



2023 MESTI STATISTICAL REPORT

DECEMBER 2024



PREFACE

The 2023 Statistical Report has been prepared to capture data from the various Agencies under the Ministry of Environment, Science, Technology, and Innovation. The purpose of this Statistical Report is to provide accurate and reliable administrative data submitted by the Departments, making it readily available and accessible to stakeholders for informed decision-making. It also serves as a platform to evaluate the credibility and usefulness of such information. Additionally, the report aims to improve data collection, analysis, and interpretation of projects and programs undertaken by the Ministry, thereby strengthening the Statistical Unit of the RSIM Directorate.

In preparing the 2023 Statistical Report, the Research, Statistics, and Information Management (RSIM) Directorate formed a Working Group with focal persons from within the Ministry and sector agencies, who submitted indicators for review and approval.

This report provides general information about the various Agencies under the Ministry, covering their respective functions and activities during the year under review. The data and other information presented in this Statistical Report were obtained from the Environmental Protection Agency, the Council for Scientific and Industrial Research, the Ghana Atomic Energy Commission, the Nuclear Regulatory Authority, and the National Biosafety Authority.

ACKNOWLEDGEMENT

The Ministry of Environment, Science, Technology and Innovation. wishes to express its profound gratitude to the focal persons from the Agencies and the Ghana Statistical Service (GSS) for their contribution and commitment towards the preparation of the 2023 Statistical Report.

The Ministry appreciates the cooperation of the Sector's Agencies in ensuring the successful development and validation of this Statistical Report.

We acknowledge the continuous leadership of the Chief Director in ensuring the 2023 Statistical Report is developed.

Appreciation goes to the Team from the Ministry of Environment, Science, Technology and Innovation for their continuous direction. To the MESTI RSIM Team led by the Director RSIM, for the zeal, commitment and immense contribution in preparing this Report.

It is envisaged that the 2023 Statistical Report will be of great benefit to all stakeholders as well as, improve decision-making and policy formulation of the Ministry with the use of evidence.



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LIST OF ABBREVIATIONS

CSIR - Council for Scientific and Industrial Research

EI - Executive Instrument

EPA - Environmental Protection Agency

GAEC - Ghana Atomic Energy Commission

GMO - Genetically Modified Organism

GSS- Ghana Statistical Service

IPR - Intellectual Property Rights

L.I. - Legislative Instrument

MEST - Ministry of Environment, Science, and Technology

MESTI - Ministry of Environment, Science, Technology, and Innovation

MMDAs - Metropolitan, Municipal, and District Assemblies

MDAs - Ministries, Departments, and Agencies

NBA - National Biosafety Authority

NRA - Nuclear Regulatory Authority

PCT - Patent Cooperation Treaty

PNDCL - Provisional National Defence Council Law

PM10/PM2.5 - Particulate Matter (sizes 10 and 2.5 micrometers)

PPP - Public-Private Partnership

R&D - Research and Development

RSIM - Research, Statistics, and Information Management

SDG - Sustainable Development Goal

UG - University of Ghana

UNSDGs - United Nations Sustainable Development Goals



EXECUTIVE SUMMARY

The Ministry of Environment, Science, Technology, and Innovation (MESTI) was established in 1993 as the Ministry of Environment and Science (MES) but it has gone through several, institutional transformations to its present title and core functions. The Ministry was first dissolved in 2006, and its portfolios on Environment and Science were added to the Ministry of Local Government and the Ministry of Education respectively. In 2009, it was reconstituted and named the Ministry of Environment, Science and Technology (MEST), under Executive Instrument (E.I) 7 Civil Service (Ministries) Instrument, 2009. Its present name The Ministry of Environment Science Technology and Innovation (MESTI) comes under Executive Instrument (E.I)1 Civil Service (Ministries) Instrument, 2017. The Vision, Mission and Core Functions as provided below have equally been reframed to reflect its current mandate and sectoral responsibilities.

The Ministry is mandated to initiate and formulate policies on Environment, Science, Technology and Innovation, as well as coordinate, monitor and evaluate the implementation of plans, programmes, and performance of the sector for national development.

It is against this backdrop that the Ministry finds it relevant to carry out a comprehensive analysis of administrative data produced by its Agencies and improve upon the sector's data collection processes for the year 2023.

The Council for Scientific and Industrial Research (CSIR) made significant contributions in agricultural research and technology development. In 2023, it developed and disseminated four improved crop varieties, including maize, rice, soybean, and tomato. A total of 34 new technologies and innovations were introduced, with an adoption rate of 55% for improved chicken breeds and 45% for fish farming techniques. CSIR also collected and conserved 2,471 plant accessions, distributing 1,804 to farmers. To enhance agricultural productivity, five ICT applications were developed, including the Kuafo Marketplace and AgriTech Advisor. Additionally, CSIR published 141 research papers and secured one patent and 92 copyrights for various innovations.

The Environmental Protection Agency (EPA) continued its efforts in climate action and environmental compliance. In 2023, 40 Metropolitan, Municipal, and District Assemblies (MMDAs) were equipped with the capacity to implement climate action plans. The total greenhouse gas emissions recorded during the year



amounted to 53.4 million tonnes. A total of 16,255 applications for environmental permits were received, with 14,497 approved, representing an 89.2% approval rate. In terms of regulatory enforcement, 14,017 industries and entities were monitored, with a compliance rate of 46.2%. EPA also conducted environmental education programs in 415 schools and sensitized 2,814 people in 122 communities. Furthermore, air quality monitoring in six locations showed pollution levels exceeding WHO standards by five to 48 times.

The Ghana Atomic Energy Commission (GAEC) played a critical role in research, radiation safety, and capacity building. The commission monitored 1,061 base stations and assessed 50 sites for radiation safety. It trained 760 farmers in soil, water, and nutrient management technologies and organized 40 training programs while collaborating on an equal number of research projects. During the year, GAEC engaged 36,200 clients, produced 129 refereed journal articles, and recorded 29,000 visits to its online platforms. However, the organization faced a significant challenge with a high employee attrition rate of 69%, highlighting the need for improved workforce retention strategies.

The National Biosafety Authority (NBA) remained focused on regulating biosafety and monitoring genetically modified organisms (GMOs). In 2023, the authority made four decisions on GMO use and one on non-GMO applications. However, monitoring and enforcement activities were limited, with only two biosafety inspections conducted during the year. On the other hand, NBA prioritized capacity building and public engagement by organizing 12 training sessions and five public education programs on biosafety regulations.

The Nuclear Regulatory Authority (NRA) ensured regulatory compliance in radiation safety. A total of 590 facilities were inspected and authorized, with 357 permits issued and 103 new pieces of equipment registered. The authority recorded a high level of compliance, with only 12 enforcement notices issued across all inspected facilities, indicating strong adherence to regulatory requirements.

The RSIM Directorate is responsible for the analysis of the administrative data to generate a Statistical Report for the Ministry. The RSIM Directorate, in collaboration with focal persons from the various Departments and Agencies, collected, collated and analyzed data to ensure that accurate and reliable data and information is presented to stakeholders.

1.0 INTRODUCTION

In these modern times, access to reliable and accurate data/information forms an essential part of a growing economy which leads to improved governance and socio-economic advancement. This is mainly due to the high penetration and adoption of various technologies within different sectors of the economy. Data is expected to be readily available, which is of high quality, reliable, accurate and accessible. Reliable and accurate data play a crucial role in effective policy decision-making by providing a strong foundation of evidence and fostering confidence among stakeholders. When decisions are based on trustworthy information, they are more likely to yield better outcomes and results, benefiting all those who rely on the policies for guidance and implementation.

Data is a vital component in the operation and administration of organizations and projects. It serves as a foundation for identifying needs, setting clear goals and objectives, and effectively monitoring the progress of government initiatives, programs, and projects. By leveraging accurate and timely information, organizations can make informed decisions and ensure the successful implementation and evaluation of their efforts. Inaccurate or lack of data/information could have real-life implications for business institutions, especially government institutions. This is because they may not be able to give an up-to-date or accurate account of programmes and projects to stakeholders and the general public; hence, the significance and accessibility of timely and accurate data/information cannot therefore be overemphasized.

Access to accurate and reliable data in public policy decision-making is acknowledged by both local and international communities as it helps to create a more transparent, accountable and responsible Government/Institutions. The availability and accessibility of reliable and accurate data generated by Government Institutions to all stakeholders and the general public are vital for evidence-based planning for socio-economic development.

The Ministry of Environment, Science, Technology and Innovation has developed and published the Annual Statistical Report 2023, which showcases reliable and accurate data on the projects, programs, and activities of its agencies.

2.0 BACKGROUND

The Ministry of Environment, Science, Technology and Innovation and its Agencies in line with Sections 11 and 13 of the Civil Service Law 1993, (PNDCL 327) and by Executive Instrument (EI. 12, 2021), is mandated to initiate and formulate policies on Environment, Science, Technology and Innovation, as well as coordinate, monitor and evaluate the implementation of plans, programmes, and performance of the Sector for national development. The Ministry is the Government's principal advisor on environmental sustainability, science and technological research and international matters that affect environment, science, and technological development.

The Ministry of Environment, Science, Technology, and Innovation has oversight responsibility over five (5) Agencies namely;

2.1 Council for Scientific and Industrial Research (CSIR): The Council for Scientific and Industrial Research (CSIR) has its origin from the National Research Council which was established in 1958. In its current form, the CSIR has been established by the Council for Scientific and Industrial Research (CSIR) Act of 1996 (Act 521). The Council is mandated to coordinate scientific and industrial research activities of its institutes in support of the national economy, especially in food and agriculture (for ensuring food security), industry (especially intermediate technologies for small and medium enterprises) and frontier technologies such as biotechnology and non-sciences. Currently, CSIR oversees the activities of Thirteen (13) institutes. They are:

1. Animal Research Institute
2. Building and Road Research Institute
3. Crops Research Institute
4. Food Research Institute
5. Forestry Research Institute of Ghana
6. Institute of Industrial Research
7. Institute of Scientific and Technological Information
8. Oil Palm Research Institute
9. Plant Genetic Resources Research Institute
10. Soil Research Institute
11. Science and Technology Policy Research Institute (STEPRI)
12. Water Research Institute and
13. Savannah Agriculture Research Institute (SARI)

2.1.1 Animal Research Institute

The CSIR-Animal Research Institute (CSIR-ARI) is mandated to develop and transfer technologies related to livestock and poultry production in Ghana and to stimulate, through Research and Development, accelerated production and consumption of animal protein.

