National Water Policy, National Social Protection Policy, GhN Forest and Wildlife Policy, Ghana Green Jobs Strategy, Ghana's National Energy Transition Framework (2022-2070), National Ageing Policy, National Gender Policy, National Health Policy: Ensuring healthy lives for all, Education Strategic Plan 2018 - 2030, MSME & Entrepreneurship Policy, National Housing Policy, National Transport Policy

FOOD - Agriculture and Food Security, RESP - Disaster preparedness and response, NATU - Natural resource management, SOCI - Social development, and INFR - Energy and Infrastructure

MITI - climate mitigation, ADAP - climate adaptation, GG Index - Green Growth Index, SDG - Sustainable Development Goals

Table 5 Checklist for the green growth indicators in natural capital protection

Indicator code	Indicator name	National policies						Sectoral programs*	Development Priorities				Climate action	Global issues		Global issues	
		LTNDP	MTNDPF	NCCAS	NCCP	NDCs	NBSAP		FOOD	RESP	NATU	SOCI	INFR	MITI	ADAP	GG Index	SDG
EQ1	Energy intensity		☑			☑				☑				☑	☑	☑	☑
EQ2	Renewable energy share									☑	☑				☑	☑	☑
EQ3	Efficient transport	☑	☑		☑	☑	☑	☑	☑	☑	☑			☑	☑		☑
EQ4	Low-carbon electricity	☑	☑							☑					☑		☑
EQ5	Per capita electricity consumption	☑	☑	☑	☑					☑					☑		☑
GE1	Water use efficiency	☑	☑		☑	☑				☑				☑		☑	☑
GE2	Level of water stress	☑	☑			☑				☑				☑		☑	☑
GE3	Capture fisheries	☑	☑			☑				☑				☑		☑	☑
GE4	Agriculture water use efficiency					☑		☑		☑		☑		☑			☑
GE5	Renewable water resources per capita									☑				☑			☑
BE1	Soil nutrient balance		☑				☑			☑					☑	☑	☑
BE2	Organic agriculture area	☑	☑			☑		☑		☑				☑	☑	☑	☑
BE3	Cereal yield		☑							☑				☑	☑		☑
BE4	Agricultural productivity									☑					☑		☑
BE5	Natural capital productivity			☑					☑	☑	☑			☑	☑		☑
CV1	Domestic material consumption						☑	☑		☑					☑		☑
CV2	Material footprint	☑	☑				☑	☑		☑				☑	☑	☑	☑
CV3	Food loss and food waste		☑							☑							☑
CV4	Sanitation coverage						☑		☑	☑					☑		☑
CV5	Sewer, septic and latrine coverage									☑					☑		☑

Indicators: EQ1 - PM2.5 air pollution, EQ2 - DALY rate from unsafe water, EQ3 - Degraded land over total land area, EQ4 - Chlorophyll-a deviations, EQ5 - Water with good ambient quality, GE1 - CO2 emissions per capita, GE2 - Non-CO2 per capita excl. AFOLU, GE3 - Non-CO2 emissions in AFOLU, GE4 - Carbon intensity of energy production, GE5 - CO2 emissions per manufacturing value-added, BE1 - Protected key biodiversity areas, BE2 - Share of forest areas, BE3 - Forest area within legally established PAS, BE4 - Forest under certification scheme, BE5 - Change in extent of water ecosystems, CV1 - Red list index, CV2 - Terrestrial protected areas, CV3 - International tourism receipts, CV4 - Plant genetic resources accessions, CV5 - Share of exports of cultural goods

Legend: ☑ direct relevance, explicit mention of the indicator with the same measurement unit ☑ indirect relevance, implicit mention of the indicator with no relevant unit

Notes: * National Environmental Sanitation Policy, National Environmental Policy, National Water Policy, National Social Protection Policy, GhN Forest and Wildlife Policy, Ghana Green Jobs Strategy, Ghana's National Energy Transition Framework (2022-2070), National Ageing Policy, National Gender Policy, National Health Policy: Ensuring healthy lives for all, Education Strategic Plan 2018 - 2030, MSME & Entrepreneurship Policy, National Housing Policy, National Transport Policy

FOOD - Agriculture and Food Security, RESP - Disaster preparedness and response, NATU - Natural resource management, SOCI - Social development, and INFR - Energy and Infrastructure

Table 6 Checklist for the green growth indicators in green economic opportunities

Indicator code	Indicator name	National policies						Sectoral programs*	Development Priorities				Climate action	Global issues		Global issues	
		LTNDP	MTNDPF	NCCAS	NCCP	NDCs	NBSAP		FOOD	RESP	NATU	SOCI	INFR	MITI	ADAP	GG Index	SDG
GV1	Adjusted net savings										☑				☑	☑	
GV2	Renewable electricity capacity	☑	☑	☑				☑					☑	☑	☑		☑
GV3	Revenue from biodiversity economic instruments												☑	☑	☑		☑
GV4	Agriculture orientation index								☑		☑			☑	☑		☑
GV5	Transport productive capacity		☑					☑		☑			☑		☑		☑
GT1	Exports of environmental goods													☑		☑	☑
GT2	Ores and metals exports													☑	☑		☑
GT3	Medium and high-tech exports										☑			☑	☑		☑
GT4	New business density																☑
GT5	Exports of manufactured goods													☑	☑		☑
GJ1	Renewable energy employment					☑		☑				☑		☑	☑	☑	☑
GJ2	Employed below poverty line		☑							☑		☑			☑		☑
GJ3	Vulnerable employment	☑	☑					☑		☑		☑			☑		☑
GJ4	Youth not in education, employment, training														☑		☑
GJ5	ODA flows for scholarships											☑			☑		☑
GN1	Environmental technologies												☑	☑	☑	☑	☑
GN2	Collaboration in research & development																☑
GN3	Share of education expenditure	☑													☑	☑	☑
GN4	Medium/high-tech manufacturing value added												☑	☑	☑		☑
GN5	Intellectual property charges																☑

Indicators: GV1 - Adjusted net savings, GV2 - Renewable electricity capacity, GV3 - Financial flows for clean energy R&D, GV4 - Agriculture orientation index, GV5 - Roads quality, GT1 - Exports of environmental goods, GT2 - Environmental technologies exported, GT3 - ISO 14001 certificates issued, GT4 - New business density, GT5 - High-technology exports, GJ1 - Green employment in manufacturing, GJ2 - Employed below poverty line, GJ3 - Vulnerable employment, GJ4 - Firms offering formal training, GJ5 - ODA flows for scholarships, GN1 - Environmental technologies, GN2 - Scientific and technical journals, GN3 - Researchers per million inhabitants, GN4 - Medium/high-tech manufacturing value-added, GN5 - Trademark applications

Legend: ☑ direct relevance, explicit mention of the indicator with the same measurement unit ☑ indirect relevance, implicit mention of the indicator with no relevant unit

Notes: * National Environmental Sanitation Policy, National Environmental Policy, National Water Policy, National Social Protection Policy, GhN Forest and Wildlife Policy, Ghana Green Jobs Strategy, Ghana's National Energy Transition Framework (2022-2070), National Ageing Policy, National Gender Policy, National Health Policy: Ensuring healthy lives for all, Education Strategic Plan 2018 - 2030, MSME & Entrepreneurship Policy, National Housing Policy, National Transport Policy

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MITI - climate mitigation, ADAP - climate adaptation, GG Index - Green Growth Index, SDG - Sustainable Development Goals

Table 7 Checklist for the green growth indicators in social inclusion

Indicator code	Indicator name	National policies						Sectoral programs*	Development Priorities				Climate action	Global issues		Global issues	
		LTNDP	MTNDPF	NCCAS	NCCP	NDCs	NBSAP		FOOD	RESP	NATU	SOCI		INFR	MITI	ADAP	GG Index
AB1	Access to safe water and sanitation	☑	☑		☑			☑		☑		☑			☑	☑	☑
AB1.a	Access to safe water	☑	☑		☑			☑		☑		☑			☑	☑	☑
AB1.b	Access to sanitation	☑	☑		☑			☑		☑		☑			☑	☑	☑
AB2	Access to electricity and clean fuels		☑					☑		☑		☑	☑	☑	☑	☑	☑
AB2.a	Access to electricity	☑	☑					☑		☑		☑	☑	☑	☑	☑	☑
AB2.b	Access to clean cooking fuels		☑			☑		☑		☑		☑		☑	☑	☑	☑
AB3	Prevalence of undernourishment		☑						☑	☑		☑			☑		☑
AB4	Convenient access to public transport	☑	☑			☑		☑		☑		☑	☑	☑	☑		☑
AB5	Property rights							☑		☑					☑		☑
GB1	Women in national parliaments	☑	☑					☑				☑			☑	☑	☑
GB2	Gender account in financial institution									☑					☑	☑	☑
GB3	Equal gender pay							☑				☑			☑	☑	☑
GB4	Mothers with maternity cash benefits											☑			☑		☑
GB5	School enrollment gender parity		☑					☑				☑			☑		☑
SE1	Inequality in income	☑	☑					☑		☑		☑			☑	☑	☑
SE2	Rural-urban access to electricity									☑		☑	☑	☑	☑	☑	☑
SE2.a	Youth unemployment disparity	☑	☑							☑		☑	☑	☑	☑	☑	☑
SE2.b	Age dependency ratio							☑		☑		☑		☑	☑	☑	☑
SE3	Cash benefit for people with disabilities	☑	☑					☑	☑			☑			☑		☑
SE4	Share of old people receiving pension														☑		☑
SE5	Universal health coverage							☑				☑			☑		☑
SP1	Population living in slums	☑	☑					☑				☑			☑	☑	☑
SP2	Victims of intentional homicides		☑	☑				☑		☑		☑			☑	☑	☑
SP3	Score of Hyogo Framework	☑	☑					☑				☑			☑	☑	☑
SP4	Victims of intentional homicides,							☑							☑		☑
SP5	Score of Hyogo Framework	☑	☑	☑		☑				☑					☑		☑

Indicators: AB1 - Access to safe water and sanitation, AB1.a - Access to safe water, AB1.b - Access to sanitation, AB2 - Access to electricity and clean fuels, AB2.a - Access to electricity, AB2.b - Access to clean cooking fuels, AB3 - Prevalence of undernourishment, AB4 - Convenient access to public transport, AB5 - Property rights, GB1 - Women in national parliaments, GB2 - Gender account in financial institution, GB3 - Equal gender pay, GB4 - Mothers with maternity cash benefits, GB5 - School enrollment gender parity, SE1 - Inequality in income, SE2 - Rural-urban access to electricity and clean fuels, SE2.a - Urban-rural access to electricity, SE2.b - Urban-rural access to clean cooking fuels, SE3 - Youth unemployment disparity, SE4 - Age dependency ratio, SE5 - Cash benefit for people with disabilities, SP1 - Share of old people receiving pension, SP2 - Universal health coverage, SP3 - Population living in slums, SP4 - Victims of intentional homicides, SP5 - Implementing local disaster risk reduction strategies

Legend: ☑ direct relevance, explicit mention of the indicator with the same measurement unit ☑ indirect relevance, implicit mention of the indicator with no relevant unit

Notes: * National Environmental Sanitation Policy, National Environmental Policy, National Water Policy, National Social Protection Policy, GhN Forest and Wildlife Policy, Ghana Green Jobs Strategy, Ghana's National Energy Transition Framework (2022-2070), National Ageing Policy, National Gender Policy, National Health Policy: Ensuring healthy lives for all, Education Strategic Plan 2018 - 2030, MSME & Entrepreneurship Policy, National Housing Policy, National Transport Policy

FOOD - Agriculture and Food Security, RESP - Disaster preparedness and response, NATU - Natural resource management, SOCI - Social development, and INFR - Energy and Infrastructure

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4.2 Data availability

4.2.1 Green growth indicators and sustainability targets

Table 8 presents the data availability and sources for the 80 green growth indicators covering the four dimensions – efficient and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion. The efficient and sustainable resource use indicators with data for 2022 include only efficient transport (EE3) and sustainable fisheries (EW3), which have data for 2022. The most recent data for most indicators is for 2020. The two indicators without time-series data from 2010 are food loss and food waste (ME3) and municipal solid waste recycled. Most data for the efficient and sustainable resource use indicators were downloaded from the UNSTATS database and the Food and Agriculture Organization of the United Nations (FAO) database. For the SDG indicators, data were downloaded from the FAO database if data coverage from other international data sources is better than in the UNSTATS database. This is the case for three efficient and sustainable resource use indicators, including material consumption per GDP (ME1), material footprint (ME2), and food loss and food waste (ME3). There are nine (9) SDG indicators in the efficient and sustainable resource use dimension. Except for electricity transmission losses (EE5), for which data were collected from the Ghana Energy Commission Report, all indicators were downloaded from international sources.

Many natural capital protection indicators have time-series data until 2022, almost half of the 20 green growth indicators. Five indicators have intermittent time-series data, needing imputation to fill in data gaps. Solid waste generation (EQ3) and water with good ambient quality (EQ5) have only two data points, including 2015 and 2018 (or 2019 for EQ3). These indicators are important, and no proxy variable is available. It was thus assumed that the value in 2015 holds for the years from 2010 to 2014, and the average value of the two data points holds between 2015 and 2018 (or 2019 for EQ3). EQ3 and EQ5 are SDG indicators, so data availability is expected to improve in the coming years. Except for water with good ambient quality (EQ5), for which data was collected from Ghana's Water Resources Commission, the data for the natural capital protection indicators were downloaded from international sources, particularly the UNSTATS database and WB Open Data.

Natural capital protection is one of the dimensions with the most significant number of SDG indicators. However, out of the 14 SDG indicators, only eight of them were downloaded from the UNSTATS database. The WB Open Data and Climate Watch Data provided more comprehensive data for several SDG indicators.

Four indicators in the green economic opportunities dimension have the most recent data available for 2022. Like in natural capital protection, six indicators have intermittent time-series data. Moreover, firms offering formal training (GJ4) and Researchers (in full-time equivalent) per million inhabitants (GN3) have only two data points, requiring data imputations. Except for renewable electricity capacity (GV2), with data from the Ghana Energy Commission Report, the eight SDG indicators in the green economic opportunities dimension were downloaded from the UNSTATS database. Among the four pillars, green investment has the least number of green growth indicators represented by the SDGs. Six of the non-SDG indicators were downloaded from the WB Open Data, including vulnerable employment (GJ3), firms offering formal training (GJ4), trademark applications (GN5), new business density (GT4), high-technology exports (GT5), and adjusted net savings (GV1).

Almost half of the 20 green growth indicators in the social inclusion dimension have data for 2022, and many of them have completed time-series data from 2010. However, six indicators have only intermittent time-series data requiring imputation to close data gaps. One of the social inclusion dimension indicators has only one data point – the proportion of the population that has convenient access to public transport (AB4). Data availability for indicators related to sustainable transport is poor; thus, it was challenging to find a proxy variable. Therefore, the 2020 data for AB4 was assumed to hold for all years from 2010 to 2022. Together with the natural capital protection, the social inclusion dimension has the most significant number of indicators representing SDGs, with 14 SDG indicators. However, considering that three SDG indicators (i.e., AB1, AB2, and SE2) are represented by two indicators, social inclusion covers more SDG indicators than natural capital protection. Unlike in the latter dimension, the data for the SDG indicators in the former dimension were downloaded from the UNSTATS database. Four out of five indicators in access to basic services and resources, as well as the social protection pillar, were taken from this database. The World Bank databases like Open Data, TCdata360, and Women, Business and the Law were the other important data sources for social inclusion indicators.

Table 8 Data availability and sources of the green growth indicators

Indicator Code	Available years	Source of downloaded data	Relationship to green growth	Sustainability targets	Source of the targets
EFFICIENT AND SUSTAINABLE RESOURCE USE					
EE1 *	2000 - 2020	UNSTATS database	negative	1.756	Top 5 developing countries
EE2 *	2000 - 2020	UNSTATS database	positive	92.606	Top 5 developing countries
EE3	2007-2022	WB Logistics Performance Index	positive	3.145920417	Top 5 developing countries
EE4	1965-2021	Our World in Data	positive	99.90778884	Top 5 developing countries
EE5	2000-2022	Ghana Energy Commission Report	negative	4.1	Top 5 developing countries
EW1 *	2000 - 2020	UNSTATS database	positive	98.296	Top 5 developing countries
EW2 *	2000 - 2020	UNSTATS database	negative	25-75	SDG target
EW3 *	2000-2022	UNSTATS database	positive	5.812	Top 5 developing countries
EW4	1994-2020	FAO Aquastat	negative	23.70479789	Top 5 developing countries
EW5	1961 - 2020	WB Open Data	positive	23.70479789	Top 5 developing countries
SL1	1960-2020	FAOSTAT	negative	5	Expert opinion
SL2	2005 - 2020	FAOSTAT	positive	23.63889797	Top 5 developing countries
SL3	1961 - 2020	FAOSTAT	negative	0.038	Top 5 developing countries
SL4	1991-2021	FAOSTAT	positive	121637.9221	Top 5 developing countries
SL5	1961 - 2019	Our World in Data	positive	1.0932244	Top 5 developing countries
ME1 *	1970 - 2019	WB Open Data and OECD database	negative	1.63E-08	Top 5 developing countries
ME2 *	1970 - 2019	UNEP Global Material Flows Database	negative	9.280505096	Top 5 developing countries
ME3 *	2014 - 2018	FAOSTAT	negative	10.06335707	Top 5 developing countries
ME4 *	2012, 2014, 2016 - 2021	UNSTATS database	positive	8387766.943	Top 5 developing countries
ME5	2006-2020	FAOSTAT	positive	1.992031462	Top 5 developing countries
NATURAL CAPITAL PROTECTION					
EQ1 *	2000-2019	WB Open Data	negative	10	SDG target
EQ2	1990 - 2019	Institute for Health Metrics and Evaluation GHDx database	negative	51.24954078	Top 5 developing countries
EQ3 *	2015, 2019	UNSTATS database	negative	0.826	Top 5 developing countries
EQ4 *	2000 - 2022	UNSTATS database	negative	0.046183	Top 5 developing countries
EQ5 *	2015, 2018	Water Resources Commission, Administrative Data, 2017	positive	75	National Target
GE1 *	1990 - 2022	Climate Watch Data and WB Open Data	negative	0.179310633	Top 5 developing countries
GE2 *	1990 - 2022	Climate Watch Data and WB Open Data	negative	0.122589744	Top 5 developing countries
GE3	1990 - 2022	Climate Watch Data and WB Open Data	negative	0.046821634	Top 5 developing countries
GE4	1980 - 2019	Our World in Data	negative	0.08808	Top 5 developing countries
GE5	2000 - 2020	UNSTATS database	negative	0.014	Top 5 developing countries



Table 8 Data availability and sources of the green growth indicators (continued)					
Indicator Code	Available years	Source of downloaded data	Relationship to green growth	Sustainability targets	Source of the targets
BE1 *	2000 - 2022	UNSTATS database	positive	100	SDG target
BE2 *	1990 - 2021	WB Open Data	positive	17	SDG target
BE3 *	2000, 2010, 2015 - 2020	UNSTATS database	positive	74.456	Top 5 developing countries
BE4 *	2000, 2005, 2010, 2015 - 2022	UNSTATS database	positive	3418.442	Top 5 developing countries
BE5 *	2000 - 2022	UNSTATS database	positive	0.115079	Top 5 developing countries
CV1 *	2000 - 2002, 2007 - 2022	UNSTATS database	negative	1	Top 5 developing countries
CV2 *	2016 - 2022	WB Open Data	positive	17	SDG targets
CV3	1995 - 2022	WB Open Data	positive	5489900000	Top 5 developing countries
CV4 *	1995, 2000, 2005, 2010, 2012, 2014, 2016 - 2021	FAOSTAT	positive	89991.2	Top 5 developing countries
CV5	2013, 2015 - 2019	UNESCO UIS Data	positive	5.8554	Top 5 developing countries
GREEN ECONOMIC OPPORTUNITIES					
GJ1	2010, 2013, 2015 - 2018	UNIDO	positive	0.06945	Top 5 developing countries
GJ2 *	2000 - 2022	UNSTATS database	negative	0.126	Top 5 developing countries
GJ3	1991 - 2021	WB Open Data	negative	15.1898662	Top 5 developing countries
GJ4	2007, 2013	WB Open Data	positive	64.62	Top 5 developing countries
GJ5 *	2006 - 2021	UNSTATS database	positive	14.151316	Top 5 developing countries
GN1	1973, 1995 - 1997, 1999 - 2002, 2004 - 2006, 2008 - 2019	OECD database	positive	96.66666667	Top 5 developing countries
GN2	2000 - 2018	Our World in Data	positive	365.765338	Top 5 developing countries
GN3 *	2007, 2010	UNSTATS database	positive	825.345586	Top 5 developing countries
GN4 *	2000 - 2020	UNSTATS database	positive	38.192	Top 5 developing countries
GN5	2015, 2017, 2019 - 2020	WB Open Data	positive	99796.9	Top 5 developing countries
GT1	2000 - 2010, 2013, 2015 - 2019	COMTRADE DATA	positive	7.898475802	Top 5 developing countries
GT2 *	2000 - 2022	UNSTATS database	positive	5.246832891	Top 5 developing countries
GT3	2000 - 2009, 2011 - 2022	ISO database	positive	2040.8	Top 5 developing countries
GT4	2017 - 2020	WB Open Data	positive	14.97049291	Top 5 developing countries
GT5	2008 - 2010, 2013, 2015 - 2021	WB Open Data	positive	25.51204002	Top 5 developing countries
GV1	1990 - 2019	WB Open Data	positive	25.79957453	Top 5 developing countries
GV2 *	2000 - 2022	Ghana Enegy commission Report	positive	40000	National target
GV3 *	2000 - 2021	UNSTATS database	positive	321.024	Top 5 developing countries
GV4 *	2001 - 2021	UNSTATS database	positive	1.83	Top 5 developing countries
GV5	2006 - 2019	Global Economy	positive	4.98	Top 5 developing countries

Table 8 Data availability and sources of the green growth indicators (continued)					
Indicator Code	Available years	Source of downloaded data	Relationship to green growth	Sustainability targets	Source of the targets
SOCIAL INCLUSION					
AB1 *	2000 - 2022	UNSTATS database	positive	100	SDG targets
AB1_a*	2000 - 2022	UNSTATS database	positive	100	SDG targets
AB1_b*	2000 - 2022	UNSTATS database	positive	100	SDG targets
AB2 *	2000 - 2022	UNSTATS database	positive	100	SDG targets
AB2_a*	2000 - 2022	UNSTATS database	positive	100	SDG targets
AB2_b*	2000 - 2022	UNSTATS database	positive	100	SDG targets
AB3 *	2001 - 2020	UNSTATS database	negative	0	Expert opinion
AB4 *	2020	UNSTATS database	positive	100	Highest score
AB5	1995 - 2021	WB TCdata360	positive	100	Highest score
GB1 *	2000 - 2022	UNSTATS database	positive	50	SDG targets
GB2 *	2000 - 2022	UNSTATS database	negative	1	SDG targets
GB3	1971 - 2021	WB Women, Business and the Law	positive	100	Highest score
GB4 *	2003, 2008, 2014 - 2020	UNSTATS database	positive	100	Highest score
GB5	1970 - 1995, 1998 - 2009, 2012, 2014 - 2016, 2019	WB Open Data	negative	1	Expert opinion
SE1	1972 - 2022	WB Open Data	negative	1.278115276	Top 5 developing countries
SE2 *	1990 - 2022	UNSTATS database	negative	1	Expert opinion
SE2_a*	1990 - 2022	UNSTATS database	negative	1	SDG targets
SE2_b*	1990 - 2022	UNSTATS database	negative	1	SDG targets
SE3 *	2000 - 2022	UNSTATS database	negative	1	Expert opinion
SE4	1960 - 2022	WB Open Data	negative	3.866945493	Top 5 developing countries
SE5 *	2019, 2021	UNSTATS database	positive	95.815	Top 5 developing countries
SP1 *	2000, 2016, 2019	UNSTATS database	positive	100	SDG targets
SP2 *	2000, 2005, 2010, 2015, 2017, 2019, 2021	UNSTATS database	positive	100	SDG targets
SP3 *	2000 - 2020 (2 years range)	UNSTATS database	negative	6.618574	Top 5 developing countries
SP4 *	2004 - 2012, 2014 - 2021	UNSTATS database	negative	0	SDG target
SP5	2019-2020	UNSTATS database	positive	100	Top 5 developing countries
SP3 *	2000 - 2020 (2 years range)	UNSTATS database	negative	6.618574	SDG target
SP4 *	2004 - 2012, 2014 - 2021	UNSTATS database	negative	0	SDG target
SP5	2014 - 2022	Index for Risk Management database	positive	5	Highest score

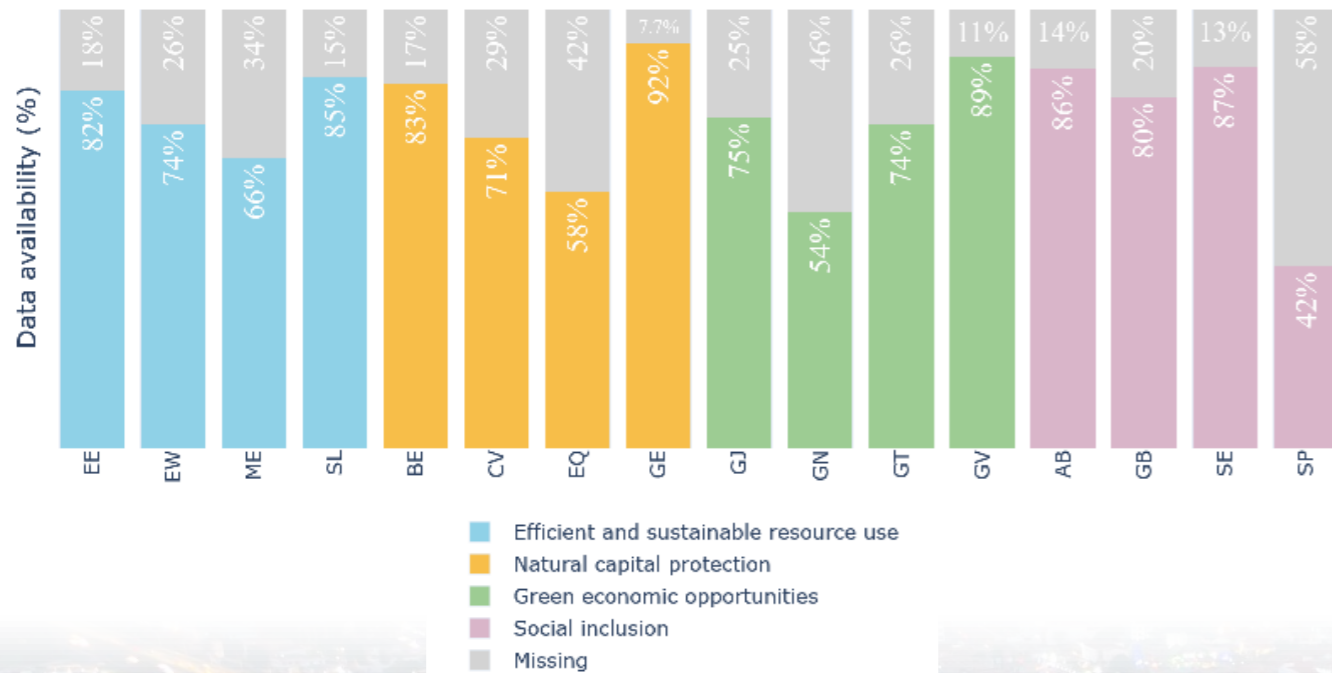
*SDG indicators

Definitions: UNSTATS - United Nations Statistics Division, WB - World Bank, FAO - Food and Agriculture Organization, FAOSTAT - Food and Agriculture Organization Statistics, OECD - Organization for Economic Cooperation and Development, UNEP- United Nations Environment Programme, IHME - Institute for Health Metrics and Evaluation, GDHx - Global Health Data Exchange, WHO - World Health Organization, CW - Climate Watch, UNESCO - United Nations Educational, Scientific and Cultural Organization, UNCTAD - United Nations Conference on Trade and Development, UN COMTRADE - United Nations Commodity Trade Statistics Database, ISO - International Organization for Standardization, IRENA - International Renewable Energy Agency

Figure 15 presents the data availability and gaps for each pillar's different green growth indicators. The GHG emissions reduction (GE) and green investment (GV) indicators have the best data availability, with 92 and 89 percent, respectively. Most pillars have data availability ranging from 71 percent to 87 percent. The indicators

with the most significant data gaps are those in social protection (SP), environmental quality (EQ), and green innovation (GN). To allow computation of the Green Growth Index, simple imputations were done to fill in the data gaps. The imputation methods are discussed in section 2.3.2.

Figure 15 Data gaps for the indicators by pillars, 2010-2022



Through normalization, the different units of the green growth indicators (see details in Table 3) have been rescaled to a uniform unit with a scale of 1 to 100 to allow their aggregations (see methods in section 2.3.2). In addition, the green growth indicators were benchmarked against sustainability targets so that the normalized scores would measure how far the indicators are from the sustainability targets (i.e., distance to targets). For example, a score of 100 would mean that the sustainability target for an indicator was achieved. Table 8 shows the different sustainability targets used to benchmark the 80 green growth indicators. The identification of sustainability targets was based on the following rules:

1. For SDG indicators

- a. Explicit targets defined in SDG documents or relevant literature, e.g., 17 percent for the share of forest to total land area.
- b. Implicit targets which are the expected norm, e.g., 0 percent for the proportion of the urban population living in slums.
- c. If explicit and implicit targets are not available, the average value of the top 5 performing developing countries, which the national experts selected as the target to benchmark Ghana's performance.

2. For non-SDG indicators

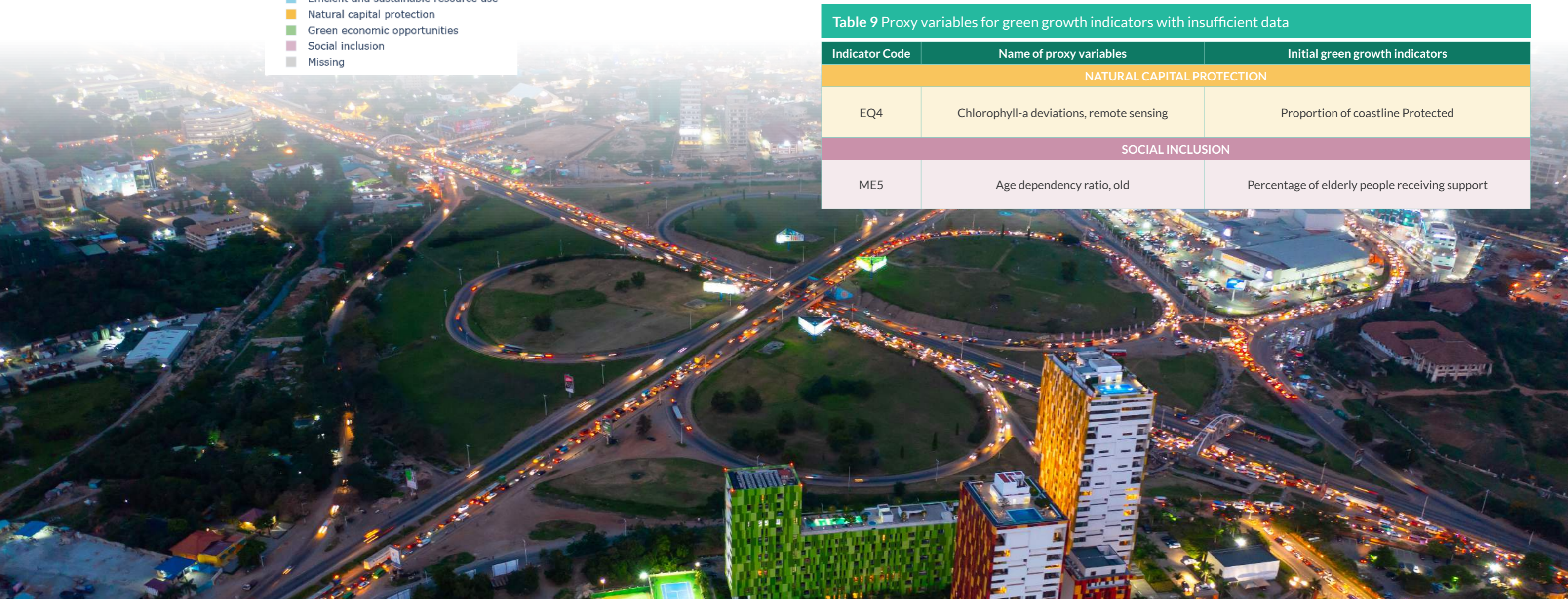
- a. Expert opinion from the publisher of the indicator, e.g., 0-5 tons per hectare for nutrient balance per unit area according to FAO, zero for the share of unemployment to represent the expected norm.
- b. Average value of top 5 performing developing countries, which the national experts selected as the target to benchmark Ghana's performance.

4.2.2 Green growth indicators and proxy variables

Two proxy variables were used in the Ghana Green Growth Index due to a lack of data for the indicators selected by the national experts (Table 9), including chlorophyll-a deviations remote sensing (EQ4) and age dependency ratio, old (SE4). The indicators selected by the national experts were the proportion of coastline Protected for EQ4 and the percentage of elderly people receiving support for ME5. The chlorophyll-a deviations remote sensing (EQ4), an SDG indicator, has available data from the UNSTATS database for the years 2000 - 2022 (Table 8). The age dependency ratio, old (SE4) has available data from WB Open Data for the years 1960 - 2022. The proxy variables used instead of these indicators will be replaced as the data availability for the indicators improves in the coming years. The proxy variables were drawn from the list presented to the participants as alternative indicators during the first participatory workshop.

Table 9 Proxy variables for green growth indicators with insufficient data

Indicator Code	Name of proxy variables	Initial green growth indicators
NATURAL CAPITAL PROTECTION		
EQ4	Chlorophyll-a deviations, remote sensing	Proportion of coastline Protected
SOCIAL INCLUSION		
ME5	Age dependency ratio, old	Percentage of elderly people receiving support





Ghana's Green Growth Index

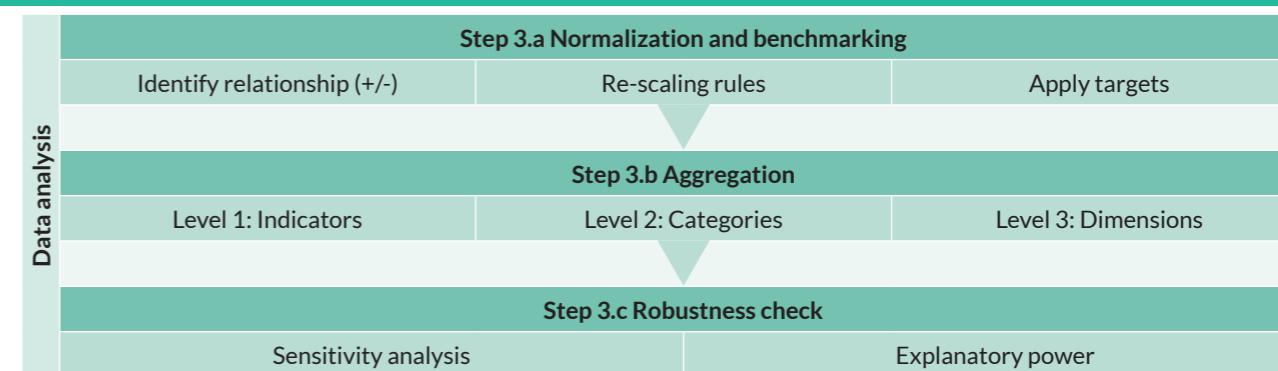
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5.1 Overall green growth performance	58
5.1.1 Distance to sustainability targets	58
5.1.2 Performance dashboards	59
5.1.3 Green growth trends	60
5.2 Green growth indicators	62
5.2.1 Efficient and sustainable resource use	62
5.2.2 Natural capital protection	66
5.2.3 Green economic opportunities	70
5.2.4 Social inclusion	73
5.2 Green growth indicators	77

This chapter assesses Ghana's green growth using a structured approach outlined in Step 3 of the analytical process (Figure 16). The process begins with normalization and benchmarking to ensure that data are comparable across different parameters. The analysis then advances to Step 3b, aggregating scores at various levels, including pillars (combining normalized scores of indicators), dimensions (combining average scores of the pillars), and overall Index

(combining average scores of the dimensions). The final phase, Step 3c, involves a robustness check, where the indicators' sensitivity and the overall model's explanatory power are examined to confirm the soundness of the analysis. This methodology ensures a transparent and systematic evaluation of Ghana's progress in green growth from 2010 to 2022, highlighting achievements and identifying areas needing further development.

Figure 16 Data analysis of the green growth indicators



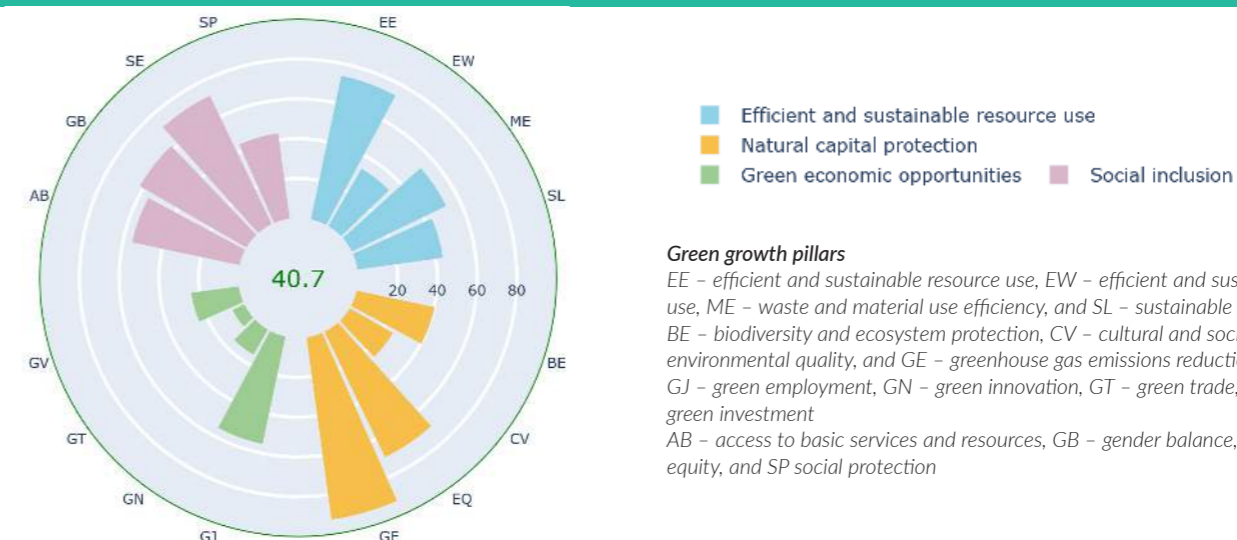
5.1 Overall green growth performance

5.1.1 Distance to sustainability targets

Figure 17 shows Ghana's advancement towards green growth, represented by the four dimensions of the Green Growth Index: efficient and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion. Each dimension consists of four pillars, with scores indicating the country's performance relative to sustainability targets. The interpretation of scores is categorized as follows: 1-20 denotes very low performance, 21-40 signifies low performance, 41-60 reflects moderate performance, 61-80 indicates high performance, and 81-100 represents very high performance in achieving sustainability targets for the transition to green growth.

In 2022, Ghana achieved an overall Green Growth Index score of 40.7 (or ca. 41), representing a moderate green growth performance. This score, derived from the geometric aggregation of scores across the dimensions as mentioned above, illustrates significant advancements in areas such as GHG emissions reduction and energy efficiency but also underscores the need for considerable improvements in other pillars. Notably, the moderate Green Growth Index score can be attributed to the very low performance in pillars critical to economic transformation, such as green investment (GV), green trade (GT), and green innovation (GN). This highlights the urgency for targeted interventions to enhance Ghana's capacity for green industrialization and eco-friendly trade practices. Strategic and concerted efforts are needed to translate the extensive policy frameworks into tangible outcomes to elevate overall performance. This includes mobilizing investments in green technologies, expanding access to resources and services, and intensifying biodiversity protection, all of which are integral to realizing Ghana's vision of a resilient and sustainable green economy.

Figure 17 Distance to sustainability targets by pillar



Green growth pillars
 EE – efficient and sustainable resource use, EW – efficient and sustainable water use, ME – waste and material use efficiency, and SL – sustainable land use
 BE – biodiversity and ecosystem protection, CV – cultural and social value, EQ – environmental quality, and GE – greenhouse gas emissions reduction
 GJ – green employment, GN – green innovation, GT – green trade, and GV – green investment
 AB – access to basic services and resources, GB – gender balance, SE – social equity, and SP social protection

Ghana's scores in the natural capital protection dimension show a varied performance. The very high score of 92.7 in GHG emissions reduction (GE) reflects the strong emphasis that Ghana places on reducing emissions, in line with the Updated Nationally Determined Contribution (NDCs) and the National Climate Change Master Plan (NCCAS), which aims to create a low-carbon society. The environmental quality (EQ) pillar also scores relatively high at 70.31, suggesting effective pollution control measures as advocated in the National Environmental Policy. However, the cultural and social values (CV) and biodiversity and ecosystem protection (BE) pillars score 25.25 and 40.34, respectively, indicating further need to strengthen implementation of the National Biodiversity Strategy and Action Plan (NBSAP) and other related sectoral policies.

In the efficient and sustainable resource use dimension, the score of 74.07 for efficient and sustainable energy (EE) denotes high performance, likely reflecting the policies outlined in the National Energy Transition Framework, which targets a sustainable energy future for Ghana. However, the moderate score of 52.91 for waste and materials use efficiency (ME) and low scores of 33.62 and 43.64 for efficient and sustainable water use (EW) and sustainable land use (SL), respectively, highlight the challenges faced in water management and land stewardship, despite the policies aimed at modernizing agriculture and ensuring food security.

The social inclusion dimension scores indicate Ghana's focused efforts on equitable social development. The high performance in social equity (SE), with a score of 71.95, and the moderate performance in gender balance (GB), with 62.22, can be tied to the national Gender Policy and Social Protection Policy, which strives for inclusivity and gender parity. The moderate scores for access to basic services and resources (AB) and social protection (SP), at 55.55 and 43.49, indicate the need to enhance efforts towards achieving the ambitious goals set in Agenda 2057 for providing universal access to services and strengthening social safety nets.

However, the scores in the green economic opportunities (GEO) dimension underscore significant areas for policy and action focus. Very low scores in green investment (GV), green trade (GT), and green innovation (GN) of 24.43, 6.82, and 14.84, respectively, underscore a critical need for Ghana to bolster its economic framework to attract green investments, enhance trade in environmental goods, and foster innovation in line with its Long-term National Development Plan (LTNDP). The moderate green employment (GJ) score of 55.57 reflects efforts from the National Green Jobs Strategy, highlighting some progress in creating employment aligned with environmental sustainability.

The scores highlight Ghana's robust commitment to reducing GHG emissions and improving energy efficiency while revealing areas such as biodiversity protection, water management, green finance, and trade where further efforts are necessary. Ghana's policies, particularly those under Agenda 2057 and various sectoral policies, are instrumental in shaping these outcomes. The Green Growth

Index emphasizes opportunities for improving performance, where continued investment in policy implementation, capacity building, and international cooperation in various pillars remain crucial to moving closer to the sustainability targets and ultimately realizing the vision of a green and resilient Ghana.

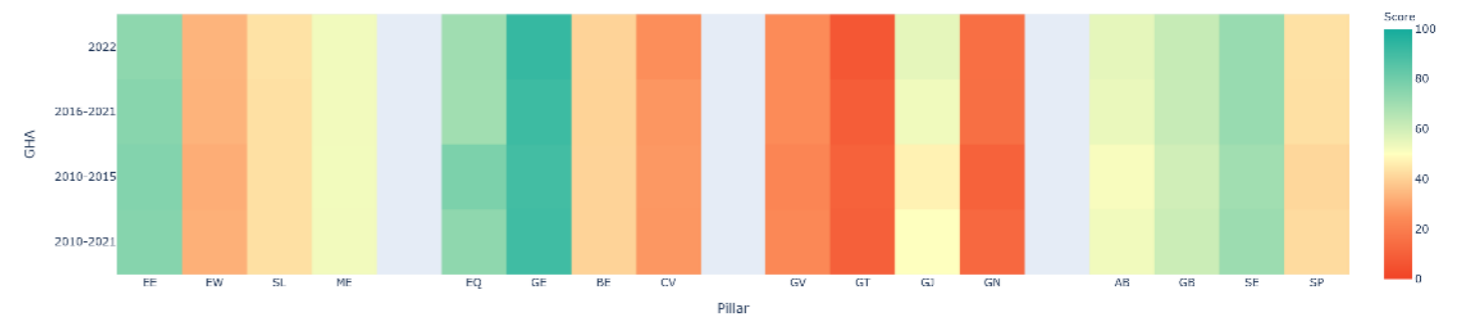
5.1.2 Performance dashboards

Figure 18 compares Ghana's scores across different pillars in 2022 against the average scores for three periods: 2016-2021, 2010-2015, and 2010-2021. While the figure reveals minimal differences in scores across these periods, it further highlights the challenges for specific pillars over time. While Ghana had made notable strides in GHG emissions reduction and energy efficiency, it continued to be challenged by persistent poor performance in biodiversity protection, cultural integration of green values, and stimulating green economic sectors.

The GHG emissions reduction (GE) pillar stood out in the natural capital protection dimension, with scores consistently above 89 since 2010, peaking at 92.7 in 2022. This very high performance aligned with Ghana's aggressive policies, such as the Updated NDCs and the National Climate Change Master Plan, which focus on significant GHG emission reductions. The environmental quality (EQ) pillar showed high performance, albeit with a slight decrease from the previous period, possibly suggesting challenges in maintaining the momentum of environmental quality initiatives. In contrast, cultural and social values (CV) and biodiversity and ecosystem protection (BE) scored around 27 and 40, respectively, throughout the periods. In the efficient and sustainable resource use dimension, the score for efficient and sustainable energy (EE) remains high, above 74 since 2010. Efficient and sustainable water use (EW) presents a moderate score, indicating potential areas for improvement, possibly in implementing the Water Policy. Material use efficiency (ME) and sustainable land use (SL) show moderate performance, suggesting steady, but not rapid, progress in these areas over time.

The social inclusion dimension shows moderate to high scores, with social equity (SE) scoring 71.95 in 2022, suggesting that policies such as the National Social Protection Policy have a positive impact. Gender balance (GB) also demonstrates a progressive trend, with a score of 62.22 in 2022, resonating with the objectives of the Gender Policy. However, access to basic services and resources (AB) and social protection (SP) exhibit more modest gains, increasing by 2 points between 2010-2015 and 2016-2021. There is a significant variance in performance in the green economic opportunities dimension. Green investment (GV) and green trade (GT) show very low performance, with scores of 24.43 and 6.82, respectively, in 2022, suggesting some barriers to realizing these investments and trade opportunities. Conversely, green employment (GJ) has shown a notable improvement from a moderate score of 47.13 in 2010-2015 to a higher score of 55.57 in 2022, possibly reflecting the positive outcomes of the National Green Jobs Strategy.

Figure 18 Performance dashboard by pillars



Green growth pillars

EE – efficient and sustainable resource use, EW – efficient and sustainable water use, ME – waste and material use efficiency, and SL – sustainable land use
BE – biodiversity and ecosystem protection, CV – cultural and social value, EQ – environmental quality, and GE – greenhouse gas emissions reduction
GJ – green employment, GN – green innovation, GT – green trade, and GV – green investment
AB – access to basic services and resources, GB – gender balance, SE – social equity, and SP social protection

5.1.3 Green growth trends

The trend depicted in Figure 19 for Ghana's Green Growth Index scores from 2010 to 2022 exhibits a consistent and gradual ascent, reflecting the country's steady transition to green growth. From a score of 38.17 in 2010 and 40.70 in 2022, Ghana's trajectory moved from a "low" to a "moderate" performance level. The upward trend, although modest, indicates a positive progression in Ghana's efforts to integrate green growth into its developmental agenda. The trend for Ghana's Green Growth Index from 2010 to 2022 across the four dimensions shows a distinct pattern of progression and challenge (Figure 20). Comparatively, the social inclusion dimension performed the best. Figure 20 presents a consistently increasing trend, moving from a score of 53.56 in 2010 to 57.35 in 2022, maintaining a moderate performance throughout and edging towards the high-performance level. This suggests Ghana's effective strides towards inclusive growth. National experts' observations during the second participatory workshop supported the idea that social inclusion is crucial for sustainable development and poverty reduction (Box 1). The progressive shift in governance to include women, persons with disabilities (PWDs), and children in decision-making processes has likely contributed to the positive trend observed in this dimension. The natural capital protection dimension initially showed a slight

upward trend until 2013, followed by fluctuations and a gentle decline, settling at a moderate level of 50.76 in 2022. This trend can be attributed to the decrease in Ghana's scores in degraded land over total land area (EQ3) and international tourism receipts CV3. Experts have noted the critical role of natural capital in national development, such as acting as a carbon sink and providing ecosystems for air quality purification (Box 1). This underscores the importance of bolstering efforts in this area. The efficient and sustainable resource use dimension saw a gradual but somewhat stagnant trend, slightly increasing from 47.63 in 2010 to 48.97 in 2022, indicating moderate performance. The importance of sustainable resource use for development and environmental performance monitoring is recognized by national experts, suggesting that further emphasis on efficiency and sustainability in resource use is essential for Ghana's development. In stark contrast, despite an initial increase, the green economic opportunities dimension experiences a plateau and slight decline, with a score of 19.25 in 2022, reflecting a very low performance. These consistently very low scores highlight a gap between the ambition for green economic growth and the realization of targets. The national experts suggested that Ghana is now gearing towards green investment, which could help improve performance in the green economic opportunities dimension.