Research programmes being undertaken by the Institute include:

- a) Economic feed and management packages for both smallholder and commercial animal agriculture.
- b) Utilization of agricultural and industrial by-products for high quality feed.
- c) Grasscutter breeding and production programmes.
- d) Enhancing crop-livestock integration in the national farming system.
- e) Efficient use and improvement of national rangelands for animal grazing.
- f) Development of effective disease control and management strategies.
- g) Integration of plant medicine into the orthodox animal health care system.
- h) Identification of socio-cultural and economic factors limiting animal production and technology transfer.
- i) Development of local dairy industry.
- j) Poultry Breeding Programme.

2.1.2 Building and Road Research Institute

The CSIR-Building and Road Research Institute (CSIR-BRRI) is mandated to undertake research into all aspects of building and road design and construction with the view to ensuring efficiency, safety and economy. Additionally, research activities of the Institute are directed at developing construction materials from local sources to reduce construction cost and make housing affordable.

The focus of research and development programmes of the CSIR-BRRI is on

- a) Construction Cost Data Analysis and Documentation.
- b) Development of National Accident Database.
- c) Accident Prediction Models for Signalized Intersections on Urban Roads in Ghana.
- d) Development of local mixtures in cement for housing construction.

- e) Timber and Anti-Termite Treatment.
- f) Environmental Impact Studies of Erosion-Susceptible Settlement, Earthquake and Landslide in Ghana.
- g) Evaluation of Readily Available Marginal Materials in Road Construction.
- h) Integrated Geophysical Methods and Geographical Information Systems or Improving Boreholes Siting and Mapping of Construction Materials in Ashanti Region.
- i) Improving Reliability of Road Construction Cost in Ghana, the Issue of Record Keeping.
- j) Bamboo for Housing and Storage Structures in Farming Communities.
- k) Stabilization of Marginal Materials for Road Construction and Housing Development.
- l) Land-fill Studies/Solid Waste Disposal.

2.1.3 Crops Research Institute (CRI)

The CSIR-Crops Research Institute (CSIR-CRI) is mandated to research and develop improved varieties of food and industrial crops and their production technologies to enhance food security and poverty reduction

The crops include:

- a) Legumes (cowpea, soybean, groundnut, and Bambara groundnut).
- b) Cereals (maize, rice).
- c) Roots and Tubers (yam, cocoyam, cassava, taro and sweet potato).
- d) Vegetables (pepper, garden eggs, tomato, onion, leafy vegetables).
- e) Tropical fruits (citrus, mango, avocado, pineapple, cashew, pawpaw).
- f) Industrial crops (rubber, sugar cane).

Current research and development programmes cover.

- a) Maize Improvement (developing varieties with quality protein, high nitrogen use efficiency, drought, striga and stem borer resistance).
- b) Rice Improvement (developing varieties for high yields and tolerance for biotic and abiotic stresses, developing technologies for efficient water management).



- c) Legume Improvement (breeding for early and medium-maturing varieties of cowpea, soybean and groundnut and Bambara groundnut with promiscuous nodulation, seed longevity, and shattering resistance, as well as rosette resistance in groundnut.
- d) Horticulture (developing vegetable and Musa spp of good quality, with resistance to pests and diseases, developing agronomic recommendations for vegetable production, production of healthy planting materials for farmers)
- e) Resource and Crop Management (developing cropping systems for optimum use of resources for high and sustainable productivity).
- f) Crop Protection (developing integrated pest and disease management strategies including biological control of pests in addition to phytosanitary functions.
- g) Biotechnology (using tissue culture for germplasm conservation and mass production of healthy planting materials, using molecular technologies to characterise crop genetic materials, using genetic markers to tag genes of desired traits and to develop genetic markers to measure genetic diversity between crop genotypes.
- h) Postharvest Research (developing suitable techniques for the production and storage of seeds as well as production of breeder seed to support the national seed industry.

2.1.4 Food Research Institute (FRI)

The mandate of the CSIR-Food Research Institute (CSIR-FRI) is to conduct applied research, through laboratory and pilot scale investigations, into problems of food processing and preservation, storage, marketing, distribution and utilization in order to assist the local food industries to improve on and diversify their operations. The Institute also advises Government on its food policy.

The research programmes of the Institute cover

- a) Development of Biochemical and Molecular Market for Determining Quality Assurance in the Primary Processing of Cocoa in West Africa.
- b) Small and Medium Enterprises (SMEs) Project on “Development of the Small and Medium Scale Enterprise Sector Producing Cassava Based Products to Meet Emerging Urban Demand in West Africa.”
- c) Sustainable up-take of Cassava as an Industrial Commodity.



- d) Industrial Development of Sorghum Malt and its Utilization in Food Industries.
- e) Dissemination of Improved Rice Post-production and Marketing Technologies through coalition Arrangement to Enhance Rural Livelihoods in Northern Ghana.
- f) Studies on High Quality Bambara Flour Technologies.
- g) Project on Poverty Alleviation and Enhanced Food Availability in West Africa Through Improved Yam Technologies.
- h) Mushroom Production Project.

2.1.5 Forestry Research Institute of Ghana, Fumesua, Kumasi (CSIR-FORIG)

The mandate of the CSIR-Forestry Research Institute of Ghana (CSIR-FORIG) is to undertake forest, forest products and related research to ensure sustainable management and utilization of Ghana's forest resources. CSIR-FORIG's research and development activities are conducted under three core research units and six divisions namely;

- a) Forest and Wildlife Unit (Forest and Wildlife Management and Governance Division; Forest, Livelihoods and Sustainable Development Division).
- b) Forest Products and Trade Unit (Wood Industry Development and Trade Division; Forest Products and Marketing Division).
- c) Environmental Land-Use and Biodiversity Unit (Ecosystem Services and Climate Change Division; Biodiversity and Land-Use Division).

2.1.6 Institute of Industrial Research (CSIR-IIR)

The CSIR-Institute of Industrial Research (CSIR-IIR) is mandated to undertake research into process and product design and development, and to promote adaptive technology, scientific instrumentation and calibration, as well as repair of precision equipment.

Research and development activities of the Institute cover such areas as:

- a) Renewable Energy Interventions in Rural Communities.
- b) Recycling of Waste-Water.
- c) Development of Machinery for Integrated Agro-processing.
- d) Development of Refractory Bricks for Hospital Incinerators.

- e) Development of Teaching Software on Science for Schools.
- f) Local Production of Scientific Laboratory Glassware.
- g) Promotion of Bio-sanitation Toilets in Institution and Rural Communities.
- h) Feasibility Studies/Business Plan on Industrial Ventures.

2.1.7 Institute for Scientific and Technological Information

The mandate of the CSIR-Institute for Scientific and Technological Information is to develop a national capacity and capability for the efficient and effective delivery of real-time scientific and technological information and customized knowledge on demand for the benefit of policy makers, research scientists, industrialists and others in appropriately packaged form for national development.

The Institute has core competencies in the:

- a) Development of an efficient system for the bibliographic control of existing and current Indigenous science and technology literature through the national network system.
- b) Creation of databases and referral services.
- c) Improvement and development of systems for the marketing of available scientific and technological information and maintenance of a national microfiche collection.
- d) Human resource development in modern library and information science and technology.
- e) Provision in cartographic form of a comprehensive and scientifically organized inventory of the inventory of the total national resource base as needed for development planning at the national and local levels as well as for education and research.
- f) Publication and dissemination of the results of national research and development activities, which are crucial for the socio-economic development of Ghana.
- g) Provision of central publishing and printing services to the national science and technology system in Ghana.



2.1.8 Oil Palm Research Institute (OPRI)

The mandate of the CSIR-Oil Palm Research Institute (CSIR-OPRI) is to undertake sustainable and demand-driven research on palm oil and coconut to provide scientific and technological support for the development of the entire oil palm and coconut industries.

Research focus of the CSIR-OPRI covers such areas as:

- a) Development, maintenance and evaluation of oil palm genetic resources for breeding and seed production.
- b) Selection and improvement of Oil Palm for high yield and tolerance to drought, diseases and pests.
- c) Development of sustainable weed management strategies for oil palm.
- d) Oil palm intercropped with food crops: development of fertilizer management strategies.
- e) Development of an integrated control programme for the oil palm leaf miner and other pests.
- f) Etiology and control of Blast and dry bud rot diseases of oil palm in Ghana.
- g) Studies into Fusarium Wilt of oil palm.
- h) Cape Saint Paul Wilt Disease (CSPWD) epidemiology and vector studies.
- i) Development and evaluation of coconut progenies for high yield and tolerance to CSPWD.
- j) Development of suitable permanent cropping systems for coconut.
- k) Soil fertility maintenance under coconut.
- l) Control of the Oryctes beetle, the most important pest of coconut.

2.1.9 Plant Genetic Resources Research Institute

The CSIR-Plant Genetic Resources Research Institute (CSIR-PGRRI) is mandated to collect and conserve the plant genetic resources of Ghana as well as coordinate plant genetic resource activities in the country.

The core competence of the Institute is in:

- a) Plant Genetic Resource Management.
- b) Plantation Crops Establishment and Development.



- c) Ecotourism and Arboretum Development.
- d) Plant Genetic Resources Policy Development.
- e) Seed Conservation and Utilization.
- f) Vegetative Propagation of Horticultural Crops.

Research and development activities cover areas such as:

- Collection, characterization, Agro-morphological and molecular evaluation and conservation of plant genetic resources.
- Research into appropriate vegetative propagation of some tree crops including citrus, mango, nutmeg, avocado, to increase the supply of planting materials to farmers and other interested individuals.
- On-station characterization, evaluation and conservation of underutilized plant species of economic importance.
- Establishment and maintenance of field Gene Bank.
- Conservation of orthodox seeds under very low-temperature regimes.
- In-vitro conservation of recalcitrant plants.

2.1.10 Savanna Agricultural Research Institute (SARI)

The mandate of the CSIR-Savanna Agricultural Research Institute is to provide farmers in the Northern, Upper East and West Regions with appropriate technologies to increase their food and fiber crop production based on a sustainable production system which maintains and/or increases soil fertility.