Figure 19 Trend in the Green Growth Index in Ghana, 2010-2022

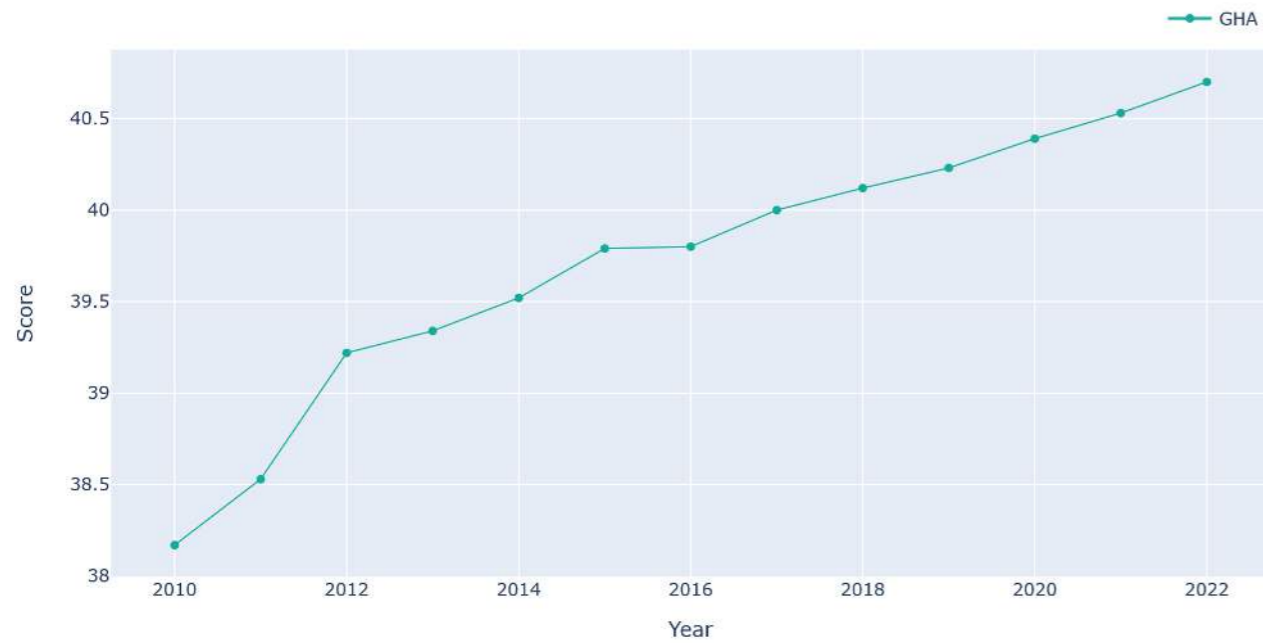
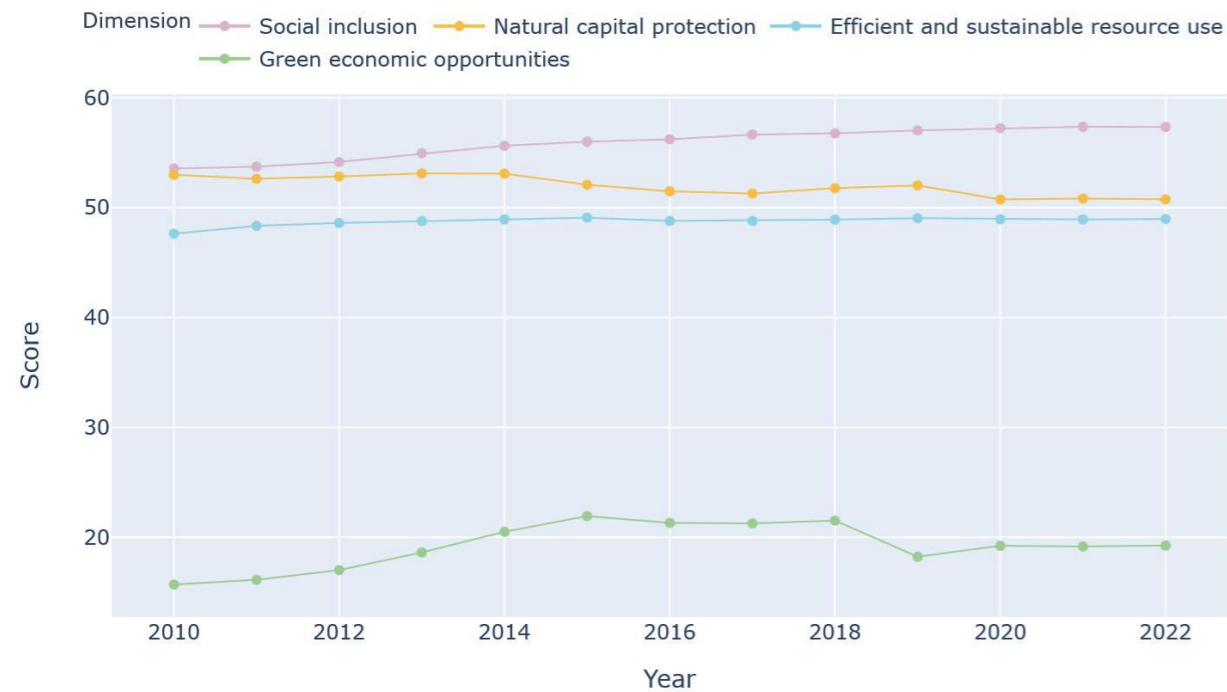


Figure 20 Trend in the green growth dimensions in Ghana, 2010-2022



Box 1 National experts' rating and opinion on the opportunities for improving Ghana's performance in the four green growth dimensions

During the second participatory workshop, the national experts were grouped into three (3), each providing their feedback and assessments of the Green Growth Index scores. Below are the ratings and assessments at the dimension level.

Rating on efficient and sustainable resource use: VERY HIGH (1 group), HIGH (2 groups)

The national experts suggested that there is much room for improving the efficient and sustainable resource use indicators. Many green growth indicators with scores above 50, showing that Ghana is becoming more aggressive with sustainability. Sustainable resource use is critical to the development of every country. Maximum utilization of a country's resources is the only way a country can develop. This also helps to monitor environmental performance.

Rating on natural capital protection: VERY HIGH (1 group), HIGH (2 groups)

The national experts suggested much potential for developing and opportunities for improving the NCP dimension. Natural capital protection is of very significant importance for national development. For instance, it serves as a carbon sink, provides ecosystems for air quality purification, and supports human well-being.

Rating on green economic opportunities: VERY HIGH (3 groups)

The national experts agreed that green economic opportunities will lead to sustainable employment and economic growth. Currently, the whole country is gearing towards green investment, although the scores are far from the targets.

Rating on social inclusion: VERY HIGH (3 groups)

The national experts suggested that basic services and resources are the necessities of life and required for human survival. And yet, very few sections of the Ghanaian population, especially the vulnerable, have access to basic services and resources. Governance of the right to information (RTI) and access to basic services have been decentralized.

5.2 Green growth indicators

5.2.1 Efficient and sustainable resource use

Figure 21 presents a comprehensive analysis of the scores for the efficient and sustainable resource use indicators for 2022, including

a time series analysis from 2010 to 2022. In this dimension, an analysis of the various pillars for the year 2022 in the previous section reveals distinct disparities in performance. Efficient and sustainable energy reaching a high score performed best, followed by material use efficiency and sustainable land use, with moderate performance. Ghana's lowest performance in this dimension is on efficient and sustainable water use, with a low score.

Figure 21 Scores for indicators in the efficient and sustainable resource use dimension



In the efficient and sustainable resource use dimension, efficient and sustainable energy emerged as the best-performing pillar. This is primarily attributed to consistently high scores in two key indicators: electricity transmission losses (EE5) and energy intensity (EE1). In 2012, EE5 remarkably scored 100 and consistently maintained this score until 2022. This aligned with the LTNDP's goal of reducing transmission and distribution losses to 6 percent by 2057. The MTNDPF acknowledges that conservation issues, along with inadequate and obsolete grid networks, have been significant challenges in the past. The sustained high performance in this indicator suggested that adequate measures have been implemented to address these challenges, resulting in reduced losses in electricity transmission and distribution. Energy intensity (EE1) scored an impressive 90.38 in 2022, indicating very high performance, and had shown a steady increase from 88.52 in 2010. This improvement aligned with the national policy objectives outlined in the LTNDP, which emphasizes efficient use of energy and the adoption of cleaner technologies as the country progresses industrially. The MTNDPF also supports this by promoting energy-efficient technologies in public and private buildings. This strategic focus, coupled with a push for mass public transport systems to reduce emissions, reflects a national commitment to enhancing energy efficiency, as noted by the national experts who highlighted the potential for significant cost savings and adherence to the UN protocols on energy transition, including the Paris Agreement. Low-carbon electricity (EE4) scored 84.28 in 2022, showing high performance but slightly declining from 86.02 in 2010. The LTNDP aims to develop an optimal electricity generation mix, including a significant role for renewables. The NDCs also advocates for low-carbon electricity generation. However, the national experts participating in the second participatory workshop noted that the current electricity generation from renewables could be much higher than Ghana's SDG targets (Box 2). The gap identified by experts between policy targets and actual performance indicates opportunities to develop renewable supply further in the electricity sector.

The renewable energy share (EE2) registered a moderate performance at 44.03 in 2022, reflecting a decline from a high of 56.49 in 2010. The national experts identified this indicator as having significant room for improvement, with renewable energy being both environmentally friendly and cost-efficient. The LTNDP and NDCs policies emphasize increasing the share of renewable energy in the national energy mix, targeting a rise to 10 percent by 2030 and 15 percent by 2047. However, the current low contribution of renewable energy to Ghana's total energy consumption indicates a gap between policy objectives and implementation. The national experts highlighted challenges such as financing, technical expertise, and policy bottlenecks, underscoring the need for aggressive education and public acceptability for renewables (Box 2). Efficient transport (EE3) has fluctuated over the years, slightly increasing to 51.64 in 2022, representing moderate performance. While this indicator is not explicitly mentioned in several of Ghana's key policies like the LTNDP, NCCAS, or NDCs, the MTNDPF includes strategies to improve port operations and logistics, directly influencing this indicator. The need for efficient and competitive seaport operations, as well as the development of integrated truck staging and management systems, align with improving transport efficiency.

The materials use efficiency, including waste, showed a mixed performance. Material consumption per GDP (ME1) exhibited very high performance, with a score of 98.78 in 2022, slightly increasing

from 97.62 in 2010. This indicator, not mentioned in Ghana's key policy documents like the LTNDP, MTNDPF, or NCCAS, gauges the efficiency of material use in the economy. The high score suggests either effective utilization or underutilization of materials relative to the GDP. The national experts explained that material use is currently low in the country. However, they also pointed out that there is still significant room for improving circular economic practices and material use efficiency, which can create employment and reduce waste in the economy. Material footprint (ME2) decreased from a very high score of 92.37 in 2010 to 89.06 in 2022. This indicator, also not addressed in national policies, reflects the per capita material footprint. The decline suggests an increasing material footprint, which national experts argue could be mitigated through better recycling practices and reducing waste, especially considering Ghana's significant importation and waste generation in sectors like second-hand clothing. The reduction in performance underscores the need for strategies that promote sustainable consumption and production patterns. The average food loss to production and food waste to consumption (ME3) showed moderate performance at 68.94 in 2022, improving from 66.6 in 2010. The MTNDPF aims to reduce food losses, and the NCCAS emphasizes training to minimize post-harvest losses. Despite these policy alignments, experts during the participatory workshop highlighted the need for clear structures for solid waste recycling and high food production and consumption losses (Box 2). These insights suggest that while policies are in place, implementing and establishing adequate systems remain significant challenges.

The scores for municipal solid waste recycled (ME4) and Ratio treated municipal wastewater (ME5) remained low from 2010 to 2022. ME4 scored only 3.43 in 2022. Despite the LTNDP's targets for recycling and composting facilities and the MTNDPF's strategies to support recycling, the national experts identified financing, policy challenges, and inadequate technology as significant impediments. The low score indicates that, while policies and plans recognize the importance of recycling, adequate implementation and overcoming resource constraints could improve performance in recycling solid waste. For ME5, Ghana scored 4.32 in 2022. The MTNDPF includes strategies for developing sewerage masterplans and promoting wastewater recycling, and the NCCP advocates for water recycling for various purposes. However, experts noted the need for more support and incentives, highlighting a gap between policy objectives and practical implementation (Box 2). The low score reveals enormous opportunities to improve performance in the ratio of treated municipal wastewater (ME5), including resource allocation to improve wastewater treatment infrastructure.

The sustainable land use indicators present a contrasting performance. Soil nutrient balance (SL1) and share of ruminant livestock (SL3) have maintained very high-performance scores of 100 and 99.6, respectively, over time. SL1 represents efficient nutrient management in agricultural practices. The national experts emphasized that without proper nutrient balance, there is a risk of further land degradation due to the overuse of chemical fertilizers. The high score in SL1 suggests effective nutrient management practices, reflecting alignment with sustainable agriculture practices promoted in policies like LTNDP and MTNDPF. Similarly, SL3 is implicitly mentioned in the MTNDPF, highlighting the need to enhance small ruminant production. Conversely, the organic agriculture area (SL2) remained very low at 2.51 in 2010 and 5.46 in 2022. The LTNDP and MTNDPF policies support the expansion of organic

farming, aligning with this indicator. However, experts highlighted Ghana's land ownership and tenure system as significant hindrances to effective land use and adopting organic farming practices. This disconnect between policy ambitions and practical implementation, such as land tenure issues, is a challenge to improving the indicator's performance. Agricultural productivity (SL4) also scored low at 11.26 in 2022. The LTNDP recognizes the need for aggressive improvements in agricultural productivity. However, as highlighted by experts, land use inefficiency, land degradation, and improper zoning for land use are significant challenges (Box 2). Scoring a low 1.87 in 2022, farm machinery per unit land (SL5) indicates limited mechanization in agriculture. While the NCCAS promotes farming technologies that enhance productivity, limited emphasis in other key documents like the LTNDP and MTNDPF may reflect a gap in policy focus on agricultural mechanization.

Efficient and sustainable water use is the least-performing pillar within the efficient and sustainable resource use dimension. Water use efficiency (EW1) scored 33.68 in 2022, within the low-performance range, although there has been a gradual increase from 19.56 in 2010. The gradual increase aligns with the initiatives mentioned in the LTNDP, emphasizing Integrated Water Resource Management. The MTNDPF also promotes efficient water use. The national experts have acknowledged the potential for significant improvement in water use efficiency, citing it as critical for sustainable development. Despite these policy frameworks, the low score suggests that further efforts are needed to maximize water use efficiency, particularly in addressing implementation challenges and capacity gaps. The performance in the level of water stress (EW2) is also low, with a score of 25.9 in 2022, slightly improving from 22.53

in 2010. The LTNDP's projections of declining per capita water availability and MTNDPF's acknowledgment of decreasing water availability per capita highlight the growing challenges in managing water stress. The national experts' emphasis on efficiently managing freshwater resources aligns with these concerns, suggesting a need for more aggressive policies and awareness campaigns to mitigate water stress.

A significant area of concern is the renewable water resources per capita (EW5), which scored a very low 1.74 in 2022, slightly declining from 1.93 in 2010. The LTNDP forecasts a rapid increase in total water requirements, exceeding available resources. This projection aligns with the low score in EW5, highlighting the challenge of maintaining sustainable internal freshwater resources amidst growing demand. The low score and the LTNDP's predictions call for well-informed infrastructure interventions and efficient water resource management strategies to prevent environmental damage and ensure water security. Another indicator requiring policy attention is sustainable fisheries (EW3). The score plummeted to a very low 6.79 in 2022, down from 9.52 in 2010. The decline in scores indicates significant challenges in the sustainable management of fisheries. The challenges in greening the fishery sector need to be addressed to create economic opportunities and improve green growth performance. In stark contrast, the share of surface irrigation (EW4) maintained a consistent score of 100 from 2010 to 2022. The LTNDP and MTNDPF contain provisions for developing irrigation infrastructure, which likely contributed to this high score. However, experts pointed out that opportunities in agricultural productivity through irrigation still need to be utilized, particularly in northern parts of Ghana.



Box 2 National experts' rating and opinion on the opportunities for improving Ghana performance in efficient and sustainable resource use

During the second participatory workshop, the national experts were grouped into three (3), each providing feedback and assessments of the Green Growth Index scores. Below are the ratings and assessments at the pillar level.

Rating on efficient and sustainable energy: HIGH (2 groups), VERY HIGH (1 group)

The national experts explained that there is still much room for improving this pillar. More awareness of greener energy and efficient energy use will help contribute to this. Ghana stands to benefit in respect of cost savings when citizens adopt the culture of efficient energy use, especially in public organizations. This will also help Ghana adhere to the UN protocols on energy transition to achieve the Paris Agreement, creating an investment opportunity.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's efficient and sustainable energy performance:

- EE2 - Share of renewable to total final energy consumption (3 groups)
- EE4 - Electricity generation from renewables (2 groups)
- EE5 - Electric power transmission and distribution losses (1 group)

Three groups selected EE2 because current electricity generation from renewables is very low compared to the country's SDG targets and can stimulate interest. Moreover, renewable energy is environmentally friendly and cost-efficient. EE2 and EE5 indicators are considered low-hanging fruits. However, the national experts identified several challenges in improving performance in these indicators: financing, implementation, and high capital investment. Moreover, technical expertise, politicization of resource use, and policy and regulatory bottlenecks are significant challenges in electricity generation from renewables (EE4). To address these challenges, aggressive education for public acceptability, as well as initial investment and maintenance costs, will be essential.

Rating on efficient and sustainable water use: HIGH (1 group), VERY HIGH (2 groups)

The national experts explained that there are many opportunities to improve efficient and sustainable water use and that there is a framework to help Ghana follow this path. Water is critical for sustainable development. Hence, the ability to maximize water usage will lead to sustained growth.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's efficient and sustainable water use performance:

- EW1 - Water Use Efficiency (3 groups)
- EW2 - Level of water stress (2 groups)
- EW4 - Share of surface irrigation to total irrigation (1 group)

Three groups selected EW1, recognizing that water use efficiency is essential for green growth performance in all aspects of Ghana's society. However, Ghana is not efficiently managing water resources, particularly in the use of freshwater, as compared to the available water resources.

The ministry is looking at improving access to water, which has implications for EW2. Regarding EW4, the quest for local farming presents the opportunity for irrigation. The challenges identified by the national experts in improving performance in these indicators include inadequate education and awareness of water efficiency, implementation, resource constraints, capacity needs, and gaps. Water availability and pollution of available water bodies add up to these challenges.

Rating on sustainable land use: HIGH (2 groups), VERY HIGH (1 group)

The national experts explained that land is used inefficiently, with land degradation and improper zoning for land use. Policy frameworks and programs supporting the environment are available. Proper land use is very important for city development. However, Ghana's land ownership and land tenure system are huge hindrances to Ghana's Green Growth performance in sustainable land use.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's sustainable land use performance:

- SL4 - Agricultural productivity (3 groups)
- SL1 - Soil nutrient balance (1 group)
- SL2 - Organic agriculture area (1 group)

Three groups selected SL4 because Ghana has significant opportunities to improve performance in agricultural productivity. With agriculture as the backbone of all economies, maximum utilization of agricultural land and prioritization of organic methods are important. Farmers will keep shifting from one area to another without nutrient balance, leading to additional land degradation. Moreover, farmers are more likely to use chemical fertilizers on their land, posing a challenge to soil nutrient balance. Other challenges identified by the national experts in improving performance in these indicators include a lack of education and awareness about sustainable land use, poor land governance and administration, and financing and resource constraints.

Rating on material use efficiency: HIGH (1 group), VERY HIGH (2 groups)

The national experts explained that material use is currently low and poor circular economy practices in Ghana. Effective and efficient material use will create employment and reduce waste in Ghana's economy.

Box 2 National experts' rating and opinion on the opportunities for improving Ghana's performance in efficient and sustainable resource use

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's material use efficiency performance:

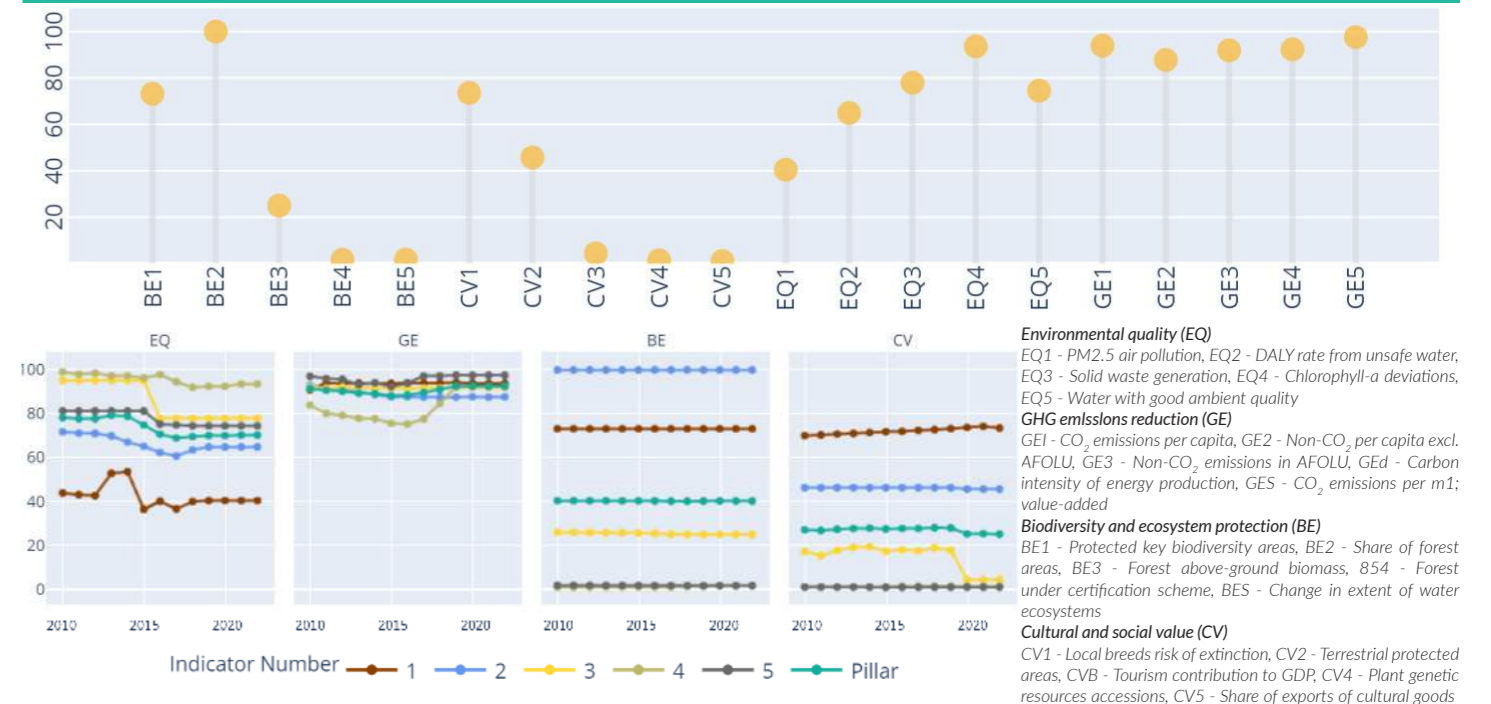
- ME4 - Municipal solid waste recycled (3 groups)
- ME3 - Food loss and food waste (2 groups)
- ME5 - Ratio treated municipal wastewater (1 group)

Three groups selected ME4 because there are no clear structures for solid waste recycling and high losses associated with food production and consumption. The country is currently facing serious challenges with solid waste. Hence, the government is putting much effort into curbing the situation through partnerships. Material use will reduce pollution and improve production. The challenges identified by the national experts in improving performance in these indicators include financing and resource constraints, policy and regulatory issues, inadequate technology, implementation, and a lack of support and incentives.

5.2.2 Natural Capital Protection

Among the natural capital protection pillars, GHG emissions reduction was the best-performing pillar (Figure 22). All GHG emissions reduction indicators achieved very high scores in 2022,

indicating Ghana's strong commitment to reducing emissions and improving energy efficiency. Conversely, cultural and social values, specifically plant genetic resources accessions (CV4) and the share of exports of cultural goods (CV5), demonstrated the lowest performance, with scores of 1.44 and 1.07, respectively, in 2022, indicating a very low level of achievement.

Figure 22 Scores for indicators in the natural capital protection dimension

In the **GHG emissions reduction pillar**, every indicator reflects very high performance. Ghana's remarkable performance in CO₂ emissions per capita (GE1), with a score increasing from 91.02 in 2010 to 93.94 in 2022, aligns with the LTNDP goal of contributing to global GHG emissions reduction. The NCCP also acknowledges Ghana's status as a carbon sink until the mid-1990s. As experts in the second participatory workshop pointed out, Ghana's per capita emission is significantly below the global average. The high GE1 scores could be associated with the country's effective policies and measures, as stated in the NDCs, which includes efforts like improved cookstoves and electric vehicles aimed at reducing carbon intensity in relation to population growth. The non-CO₂ per capita

excluding AFOLU (GE2) and non-CO₂ emissions in AFOLU (GE3) scored 87.74 and 91.9, respectively, in 2022, both maintaining high performance despite a slight decrease from their 2010 scores. The performance in GE2 suggests a high level of control over non-CO₂ emissions like methane and nitrous oxide. The LTNDP highlights these gases' significant share in national emissions, reinforcing the need for focused mitigation strategies. The NDC's inclusion of Short-Lived Climate Pollutants (SLCPs) in its mitigation assessment, aimed at reducing emissions from sectors like energy, industrial processes, and waste, directly addresses these concerns. However, national experts have pointed out the need for innovation and institutional capacity to enforce environmental regulations more effectively in this area (Box 3).

The performance in the GE3 indicator underlines the significant role of agriculture and land use changes in GHG emissions, as the LTNDP identifies the AFOLU sector as a significant contributor. This indicator's very high performance aligns well with the policies outlined in the NDCs, which cover all categories and biomass pools in LULUCF, demonstrating Ghana's commitment to managing emissions from these sectors comprehensively. The significant improvement in carbon intensity of energy production (GE4) from 84 in 2010 to 92.33 in 2022 reflects Ghana's policy focus, as stated in the NDCs, on low-carbon electricity generation. Despite the country's heavy reliance on fossil fuels for energy production, as noted by experts, the shift towards more carbon-efficient energy production is evident. However, challenges such as policy implementation, financial constraints, and technological advancements remain critical areas for further progress. Finally, CO2 emissions per manufacturing value-added (GE5) consistently showed very high performance, with a score of 97.6 in 2022, marginally decreasing from 97.15 in 2010. While this indicator is not explicitly mentioned in current policies and plans, the high score reflects an underlying efficiency in the manufacturing sector's energy use.

The **biodiversity and ecosystem protection** pillar showed high and very low indicator performances. The share of forest areas (BE2) consistently scored 100 from 2010 to 2022. Although this indicates sustained very high performance in forest area preservation, Ghana has experienced a decline in forest area since the 1990s. The LTNDP's data on the increase in forest cover over 25 years and the MTNDPF's implementation of key interventions under the Forest Plantation Strategy (2016-2040) align with the very high scores. Despite the decline in forest areas, its share of the total land area remained above the SDG target of 17 percent. The national experts recognized that forest areas established by legislation are essential for Ghana's sustainable development. It reflects the impact of deliberate policies and initiatives to expand and protect forest reserves. The protected key biodiversity areas (BE1) scored 73.22 in 2022, a high score that has remained steady since 2010. Although not explicitly mentioned in several policy documents like the LTNDP and NCCP, the MTNDPF emphasizes adopting climate-smart agricultural practices, which indirectly support biodiversity conservation. The NBSAP explicitly states the rapid deforestation and biodiversity loss Ghana has experienced, stressing the need to counter the historical trend of deforestation.

Forest areas within legally established protected areas (BE3) scored 25.04 in 2022, showing only a low level of performance and a marginal decrease from its 2010 score of 26.09. Most policy documents need to address this area explicitly. Regarding the BE3 indicator, the national experts pointed to increasing land degradation activities, implying a need for more robust legal protection of forest areas and more effective enforcement mechanisms. Forest under certification scheme (BE4) and change in the extent of water ecosystems (BE5) scored very low at 1.66 and 1.8, respectively, in 2022, highlighting critical areas needing policy attention. The absence of the BE4 indicator in national policies like the LTNDP, MTNDPF, and NBSAP suggests a lack of focus on certification schemes as a tool for forest management. The very low BE5 score reveals significant concerns regarding preserving water-related ecosystems, although the NCCP mentions preserving and conserving water resources. The national experts highlighted several challenges to improving biodiversity and ecosystem protection indicators, including weak institutional capacity, limited implementation and policy priorities, insufficient political will, and the problem of corruption (Box 3).