Some of the research and development activities of the Institute focus on:

- a) Development of improved cotton varieties.
- b) Purification of seed stock of commercial cotton varieties.
- c) On-farm evaluation of promising cotton lines.
- d) Rice improvement (participatory varietal selection of promising rice lines with farmer; on-farm testing of promising varieties; breeder and foundation seed production; promotion of community seed production at the rural level).
- e) Maize improvement (multi-locational evaluation of open-pollinated varieties for release; development of low nitrogen tolerant inbred lines for hybrid maize seed production; conversion of normal maize to quality protein maize;

development of drought and striga tolerant inbred lines for varietal development; identification of genomic regions with maize traits using molecular/genetic markers).

f) Cassava improvement (identification of potential cassava varieties for multi-locational testing; undertaking cassava genotype testing with farmer participation).

g) Yam, Sweet Potato, Frafra Potato improvement (on-farm trials of identified yam, sweet potato and Frafra potato clones; integration of leguminous crops as rotation and intercrop for enhanced soil fertility in yam production; evaluation of cover crops for weed control).

h) Vegetable improvement (on-station and on-farm evaluation and selection of tomato, chili pepper, sweet pepper, okra and onion genotypes under rain-fed and irrigation; multi-location testing of various vegetable genotypes in selected Agro-ecological zones in northern Ghana).

i) Sorghum improvement (sorghum germplasm collection, characterisation and evaluation; development of open panicle Kapaala; sorghum hybridization; production of breeder and foundation seeds)

j) Legume improvement (development of high-yielding, extra-early, medium and late maturing cowpea, groundnut and soybean varieties; selection for grain type in cowpea; screening of cowpea genotypes for resistance to pests and diseases; development of groundnut genotypes resistant to *Cercospora* leaf spot).

2.1.11 Science and Technology Policy Research Institute (STEPRI)

The CSIR-Science and Technology Policy Research Institute is mandated to provide research support for national science and technology policy development, monitoring and evaluation. The Institute's core competence covers:

a) Technology evaluation, transfer and diffusion

b) Facilitation of commercialization of technological innovations

c) Science and technology acculturation and popularization

d) Policy studies on science and technology human resource development and management

e) Science and technology policy studies, monitoring and assessment; innovation studies with emphasis on new technologies, ICT and biotechnology.

2.1.12 Soil Research Institute

The mandate of the CSIR-Soil Research Institute (CSIR-SRI) is to undertake scientific research to generate information for effective planning, utilization and management of the soil resources of Ghana for sustainable agriculture, industry and environment.

Research and development programmes undertaken by the Institute include:

- a) Land Suitability Evaluation Programme.
- b) Soil Inventorisation and Classification Studies.
- c) Land Evaluation Studies for Agricultural Development.
- d) Soil Fertility Management and Improvement Programme.
- e) Organic Agriculture Studies.
- f) Fertilizer Experimentation Studies for Arable and Tree Crops.
- g) Environmental Management Programme.
- h) Land Degradation and Climate Change Studies.
- i) Erosion Control and Soil-Water Management Studies.
- j) Provision of Laboratory Analytical Services for Soil, Plant and Water Samples.
- k) Research Commercialization Programme.

2.1.13 Water Research Institute

The mandate of the CSIR-Water Research Institute (CSIR-WRI) is to undertake research into all aspects of water resources (both living and non-living) of Ghana to provide scientific and technical information and services needed for the sustainable development, utilization and management of the resources for socio-economic advancement of the country. Research and development programmes and activities cover:

- a) Surface Water (delineation of hydrological basins of Ghana; water resources assessment of river basins; technology for modern rainwater harvesting for households and small communities; design of urban drainage and flood control systems; integrated assessment of sediment transport in the river basins of Ghana).

b) Ground Water (preliminary geophysical investigation for the siting of boreholes-using 2D Resistivity Method; Exploitation of ground water resources to meet domestic supply; assessment of ground water resources and evaluation of recharge to the aquifer systems of Ghana; development of database for ground water resources).

c) Environmental Chemistry (water quality assessment in Ghana-monitoring of drinking water quality in relation to public health; domestic and industrial waste water studies; guidelines prepared for the treatment of septic and public toilet sludge using anaerobic and facultative pond systems in tropical climates; techniques developed for sewage treatment and small scale plant for the treatment of industrial effluent).

d) Environmental Biology and Health (control of obnoxious aquatic weeds in water bodies; monitoring of irrigation water for growing of vegetables; control of malaria and onchocerciasis in coastal and forest zones in Ghana using biological control agents; monitoring of pesticide contamination in farming areas of Ghana; monitoring of microbial pollution in lagoons and immediate inshore coastal environments).

e) Fishery (breeding and selection of tilapia for faster growth and mass production of fingerlings for fish farmers; fish feed formulation using local ingredients; introduction and promotion of cage and pen fish farming; documentation and distribution of freshwater fish species of Ghana; promotion of integrated aquaculture and agriculture).

2.2 Ghana Atomic Energy Commission (GAEC): The Ghana Atomic Energy Commission was established by an Act of Parliament, Act 204 of 1963 but currently functions under Ghana Atomic Energy Commission Act, 2000 (Act 588). The Commission is mandated to: Advise Government on the peaceful uses of nuclear energy for development and promote the commercialization of research and development results. Currently, GAEC has Seven (7) Institutes, namely:

- a. National Nuclear Research Institute (NNRI)
- b. Biotechnology and Nuclear Agriculture Research Institute (BNARI)
- c. Radiation Protection Institute (RPI)
- d. Radiological and Medical Sciences Research Institute (RAMSRI)
- e. Ghana Space Science Technology Institute (GSSTI)
- f. School of Nuclear and Allied Sciences (SNAS) and
- g. Nuclear Power Institute (NPI)

All the Institutes are located at Kwabenya with decentralized laboratories. The Research Institutes under GAEC are the following:

2.2.1 The National Nuclear Research Institute (NNRI)

It was established to promote and strengthen Nuclear Science and technology research, and training for the socio-economic development of Ghana.

The vision of the National Nuclear Research Institute is to become an Institution of excellence in the application and peaceful utilization of Nuclear Science and Technology for the welfare, safety and security of Ghana.

In accordance with its established act and provisions, the mission of the Institute is to promote and strengthen Nuclear Science and Technology Research, training and development for the Socio-Economic Development of Ghana.

The NNRI has the following Centres:

1. Accelerator Research Centre (ARC).
2. Engineering Services Centre (ESC).
3. Environmental Resources Research Centre (ERRC).
4. National Data Centre (NDC).
5. Nuclear and Analytical Chemistry Research Centre (NACRC).
6. Nuclear Applications Centre (NAC).
7. Nuclear Reactor Research Centre (NRRC).
8. Water Resources Research Centre (WRRC).

Some of the research and commercial activities carried out in Centres under the Institute include:

- a) The National Data Centre (NDC) receives and uses data to provide technical advice and support on matters pertaining to the verification of the Comprehensive Nuclear Test Ban Treaty (CTBT). The Centre also advises national authorities on issues relating to earthquake disasters and its management.
- b) The use of Non-Destructive Evaluation (NDE) techniques is to check the integrity of LPG Storage Vessels, mineral processing tanks, distillation columns and other industrial process plants. The Institute also organizes NDT training for professionals.

c) Collaboration with Water Resources Commission to use isotopic techniques in assessing recharge areas, sources of water and pollution in the three (3) Northern Regions and the Central Region. This may be intensified to cover other parts of the country.

2.2.2 The Radiation Protection Institute (RPI)

It was established to provide an effective national regulatory framework for the protection of people, property, and environment, safety and security of radioactive materials and nuclear installations.

The RPI's mission is to provide an effective national scientific and technical framework for the protection of people, property and the environment, against any adverse effect of ionizing and non-ionizing radiation, and the safety and security of radioactive materials and nuclear installations.

The RPI has the following Centres:

1. Radiation Protection Training and Consultancy Centre (RPTCC)
2. Nuclear Safety and Security Centre (NSSC)
3. Radioactive Waste Management Centre (RWMC)
4. Health Physics and Instrumentation Centre (HPIC)
5. Environmental Radiation Protection Centre (ERPC)

Some of their activities include:

- a) Regulatory Inspection through the issuance of import/export permits, new installations, and for cross boarder movements of radiation sources and radioactive materials. Development of regulatory guidelines for the control of radiation sources and irradiating devices has been part of their duties.
- b) Personnel monitoring by ensuring safe working conditions in the nuclear and related industries. E.g. medical x-ray diagnosis and mining Industries.
- c) Conducting Safety assessment of Base Stations before installation and monitoring of Radio frequencies for FM Stations and Mobile Phone companies.
- d) Calibration of radiation detection equipment and nuclear density gauges used in medical and industrial facilities.
- e) Radiological Safety Assessment, Consultancy, & Environmental Impact Assessment.

- f) Management of radioactive waste.
- g) Development and Implementation of the borehole disposal concept for Disused Sealed Radioactive Sources (DSRS) in Ghana.
- h) Training and Public Education in Radiation Safety, Radiation Protection & Nuclear Security.

The National Radioactive Waste Management Centre Transports nuclear waste for registration, processing and storage and provides technical services to organizations on management of disused radioactive sources. The presence of any radioactive materials as a result of drilling Oil and Gas in the Western Region will be researched into by this institute.

2.2.3 Biotechnology and Nuclear Agriculture Research Institute (BNARI)

The Biotechnology and Nuclear Agriculture Research Institute (BNARI) was established to research, develop and implement activities on safe applications of biotechnology and nuclear agriculture and transfer these technologies to end-users in order to enhance agricultural productivity, health delivery and industrialization.

BNARI exists to carry out research and development activities on safe applications of biotechnology and nuclear science and the transfer of these technologies to end-users in order to enhance agricultural productivity, health delivery and industrialization.

BNARI is currently made up of Seven (7) Scientific Research Centres namely:

1. Nuclear Agriculture Research Centre (NARC).
2. Radiation, Entomology and Pest Management Centre (REPMC).
3. Radiation Technology Centre (RTC).
4. Soil and Environmental Sciences Research Centre (SESRC).
5. Socioeconomic and Commercialisation Centre (SECC).
6. Plant Disease Research Centre (PDRC).
7. BNARI also has a Socioeconomic and Commercialisation Centre (SECC).

Some of BNARI's activities include:

- a) Irradiation of food products to reduce postharvest losses and increase the shelf-life of agricultural produce. Sensitizations workshops are being held for



identified stakeholders to patronize this technology capable of addressing post-harvest losses in agriculture and further enhance their packaging for export.

b) Development of Integrated Pest Management (IPM) strategies for pests and vectors of agricultural, medical and veterinary importance by using the Sterile Insect Technique (SIT) for the control of insect pests. Production of protein bait to curb the fruit fly menace is a major on-going project at the institute.

c) Rapid production of disease-free planting materials of food crops and ornamentals. Over the years, BNARI multiplied some disease-free planting materials (pineapple, plantain, potato etc.) for farmers.

d) Provision of veterinary services.

2.2.4 The Radiological and Medical Science Research Institute (RAMSRI)

It was established to carry out medical research, applying nuclear techniques to promote human health and nutrition.