The **environmental quality** indicators showed contrasting scores. PM2.5 air pollution (EQ1) remained relatively stable but showed a moderate performance with a score of 40.51 in 2022, consistent since 2019 but lower than its 2010 score of 44. The MTNDPF and NDCs highlight instances where particulate matter (PM10) levels in Accra exceeded the national standards. In the second participatory workshop, national experts emphasized the need for improvement in air quality, citing its direct impact on health and living conditions (Box 3). This moderate performance underscores the need for more stringent air quality regulations, effective enforcement, and public awareness to change attitudes toward environmental preservation. The DALY rate from unsafe water (EQ2) saw a decline in performance, with the scores falling from 71.84 (high performance) in 2010 to 64.93 (moderate performance) in 2022. The declining performance reflects the challenges in consistently providing safe water nationwide. The absence of this indicator in major national policies like the LTNDP, NCCP, and NBSAP suggests that, while water quality is a recognized issue, it may need more focused policy attention to drive significant improvements. The national experts mentioned inadequate institutional capacity to enforce air and water quality regulations as one of the challenges in improving environmental quality performance.

Degraded land over total land area (EQ3) scored high at 77.97 in 2022, although a significant decrease from the very high score of 95.3 in 2010. Several national policies are addressing land degradation issues in Ghana. The LTNDP emphasizes rehabilitating and restoring degraded landscapes, the MTNDPF focuses on restoring degraded forests, mining areas, and wetlands, and the NDCs commits to restoring degraded ecosystems through community efforts. However, the significant decrease from the 2010 score of 95.3 suggests that land degradation is an increasing concern, and continued efforts are needed to maintain and improve land quality. The national experts emphasized that poor land management contributed to potable water scarcity. The chlorophyll-a deviations (EQ4) and water with good ambient quality (EQ5) scored 93.6 and 74.53 in 2022, respectively, indicating very high and high performances. Although EQ4 showed a slight decrease from its 2010 score of 99.11, the very high performance reflects effective management of coastal and marine areas, with the LTNDP and MTNDPF emphasizing the management and conservation of these ecosystems. The EQ5 indicator score showed high performance. The LTNDP's assessment of the poor state of water ecosystems in 2015 and the MTNDPF's goal to surpass 75 percent of water bodies with good ambient water quality demonstrate an awareness and response to water quality issues. However, the NCCP's emphasis on community-based activities to improve land and water quality suggests that more grassroots-level interventions are necessary to further enhance water quality nationwide.

The **cultural and social value** pillar revealed the least robust performance. Notably, plant genetic resources accessions (CV4) and share of exports of cultural goods (CV5) demonstrated very low performance, with scores of 1.44 and 1.07, respectively, in 2022. The CV4 indicator score reflects critical gaps in preserving genetic diversity in agriculture. While the NBSAP emphasizes the importance of conserving genetic biodiversity, the lack of explicit mention in other national policies suggests a need for more focused attention and resources. This score and the national expert statements highlight a disconnect between policy priorities and the implementation of measures to preserve plant genetic resources

effectively. The experts highlighted the lack of understanding and education about the importance of traditional preservation practices and commitment to developing traditional areas as key challenges in improving cultural and social value indicators (Box 3). The CV5 indicator score indicated underperformance in leveraging cultural goods in international trade, which the national experts pointed out during the second participatory workshop. They identified the export of cultural goods as an underexploited area with significant potential. So far, promoting cultural goods in international markets is not a focus of policy frameworks or initiatives.

Notably, international tourism receipts (CV3) experienced a drastic decline, plummeting from 17.39 in 2010 to 4.42 in 2022. This downturn is likely influenced by the global COVID-19 pandemic, as evidenced by the MTNDPF, which reported a substantial drop in tourist arrivals and receipts in 2020 due to port closures. This indicator's performance underscores tourism's vulnerability to external shocks and highlights the need for resilient and diversified strategies to bolster this sector. In contrast, the Red List Index (CV1), scoring 73.58 in 2022, shows high performance and an improvement from its 2010 score of 70.09. This success aligns with expert opinions emphasizing the importance of traditional beliefs and values in conserving biodiversity (Box 3). The NBSAP supports the CV1 indicator by advocating for developing regulations to protect endangered species and creating an inventory of threatened species using the International Union for Conservation of Nature (IUCN) RED list category. This score reflects a strong national commitment to biodiversity conservation. It aligns with national experts' opinion that the red list index is culturally relevant for preserving certain species and life forms. The terrestrial protected areas (CV2) scored 45.75 in 2022, a moderate performance but slightly lower than its 2010 score of 46.39. This can be partly attributed to the significant coverage of forest and wildlife reserves as outlined in the LTNDP and MTNDPF. These policies highlight the management of protected areas and the aim to conserve biodiversity. However, the decline from the 2010 score suggests a need for reinforced efforts and possibly reflects challenges such as replacing traditional laws with state laws, leading to diminished traditional conservation practices, as noted by experts.



Box 3 National experts' rating and opinion on the opportunities for improving Ghana performance in natural capital protection

During the second participatory workshop, the national experts were grouped into three (3), each providing feedback and assessments of the Green Growth Index scores. Below are the ratings and assessments at the pillar level.

Rating on environmental quality: HIGH (1 group), VERY HIGH (2 groups)

The national experts emphasized the environmental effects of pollution, including floods. According to them, the need for environmental quality is a right and must not be compromised. Hence, promoting sound environmental practices will lead to a healthy population and increased productivity. There are numerous opportunities for growth from environmental quality.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's environmental quality performance:

- EQ1 - PM2.5 air pollution (3 groups)
- EQ2 - DALY rate from unsafe water (1 group)
- EQ3 - Degraded land over total land area (1 group)
- EQ5 - Water with good ambient quality (1 group)

Three groups selected EQ1 because of its impact on health and living conditions, where people have fundamental rights to live in a clean and safe environment. Water quality and air pollution are areas needing improvement in Ghana. Moreover, poor land management has caused more harm than good, leading to scarcity of potable water, which is critical for human survival. The national experts identified a few challenges in improving performance in these environmental quality indicators, including inadequate institutional capacity to enforce air and water quality regulations, a lack of policy priorities and capital investment, the attitude of the general public, and poor land tenure and land administration system.

Rating on GHG emissions reduction: MODERATE (1 group), VERY HIGH (2 groups)

The national experts explained that the proportion of energy generated from fossil fuel to renewable energy sources is still very high. Also, agricultural and waste management practices result in the emissions of methane. Comparatively, GHG emissions per capita are far below the global average. However, carbon emissions are causing a lot of respiratory diseases that lead to premature death, especially in developing countries.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's GHG emissions reduction performance:

- GE1 - CO2 emissions per capita (3 groups)
- GE4 - Carbon intensity of energy production (3 groups)

The three groups' opinions were aligned regarding GHG emissions, and the same indicators for this pillar were selected. They emphasized that the ratio of energy produced from fossil fuel to renewable (including hydro) is extremely high, resulting in increased carbon emissions. Carbon emission reduction is vital, especially for the ratio of population and energy intensity. Because energy production is from fossil fuels, Ghana will need to be decarbonized. The challenges identified by the national experts in improving performance in the two GHG emissions reduction indicators include the institutional capacity to enforce environmental regulations, limited innovations to solve GHG emission issues, and a lack of policy priorities, implementation, and financing. Thus, financial obligations, technology, and human and technical assistance are needed.

Rating on biodiversity and ecosystem protection: HIGH (1 group), VERY HIGH (2 groups)

According to national experts, more than 82 percent of primary forest cover is depleted, so there is a need to improve biodiversity and ecosystem protection indicators. Biodiversity and ecosystem protection provide the best solution for carbon capture.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's biodiversity and ecosystem protection performance:

- BE2 - Share of forest areas (3 groups)
- BE3 - Forest area within legally established PAs (3 groups)

The opinions of the three groups on biodiversity and ecosystem protection were also aligned, selecting both BE2 and BE3 indicators. They highlighted the rapid decline in forest cover, resulting in the erosion of carbon sinks and vulnerability to the adverse impact of climate change. Land degradation activities are increasing and need to be averted. Forest areas established by legislation are essential for sustainable development. The challenges the national experts identified in improving performance in the forest sector include weak institutional capacity to enforce forest preservation, limited implementation, financing, policy priorities, and political will, a lack of education on the importance of forest reserves, poor land tenure system, insufficient political will, and problem of corruption.

Rating on cultural and social value: HIGH (2 groups), VERY HIGH (1 group)

The national experts explained that replacing traditional laws with state laws has resulted in people flaunting traditional preservation practices to the detriment of the environment. Traditional beliefs and values are critical to conserving protected areas and forest reserves. The general public's attitude to cultural and social values is key to natural capital protection.

Box 3 National experts' rating and opinion on the opportunities for improving Ghana performance in natural capital protection (continued)

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's cultural and social value performance:

- CV3 - International tourism receipts (2 groups)
- CV5 - Share of exports of cultural goods (2 groups)
- CV1 - Red list index (1 group)

The national experts suggested that cultural and social values improve tourism potential and increase revenue generation. Tourism and the export of cultural goods are not yet fully exploited in Ghana. The red list index is culturally relevant for preserving certain species and life forms. The challenges to improving performance in these cultural and social value indicators include a lack of understanding and education about the importance of traditional preservation practices, policy priorities and political will, budget, and commitment to developing traditional areas.

5.2.3 Green economic opportunities

In evaluating the performance of the green economic opportunities dimension in 2022, a mixed picture emerged with varying levels

of achievement across its pillars (Figure 23). Green employment was the best-performing pillar in 2022, with notably high scores in several indicators, while green trade exhibited the weakest, with scores predominantly in the lower range.

Figure 23 Scores for indicators in the green economic opportunities dimension

Green employment demonstrated a relatively strong performance, particularly in the indicator GJ2, scoring very high at 88.23 in 2022. This indicator has consistently improved from 81.97 in 2010, reflecting significant strides in reducing poverty among the employed population. This aligns with the MTNDPF, which discusses poverty incidence by employment status. While specific policies directly targeting this indicator are limited, the overall economic growth and poverty reduction strategies positively impact this indicator. Continued focus on sustainable economic policies could further enhance these outcomes. The Official development assistance (ODA) flows for scholarships (GJ5) also stood out with a score of 83.17 in 2022, steadily rising from a very low score of 16.45 in 2010. This green employment indicator, however, is not prominently

discussed in key policies. The national experts emphasized the opportunity presented by Ghana's predominantly young population to build and retain long-term capacity in the green sector (Box 4). Leveraging this demographic advantage through scholarships and training in green sectors can be an effective strategy for sustainable development. The firms offering formal training (GJ4) maintained a high score of 60.02, showing a positive trend since 2010. However, experts pointed out the inadequacy of training personnel for green jobs, a gap not directly addressed in current policies like the LTNDP, MTNDPF, NCCAS, NCCP, NDCs, and NBSAP. Enhancing formal training offerings in firms, particularly in green sectors, could be a strategic focus for future policy formulations, aligning with the need for capacity building in the green economy.

Vulnerable employment (GJ3) showed moderate performance at 31.64 in 2022. This reflects the challenges highlighted by experts, such as inadequate training and financial constraints. The MTNDPF and LTNDP acknowledge the high proportion of workers in vulnerable employment, particularly in rural areas and among females. This underscores the need for more targeted policies and programs, particularly in skill development and financial support for vulnerable employment groups, to improve the quality of jobs in Ghana. Conversely, green employment in manufacturing (GJ1) has remained stagnant at 14.8 since 2013, after a decline from 38.88 in 2010. Experts highlighted that most sectors in Ghana are not green-oriented, which limits the creation of green employment opportunities. Green employment is not emphasized in key policy documents like the LTNDP, MTNDPF, NCCAS, NCCP, and NBSAP. Only the NDCs broadly mentions the creation of decent and green jobs without specifically emphasizing manufacturing employment. According to national experts, the challenge lies in the lack of incentives for setting up green manufacturing businesses and limited human resource capacity. Addressing these gaps through targeted policy interventions and incentives could help improve green employment performance in the future.

For green investment, the adjusted net savings (GV1) showed a high performance, with a score of 62.94 in 2022. The GV1 indicator followed a positive trend, considering its score of only 36.34 in 2010. During the second participatory workshop, national experts underscored the potential of green investment to reduce carbon emissions and health-related risks (Box 4). This progress is not directly reflected in national policies like the LTNDP, MTNDPF, NCCAS, NCCP, NDCs, or NBSAP, suggesting that the improvements could have been driven more by global commitments and trends rather than specific national policy initiatives. The renewable electricity capacity (GV2) and financial flows for clean energy R&D (GV3) showed some modest improvements but remained within the low-performance range, with scores of 13.64 and 5.47, respectively. The low GV2 score reflects the challenges in scaling renewable energy capacity. The LTNDP and MTNDPF acknowledge the potential of untapped hydro resources and the installation of renewable energy systems, indicating an awareness of the importance of renewable energy. However, the gap between policy ambitions and actual performance suggests challenges in implementation, possibly due to inadequate partnerships, lack of local capacity, and stringent criteria for investment fund eligibility, as noted by national experts. The GV3 indicator performance indicates that international funding in green economic sectors, particularly clean energy R&D, is disproportionately low. This indicator is not featured prominently in key national policies despite its potential. The national experts highlighted the limited awareness and stringent eligibility criteria for accessing international development funds.

The agriculture orientation index (GV4) and road quality (GV5) exhibited very low to low performance, with GV5 notably declining from 58.55 in 2010 to 36.36 in 2022. Challenges such as financial and resource constraints and limited awareness about green investment opportunities in agriculture could be contributing factors. A more deliberate inclusion of green agricultural practices and investments in national policies could foster improvement in this area. Regarding the GV5 indicator, the score decline suggests

deteriorating infrastructure investment quality. The MTNDPF's goal to increase the percentage of the road network in good condition indicates an awareness of the issue but also highlights a discrepancy between policy objectives and outcomes. The national experts identified challenges like financial and implementation constraints and resource limitations to impede progress.

The green innovation indicators revealed a need for significantly improving performance. Trademark applications (GN5) consistently score very low, with a minimal change from 1.87 in 2010 to 1.85 in 2022, indicating a need for growth in green-related intellectual property. Despite the recognized opportunity for innovation and ownership in the green sector, as noted by experts, the absence of targeted policy support or initiatives in national documents underscores a missed opportunity. Encouraging trademark applications in the green sector could be facilitated by creating awareness, providing financial and legal assistance, and establishing clear pathways for intellectual property rights in environmental technologies. The environmental technologies (GN1) and medium/high-tech manufacturing value-added (GN4) showed marginal improvements, and their performances remained at a low range, with scores of 21.01 and 28.61, respectively, in 2022. The GN1 score reflected the nascent stage of green innovation in Ghana. National experts have emphasized the country's limited number of innovative green systems, highlighting a crucial opportunity for growth in this area. The green patent publications indicator is not highlighted in national policies such as the LTNDP, MTNDPF, NCCAS, NCCP, NDCs, and NBSAP. This lack of policy focus could partly explain the low scores and suggests that integrating specific targets and strategies could stimulate growth in green technological innovations. The GN4 indicator score is consistent with national experts' remarks about the manufacturing sector's gradual shift towards green technology (Box 4). To enhance performance, there is a need for policy initiatives that specifically support the development and integration of medium and high-tech green industries, potentially through incentives for green technology adoption and investment in research and development.

Scientific and technical journals (GN2) and researchers per million inhabitants (GN3) also scored poorly in 2022 at 12.19 and 10.54, respectively. The very low performance in GN2 indicates a need for more robust support and emphasis on research publications in green technology. This aligns with the national experts' feedback on limited awareness and capacity for green innovation. There is a lack of targeted initiatives or benchmarks in national policies for promoting research publications in green technology. Concerted efforts to foster research and publication in environmental sciences through educational and research funding and recognition of excellence could improve performance in this field. The GN3 indicator's very low performance indicates a broader challenge in the research sector. The LTNDP acknowledges the importance of promoting research innovation, suggesting a recognition of the need to motivate and challenge Ghanaian researchers. However, the limited emphasis on green innovation, specifically within the broader research agenda, may lead to insufficient development in this field. Addressing this could involve integrating green innovation as a key focus area in research policies, coupled with financial and mentorship support to encourage growth in the number of researchers dedicated to environmental technologies.

The green trade pillar exhibited the weakest performance across the green economic opportunities dimension. All indicators had very low performance. Notably, the exports of environmental goods (GT1) decreased from 12.18 in 2010 to 7.41 in 2022, and high-technology exports (GT5) also saw a significant decline from 10.31 in 2010 to 5.4 in 2022. The decrease in GT1 reflects challenges in expanding the export of environmental goods. The national experts noted the considerable potential for green trade to contribute to international and local development, but this potential still needs to be exploited. A lack of emphasis on green trade in key policy documents like the LTNDP, MTNDPF, NCCAS, NCCP, NDCs, and NBSAP indicates a gap in strategic focus. Enhancing local capacity and technology specific to green trade, along with creating incentives for the export of environmental goods, could be vital steps towards improving the GT1 score. Also, the significant decline in GT5 indicated a reduction in the export of high-technology goods. The challenges noted by the national experts, including technological limitations and lack of local capacity, point to missed opportunities in the high-tech sector. A focused strategy to develop and export high-technology goods, particularly those with environmental benefits, could reverse this trend.

The environmental technologies exported (GT2), ISO 14001 certificates issued (GT3), and the new business density (GT4) showed minimal to no improvement, with scores ranging from 3.62 to 10.91 in 2022. The low GT2 score indicates limited progress in exporting environmentally sound technologies. The lack of policy mentions suggests a need for targeted initiatives to promote the development and export of environmental technologies. Addressing challenges such as financing, technical know-how, and resource constraints, as identified by national experts, could support growth in this area. The GT3 performance highlighted the need for greater compliance and certification in environmental management systems. Despite national experts recognizing the benefits of ISO 14001 certification in promoting green trade, the high cost of acquiring ISO 14001 certification and the absence of policy support limit progress (Box 4). Developing incentive mechanisms and reducing barriers to certification could facilitate improvement in this indicator. The stagnant performance in GT4 suggested challenges in fostering new green businesses. The national experts pointed out that the growth of environmentally sound businesses is crucial for green trade, but the lack of policy focus and challenges like inadequate financing and local capacity impede progress. Policymaking that supports entrepreneurship in the green sector through financial incentives and capacity building could enhance performance in this indicator.

Box 4 National experts' rating and opinion on the opportunities for improving Ghana performance in green economic opportunities

During the second participatory workshop, the national experts were grouped into three (3), each providing feedback and assessments of the Green Growth Index scores. Below are the ratings and assessments at the pillar level.

Rating on green investment: VERY HIGH (3 groups)

The national experts mentioned that international funding for the green economic sectors is disproportionately low in Ghana, although there are ample opportunities in all sectors, including energy. Green investment is a global commitment to reducing carbon emissions and health-related risks.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's green investment performance:

- GV1 - Adjusted net savings (2 groups)
- GV2 - Renewable electricity capacity (1 group)
- GV3 - Financial flows for clean energy R&D (2 groups)

According to national experts, green investment will lead to cost savings on health, transportation, energy, etc. GV1, for example, is relevant because it considers investment in human capital, depletion of natural resources, and pollution. Green investment is very low in Ghana, corresponding to this pillar's very low score. Several challenges were identified by the national experts in improving green investment performance, including inadequate partnership, a lack of local capacity and tax incentives, financial, implementation, management, and resource constraints, and low public acceptability. Moreover, there is limited awareness about investment opportunities in the green economic sector and very stringent eligibility criteria for assessing Insurance Dedicated Funds (IDF), disqualifying many local businesses.

Rating on green trade: HIGH (1 group), VERY HIGH (2 groups)

The national experts agreed on the importance of green trade indicators, highlighting that trade contributes significantly to international development and local capacity development. The latter will lead to local content development in green trade. As Ghana has a fast-growing economy, more Ghanaians are becoming aware of Ghana's opportunities in green trade. Not enough economic value has been placed on the eco-services being rendered in Ghana, which presents an opportunity to improve climate change mitigation.

Box 4 National experts' rating and opinion on the opportunities for improving Ghana performance in green economic opportunities (continued)

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's green trade performance:

- GT1 - Exports of environmental goods (2 groups)
- GT3 - ISO 14001 certificates issued (2 groups)
- GT4 - New business density (1 group)

According to national experts, green trade in the environment supported by ISO and the number of young people in environmentally sound businesses will help enhance growth. Increasing the number of companies getting ISO certification will promote a good environment. Green trade will require improving exporters' compliance levels. The challenges identified in enhancing performance in green trade indicators include a lack of technology to support export, local capacity in green trade, financing and technical know-how, implementation and management, and public acceptance. Moreover, the cost of acquiring the ISO 14001 Certification is prohibitively high.

Rating on green employment: VERY HIGH (3 groups)

National experts in the three groups agreed that green employment will support economic growth and sustainable jobs for the youth. Green businesses' number and scale/size are still very low, limiting green employment creation. With most sectors still needing to be green-oriented in Ghana, there are considerable opportunities to increase green employment.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's green employment performance:

- GJ1 - Green employment in manufacturing (3 groups)
- GJ3 - Vulnerable employment (1 group)
- GJ4 - Firms offering formal training (1 group)
- GJ5 - ODA flows for scholarships (1 group)

Several green employment indicators were identified as relevant to creating green economic opportunities in Ghana. For example, the national experts suggested that training and development for green employment will increase knowledge in green space. The Ghanaian population is predominantly young, which presents an excellent opportunity to build and retain long-term capacity. The green employment indicators provide knowledge about the number of people employed in the green sector and the number of green manufacturing companies and activities. Vulnerable issues in employment indicate the number of decent jobs created. The challenges highlighted by the national experts include inadequate training of personnel, limited human resource capacity, financial and resource constraints, implementation and management issues, and insufficient incentives for setting up green manufacturing businesses.

Rating on green innovation: VERY HIGH (3 groups)

Green innovation was considered to be of very high relevance in creating green economic opportunities. Ghana's ability to develop green innovation technologies will lead to development. The country has limited green innovative systems; hence, there is room for innovation. However, the green innovation concept is still a new concept yet to be fully understood by businesses and integrated into the existing business ecosystem.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's green innovation performance:

- GN4 - Medium/ high-tech manufacturing value-added (3 groups)
- GN5 - Trademark applications (2 groups)
- GN1 - Environmental technologies (1 group)

In choosing these indicators, the national experts highlighted the key role of innovation and ownership in development. They mentioned that manufacturing companies are gearing toward green technology.

This presents an opportunity to produce value-added goods. Several challenges were identified: low patent rights countrywide, lack of financing and mentorship, financing and resource constraints, implementation and management issues, and limited awareness and capacity.

5.2.4 Green economic opportunities

In 2022, the social inclusion dimension displayed mixed results across its pillars. Figure 24 shows that the social equity pillar exhibited the highest overall performance. This was particularly

evident in indicators such as urban-rural access to electricity and clean fuels (SE2), youth unemployment disparity (SE3), and age dependency ratio (SE4). In contrast, the social protection pillar showed the least favorable performance, particularly in the share of old people receiving pensions (SP1) and implementing local disaster risk reduction strategies (SP5).

Figure 24 Scores for indicators in the social inclusion dimension

The social equity pillar showed significant achievements. The inequality in income (SE1) scored high at 83.2 in 2022, although it has slightly decreased from 85.94 in 2010. The national experts participating in the second workshop highlighted that equity in distributing national resources is pivotal for poverty reduction (Box 5). However, they noted challenges such as corruption and socio-cultural hindrances, which could impact this indicator. The LTNDP acknowledges the increasing disparity in income distribution, with the top 20 percent of the population enjoying a larger share of national income than the poor. The MTNDPF further underscores this widening inequality, evidenced by the rising Gini coefficient. These policy insights align with the expert opinions that, while improvements have occurred, a significant gap exists between the wealthiest and the poorest, affecting social cohesion and equity. Urban-rural access to electricity (SE2_a) and clean fuels (SE2_b) scored very high in 2022, with the former indicator reaching 99.77. The LTNDP and MTNDPF highlight significant improvements in electricity access across both rural and urban areas. The LTNDP notes the decreased access gap between these areas and correlates reducing income inequality with improved electricity access. This policy focus aligns well with the high scores and reflects the successful implementation of strategies to enhance electricity access across different regions and social strata. Despite the overall high performance of SE2_b in the SE pillar, this specific indicator was not explicitly mentioned in the major policies like the LTNDP and the MTNDPF. The very high score in this area could be attributed to broader initiatives to improve living standards and infrastructure development. The national experts recognized the importance of equitable access to basic services for national development but pointed out the need for more growth in this area.

The youth unemployment disparity (SE3) and old age dependency ratio (SE4) also maintained very high scores of 85.06 and 97.24, respectively, in 2022. The SE3 indicator score reflects the efforts to address unemployment disparities. The LTNDP mentions skill-based interventions and projects aimed at reducing youth unemployment, albeit acknowledging their limited effectiveness in the past. The

MTNDPF reports on initiatives like the Youth Enterprise Scheme and Nation Builders Corps, which have exceeded job creation targets. This policy alignment with the indicator's objectives could be a significant factor in the SE3 indicator's very high performance. However, national experts have pointed out challenges such as high unemployment and resource constraints that still need to be addressed. Although SE4 maintained a very high score in 2022, this indicator is not highlighted in the key policies reviewed, including the LTNDP and the MTNDPF. The very high performance could be attributed to broader socio-economic developments and healthcare improvements. In contrast, cash benefits for people with disabilities (SE5) remained very low, with a score of 1.21 in 2022, slightly up from 1.1 in 2010. The lack of mention of this indicator in major policies like the LTNDP and the MTNDPF resonates with the challenges identified by experts, such as lack of social protection and safety and policy ineffectiveness. This gap highlights a critical need for targeted policy interventions and resource allocation to improve the conditions of people with severe disabilities.

In the access to basic services and resources pillar, the population with access to safe water and sanitation (AB1) scored 38.77, a low-performance range, in 2022. This score, however, represents a gradual increase from a very low score of 25.43 in 2010, suggesting some progress over the years. The national experts emphasize the criticality of water and sanitation for a healthy population (Box 5), a sentiment echoed in the LTNDP, which aims for universal access to potable water and good sanitation by 2030. The MTNDPF shows progress in access to basic drinking water services, from 80 percent in 2015 to 86 percent in 2020. However, the steady low performance in AB1 underscores the challenges in meeting these targets, emphasizing the need for accelerated water and sanitation services efforts. Similarly, the access to safe water (AB1_a) increased from a score of 21.03 in 2010 to 41.44 in 2022, transitioning from very low to moderate performance. This is supported by policy initiatives noted in the LTNDP and MTNDPF, which report improved access to safely managed drinking water, especially in rural areas. Despite these advances, the score indicates that further efforts are

needed to bridge the gap in water access, particularly in underserved regions. In stark contrast, access to sanitation (AB1_b) remains very low at 15.75 in 2022, despite an increase from 7.81 in 2010. The LTNDP and MTNDPF acknowledge the poor performance relative to other middle-income countries and the decline in access to basic services like sanitation facilities. This indicates a critical policy and infrastructure development area, particularly in urban centers.

For the population with access to electricity and clean fuels (AB2), the moderate score stabilized at 51.52 in 2022, up from 38.7 in 2010. Notably, access to electricity (AB2_a) showed significant improvement, reaching a high score of 85.31 in 2022, up from 64.02 in 2010. In contrast, access to clean fuels (AB2_b) scored low at 27.04 in 2022, albeit it increased from 11.42 in 2010. The substantial improvement in the AB2_a indicator is notable, reflecting the policies outlined in the LTNDP and MTNDPF that focus on increasing electricity access across rural and urban areas. However, the low AB2.b indicator score suggests the need for more significant efforts in promoting clean fuel adoption, as indicated in the NDC's goal to expand cleaner cooking solutions. Prevalence of undernourishment (AB3) consistently scored very high, achieving 92.36 in 2022. The MTNDPF reports a decrease in undernourishment prevalence from 7.7 percent in 2015 to 6.5 percent in 2018, corroborating this high score and indicating effective policies and interventions in food and nutrition security. Convenient access to public transport (AB4) showed a moderate score of 49.38 in 2022. The LTNDP and MTNDPF highlight initiatives to develop high-capacity public transport systems, particularly in metropolitan areas. The moderate score implies ongoing efforts in these areas, with room for improvement in public transport policy and infrastructure. Property rights (AB5) scored 45.72 in 2022, slightly decreasing from 47.87 in 2010. The AB5 indicator is not highlighted in major national policies such as the LTNDP and MTNDPF, indicating a potential policy gap on property rights.

In the gender balance pillar, the low score of 26.92 in 2022 for women in national parliaments (GB1) highlighted a persistent challenge in achieving gender parity in political representation. This stagnation is reflected in the LTNDP, which notes that women's representation in parliament has not exceeded 19% since 1965. The MTNDPF acknowledges this gap and proposes a quota system to enhance women's participation in public and political offices. However, the slight decrease in women's participation from 2017 to 2020 suggests that more robust and effective measures are required. The lack of substantial progress, despite policy efforts like GHANAP II and the Gender Equality Bill, indicates the need for stronger political will and strategies to overcome socio-cultural and political barriers, as suggested by national experts (Box 5). Conversely, the gender account in financial institutions (GB2) scored exceptionally high at 96.84 in 2022, maintaining a consistent upward trend from 96.45 in 2010. However, this achievement is not explicitly mentioned in major policies like the LTNDP or the MTNDPF, suggesting that these gains could result from broader economic developments rather than targeted gender policies. The very high GB2 indicator performance indicates success in advancing women's economic empowerment.

Equal gender pay (GB3) remained stagnant at a moderate performance level, with a score of 50.5 in 2022. The absence of specific mention in key policy documents like the LTNDP and the MTNDPF suggests a gap in policy focus on this issue. This stagnation, despite general awareness of the importance of gender equality, points to the challenges in implementing and enforcing laws and regulations that ensure equal pay for equal work. There was a slight improvement in mothers with maternity cash benefits (GB4), albeit with the score remaining low at 3.71 in 2022. The GB4 indicator is not highlighted in national policies, and more focused policies and effective implementation strategies to ensure that maternity benefits reach a

significant proportion of mothers could help improve performance. In contrast, school enrollment gender parity (GB5) showed very high performance, increasing to 97.12 in 2022 from 95.79 in 2010. This reflects Ghana's commitment to achieving gender parity in primary education, as the MTNDPF indicates. This success is a crucial step towards broader gender equality, as education lays the foundation for women's empowerment in various aspects of life. However, sustaining and translating this educational parity into other areas, such as economic participation and political representation, remains challenging.

The social protection pillar exhibited the most minor progress. The share of old people receiving pensions (SP1) and universal health coverage (SP2), scoring 19.81 and 29.44, respectively, in 2022, were performing low. The low SP1 score underlines significant challenges in providing adequate pension coverage. This is substantiated by the LTNDP, which highlights that most elderly are employed in the informal sector with minimal pension plan enrollment. The MTNDPF suggests awareness creation around the Pensions Act and decentralization of pension payments as steps towards improvement. However, the consistently low performance indicates that these measures still need to be improved, and more robust strategies are needed to establish sustainable funding arrangements for the aged, especially those outside the formal pension scheme. The national experts urged support for Ghana's old people who are not well cared for. The MTNDPF outlines strategies for achieving accessible and quality universal health coverage (SP2), including expanding health facilities and strengthening health systems. The NCCAS also emphasizes improving capacities to cope with health-related problems induced by climate change. However, the low score suggests that implementing these strategies is yet to reach its full potential, necessitating a more effective and inclusive approach to healthcare provision, especially in underserved areas. The national experts considered inadequate and ineffective policies targeting the old and vulnerable people as key challenges to improving social protection (Box 5). The very low score of 2.08 in 2022 for implementing local disaster risk reduction strategies (SP5) points to significant gaps in disaster risk management and resilience building. The LTNDP and MTNDPF mention the development of national disaster management frameworks and action plans aligned with the Sendai Framework. The NCCAS and the NDCs also highlight the need for enhanced climate resilience and early warning systems. However, the low score underlines a critical need for more effective implementation of these strategies, focusing on strengthening the resilience of vulnerable communities and critical infrastructure against disasters. The national experts suggested implementation and management issues as one of the challenges in social protection, including implementing local disaster risk reduction strategies (SP5).

In contrast, the high score for victims of intentional homicides (SP4) at 96.51 in 2022 suggests that Ghana was performing well in maintaining a low homicide rate. Although not explicitly mentioned in the policy documents reviewed, this achievement indicates a relatively stable and secure environment in the country. It could be attributed to effective law enforcement and community engagement strategies, but continuous vigilance and investment in public safety are essential to sustain this performance. The moderate score of 69.63 in 2022 for the population living in slums (SP3) reflects ongoing efforts and challenges in urban development. The LTNDP proposes systematic upgrading of slum areas and regeneration of urban spaces, focusing on essential amenities like water, sanitation, and shelter. The MTNDPF provides a baseline for the slum population, indicating an awareness of the issue. Despite these policy intentions, the moderate score signals that more comprehensive and effective urban development strategies are needed to improve living conditions in slums significantly. The national experts identified the lack of political will and financing for affordable housing as significant challenges to improving SP3 indicator performance.

Box 5 National experts' rating and opinion on the opportunities for improving Ghana performance in social inclusion

During the second participatory workshop, the national experts were grouped into three (3), each providing feedback and assessments of the Green Growth Index scores. Below are the ratings and assessments at the pillar level.

Rating on access to basic services and resources: VERY HIGH (3 groups)

The national experts explained that basic services and resources are the necessities of life and required for human survival. Only a few sections of the Ghanaian population, especially among the vulnerable, have access to basic services and resources. The Right to Information (RTI) and access to basic services have been decentralized.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's access to basic services and resources performance:

- AB1 - Access to safe water and sanitation (3 groups)
- AB2 - Access to electricity and clean fuels (2 groups)
- AB4 - Convenient access to public transport (1 group)

According to national experts, the sectors providing these services have the highest carbon footprints.

Policies on Water, Sanitation, and Hygiene (WASH) are now given priority, and more advocacy for clean fuel is in place in Ghana. Water and sanitation are key ingredients for a healthy population, and public transport plays a vital role in the performance of other sectors. However, the country is challenged by limited financing and public sector institutional capacity, implementation and management issues, resource constraints, a lack of discipline of the citizens toward sanitation, and inadequate public transport infrastructure.

Rating on gender balance: MODERATE (1 group), HIGH (1 group), VERY HIGH (1 group)

One group rated the opportunities for improving social inclusion performance through gender balance only moderately. The national experts explained that, generally, Ghana is doing reasonably well in gender balance, and there are equal opportunities for all genders. Gender perspectives are critical for green growth performance.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's gender balance performance:

- GB5 - School enrollment gender parity (2 groups)
- GB1 - Women in national parliaments (1 group)
- GB3 - Equal gender pay (1 group)

According to national experts, enrolment and success rates in primary education are critical for gender balance. There is more room for improvement in the GB1 indicator because out of 275 members of parliament in Ghana, only 20 are women (7 percent). An equal number of seats in the national parliament will lead to successful gender interventions. The selected indicators give a better measurement of gender balance and equal access. Among the challenges identified by the experts in further improving performance in these gender balance indicators include socio-cultural and political hindrances, implementation and management issues, resource constraints, and lack of education and political will for equal parliamentary representation.

Rating on social equity: MODERATE (1 group), HIGH (1 group), VERY HIGH (1 group)

Like gender balance, the national experts pointed out that, in general, Ghana is doing very well in social equity, except for persons with disabilities (PWDs). Nonetheless, they explained the need to reduce the conflict of resources. Equity in the distribution of national resources will lead to poverty reduction.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's social equity performance:

- SE3 - Youth unemployment disparity (3 groups)
- SE2 - Urban-rural access to electricity and clean fuels (2 groups)
- SE1 - Inequality in income (1 group)

The three groups have the same opinion regarding the importance of the SE3 indicator. Social equity in employment is very important for national development. A vast gap exists between the top 10 percent and the bottom 40 percent of the citizens. This has an adverse effect on social cohesion and equity. Fairness in the distribution of national resources serves as a good measure. The national experts identified several challenges in improving social equity performance, including socio-cultural hindrances and policy ineffectiveness, financing and resource constraints, implementation and management issues, a lack of social protection and safety, high unemployment, and corruption.

Box 5 National experts' rating and opinion on the opportunities for improving Ghana performance in social inclusion

Rating on social protection: VERY HIGH (3 groups)

All national experts in the three groups provided very high ratings on the importance of social protection in improving social inclusion in Ghana. The bottom 40 percent of the population has no social safety net, as measured in the Palma ratio. Social protection is very integral for equitable development and family dignity. Social protection policies are on the ascendancy.

The following indicators were selected by the groups as the indicators providing the most significant opportunities to improve Ghana's social protection performance:

- SP5 - Implementing local disaster risk reduction strategies (3 groups)
- SP1 - Share of old people receiving a pension (1 group)
- SP2 - Universal health coverage (1 group)
- SP3 - Population living in slums (1 group)

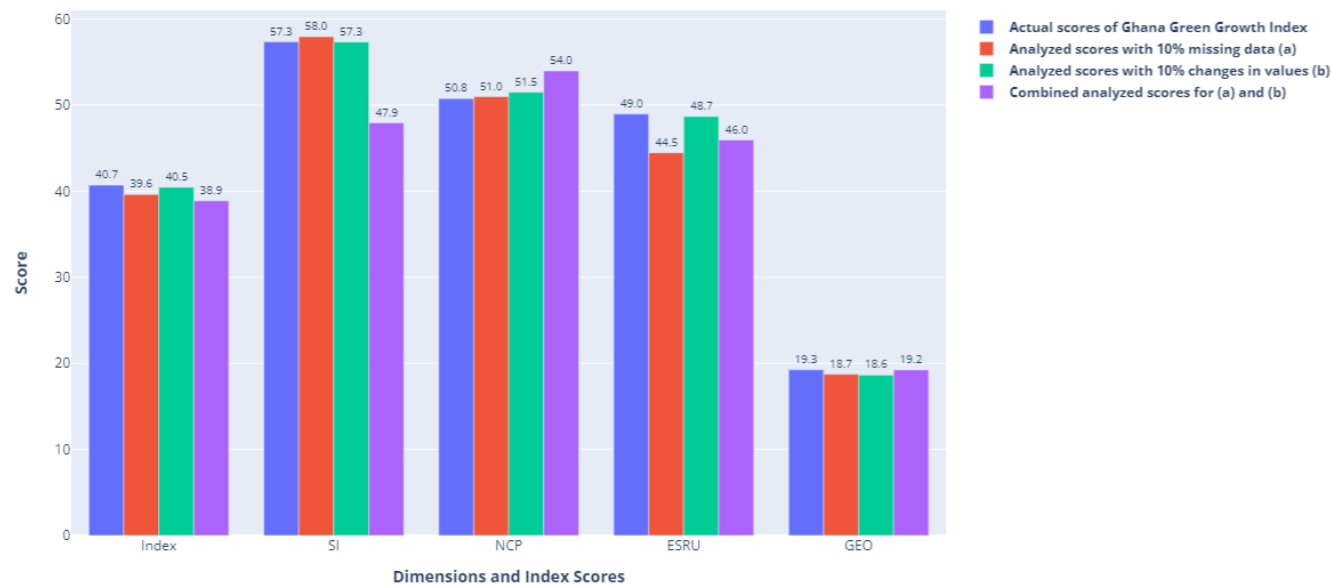
The three groups considered the SP5 indicator as critical to social protection. Implementing local disaster risk strategies will help curb most forms of disasters. Social protection provides dignity to people and families. But, according to them, Ghana's old people are not well cared for. The challenges confronting social protection improvement include inadequate and ineffective policies targeting the old and vulnerable people, financing and resource constraints, implementation and management issues, and a lack of established social protection policy, political will, and financing for affordable housing.

5.3 Robustness check

The Monte Carlo simulation was used as a robustness check and sensitivity analysis for Ghana's Green Growth Index. This technique aims to assess the stability and reliability of the index by subjecting it to uncertainties, specifically by introducing 10 percent missing indicator data, 10 percent changes in the indicator values, or a combined scenario involving both 10 percent missing data and 10 percent changes in values. Figure 25 presents the outcomes derived from the simulation analysis, providing a detailed insight into the robustness of the Green Growth Index across various scenarios.

In distinct scenarios, the efficient and sustainable resource use (ESRU) dimension exhibited an absolute decrease of 4.5 points in response to 10 percent missing values. The social inclusion (SI) dimension demonstrated a moderate sensitivity to missing data, increasing by 0.7 points. The overall Green Growth Index scores showed a significant decrease of 1.8 points in the combined scenario (i.e., missing data and changes in values). The insignificant change in the score when subjecting the Green Growth Index to a 10 percent change in values is worth noting. The natural capital protection (NCP) dimension experienced a decrease of 5 points in the combined scenario. Based on these results, the consequential impact of missing data or changes in values on the Index scores was minimal, indicating that the results of the Ghana Green Growth Index display a relatively robust resilience to various uncertainties.

Figure 25 Results of the Monte Carlo analysis to check the sensitivity of the Green Growth Index scores



A regression analysis was conducted to evaluate the explanatory power of green growth indicators, represented by aggregated scores at the pillar level within their respective dimensions. The objective was to assess the indicators' capability to enhance the comprehensibility of the Green Growth Index's structure. Panel data analysis was carried out using cross-sectional and longitudinal global data from 2010 to 2022. Regression models were executed for the four green growth dimensions: efficient and sustainable resource use, natural capital protection, green economic opportunities, and social

inclusion. The P-value data derived from the regression analysis is displayed in Table 10, where a P-value below 0.05 signifies statistical significance. Across all pillars, P-values were consistently below 0.05 for the green growth dimensions, indicating a high level of statistical significance. The R-squared values indicate that the variances in independent variables (green growth pillars) account for between 99 and 100 percent of the variance in dependent variables (i.e., green growth dimensions). These regression findings confirm the robustness of the Ghana Green Growth Index.

Table 10 Results of the regression analysis of pillar and dimension scores

Codes	Pillar Names	Coefficient	Standard Error	P-Value
MODEL 1 EFFICIENT AND SUSTAINABLE RESOURCE USE: R2 = 1.000, ADJ. R2 = 1.000				
EE	Efficient and Sustainable Energy	0.1763	0.001	0.000
EW	Efficient and Sustainable Water Use	0.2765	0.001	0.000
SL	Sustainable Land Use	0.2925	0.004	0.000
ME	Material Use Efficiency	0.2457	0.004	0.000
MODEL 2 NATURAL CAPITAL PROTECTION: R2 = 1.000, ADJ. R2 = 1.000				
EQ	Environmental Quality	0.1724	0.001	0.000
GE	Greenhouse Gas Emissions Reduction	0.1423	0.001	0.000
BE	Biodiversity and Ecosystem Protection	0.6272	0.087	0.000
CV	Cultural and Social Value	0.4873	0.003	0.000
MODEL 3 GREEN ECONOMIC OPPORTUNITIES: R2 = 0.998, ADJ. R2 = 0.997				
GV	Green Investment	0.2675	0.030	0.000
GT	Green Trade	0.5071	0.018	0.000
GJ	Green Employment	0.0841	0.014	0.000
GN	Green Innovation	0.3710	0.022	0.000
MODEL 4 SOCIAL INCLUSION: R2 = 1.000, ADJ. R2 = 1.000				
AB	Access to Basic Services and Resources	0.2621	0.0010	0.000
GB	Gender Balance	0.2297	0.0010	0.000
SE	Social Equity	0.1987	0.0020	0.000
SP	Social Protection	0.3309	0.0020	0.000



6

Conclusions

6.1 Challenges and opportunities	80
6.2 Policy recommendations	80
6.3 Next steps forward	82

6.1 Challenges and opportunities

Ghana's Green Growth Index scores from 2010 to 2022 exhibited a consistent and gradual ascent, reflecting the country's steady transition to green growth. From a score of 38.17 in 2010 and 40.70 in 2022, Ghana's trajectory moved from a "low" to a "moderate" performance level. The upward trend, although modest, indicates a positive progression in Ghana's efforts to integrate green growth into its developmental agenda. The trend for Ghana's Green Growth Index from 2010 to 2022 across the four dimensions shows a distinct pattern of progression and challenge. The national experts analyzed challenges and opportunities in the four green growth dimensions during the second participatory workshop.

In the efficient and sustainable resource use dimension, many green growth indicators have scores above 50, showing that Ghana is becoming more aggressive with sustainability. Sustainable resource use is critical to the development of every country. Maximum utilization of a country's resources is the only way a country can develop. This also helps to monitor environmental performance. In the natural capital protection dimension, enormous opportunities for improving the performance of the indicators exist. Natural capital protection is essential for national development, serving as a carbon sink, providing ecosystems for air quality purification, and supporting human well-being. Green economic opportunities will lead to sustainable employment and economic growth. Currently, Ghana is gearing towards green investment, although the scores are far from the targets. In the social inclusion dimension, basic services and resources are the necessities of life and required for human survival. And yet, only some parts of the Ghanaian population have access to basic services and resources. The decentralization of the governance of the right to information (RTI) and access to basic services could help improve performance in social inclusion indicators.

6.2 Policy recommendations

While the national experts identified opportunities in efficient and sustainable resource use, natural capital protection, and social inclusion, they also highlighted the challenges requiring policy attention. The following highlights these challenges and recommendations for each green growth dimension:

Efficient and sustainable resource use

In efficient and sustainable energy, the challenges include financing, implementation, and high capital investment, as well as technical expertise, politicization of resource use, and policy and regulatory bottlenecks. Recommendations to address these challenges include aggressive education for public acceptability, as well as initial investment and maintenance costs. More awareness of greener energy and efficient energy use will help improve efficient and sustainable energy. Ghana stands to benefit in respect of cost savings when citizens adopt the culture of efficient energy use, especially in public organizations. This will also help Ghana adhere to the UN protocols on energy transition to achieve the Paris Agreement, creating an investment opportunity.

In efficient and sustainable water use, the challenges include inadequate education and awareness of water efficiency, implementation, resource constraints, capacity needs, and gaps, as well as water availability and pollution of available water bodies. Opportunities to improve efficient and sustainable water use exist because Ghana has a framework to follow this path. Water is critical for sustainable development. Hence, the ability to maximize water usage will lead to sustained growth.

In sustainable land use, the challenges include farmers shifting from one area to another, leading to land degradation, and using chemical fertilizers on their land, posing a challenge to soil nutrient balance. Other challenges identified by the national experts in improving performance in these indicators include a lack of education and awareness about sustainable land use, poor land governance and administration, and financing and resource constraints. Policy frameworks and programs supporting the environment are available. Proper land use is essential for city development and strengthening land ownership and land tenure systems to support sustainable land use.

In material use efficiency, the challenges include financing and resource constraints, policy and regulatory issues, inadequate technology, implementation, and a lack of support and incentives. The country is currently facing severe challenges with solid waste. Hence, the government is putting much effort into curbing the situation through partnerships. Ghana's material use is currently low, and its circular economy practices are poor. Effective and efficient material use will create employment and reduce waste in the economy.

Natural capital protection

In environmental quality, the challenges include inadequate institutional capacity to enforce air and water quality regulations, a lack of policy priorities and capital investment, the attitude of the general public, and poor land tenure and land administration system. Water quality and air pollution are areas needing improvement in Ghana. Poor land management contributes to the scarcity of potable water. The need for environmental quality is a right and must not be compromised. Hence, promoting sound environmental practices will lead to a healthy population and increased productivity.

In GHG emissions reduction, the challenges include the institutional capacity to enforce environmental regulations, limited innovations to solve GHG emission issues, and a lack of policy priorities, implementation, and financing. Thus, financial obligations, technology, and human and technical assistance are needed. The ratio of energy produced from fossil fuel to renewable (including hydro) is extremely high, resulting in increased carbon emissions. Carbon emission reduction is vital, especially for the ratio of population and energy intensity. Because energy production is from fossil fuels, Ghana will need to be decarbonized.

In biodiversity and ecosystem protection, the challenges include weak institutional capacity to enforce forest preservation; limited implementation, financing, policy priorities, and political will; a lack of education on the importance of forest reserves; poor land tenure system; insufficient political will; and corruption problems. The rapid decline in forest cover results in the erosion of carbon sinks and vulnerability to the adverse impact of climate change.

Land degradation activities are increasing and need to be averted. Forest areas established by legislation are essential for sustainable development.

In cultural and social values, the challenges include a lack of understanding and education about the importance of traditional preservation practices, policy priorities and political will, budget, and commitment to developing traditional areas. Tourism and the export of cultural goods are not yet fully exploited in Ghana. The red list index is culturally relevant for preserving certain species and life forms. Replacing traditional laws with state laws has resulted in people flaunting traditional preservation practices to the detriment of the environment. Traditional beliefs and values are critical to conserving protected areas and forest reserves. The general public's attitude to cultural and social values is key to natural capital protection.

Green economic opportunities

In green investment, the challenges include inadequate partnership, a lack of local capacity and tax incentives, financial, implementation, management, and resource constraints, and low public acceptability. Moreover, there is limited awareness about investment opportunities in the green economic sector and very stringent eligibility criteria for assessing Insurance Dedicated Funds (IDF), disqualifying many local businesses. Ghana needs to address inadequate partnerships, a lack of local capacity and tax incentives, financial, implementation, management, and resource constraints, and low public acceptability. Moreover, addressing limited awareness about investment opportunities in the green economic sector and very stringent eligibility criteria for assessing Insurance Dedicated Funds (IDF) will enhance the local business environment.

In green trade, the challenges include a lack of technology to support export, local capacity in green trade, financing and technical know-how, implementation and management, and public acceptance. Moreover, the cost of acquiring the ISO 14001 Certification is

prohibitively high. Green trade in the environment supported by ISO and the number of young people in environmentally sound businesses will help enhance growth. Increasing the number of companies getting ISO certification will promote a good environment. Green trade will require improving exporters' compliance levels. As Ghana has a fast-growing economy, more Ghanaians are becoming aware of Ghana's opportunities in green trade. Not enough economic value has been placed on the eco-services being rendered in Ghana, which presents an opportunity to improve climate change mitigation.

In green employment, the challenges include inadequate training of personnel, limited human resource capacity, financial and resource constraints, implementation and management issues, and insufficient incentives for setting up green manufacturing businesses. Training and development for green employment will increase knowledge in green space. The Ghanaian population is predominantly young, which presents an excellent opportunity to build and retain long-term capacity. The green employment indicators provide knowledge about the number of people employed in the green sector and the number of green manufacturing companies and activities.

In green innovation, the challenges include low patent rights countrywide, lack of financing and mentorship, financing and resource constraints, implementation and management issues, and limited awareness and capacity. Innovation and ownership have a crucial role in development. Manufacturing companies are gearing toward green technology, which presents an opportunity to produce value-added goods. Ghana's ability to develop green innovation technologies will lead to development. The country has limited green innovative systems; hence, there is room for innovation. However, the green innovation concept is still a new concept yet to be fully understood by businesses and integrated into the existing business ecosystem.

Social inclusion

In access to basic services and resources, the challenges include limited financing and public sector institutional capacity, implementation and management issues, resource constraints, a lack of discipline of the citizens toward sanitation, and inadequate public

transport infrastructure. Policies on Water, Sanitation, and Hygiene (WASH) are now given priority, and more advocacy for clean fuel is in place in Ghana. Water and sanitation are key ingredients for a healthy population, and public transport plays a vital role in the performance of other sectors. Access of vulnerable people to basic services and resources will need to be improved.

In gender balance, the challenges include socio-cultural and political hindrances, implementation and management issues, resource constraints, and lack of education and political will for equal parliamentary representation. Enrolment and success rates in primary education are critical for gender balance. There is more room for improving women's participation in national parliaments because out of 275 members of parliament in Ghana, only 20 are women (7 percent). An equal number of seats in the national parliament will lead to successful gender interventions.

In social equity, the challenges include socio-cultural hindrances and policy ineffectiveness, financing and resource constraints, implementation and management issues, a lack of social protection and safety, high unemployment, and corruption. Social equity in employment is very important for national development. A vast gap exists between the top 10 percent and the bottom 40 percent of the citizens, adversely affecting social cohesion and equity. Fairness in the distribution of national resources serves as a good measure. The need to reduce the conflict of resources. Equity in the distribution of national resources will lead to poverty reduction.

In social protection, the challenges include inadequate and ineffective policies targeting the old and vulnerable people, financing and resource constraints, implementation and management issues, and a lack of established social protection policy, political will, and financing for affordable housing. The bottom 40 percent of the population has no social safety net. Social protection is integral for equitable development and family dignity; hence, social protection policies are increasing.