The mission of RAMSRI is to contribute to Public Health delivery through the Medical Application of Nuclear and Isotopic Techniques and Radiation related devices for the reduction of cancer incidence in Ghana and Africa and to advance research performance in Radiation Medicine, Cancer Treatment, Medical Imaging, Diagnostic Molecular Biology and Nutrition for improved Healthcare delivery.

RAMSRI has the following Centres:

1. Applied Radiation Biology Centre (ARBC)
2. Cellular and Clinical Research Centre (CCRC)
3. Nutrition Research Centre (NRC)
4. Medical Radiation Physics Centre (MRPC)
5. Radio-pharmacy and Nuclear Medicine Centre (RNMC)

Some of RAMSRI's activities are to:

a) Provide Research-based technical advice for Cancer Management and Treatment Studies for improving complication-free survival rates after radiotherapy.

b) The institute is currently sourcing funds to construct a nuclear and medical imaging center to research into the treatment of various forms of cancer. This Centre if established will support most of the health facilities across the country and the sub-region.

- c) Research projects to monitor and evaluate health conditions like tuberculosis and other communicable and non-communicable diseases using molecular technologies.
- d) Use stable isotope techniques to monitor and assess vitamin A status of children susceptible to infection as well as for obesity studies.
- e) Conducting and supervising the applications of ionizing radiation for the diagnosis and treatment of cancer in Ghana, with a focus on Radiotherapy and Nuclear Medicine Techniques.

2.2.5 The School of Nuclear and Allied Science (SNAS)

It was established to collaborate with the University of Ghana to train Nuclear Scientists to sustain skills in science in Nuclear Technology for the sub-region. The University also collaborates with the International Atomic Energy Agency (IAEA) to run a Post Graduate Education Course (PGEC) in Radiation Protection organized for radiological professionals in the sub region.

The school exists for preservation, maintenance and enhancement of nuclear knowledge in Ghana and Africa through the provision of high-quality teaching, research, entrepreneurship training, service and development of postgraduate programmes in the nuclear sciences and technology.

Departments

1. Department of Medical Physics
2. Department of Nuclear Agriculture and Radiation Processing
3. Department of Nuclear Engineering
4. Department of Nuclear Sciences and Applications
5. Department of Nuclear Safety and Security

2.2.6 The Ghana Space Science Technology Institute (GSSTI)

The Ghana Space Science and Technology Institute (GSSTI) was first established as a Centre under the School of Nuclear and Allied Sciences (SNAS) in January 2011 and launched in May 2012. It was later upgraded to an Institute in August 2013, to exploit space science and technology for socio-economic development of the country. The Institute is a state institution mandated to coordinate all space science and related technologies programmes and activities in Ghana. GSSTI is re-packaging the existing national capacities, competences, experiences and expertise in space science and related fields to find possible space technology solutions to the

problems of Ghana. It has a unique research group and technical persons working assiduously to exploit space science and technology for socio-economic development in Ghana.

The centers under the institute are:

1. Radio Astronomy and Astrophysics Centre (RAAC)
2. Remote Sensing and Climate Centre (RSCC)
3. Satellite Communication and Engineering Centre (SCEC)

2.2.7 The Nuclear Power Institute (NPI)

It was established in 2015 to promote the delivery of safe, clean, efficient and reliable nuclear energy in the country and to develop the human resource capacity for sustainable nuclear power management and operational capacity. The institute has taken over the organization of workshops and studies that will lead to the introduction of nuclear power into the country's energy mix after 2020.

NPI's mission is to promote the delivery of safe, clean, efficient and reliable nuclear energy in the country and to develop the human resource capacity for sustainable nuclear power management and operational capacity.

Centers under the Institute are:

1. Nuclear Power Management Centre (NPMC).
2. Localization and Stakeholder Support Centre (LSSC).
3. Nuclear Safety Assessment Centre (NSAC).
4. Nuclear Energy Planning Centre (NEPC).
5. Configuration Management Centre (CMC).
6. Siting and Environmental Centre (SEC).
7. Public Relations and Information Centre (PRIC).

2.3 Environmental Protection Agency (EPA): The Environmental Protection Agency (EPA) was established by the Environmental Protection Act, 1994 (Act 490) to oversee, coordinate and regulate all environmental issues. The EPA is mandated to advise the government on all environmental matters, develop regulations for managing the national and built environment, including chemical control and management and environmental impact assessments, and charge fees to be paid into

the Environmental Fund. Additionally, the EPA operates three (3) Divisions, eleven (11) Departments, eighteen (18) Regional and twelve (12) area offices.

The core functions of the EPA include:

- a) Coordinate the activities of bodies concerned with aspects of the environment.
- b) Collaborate with national, foreign, and international agencies relevant to the Environmental act.
- c) Issue environmental permits and notices.
- d) Prescribe relevant standards and guidelines.
- e) Ensure compliance with the EPA act and with environmental impact assessment procedure.
- f) Conduct investigations into environmental issues and advise the Minister.
- g) Promote relevant studies, research, surveys, and analyses.
- h) Initiate and pursue education for public awareness of the environment.
- i) Develop a comprehensive database on the environment.
- j) Conduct training programmes and publish information on the environment; and
- k) Impose and collect environmental protection levies.

2.4 National Biosafety Authority (NBA): The Biosafety Act, 2011 (Act 831) established the National Biosafety Authority (NBA) to perform the following functions: receive, process, respond to, and make decisions on applications under the Act; establish an administrative mechanism for handling and storing documents and data related to applications and other matters under the Act; act as the National Focal Point for liaising with other agencies or international organizations concerned with biotechnology and biosafety; and promote public awareness, participation and education regarding the Authority's activities under the Act.

2.4 Nuclear Regulatory Authority (NRA): Established by Act 895, 2015 to provide for the regulation and management of activities and practices for the peaceful use of nuclear and radioactive materials and protect the environment against the harmful effects of radiation hazards. The NRA is currently governed by a 7-member Board. The NRA regulates the use of ionizing and non-ionizing radiation by putting in place all the necessary regulations and guidance to help users of radiation and members of the public meet the regulatory requirements and to

enforce these regulations. The object of these controls is to ensure that in the use of ionizing and non-ionizing radiation, humans (workers, the general public and patients) and the environment are protected from the harmful effects of undue exposure to radiations.

The essence of these activities is to assist in showcasing performance, institutional planning and realignment, efficient resource management and implementation hence the successful collation and dissemination of data related to these activities are necessary.

These processes deployed in the collation and dissemination of data related to projects and programmes undertaken by the various Departments and Agencies are spearheaded by the Research, Statistics and Information Management (RSIM) Directorate of the Ministry. The RSIM Directorate compiles the administrative data into a comprehensive Statistical Report for circulation to all stakeholders for their information and use as needed.

Some of the indicators collected by MESTI from its agencies include:

No.	Agency	Indicator for Data Collected
a)	Environmental Protection Agency	1. Number of applications received and permits issued by sectors to ensure compliance with L.I. 1652.
		a) Agriculture and Natural Resources
		b) Health
		c) Energy
		d) Hospitality
		e) Manufacturing
		f) Mining
		I. Large Scale
		II. Small Scale (Gold and Diamond)
		III. Small Scale (Sand, Gravel, and Kaolin)
		IV. Medium Scale
		V. Exploration
		VI. Quarry
		g) Petroleum upstream support services
		I. Drilling
		II. Pipeline
		h) Service companies
		I. General Construction
		II. Others (Waste Oil Recycling etc.)
		2. Number of Chemical licenses issued by categories to ensure compliance with Act 490.
		a) Pesticide Products Registration

No.	Agency	Indicator for Data Collected
		b) Pesticide License Applications (Dealers)
		c) ICUMS Clearance Permit
		d) Industrial Chemicals Permits
		e) Permits to dispose of Hazardous Chemicals and waste
		f) Permit for Transboundary movement of Hazardous Wastes
		3. Number of entities monitored by sector to ensure compliance with permitting conditions and standards.
		4. Number of chemical undertakings monitored.
		5. Number of schools/pupils educated on the environment.
		6. Number of communities/people sensitized on environmental issues.
		7. Number of industries monitored for effluent quality (compliant/non-compliant).
		a) Pharmaceutical
		b) Paint and Chemical
		c) Alcoholic and non-alcoholic
		d) Food processing
		e) Cocoa Processing
		f) General Industries
		g) Secondary and Plastic
		h) Power
		i) Dairy
		j) Crude oil refinery
		k) Textile manufacturing industry
		l) Fruit Processing
		m) Pulp and Paper processing
		n) Waste Oil Recycle
		o) Fats and Oils Processing
		8. Number of sites monitored for PM10 and PM2.5 (air quality).
		9. Levels of PM10 and PM2.5 at sites monitored.
		10. Number of MDAs and MMDAs capacity built for effective climate action.
		11. Level of Greenhouse gas emissions.
		12. Percentage of sectors with climate change mitigation and adaptation strategies.
b)	Council for Scientific and Industrial Research	a. Number of Plant Accessions collected, characterized, conserved, and distributed
		b. Number of improved crop varieties developed and disseminated.
		c. Number of improved technologies/innovations developed and disseminated.
		d. No. of interventions implemented
		e. Adoption rate of disseminated technologies/varieties/improved breeds of livestock/poultry/fish.
		f. Number of people adopting technologies/varieties.

No.	Agency	Indicator for Data Collected
		g. Percentage reduction in the prevalence of neglected tropical diseases.
		h. No. of software solutions/apps developed.
		i. Number of people accessing the products.
		j. Percentage increase in private sector investment in R&D.
		k. Number of CSIR technologies patented/copyrighted.
		l. Number of publications arising out of adaptive research leading to improved technologies.
		m. Number of people trained in value addition/processing and fish farming technologies.
c)	Nuclear Regulatory Authority	a. Number of users of radiation applying the regulations and guidance documents.
		b. Number of new equipment added to the register.
		c. Number of facilities inspected and authorized.
		d. Number of permits issued.
		e. Number of enforcement notices issued.
d)	Ghana Atomic Energy Commission	a) Number of Base Stations Assessed.
		b) Number of masts/base stations monitored.
		c) Number of workers involved in the use of ionizing radiation monitored.
		d) Number of farmers trained on soil water and nutrient management technologies.
		e) Number of samples analyzed for radiation contamination assessment of consumables.
		f) Number of training programs organized.
		g) Number of clients and satisfaction levels.
		h) Number of research collaborations.
		i) Student enrollment vs graduation numbers.
		j) Publications.
e)	National Biosafety Authority	a. Number of decisions made on GMO use.
		b. Number of decisions made on non-GMO use.
		c. Number of monitoring and inspections conducted.
		d. Number of public education programs conducted.
		e. Number of training programs conducted.