6.3 Next steps forward

The development of the Ghana Green Growth Index provides the groundwork for other policy-related initiatives, including the following:

- The development of the Ghana National Green Growth Index will allow the development of a pipeline of green projects, supporting the country's transition to green growth. The projects could focus on green investment and innovation, facilitating improvement in green economic opportunities with a trickle-down effect on the other dimensions.
- Updating the Ghana Green Growth Index annually will be valuable because it helps track green growth performance. Proxy variables need to be replaced by the green growth indicators selected by national experts in the coming years. The data availability of the excluded indicators in this first edition of the Green Growth Index due to insufficient data will need to be monitored, collected, and improved. The experts should also review the list of green growth indicators if more policy-relevant indicators become available.
- The Green Growth Index, which highlights the challenges and opportunities in the green growth transition, should be used to inform the future revisions or preparation of plans and strategies (e.g., National Development Plan, National Green Growth Strategy). The trend and scores for the green growth indicators, pillars, and dimensions can inform the policy priorities in different sectors.
- Using the Green Growth Simulation Tool (GGSim), a complementary approach to the Green Growth Index, one can assess SDG co-benefits of policy interventions and green investments up to the year 2050. The data-driven and scenario-based assessments of SDG co-benefits can be integrated into the Green Growth Strategy, Low-Emission Development Strategy, National Adaptation Plan, etc. Like the Green Growth Index, GGSim's applications follow a participatory approach to ensure the policy relevance of the results and facilitate capacity building among the experts.



7.1 Normalized scores for the green growth indicators

Table 11 Normalized scores for the green growth indicators, 2011-2022

Code	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EFFICIENT AND SUSTAINABLE RESOURCE USE (ESRU)												
EE1	90.78	89.70	91.13	91.15	90.55	91.47	91.36	91.59	91.91	90.38	90.38	90.38
EE2	54.55	50.71	50.38	51.98	49.89	49.34	49.41	46.04	46.54	44.03	44.03	44.03
EE3	48.22	54.82	52.7	56.45	65	58.4	54.13	52.65	51.98	51.31	50.64	51.64
EE4	87.94	87.58	87.52	87.55	85.81	85.92	85.51	85.64	85.78	83.9	84.28	84.28
EE5	98.4	100	100	100	100	100	100	100	100	100	100	100
EW1	23.52	26	27.8	26.86	26.09	26.47	29.26	31.59	34.18	33.68	33.68	33.68
EW2	23.04	23.6	24	24.39	25.74	25.9	25.9	25.9	25.9	25.9	25.9	25.9
EW3	9.52	9.52	9.52	9.52	10.03	9.01	7.98	7.39	6.79	6.79	6.79	6.79
EW4	100	100	100	100	100	100	100	100	100	100	100	100
EW5	1.91	1.88	1.86	1.84	1.82	1.8	1.79	1.77	1.75	1.74	1.74	1.74
SL1	100	100	100	100	100	100	100	100	100	100	100	100
SL2	2.62	2.65	2.65	2.31	2.35	2.28	1.91	2.81	2.89	5.46	5.46	5.46
SL3	99.69	99.69	99.69	99.68	99.65	99.65	99.63	99.62	99.62	99.6	99.6	99.6
SL4	11.3	11.32	11.33	11.34	11.34	11.31	11.27	11.26	11.26	11.26	11.26	11.26
SL5	2.32	2.3	2.29	2.16	2.04	2.04	1.96	1.91	1.87	1.87	1.87	1.87
ME1	98.03	97.87	98.68	98.77	98.6	98.59	98.63	98.77	98.78	98.78	98.78	98.78
ME2	91.53	90.24	90.61	91.47	90.54	89.82	89.32	89.31	89.06	89.06	89.06	89.06
ME3	66.6	66.6	66.6	66.6	66.39	65.96	67.38	68.94	68.94	68.94	68.94	68.94
ME4	3	3.05	3.11	3.16	3.31	3.37	3.43	3.43	3.43	3.43	3.43	3.43
ME5	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32
NATURAL CAPITAL PROTECTION (NCP)												
EQ1	43.13	42.75	52.91	53.66	36.49	40.21	36.67	40.04	40.51	40.51	40.51	40.51
EQ2	71.22	71.11	69.96	67.14	65.25	62.37	60.75	63.57	64.93	64.93	64.93	64.93
EQ3	95.3	95.3	95.3	95.3	95.3	77.97	77.97	77.97	77.97	77.97	77.97	77.97
EQ4	98.07	98.62	97.31	97.31	96.35	97.91	94.65	92.07	92.56	92.56	93.6	93.6
EQ5	81.33	81.33	81.33	81.33	81.33	75.33	74.93	74.53	74.53	74.53	74.53	74.53
GE1	94.06	93.91	93.98	93.93	93.89	94.1	94.08	94.12	94.25	93.99	93.89	93.94
GE2	91.55	90.71	90.16	88.77	87.72	87.81	87.65	87.61	87.57	87.81	87.61	87.74
GE3	91.73	92.13	91.51	91.89	91.63	91.63	91.76	91.8	91.88	91.89	91.91	91.9
GE4	80.27	79.33	77.99	77.81	75.71	75.35	77.67	84.68	92.33	92.33	92.33	92.33
GE5	96.12	95.76	93.28	94.19	92.4	93.95	97.3	97.34	97.66	97.6	97.6	97.6
BE1	73.22	73.22	73.22	73.22	73.22	73.22	73.22	73.22	73.22	73.22	73.22	73.22
BE2	100	100	100	100	100	100	100	100	100	100	100	100
BE3	26.03	25.97	25.91	25.85	25.78	25.57	25.16	25.04	25.04	25.04	25.04	25.04
BE4	1.06	1.07	1.08	1.09	1.1	1.1	1.1	1.35	1.35	1.62	1.62	1.66
BE5	1.88	1.87	1.88	1.84	1.82	1.81	1.78	1.78	1.78	1.81	1.8	1.8
CV1	70.39	70.81	71.11	71.5	71.84	72.06	72.48	72.78	73.28	73.84	74.32	73.58
CV2	46.39	46.39	46.39	46.39	46.39	46.39	46.39	46.39	46.35	45.75	45.75	45.75
CV3	15.36	17.75	19.19	19.5	17.4	18.14	17.54	18.94	17.85	4.42	4.42	4.42
CV4	1.01	1.01	1.01	1.01	1.21	1.41	1.45	1.45	1.44	1.44	1.44	1.44

7 Statistical Tables

7.1 Normalized scores for the green growth indicators 84

7.2 Aggregated scores for pillars, dimensions, and Green Growth Inde 86

Table 11 Normalized scores for the green growth indicators (continued)												
Code	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
CV5	1.17	1.17	1.17	1.15	1	1.02	1.03	1.05	1.07	1.07	1.07	1.07
GREEN ECONOMIC OPPORTUNITIES (GEO)												
GV1	36.38	31.87	52.38	51.9	52.22	53.69	53.04	57.72	49.62	62.94	62.94	62.94
GV2	5.42	5.7	7.07	7.07	9.08	9.82	11.3	12.55	13.27	13.34	13.63	13.63
GV3	1.44	1.25	1.76	3.33	3.42	6.79	3.51	10.06	6.03	6.34	5.47	5.47
GV4	2.09	2.09	2.09	2.63	2.09	2.09	2.09	2.9	2.64	3.72	3.72	3.72
GV5	56.06	58.23	54.32	59.29	55.87	50.83	50.83	50.83	36.36	36.36	36.36	36.36
GT1	15.09	16.1	7.55	10.38	10.92	9.84	10.76	10.6	7.41	7.41	7.41	7.41
GT2	10.05	13.13	10.86	12	19.15	16.62	16.87	16.37	8.77	10.25	9.39	10.91
GT3	1.1	1.82	1.87	1.97	2.26	2.5	2.89	3.13	3.23	4.01	4.49	3.62
GT4	7.98	6.66	6.66	6.65	6.67	6.67	6.67	6.61	6.75	6.75	6.75	6.75
GT5	10.31	15.54	20.79	27.16	30.41	23.97	18.17	14.05	5.41	5.4	5.4	5.4
GJ1	38.88	38.88	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8
GJ2	84.86	86.12	87.25	86.69	85.98	86.26	86.09	87.13	88.22	87.95	88.54	88.23
GJ3	28.01	28.14	29.64	30.11	30.25	30.54	31.18	30.9	31.31	31.56	31.64	31.64
GJ4	56.16	58.09	60.02	60.02	61.3	60.65	60.02	60.02	60.02	60.02	60.02	60.02
GJ5	34.9	36.96	37.38	37.79	51.55	48.34	69.63	74.26	78.72	83.17	83.17	83.17
GN1	14.05	13.33	13.15	19.64	20.31	21.74	21.31	20.57	21.01	21.01	21.01	21.01
GN2	5.38	6.24	6.75	7.12	8.26	10.19	10.62	12.19	12.19	12.19	12.19	12.19
GN3	5.57	6.82	8.06	9.3	10.54	10.54	10.54	10.54	10.54	10.54	10.54	10.54
GN4	11.67	11.67	28.61	28.61	28.61	28.61	28.61	28.61	28.61	28.61	28.61	28.61
GN5	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.82	1.83	1.85	1.85	1.85
SOCIAL INCLUSION (SI)												
AB1	26.66	27.9	29.17	30.45	31.74	33.06	34.39	35.75	37.12	38.51	39.41	38.77
AB1_a	22.71	24.42	26.16	27.93	29.73	31.56	33.42	35.31	37.22	39.17	40.54	41.44
AB1_b	8.52	9.24	9.99	10.75	11.54	12.34	13.16	14.00	15.28	16.22	17.19	15.75
AB2	38.75	39.64	43.39	47.19	45.33	48.48	48.62	48.78	50.28	51.15	51.52	51.52
AB2_a	63.44	63.30	69.85	77.55	72.96	78.36	78.30	79.29	82.47	84.41	85.31	85.31
AB2_b	12.46	14.54	15.58	16.62	17.66	19.75	20.79	22.87	23.91	26.00	27.04	27.04
AB3	90.63	90.39	89.53	88.36	87.27	87.23	88.07	89.16	90.61	92.36	92.36	92.36
AB4	49.38	49.38	49.38	49.38	49.38	49.38	49.38	49.38	49.38	49.38	49.38	49.38
AB5	47.87	47.87	47.87	47.87	47.87	47.87	47.82	46.62	45.45	45.72	45.72	45.72
GB1	17.35	17.35	21.31	22.6	22.6	22.6	26.21	26.21	26.92	26.92	26.92	26.92
GB2	96.45	97.63	98.43	98.12	98.37	97.86	97.44	97.28	97.12	96.98	96.84	96.84
GB3	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5
GB4	32.34	33.48	37.14	39.5	44.88	39.61	39.46	39.72	39.72	39.72	39.72	39.71
GB5	95.4	95.75	95.58	95.21	95.41	94.72	95.78	97.8	97.12	97.12	97.12	97.12
SE1	86.07	85.98	85.45	84.67	83.95	83.2	83.2	83.2	83.2	83.2	83.2	83.2
SE2	84.09	85.79	87.05	91.6	89.62	91.9	91.49	92.37	92.19	92.87	93.07	93.07
SE2_a	98.14	99.30	99.41	99.69	99.56	99.72	99.70	99.75	99.73	99.77	99.77	99.77
SE2_b	67.43	66.13	67.98	69.33	74.04	72.60	75.56	78.27	80.08	81.89	83.40	83.40
SE3	81.07	80.2	79.4	78.92	81.13	83.68	87.07	85.44	88.39	85.06	85.06	85.06

Table 11 Normalized scores for the green growth indicators (continued)												
Code	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SE4	96.61	96.96	97.21	97.36	97.47	97.5	97.44	97.36	97.24	97.13	97.02	97.24
SE5	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.21	1.21
SP1	17.73	17.73	17.73	17.73	17.73	17.73	19.81	19.81	19.81	19.81	19.81	19.81
SP2	23.83	25.27	26.74	28.25	29.78	28.6	27.36	27.54	27.72	28.57	29.44	29.44
SP3	60.76	62.03	63.93	65.83	67.73	69.63	69.63	69.63	69.63	69.63	69.63	69.63
SP4	98.06	97.79	97.24	97.05	96.92	97.82	97.12	96.63	96.39	96.36	96.51	96.51
SP5	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	2.08	2.08	2.08

7.2 Aggregated scores for pillars, dimensions, and Green Growth Index

Table 12 Aggregated scores for pillars, dimensions, and Green Growth Index, 2011-2022												
Code	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EFFICIENT AND SUSTAINABLE RESOURCE USE (ESRU)												
EE	75.98	76.56	76.35	77.43	78.25	77.03	76.08	75.19	75.24	73.92	73.86	74.07
EW	31.6	32.2	32.63	32.52	32.74	32.64	32.98	33.33	33.73	33.62	33.62	33.62
SL	43.19	43.19	43.19	43.1	43.08	43.06	42.95	43.12	43.13	43.64	43.64	43.64
ME	52.7	52.42	52.67	52.86	52.63	52.41	52.61	52.95	52.91	52.91	52.91	52.91
GREEN ECONOMIC OPPORTUNITIES (GEO)												
GV	20.28	19.83	23.52	24.85	24.54	24.64	24.16	26.81	21.59	24.54	24.42	24.43
GT	8.91	10.65	9.55	11.63	13.88	11.92	11.07	10.15	6.31	6.76	6.69	6.82
GJ	48.56	49.64	45.82	45.88	48.78	48.12	52.34	53.42	54.61	55.5	55.63	55.57
GN	7.71	7.99	11.69	13.31	13.92	14.59	14.59	14.75	14.84	14.84	14.84	14.84
NATURAL CAPITAL PROTECTION (NCP)												
EQ	77.81	77.82	79.36	78.95	74.94	70.76	68.99	69.64	70.1	70.1	70.31	70.31
GE	90.74	90.37	89.38	89.32	88.27	88.57	89.69	91.11	92.74	92.72	92.67	92.7
BE	40.44	40.43	40.42	40.4	40.38	40.34	40.25	40.28	40.28	40.34	40.33	40.34
CV	26.86	27.42	27.77	27.91	27.57	27.8	27.78	28.12	28	25.31	25.4	25.25
SOCIAL INCLUSION (SI)												
AB	50.66	51.04	51.87	52.65	52.32	53.2	53.66	53.94	54.57	55.42	55.68	55.55
GB	58.41	58.94	60.59	61.19	62.35	61.06	61.88	62.3	62.27	62.25	62.22	62.22
SE	69.79	70.01	70.04	70.73	70.65	71.47	72.06	71.89	72.42	71.87	71.91	71.95
SP	40.35	40.84	41.41	42.05	42.71	43.03	43.06	43	42.99	43.29	43.49	43.49
DIMENSIONS												
ESRU	54.71	54.91	55.01	55.26	55.39	54.99	54.86	54.85	54.96	54.73	54.71	54.76
NCP	58.96	59.01	59.23	59.14	57.79	56.87	56.68	57.29	57.78	57.12	57.18	57.15
GEO	21.36	22.03	22.64	23.92	25.28	24.82	25.54	26.28	24.34	25.41	25.4	25.41
SI	54.8	55.21	55.98	56.65	57.01	57.19	57.66	57.78	58.06	58.21	58.32	58.3
Index	38.53	39.22	39.34	39.52	39.79	39.8	40	40.12	40.23	40.39	40.53	40.7



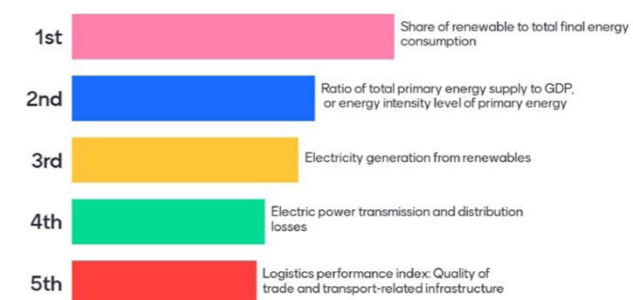
Annexes

- Annex 1** Results of the first online survey with national experts
- Annex 2** Results of Mentimeter votes from first participatory workshop
- Annex 3** Results of the second online survey with international experts
- Annex 4** List of the Ghanaians experts
- Annex 5** List of reviewers
- Annex 6** GGGI/GGPM Team

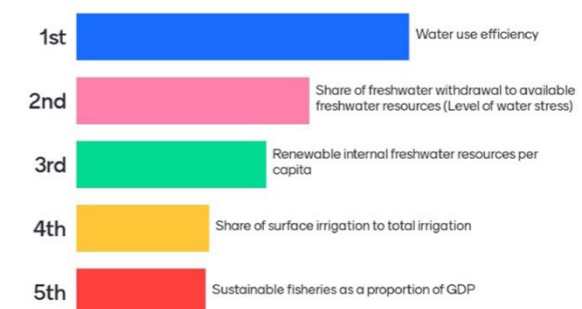
Annex 1

Results of the first online survey with national experts

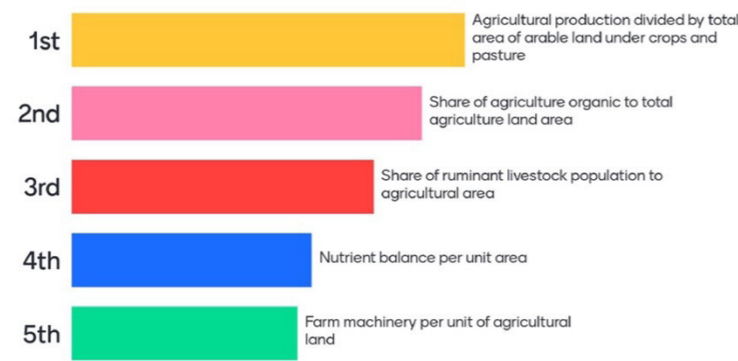
Initial Survey: Efficient and Sustainable Energy



Initial Survey: Efficient and Sustainable Water Use



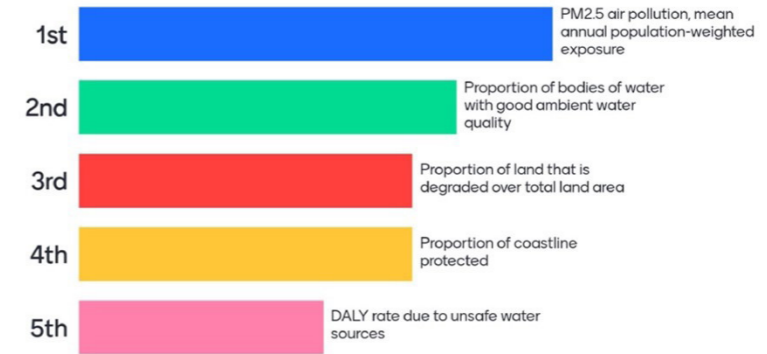
Initial Survey: Sustainable Land Use



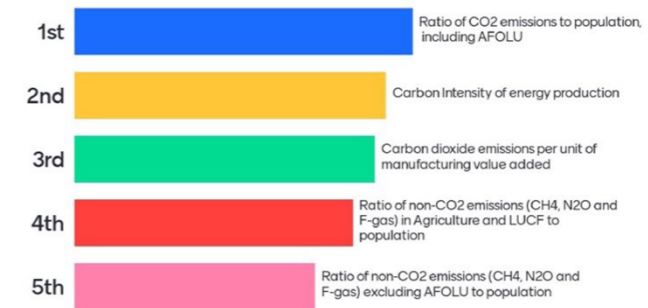
Initial Survey: Material Use Efficiency



Initial Survey: Environmental Quality



Initial Survey: Greenhouse Gas Emissions Reductions



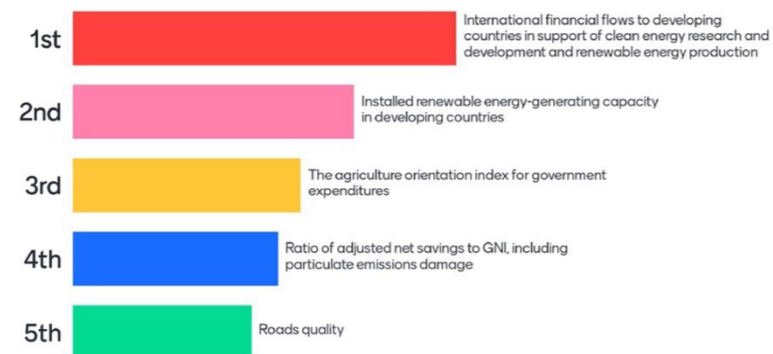
Initial Survey: Biodiversity and Ecosystem Protection



Initial Survey: Cultural and Social Value



Initial Survey: Green Investment



Initial Survey: Green Trade



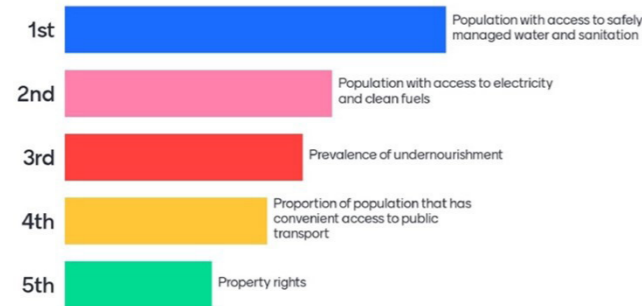
Initial Survey: Green Employment



Initial Survey: Green Innovation



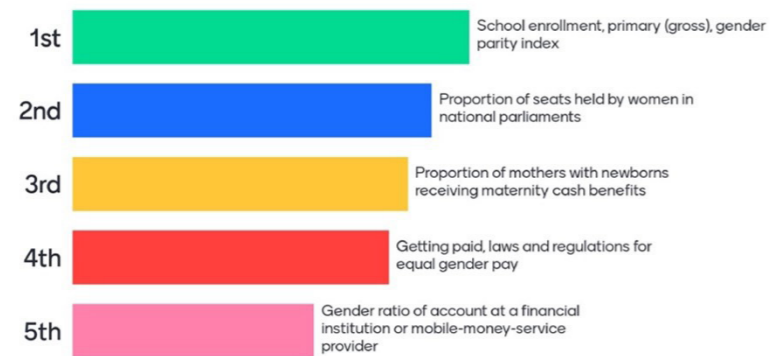
Initial Survey: Access to basic services and resources



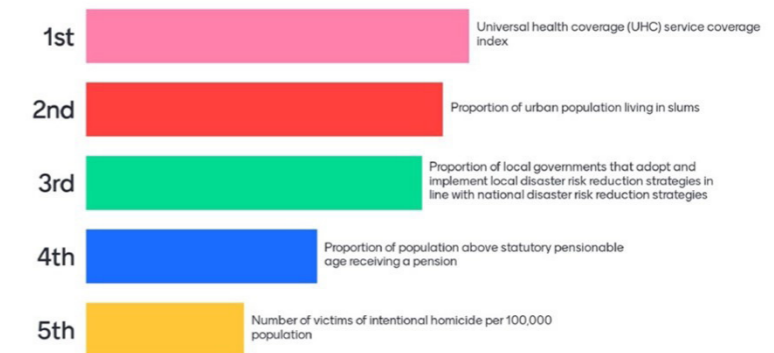
Initial Survey: Social Equity



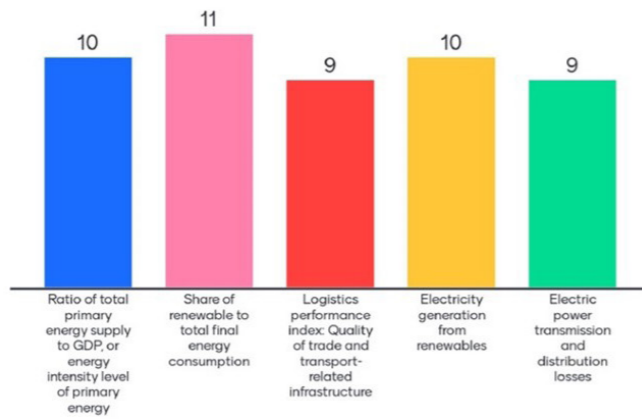
Initial Survey: Gender Balance



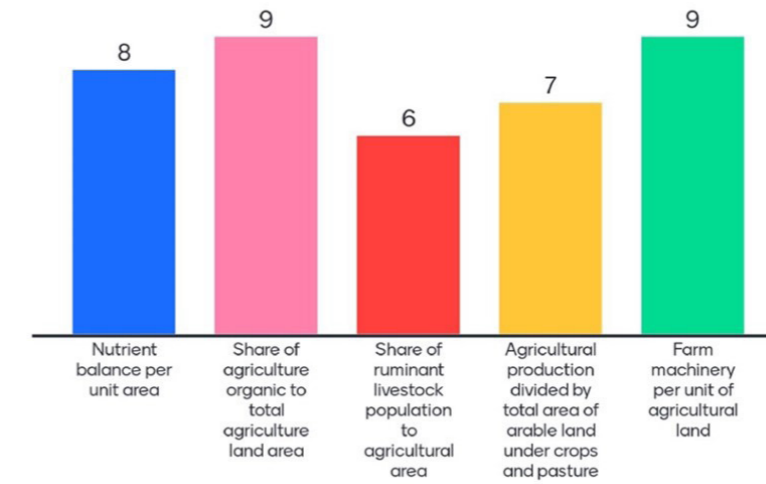
Initial Survey: Social Protection



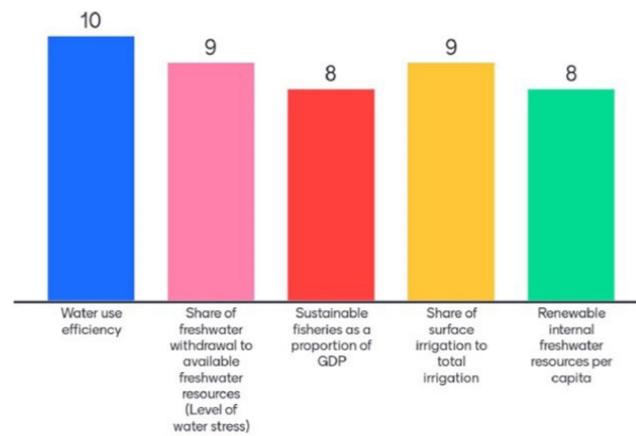
Final voting: Efficient and Sustainable Energy