Table 1 Agencies and Types of Data Collected

Based on the table above, templates were created and distributed for input on the indicators listed for each agency. The input gathered was analyzed to generate the 2023 Statistical Report.

3.0 OBJECTIVES

The main objective of the Statistical Report is to collate and disseminate a comprehensive sector-wide accurate and reliable data or statistics for informed decision-making by key stakeholders as well as for public information. It is also to serve as a means of showcasing the achievements of the Sector Ministry.

4.0 METHODOLOGY

The development of the 2023 Statistical Report was carried out through five (5) main processes, namely:

1. Organizing an inception meeting to review the indicators with focal persons from the agencies and the RSIM team to ensure that the Key Performance Indicators for data collection accurately reflect the activities undertaken by the agencies.
2. Collecting and collating data from the focal persons.
3. Analyzing and interpreting the data using the Microsoft Excel and Datawrapper as a data analysis tool.
4. Writing the 2023 Statistical Report.
5. Working Group validation of the 2023 Statistical Report.

The report also summarizes and presents data and statistics generated by the Ministry and its sector agencies for the period 2023.

5.0 PRESENTATION OF DATA

5.1 COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

During the period under review, 2471 plant accessions were collected, characterized and conserved to ensure that the diversity of these unique crops is safeguarded for current and future use. Furthermore, 1804 of some conserved germplasms were distributed to producers as demonstrated in Table 2 and Figure 1.

Table 2 Number of Plant Accessories collected, characterised, conserved and distributed

INDICATOR	2023
Number of Plant Accessions collected characterised, conserved and distributed	2471 Collected and conserved 1804 Distributed

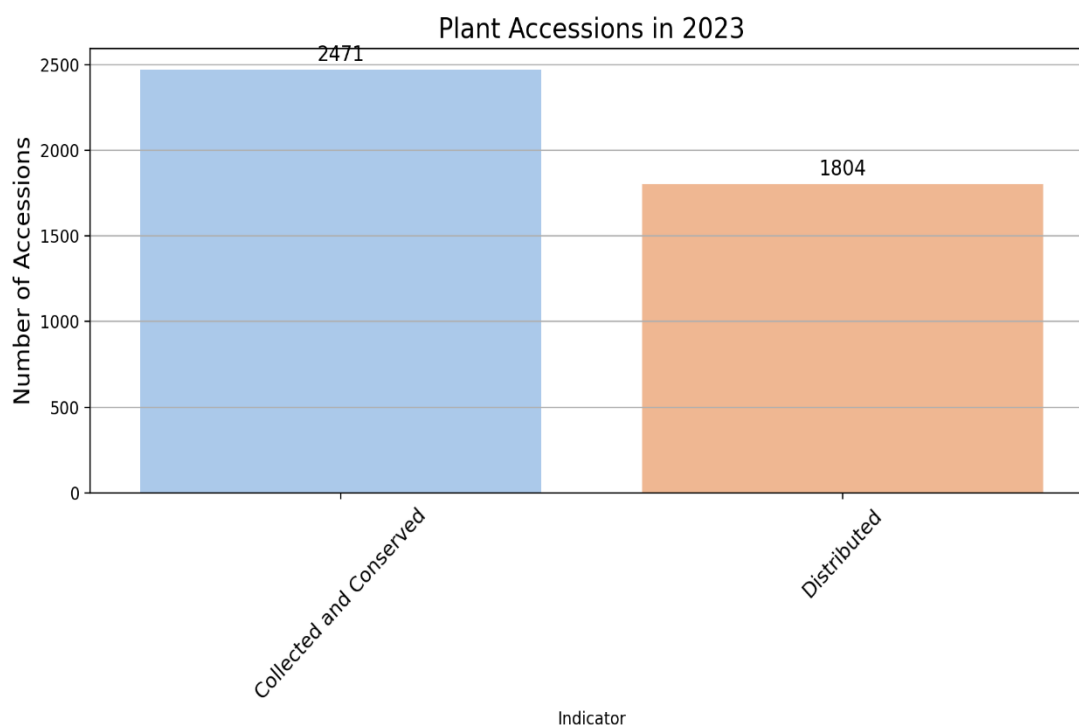


Figure 1 Plant accessions collected and distributed

Development and deployment of ICT software solutions/apps

In the field of ICT, 5 online applications were developed and deployed to promote agricultural productivity. They include the Kuafo market place for the support of agri-business, AgriTech advisor for adoption of improved technologies, CSIR Space, an information sharing hub for the scientific community, E-learning or Farm Academy for capacity building of farmers in specialized agricultural practices with certification and the Digitalized Soil map of Ghana for soil suitability for specific crops in various locations. Refer to Table 3 in appendix for details.

Table 3 Number of ICT software applications developed

INDICATOR	2023
Number of ICT software applications developed	5

In the area of crop variety development, 4 improved varieties of key crops (maize, rice, soybean and tomatoes) of high yielding qualities, climate and disease resilient were released and disseminated to farmers. In addition, 34 technologies and innovations of various dimensions were developed and disseminated for adoption by end users. With regard to technology adoption, up to 55% of farmers have adopted the improved chicken breed (ARIBRO) which are adaptable to local condition and have high survival rate. Similarly, 45% of fish farmers supplied with the brood stock of the Nile tilapia and trained in their brooding and farming techniques have adopted them. Again, biomedical efforts achieved a 9% reduction in onchocerciasis prevalence and a 10% reduction in schistosomiasis prevalence. With respect to private sector investment in R&D, it was 5% for the year under review. Refer to Figure 3 and Table 4 in appendix for details

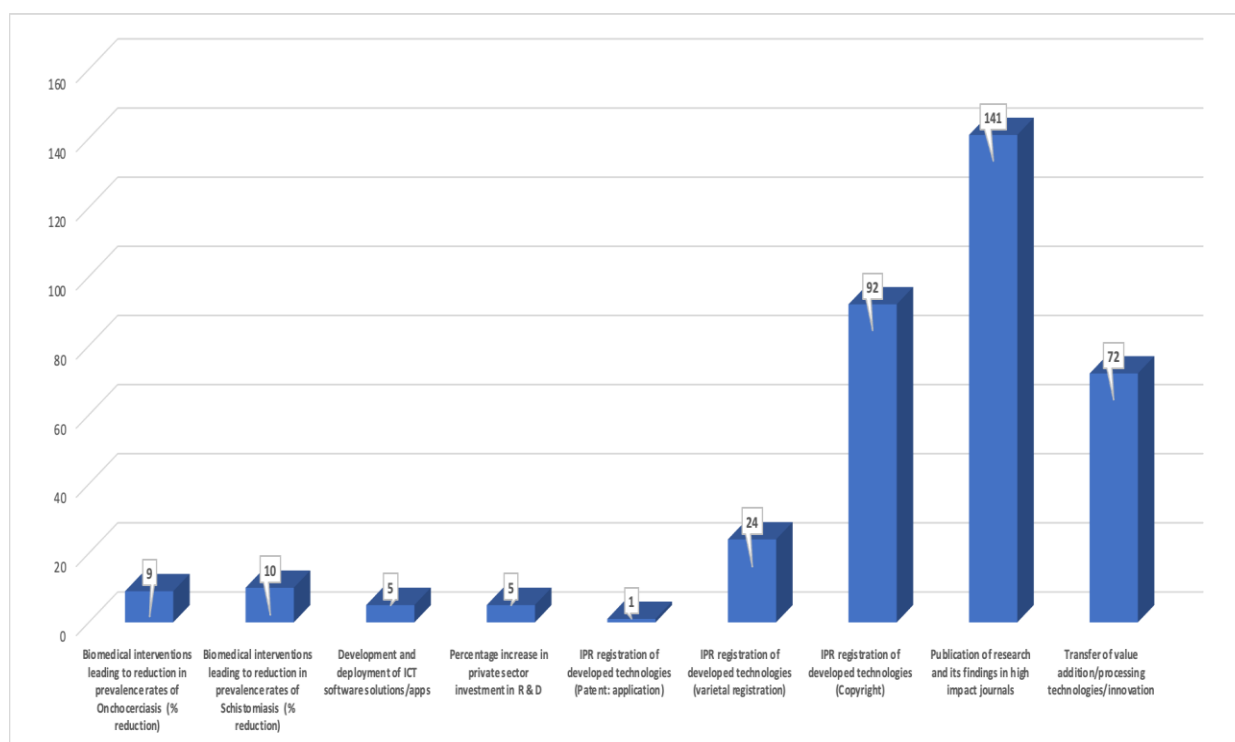


Figure 2 Achievement status of KPIs

Table 4 Key performance indicators for CSIR

Programme Area	KPI	Achievement Status
Development and transfer of improved crop varieties	Number of improved crop varieties developed and disseminated	4 (maize, rice, soybean, and tomato)
Development and transfer of improved technologies/Innovation	Number of improved technologies/innovations developed and disseminated	34
Enhancement in Forest Sustainability Management through collaborative interventions with EPA/Forestry Commission	No. of interventions implemented	3 (Planting and distribution of seeds of improved tree species, establishment of forest plantation, tree crop integration into farms)

Programme Area	KPI	Achievement Status
Adoption of disseminated technologies/varieties/improved breeds of livestock/poultry/fishes	Adoption rate of disseminated technologies/varieties/improved breeds of livestock/poultry/fishes	• 55%: Live Birds • 45%: Brood stock of Nile tilapia
	Number of people adopting technologies/varieties	-
Biomedical interventions leading to reduction in prevalence rates of neglected tropical diseases (Onchocerciasis, Schistosomiasis)	Percentage reduction in the prevalence of neglected tropical diseases	Onchocerciasis: 9% Schistosomiasis: 10%
Development and deployment of ICT software solutions/apps	No. of software solution/app developed	5
	Number of people accessing the products	1944 (No. of hits and unique visitors)
PPP arrangements for the development of demand-driven technologies	Percentage increase in private sector investment in R & D	5%
IPR registration of developed technologies/innovations	Number of CSIR technologies patented/copyrighted	1 (Patent: application No. PCT/GB2018/050300) 24 (varietal registration) 92 (copyright)
Publication of research and its findings in high impact journals	Number of publications arising out of adaptive research leading to improved technologies	141
Transfer of value addition/processing and fish farming technologies/innovation	Number of people trained in value addition/processing and fish farming technologies	72



Programme Area	KPI	Achievement Status
through training and incubation		

5.2 ENVIRONMENTAL PROTECTION AGENCY

The information provided by the Environmental Protection Agency highlights that 40 Metropolitan, Municipal, and District Assemblies (MMDAs) have been equipped with the necessary capacity to take effective climate action. This marks a significant step forward in decentralizing climate initiatives and empowering local governments to address climate-related challenges. By strengthening the capacity of MMDAs, this effort fosters localized solutions and ensures that climate action is more inclusive and responsive to the specific needs of communities.