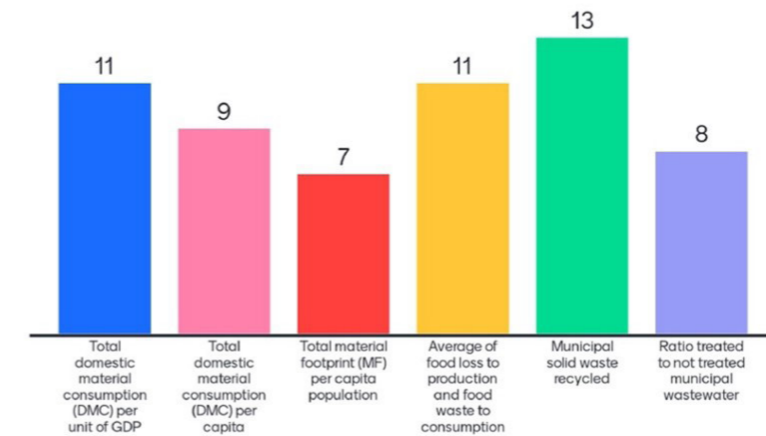
Final voting: Sustainable Land Use



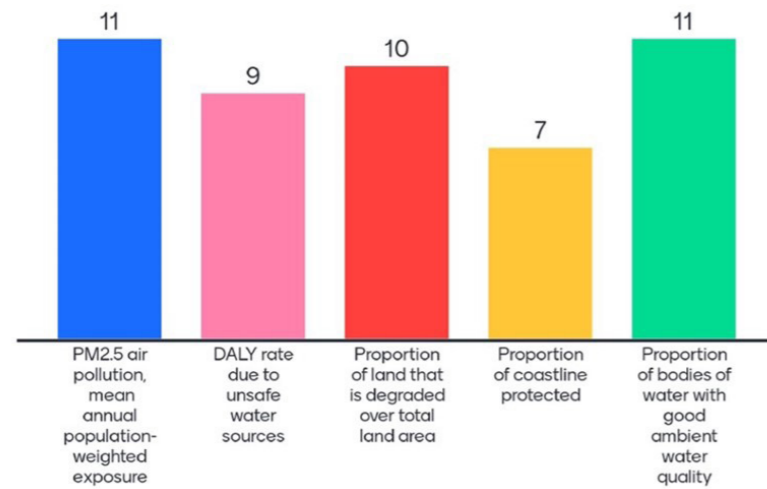
Final voting: Efficient and Sustainable Water Use



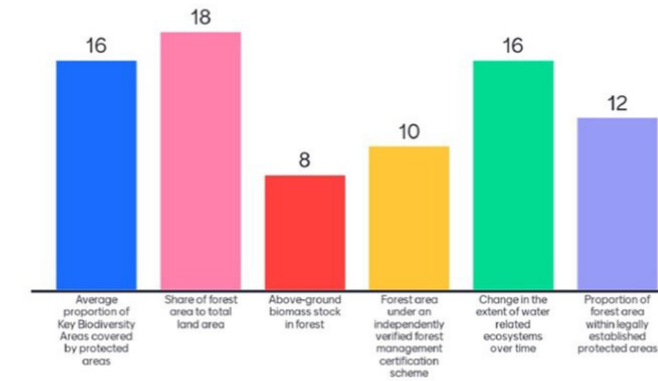
Final voting: Material Use Efficiency



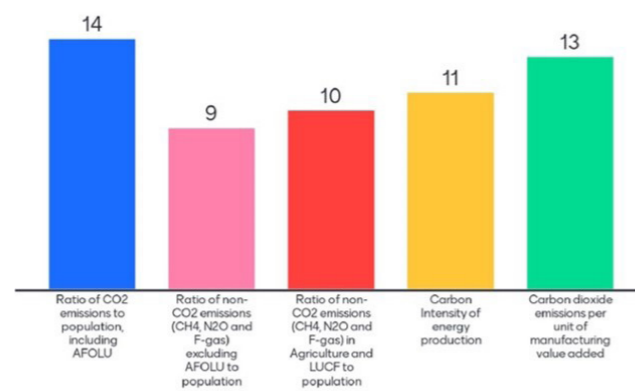
Final voting: Environmental Quality



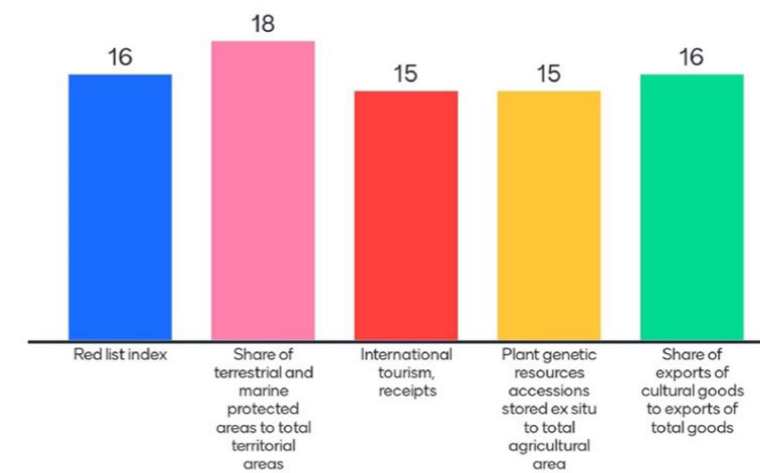
Final voting: Biodiversity and Ecosystem Protection



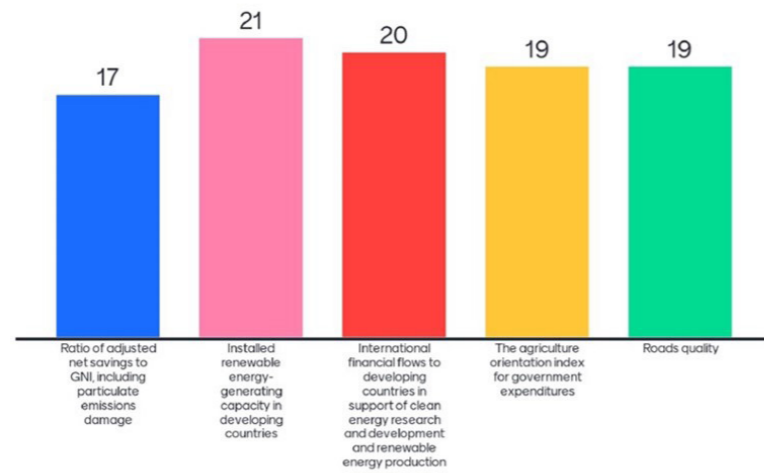
Final voting: Greenhouse Gas Emissions Reductions



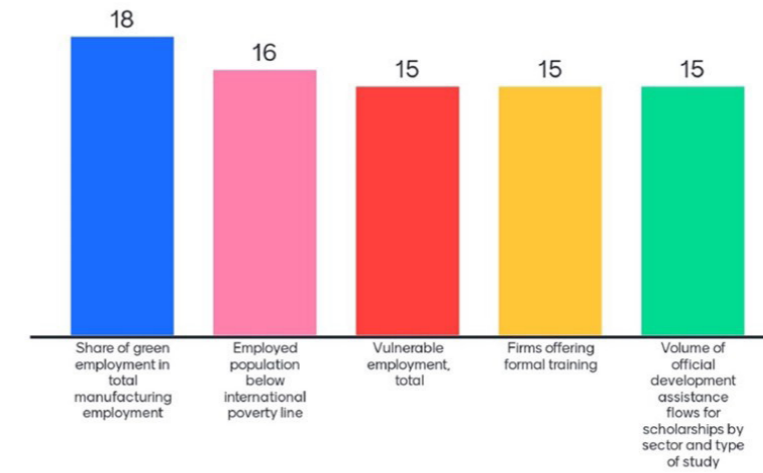
Final voting: Cultural and Social Value



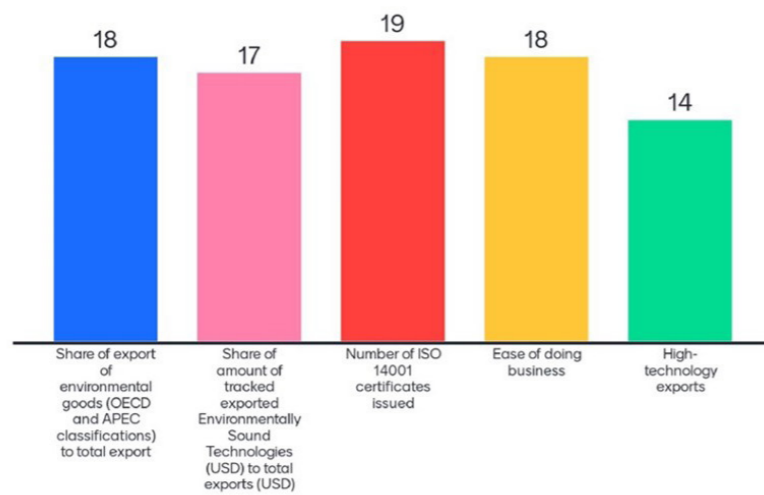
Final voting: Green Investment



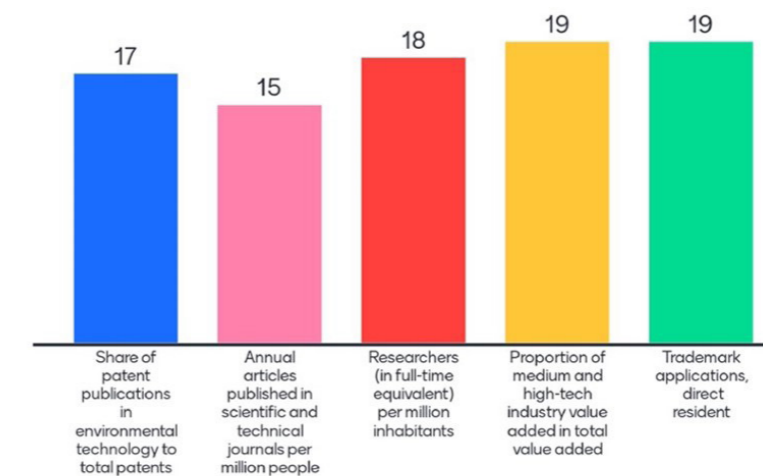
Final voting: Green Employment



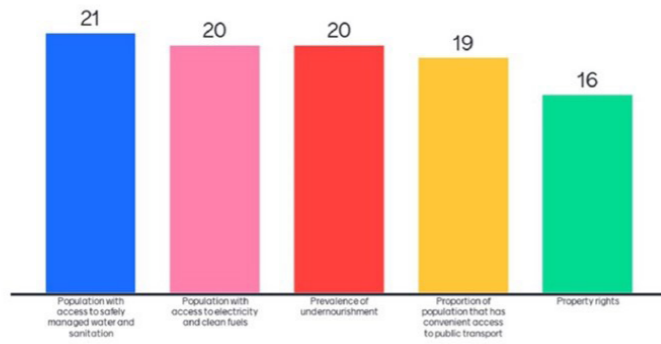
Final voting: Green Trade



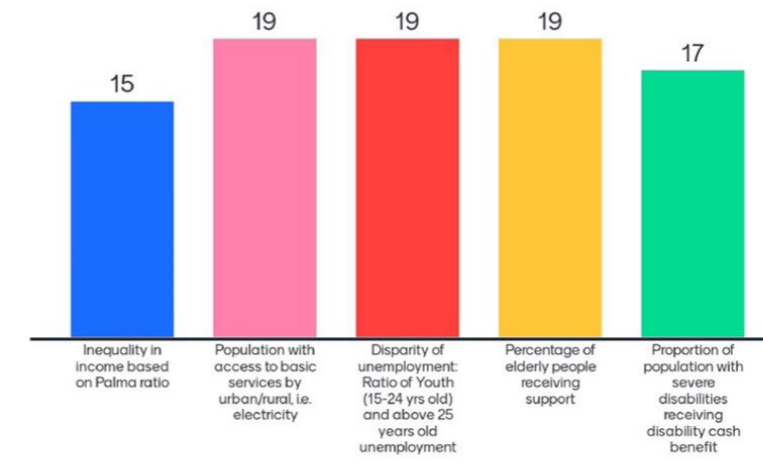
Final voting: Green Innovation



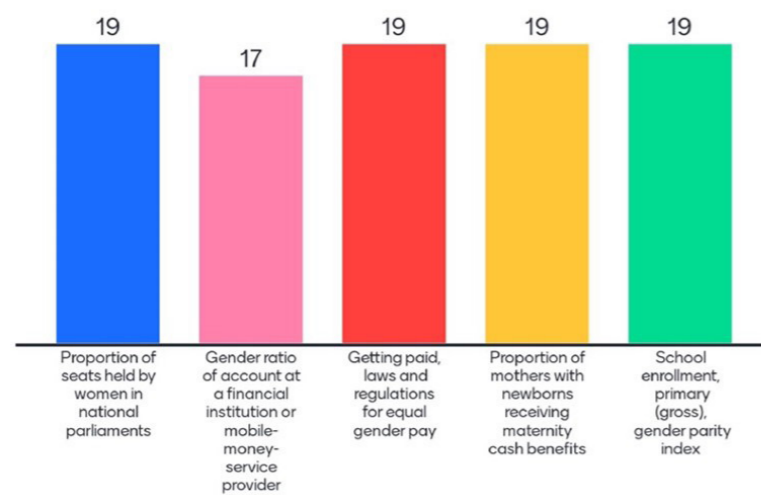
Final voting: Access to basic services and resources



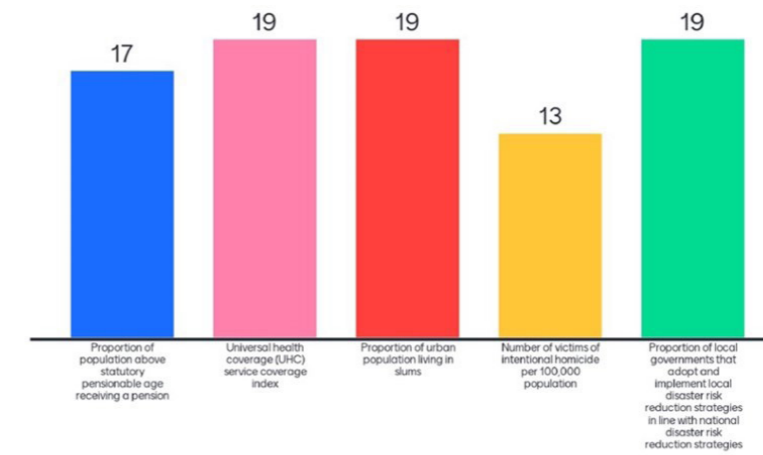
Final voting: Social Equity



Final voting: Gender Balance



Final voting: Social Protection



Annex 2

Results of Mentimeter votes from first participatory workshop

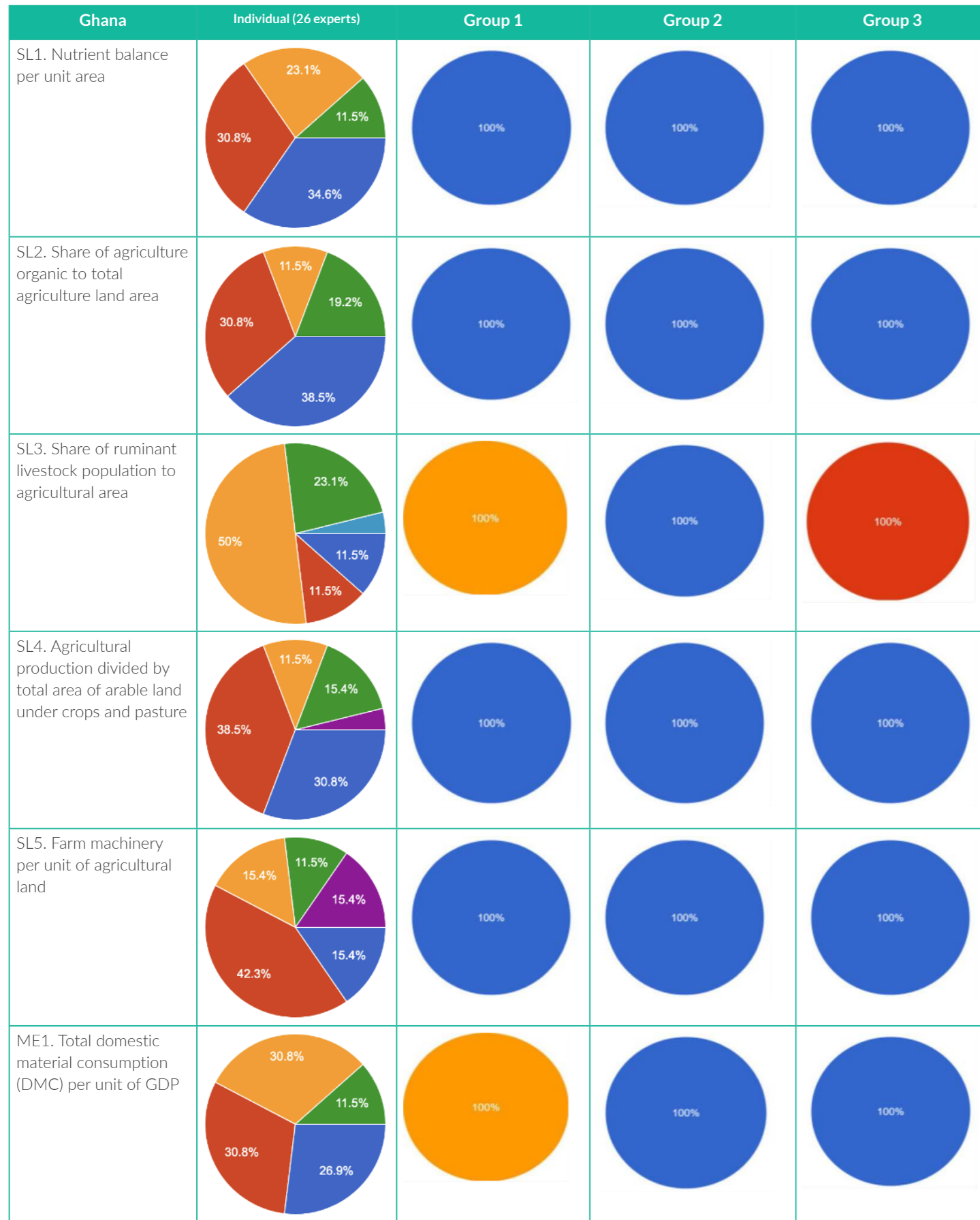
Table A.1 Checklist for the green growth indicators in efficient and sustainable energy

Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
EE1. Ratio of total primary energy supply to GDP, or energy intensity level of primary energy				
EE2. Share of renewable to total final energy consumption				
EE3. Logistics performance index: Quality of trade and transport-related infrastructure				
EE4. Electricity generation from renewables				

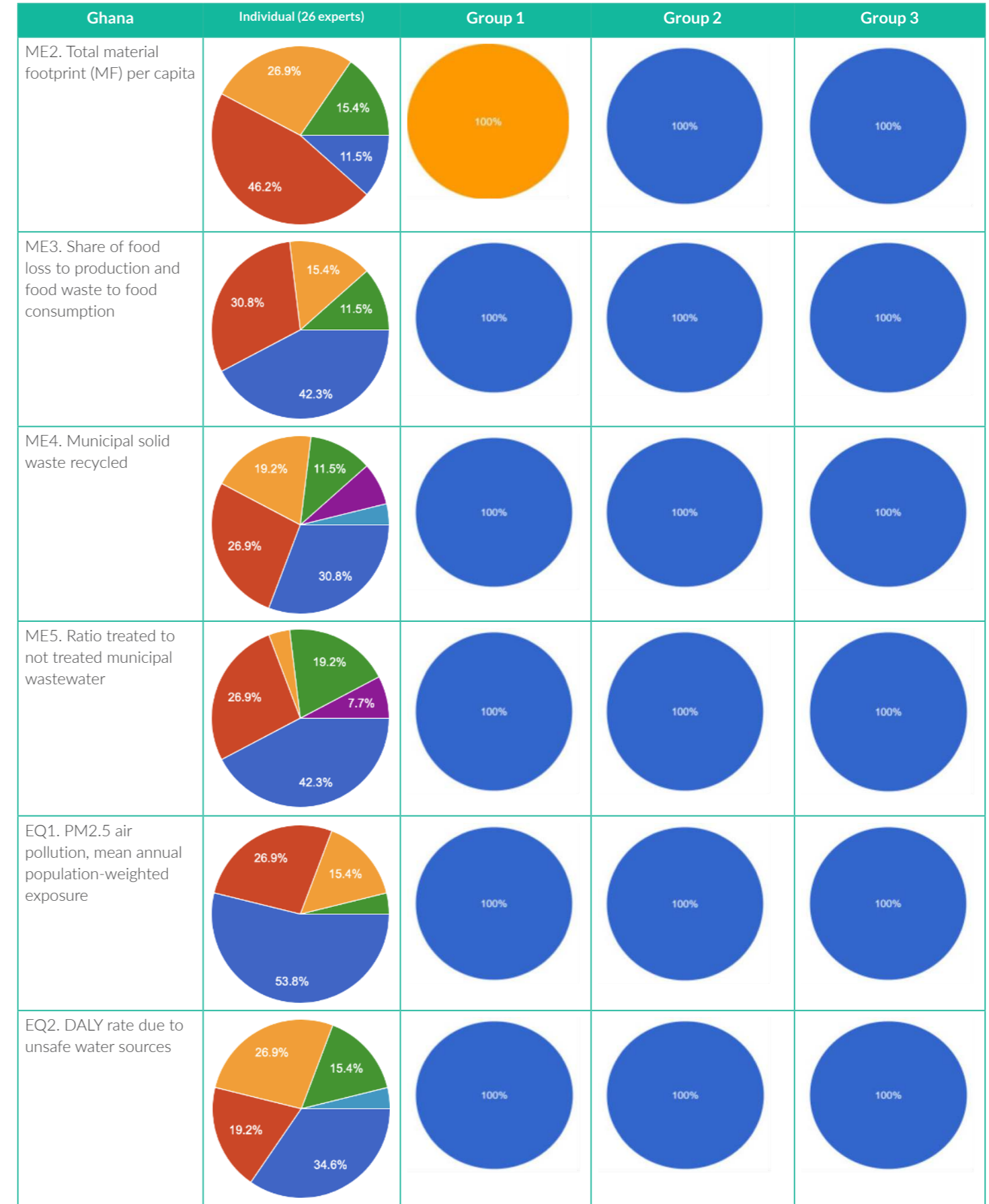
Legend:
● Very High ● High ● Moderate ● Low ● Very Low ● Not relevant

Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
EE5. Electric power transmission and distribution losses				
EW1. Water use efficiency				
EW2. Share of freshwater withdrawal to available freshwater resources (Level of water stress)				
EW3. Sustainable fisheries as a proportion of GDP				
EW4. Share of surface irrigation to total irrigation				
EW5. Renewable internal water resources per capita				