The total greenhouse gas (GHG) emissions reported for 2023 amounted to 53.4 million tonnes (MT). This figure serves as a baseline for monitoring emissions trends over time and evaluating the effectiveness of mitigation strategies. Comparing this value with data from previous years is essential to identify patterns, assess progress, and determine the impact of implemented climate policies. Such analysis provides insights that guide future policy adjustments and reinforce efforts to reduce emissions effectively.

Sixty three percent of sectors have implemented strategies for climate change mitigation and adaptation. This percentage highlights the extent to which sectors are actively developing plans to both reduce greenhouse gas emissions and adapt to the impacts of climate change.

The capacity-building efforts for MMDAs are a significant step toward localized climate action, but the scale of greenhouse gas emissions (53.4 MT) underscores the need for robust mitigation strategies.

- a) Number of applications received and permits issued by sectors to ensure compliance with L.I. 1652.

Sector	Applications Received	Applications Permitted
Agriculture and Natural Resource	177	80
Health	1,605	1,137
Energy	3,438	3,182
Hospitality	2,380	2,117

Sector	Applications Received	Applications Permitted
Manufacturing	1,438	906
Mining		
• Large Scale	5	13
• Small Scale (Gold and Diamond)	112	68
• Small Scale (Sand, Gravel and Kaolin)	12	11
• Medium Scale	7	15
• Exploration	5	13
• Quarry	19	25
Petroleum Upstream Support Services	39	36
Others	192	168
General Construction	6,826	6,726
Total	16,255	14,497

Table 5 Number of applications received and permits

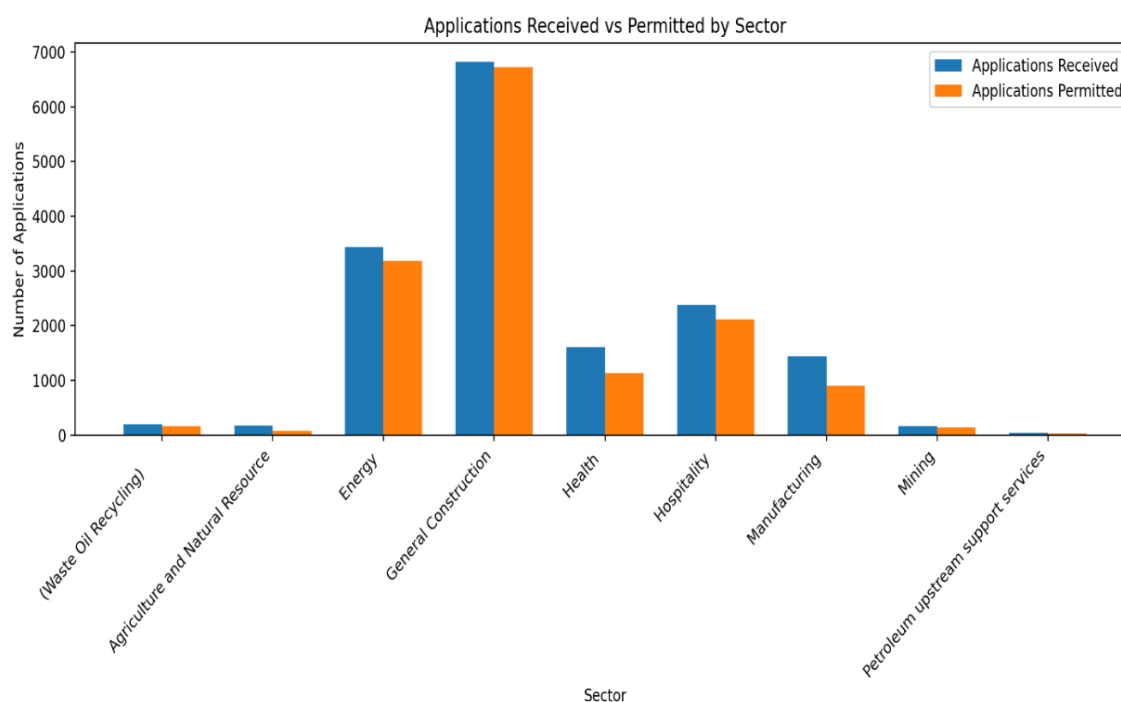


Figure 4 Number of applications received and permitted

b) Number of Chemical licences issued by categories to ensure compliance with Act 490.

The data highlights a total of 16,255 applications received across various sectors, of which 14,497 (89.2%) were permitted, demonstrating an overall favorable approval rate. General Construction accounted for the highest number of applications, with 6,826 received and 6,726 approved, reflecting a 98.5% approval rate. This suggests streamlined processes and high alignment of applications with sector requirements. Similarly, Energy (92.5%), Hospitality (88.9%), and Petroleum Upstream Support Services (92.3%) also showcased high approval rates, indicating efficient permitting mechanisms and a strong alignment between applications and regulatory frameworks. However, certain sectors experienced lower approval rates, highlighting challenges or stricter regulatory standards. Agriculture and Natural Resources had a significant gap, with only 45.2% of applications permitted, suggesting complexities or misalignment with criteria. Manufacturing (63%) and Small-Scale Mining for Gold and Diamond (60.7%) also had moderate approval rates, possibly due to stringent environmental or safety regulations. Notably, anomalies were observed in the Mining sector, where approved applications exceeded those received in some categories (e.g., Large Scale, Medium Scale, Exploration), indicating potential data inconsistencies or inclusion of pending approvals from prior periods.

Overall, the analysis underscores efficient permitting across most sectors while highlighting areas for improvement, particularly in Agriculture, Manufacturing, and Mining. Addressing these challenges through clearer guidelines, capacity building, or enhanced data management could further optimize the process. The strong performance in sectors like Construction and Energy points to their pivotal role in driving economic activity and supporting broader development objectives.

Type of Application	Applications Received	Number of Certificates, Permits, and Licenses Issued
Pesticide Products Registration	2,100	916
Pesticide License Applications (Dealers)	182	130
ICUMS Clearance Permit	48,102	48,102

Type of Application	Applications Received	Number of Certificates, Permits, and Licenses Issued
Industrial Chemicals Permits	111	83
Permits to Dispose of Hazardous Chemicals and Waste	22	15
Permit for Transboundary Movement of Hazardous Wastes	43	41
TOTAL	50,560	49,287

Table 6 Number of chemical licenses issued

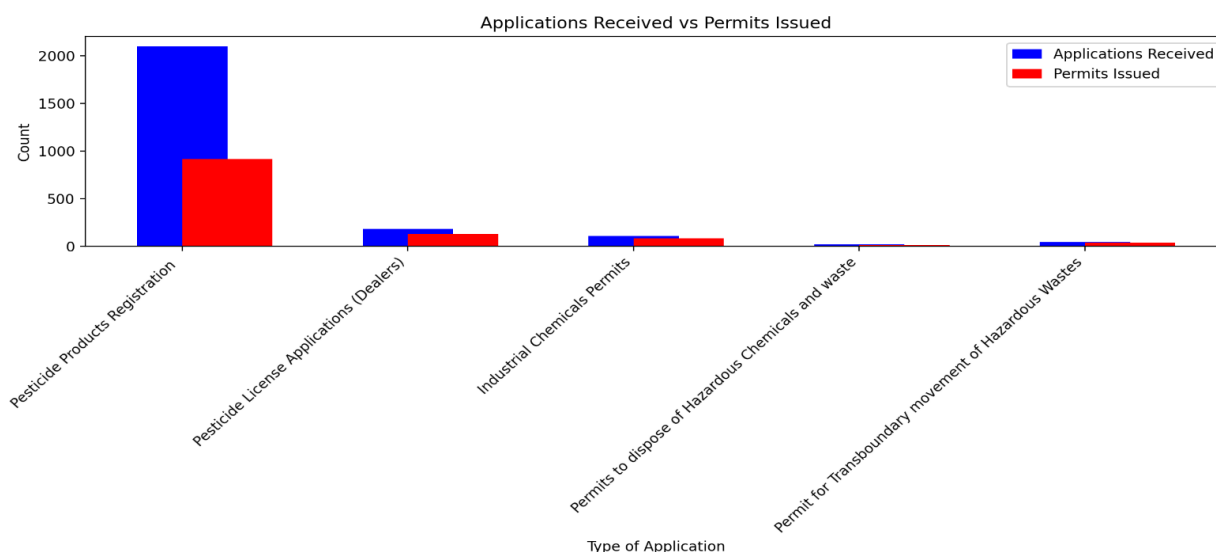


Figure 3 Chemical license applications received vs permits

c) Number of entities monitored by regions to ensure compliance with permitting conditions and standards.

A total of 14,017 facilities were monitored across regions, with 6,469 found compliant and 7,548 non-compliant, reflecting a compliance rate of 46.2%. The Ashanti Region monitored the most facilities (2,881), with a compliance rate of 52.5%, while the Upper East monitored the fewest (201), achieving a compliance rate of 34.3%. Regions like Ahafo (96% compliance) and Greater Accra West (71.9% compliance) performed better in adhering to permitting standards, whereas Bono East (17.7% compliance) and Tarkwa (24.5% compliance) showed significant challenges. These disparities indicate the need for targeted

interventions in low-performing regions to improve compliance levels and uphold environmental standards.

EPA Region	No. of Facilities Monitored	Compliant	Non-Compliant
1. Greater Accra East	858	462	396
2. Greater Accra West	727	523	204
3. Bono East	931	165	766
4. Northern	948	274	674
5. Bono	1,620	853	767
6. Eastern	631	195	436
7. Ahafo	453	435	18
8. Central	687	225	462
9. Savannah	361	273	88
10. Volta	632	326	306
11. Ashanti	2,881	1,513	1,368
12. Tarkwa	1,143	280	863
13. Upper East	201	69	132
14. Upper West	730	482	248
15. Western North	282	118	164
16. Western	306	84	222
17. Oti	328	74	254
18. North-East	298	118	180
Total	14,017	6,469	7,548

Table 7 Number of entities monitored to ensure compliance

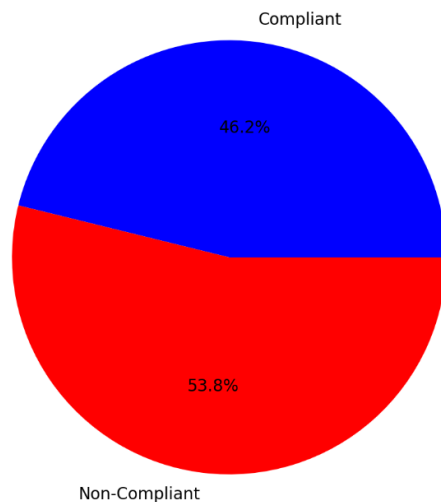


Figure 4 Overall Compliance Distribution

- **Total Compliant:** 6,469
- **Total non-compliant:** 7,548
- **Overall Compliance Rate:** 46.2%

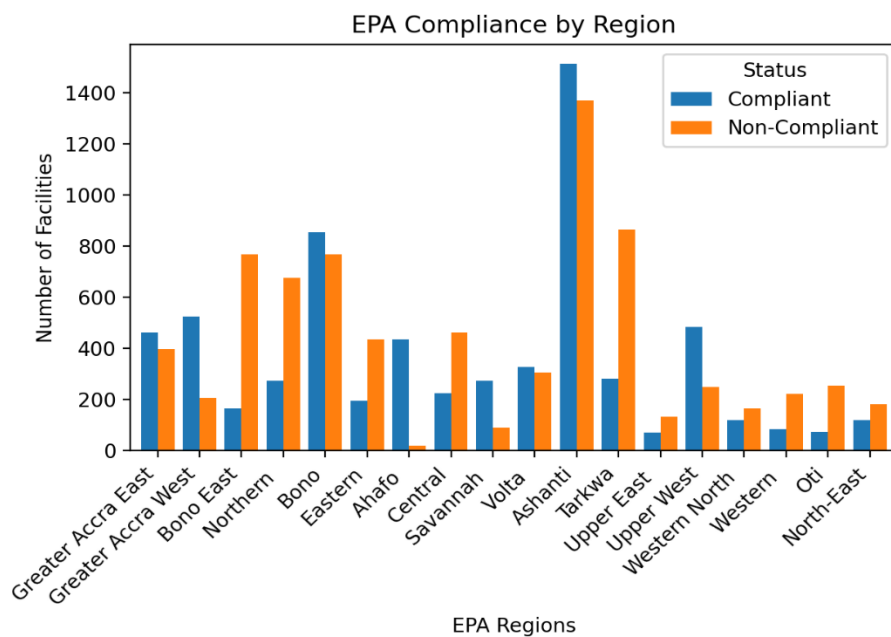


Figure 5 Compliant and Non- Compliant by EPA Regions

- **Overall Compliance Rate:** 46.2%
- **Total Facilities Monitored:** 14,017

d) Number of schools/pupils educated on environmental issues.

The data captures participation from 415 schools across regions, with the highest number of participants in Northern (15,263) and Greater Accra (12,015), while the lowest is in Volta (244) and Central (128). This highlights significant regional disparities in school participation levels.

Table 8 Number of schools/pupils educated on environmental issue

Region	Total Number of Schools	Total Number of Participants
Greater Accra	75	12,015
Bono East	9	2,776
Bono	15	7,352
Eastern	22	2,492
Savannah	27	849
Ashanti	39	4,295
Western North	44	2,625
Northern	32	15,263
Western	7	1,398
Upper West	9	329
North East	23	2,945
Tarkwa	16	1,328
Central	17	128
Volta	76	244

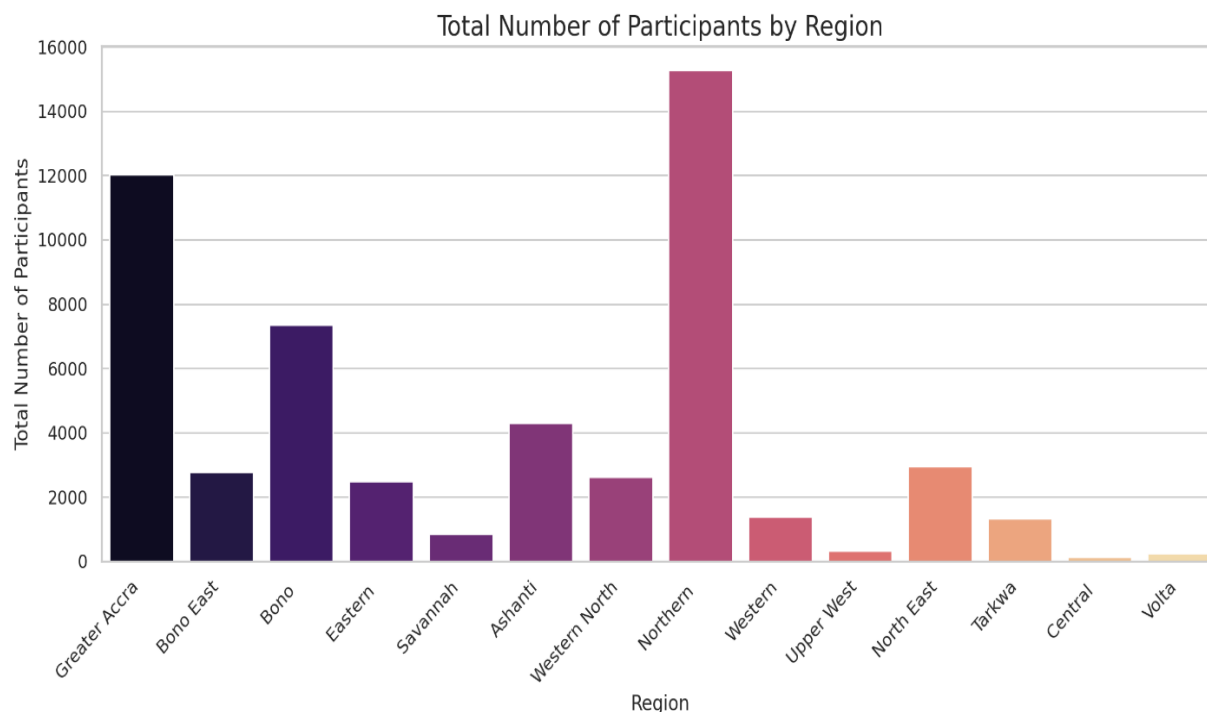


Figure 6 Participants by EPA Region

a) Number of communities/people sensitized on environmental issues.

The data shows participation across 122 communities in 16 regions, with the highest number of participants in Western North (642) and the lowest in Oti (32), totaling 2,814 participants overall.

Table 9 Number of communities/ people sensitized on environmental issues

Region	Number of Communities	Number of Participants
Ashanti	9	345
Western	8	53
Western North	12	642
Bono	9	98
Bono East	11	124
Eastern	8	148
North East	12	377
Northern	7	270
Upper East	3	62

Region	Number of Communities	Number of Participants
Upper West	11	189
Oti	1	32
Volta	8	114
Ahafo	9	149
Savannah	12	132
Greater Accra	3	79
Total	122	2,814

Number of people sensitized on environmental issues

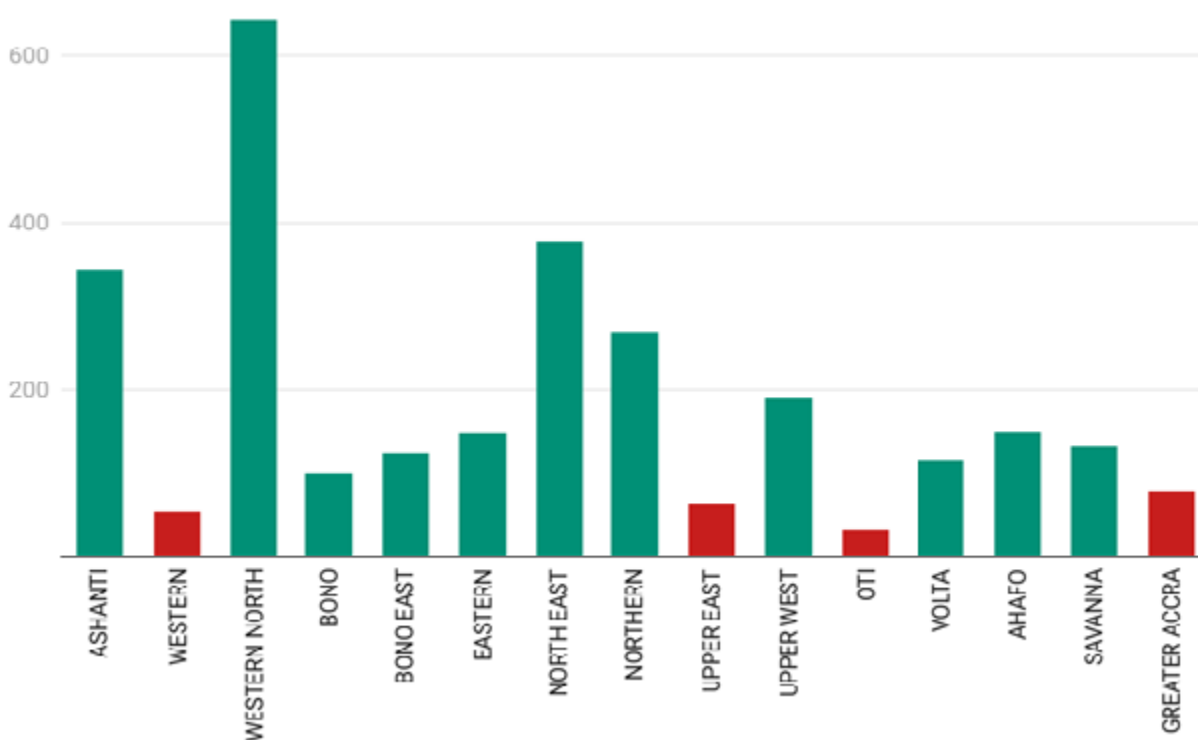


Figure 7 Number of people sensitized on environmental issues

b) Number of industries monitored for effluent quality (compliant/non-compliant)

Type of Industry	Number of Companies	Number Sampled	Compliant	Non-Compliant
Pharmaceutical	18	21	7	11
Paint and Chemical	18	22	3	15
Alcoholic and Non-Alcoholic	21	21	8	13
Food Processing	27	27	11	16
Cocoa Processing	6	8	2	4
General Industries	12	13	5	7
Secondary and Plastic	4	4	2	2
Power	2	2	2	0
Dairy	2	3	2	0
Crude Oil Refinery	4	4	2	2
Textile Manufacturing Industry	4	4	0	4
Fruit Processing	4	6	1	3
Pulp and Paper Processing	2	2	0	2
Waste Oil Recycle	1	1	0	1
Fats and Oils Processing	3	3	1	2
Total	128	141	46	82