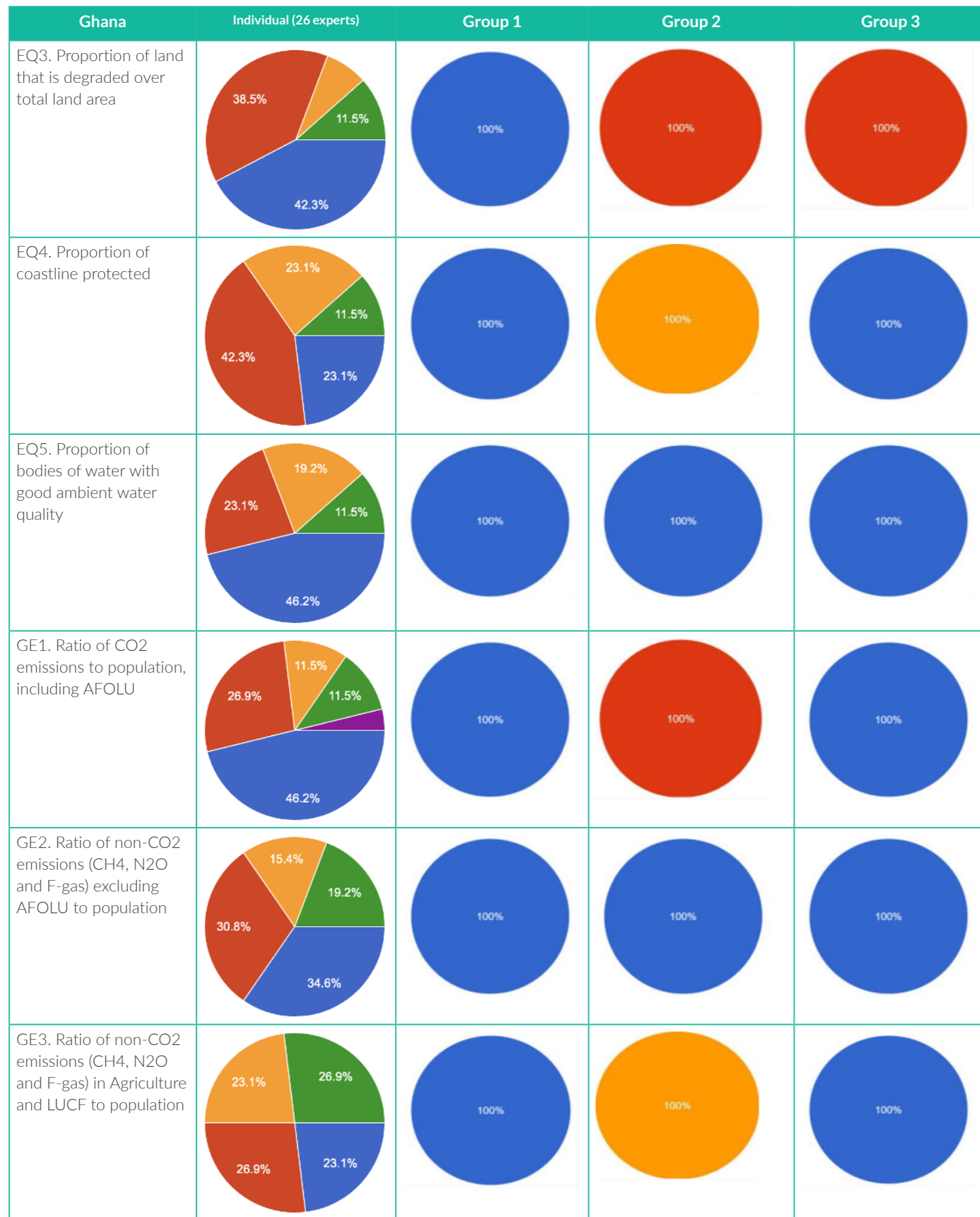
Legend:
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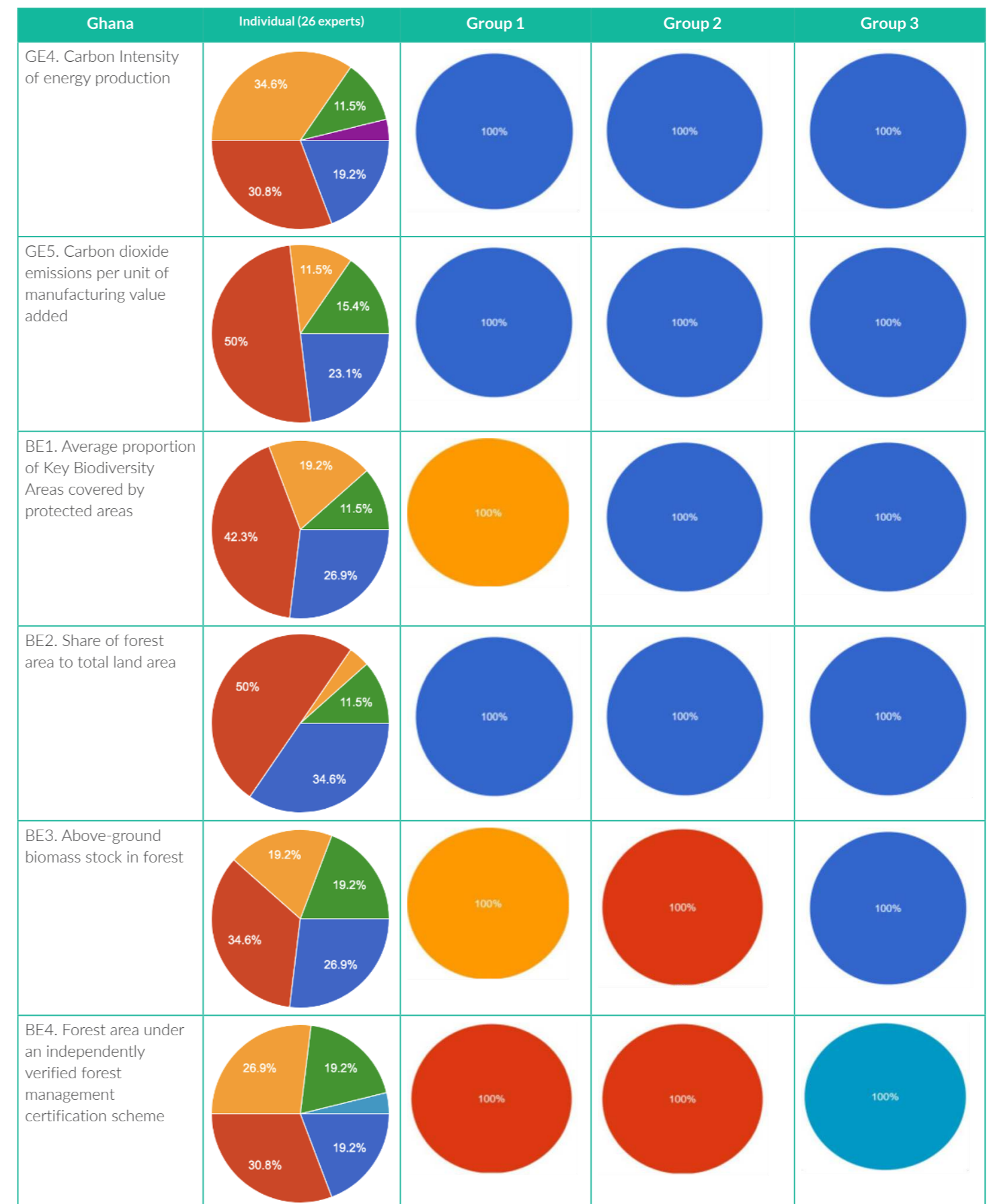
Legend:
● Very High ● High ● Moderate ● Low ● Very Low ● Not relevant



Legend:
● Very High ● High ● Moderate ● Low ● Very Low ● Not relevant



Legend:



Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
BE5. Change in the extent of water related ecosystems over time: Lakes and rivers permanent water areas		100%	100%	100%
CV1. Red list index		100%	100%	100%
CV2. Share of terrestrial and marine protected areas to total territorial areas		100%	100%	100%
CV3. International tourism, receipts		100%	100%	100%
CV4. Plant genetic resources accessions stored ex-situ to total agricultural area		100%	100%	100%
CV5. Share of exports of cultural goods to exports of total goods		100%	100%	100%

Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
GV1. Ratio of adjusted net savings to GNI, including particulate emissions damage		100%		
GV2. Installed renewable energy-generating capacity in developing countries		100%		
GV3. International financial flows to developing countries in support of clean energy research and development and renewable energy production		100%		
GV4. Agriculture Orientation Index for Government Expenditures		100%		
GV5. Roads quality		100%		
GT1. Share of export of environmental goods (OECD and APEC classifications) to total export		100%		

Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
GT2. Share of amount of tracked exported Environmentally Sound Technologies to total exports				
GT3. Number of ISO 14001 certificates issued				
GT4. Ease of doing business in Ghana				
GT5. High-technology exports				
GJ1. Share of green employment in total manufacturing employment				
GJ2. Employed population below international poverty line				

Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
GJ3. Vulnerable employment, total				
GJ4. Firms offering formal training				
GJ5. Volume of official development assistance flows for scholarships by sector and type of study				
GN1. Share of patent publications in environmental technology to total patents				
GN2. Annual articles published in scientific and technical journals per million people				
GN3. Researchers (in full-time equivalent) per million inhabitants				

Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
GN4. Proportion of medium and high-tech industry value added in total value added				
GN5. Trademark applications, direct resident				
AB1. Population with access to safely managed water and sanitation				
AB2. Population with access to electricity and clean fuels				
AB3. Prevalence of undernourishment				
AB4. Proportion of population that has convenient access to public transport				

Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
AB5. Property rights				
GB1. Proportion of seats held by women in national parliaments				
GB2. Gender ratio of account at a financial institution or mobile-money-service provider				
GB3. Getting paid, laws and regulations for equal gender pay				
GB4. Proportion of mothers with newborns receiving maternity cash benefits.				
GB5. School enrollment, primary (gross), gender parity index (GPI)				

Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
SE1. Inequality in income based on Palma ratio				
SE2. Population with access to basic services by urban/rural, i.e. electricity				
SE3. Disparity of unemployment: Ratio of Youth (15-24 yrs old) and above 25 years old unemployment				
SE4. Percentage of elderly people receiving support				
SE5. Proportion of population with severe disabilities receiving disability cash benefit				

Legend:



Ghana	Individual (26 experts)	Group 1	Group 2	Group 3
SP1. Proportion of population above statutory pensionable age receiving a pension				
SP2. Universal health coverage (UHC) service coverage index				
SP3. Proportion of urban population living in slums				
SP4. Number of victims of intentional homicide per 100,000 population				
SP5. Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies				

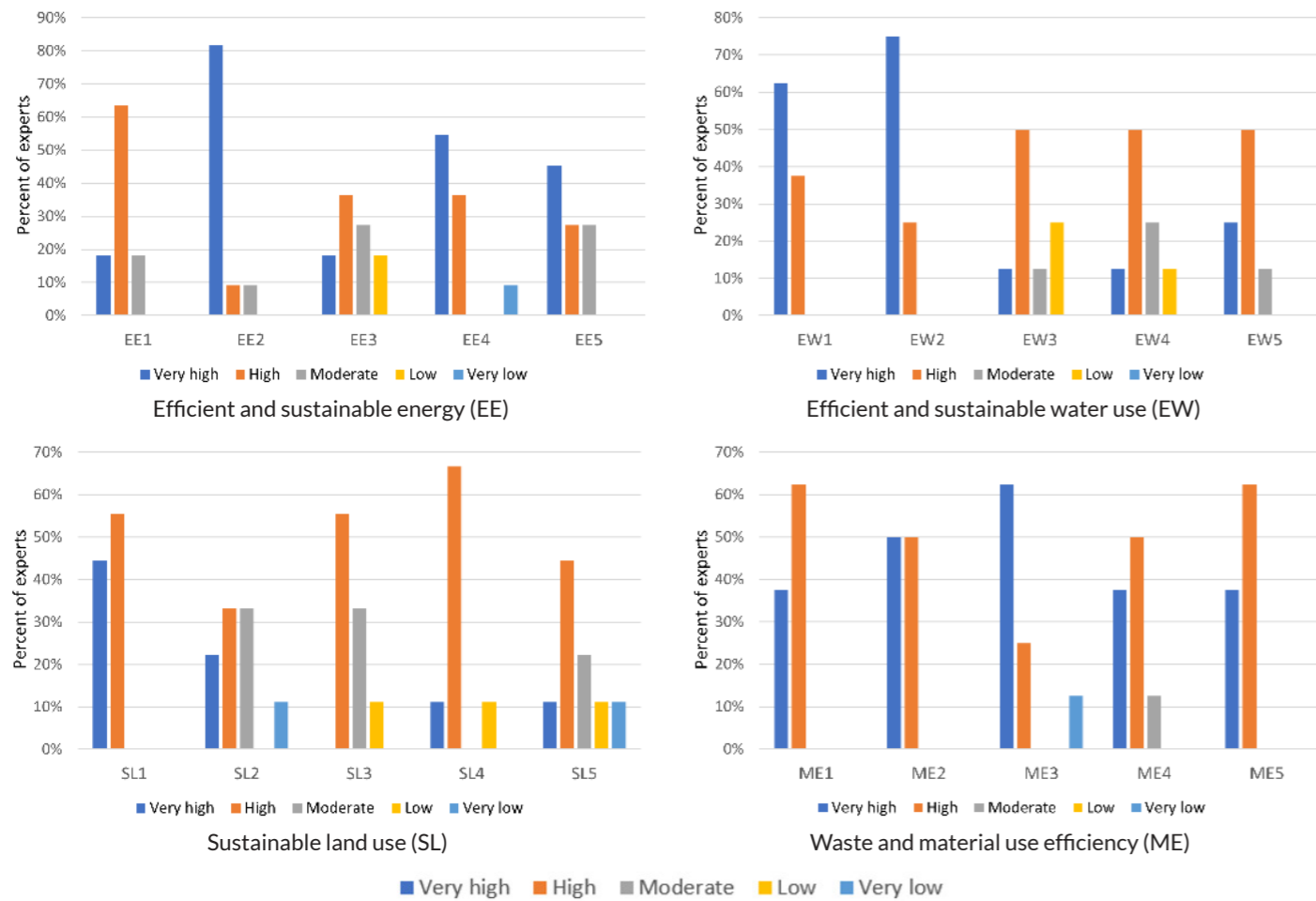
Legend:



Annex 3

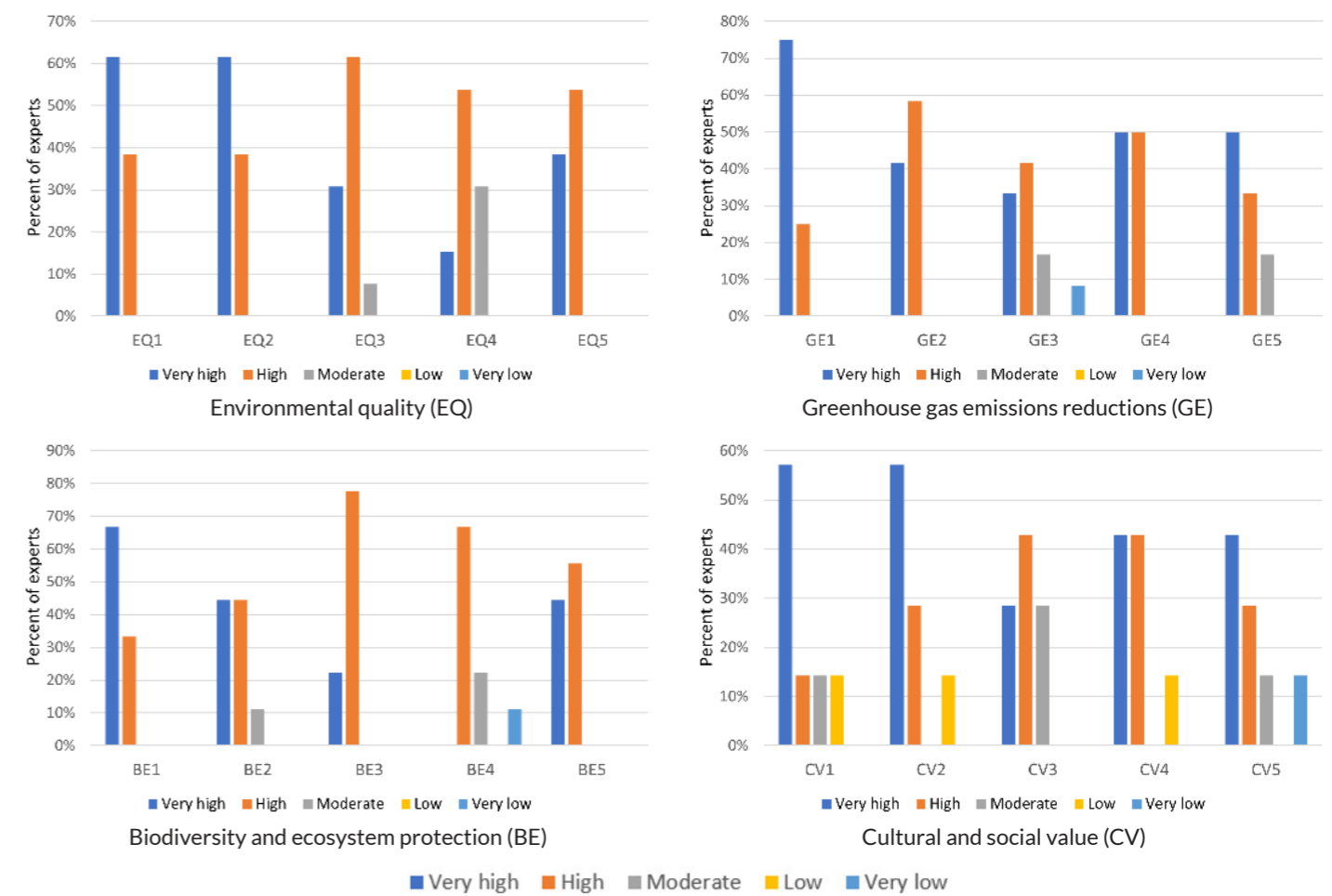
Results of the second online survey with international experts

Efficient and sustainable resource use



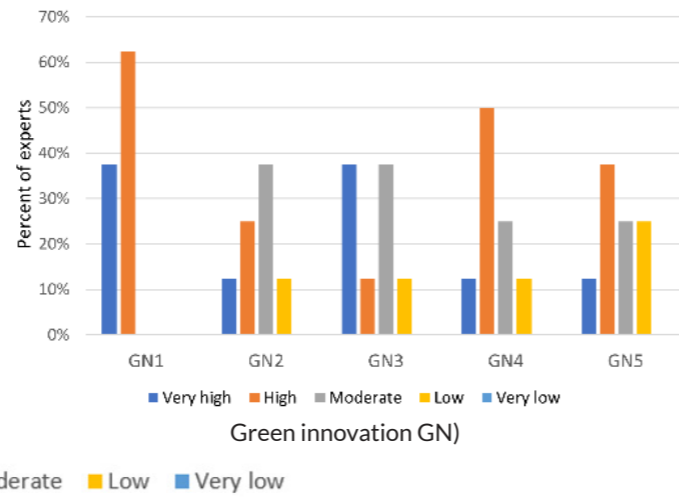
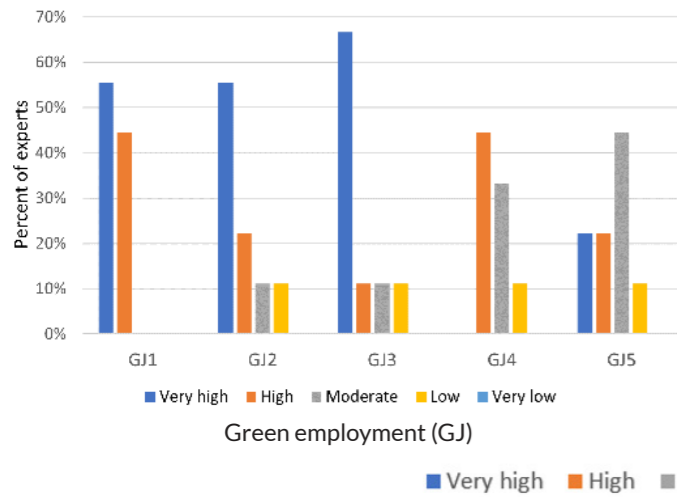
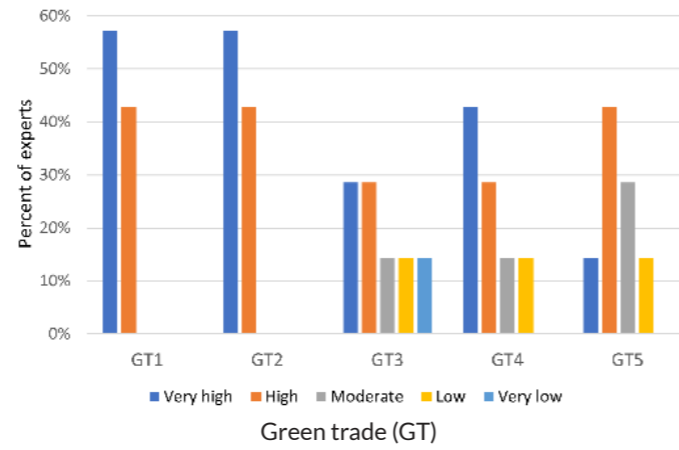
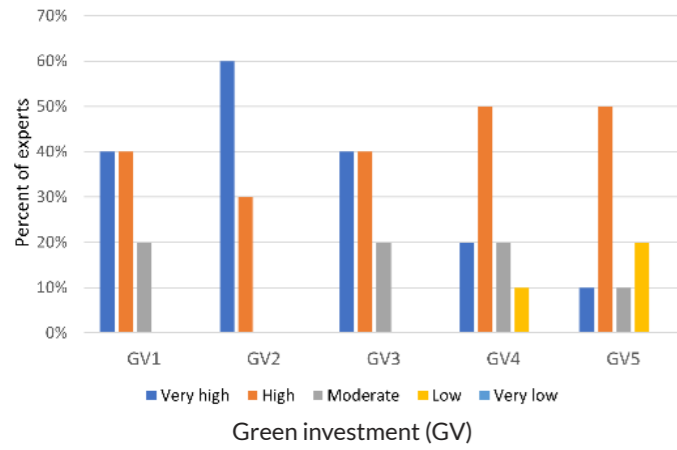
EE1 - Energy intensity, EE2 - Renewable energy share, EE3 - Efficient transport, EE4 - Low-carbon electricity, EE5 - Per capita electricity consumption
 EW1 - Water use efficiency, EW2 - Level of water stress, EW3 - Sustainable fisheries, EW4 - Share of surface irrigation, EW5 - Renewable water resources per capita
 SL1 - Soil nutrient balance, SL2 - Organic agriculture area, SL3 - Share ruminant livestock, SL4 - Agricultural productivity, SL5 - Farm machinery per unit land
 ME1 - Material consumption per GDP, ME2 - Material footprint, ME3 - Food loss and food waste, ME4 - Municipal solid waste recycled, ME5 - Waste water treatment facilities

Natural capital protection

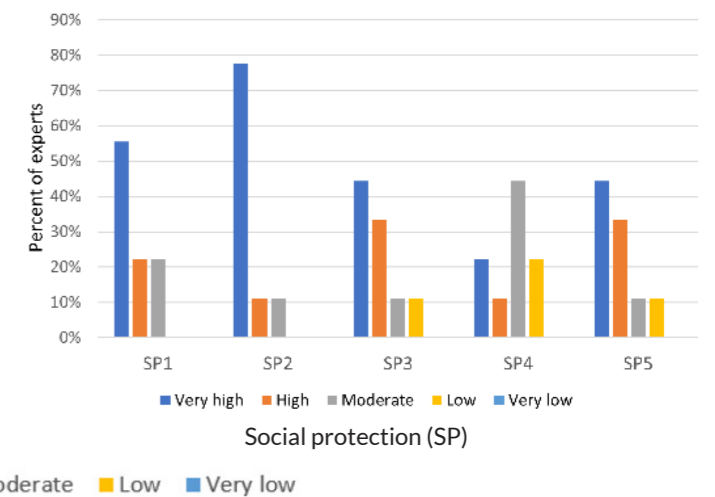
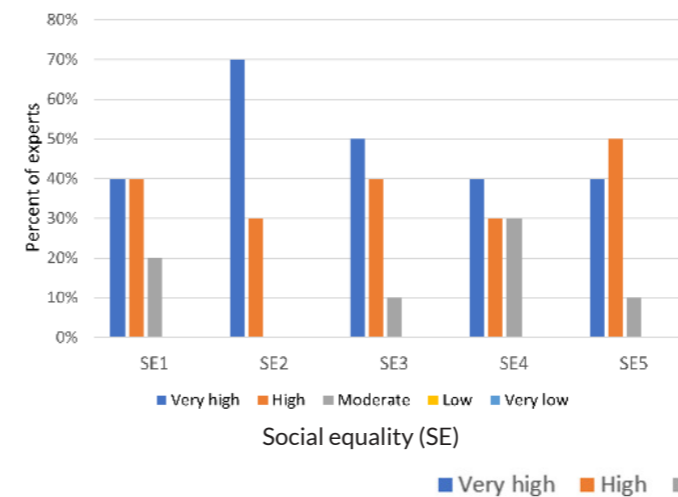
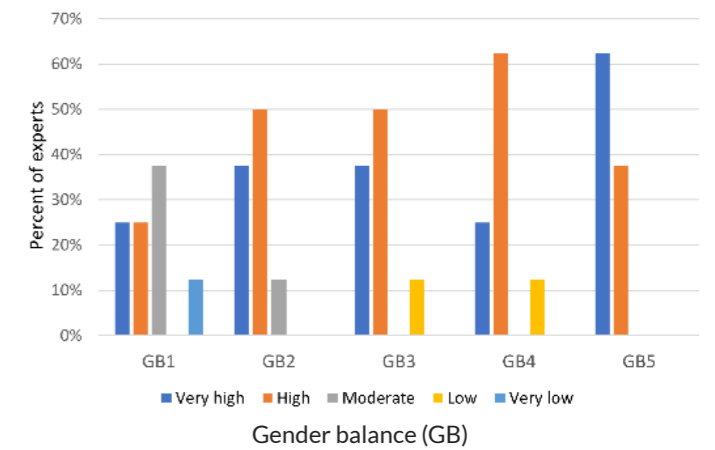
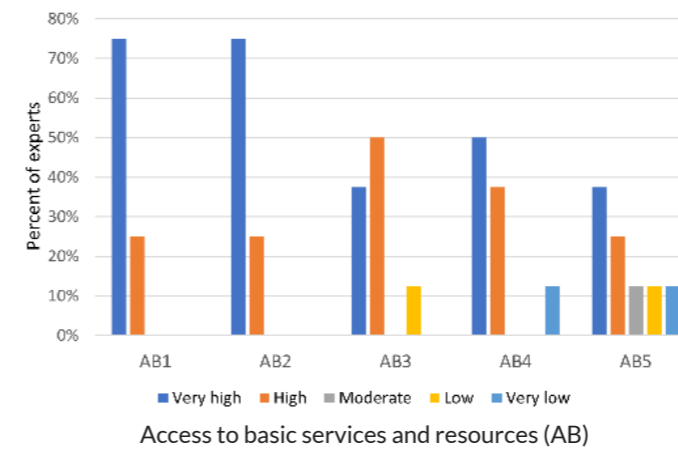


EQ1 - PM2.5 air pollution, EQ2 - DALY rate from unsafe water, EQ3 - Solid waste generation, EQ4 - Chlorophyll-a deviations, EQ5 - Water with good ambient quality
 GE1 - CO2 emissions per capita, GE2 - Non-CO2 per capita excl. AFOLU, GE3 - Non-CO2 emissions in AFOLU, GE4 - Carbon intensity of energy production, GE5 - CO2 emissions per mfg value-added
 BE1 - Protected key biodiversity areas, BE2 - Share of forest areas, BE3 - Forest above-ground biomass, BE4 - Forest under certification scheme, BE5 - Change in extent of water ecosystems
 CV1 - Local breeds risk of extinction, CV2 - Terrestrial protected areas, CV3 - Tourism contribution to GDP, CV4 - Plant genetic resources accessions, CV5 - Share of exports of cultural goods

Green economic opportunities



Social inclusion



GV1 - Adjusted net savings, GV2 - Renewable electricity capacity, GV3 - Financial flows for clean energy R&D, GV4 - Agriculture orientation index, GV5 - Road quality
 GT1 - Exports of environmental goods, GT2 - Environmental technologies exported, GT3 - ISO 14001 certificates issued, GT4 - New business density, GT5 - High-technology exports
 GJ1 - Green employment in manufacturing, GJ2 - Employed below poverty line, GJ3 - Vulnerable employment, GJ4 - Firms offering formal training, GJ5 - ODA flows for scholarships
 GN1 - Environmental technologies, GN2 - Scientific and technical journals, GN3 - Researchers per million inhabitants, GN4 - Medium/ high-tech mfg value-added, GN5 - Trademark applications

AB1 - Access to safe water and sanitation, AB2 - Access to electricity and clean fuels, AB3 - Prevalence of undernourishment, AB4 - Convenient access to public transport, AB5 - Property rights
 GB1 - Women in national parliaments, GB2 - Gender account in financial institution, GB3 - Equal gender pay, GB4 - Mothers with maternity cash benefits, GB5 - School enrollment gender parity
 SE1 - Inequality in income, SE2 - Rural-urban access to electricity, SE3 - Youth unemployment disparity, SE4 - Age dependency ratio, SE5 - Cash benefit for people with disabilities
 SP1 - Share of old people receiving pension, SP2 - Universal health coverage, SP3 - Population living in slums, SP4 - Victims of intentional homicides, SP5 - Score of Hyogo Framework

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Notes and references

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