Table 10 Number of industries monitored for effluent quality

[Number of industries monitored for effluent quality

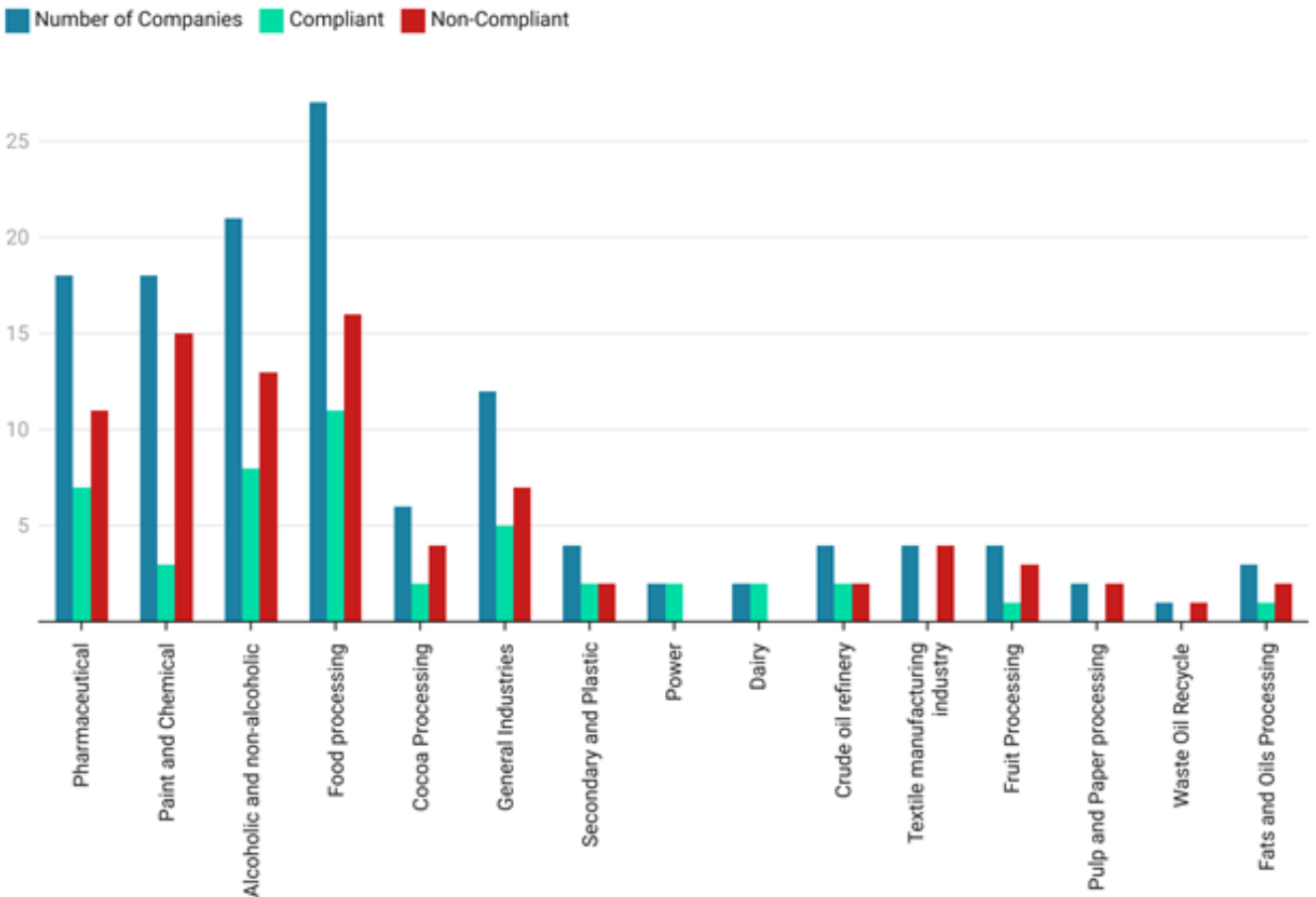


Figure 8 Number of industries monitored for effluent quality

c) Levels of PM₁₀ and PM_{2.5} at sites monitored.

Sites	PM10	PM2.5
Kaneshie First Light		220 µg/m ³
Tetteh Quarshie		210 µg/m ³
Mallam Market		200 µg/m ³
Graphic Road		240 µg/m ³
Adabraka	87.3 µg/m ³	38.1 µg/m ³
University of Ghana (UG) campus	80.8 µg/m ³	25.2 µg/m ³

Table 11 Air quality monitored at 6 sites

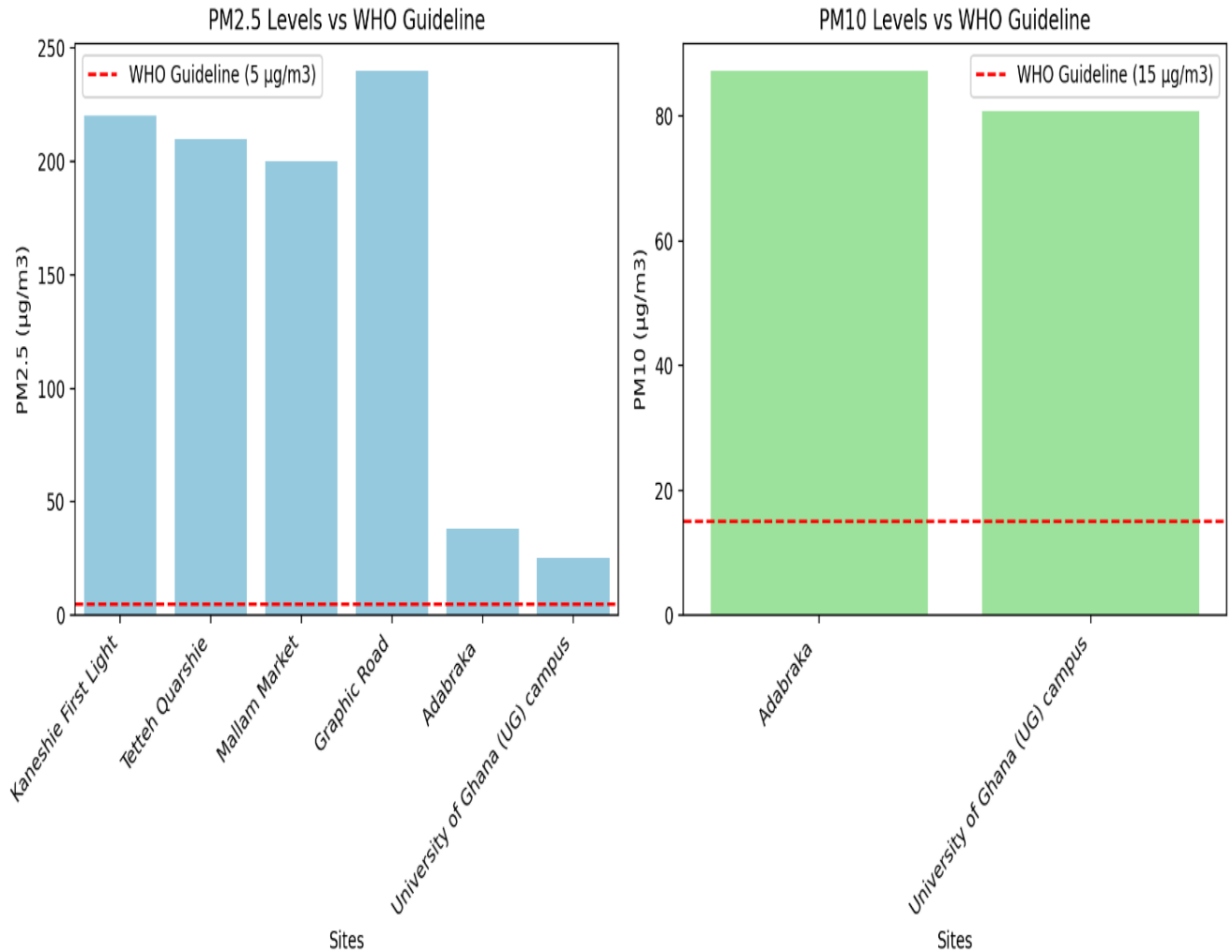


Figure 9 PM2.5 and PM10 levels monitored in certain parts of Accra

PM2.5 levels exceed guidelines by 5-48x across all sites whilst PM10 levels exceed guidelines by ~5.4-5.8x at measured sites.

Also, Graphic Road shows the highest PM2.5 exceedance (48x) whilst UG campus shows the lowest exceedance for both PM2.5 (5x) and PM10 (5.4x).

5.3 GHANA ATOMIC ENERGY COMMISSION

The employee attrition rate is notably high at 69%, which could indicate challenges in retaining staff and suggests the need for strategies to enhance employee engagement and satisfaction.

Around 40 training programs were organized, reflecting a commendable effort to build capacity and enhance skills among staff or stakeholders.

Approximately 36,200 clients were engaged, with a focus on satisfaction levels, showcasing a significant level of outreach and service delivery.

Research collaborations totaled 40, highlighting active engagement in partnerships that likely foster innovation and knowledge exchange.

In terms of academic achievements, 60 students were enrolled for the 2022/23 academic year, and 31 MPhil students are expected to graduate in 2024. This points to steady academic progress, though there appears to be a significant drop-off from enrollment to graduation that may warrant further analysis.

Web traffic analysis indicates 29,000 visits, reflecting a strong online presence and interest in the organization's activities or services.

Knowledge dissemination outputs are impressive, with 129 refereed journal publications, 3 book chapters, 77 technical reports, and 26 conference papers. This reflects a robust contribution to academic and professional fields, underscoring the organization's role in knowledge generation and sharing.

Overall, the data highlights significant achievements in training, research, and engagement, while also identifying potential areas for improvement, such as employee retention and student progression rates.

Indicator	2023
Number of Base Stations Assessed	50
Number of Masts/Base Stations Monitored	1,061
Number of Workers Involved in the Use of Ionizing Radiation Monitored	1,888
Number of Farmers Trained on Soil, Water, and Nutrient Management Technologies	760
Number of Samples Analyzed on Radiation Contamination Assessment of Consumables	259

Table 12 GAEC Indicators

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Overall, the data highlights significant achievements in training, research, and engagement, while also identifying potential areas for improvement, such as employee retention and student progression rates.

Indicators	Data
Employee Attrition Rate	69
Number of Training Programs Organized	About 40
Number of Clients and Satisfaction Levels	Approximately 36,200
Number of Research Collaborations	40
Student Enrollment vs Graduation Numbers	60 enrolled for 2022/23 academic year / 31 MPhil students set to graduate in 2024
Web Traffic Analysis	29,000 visits
Publications	129 refereed journal publications, 3 book chapters, 77 technical reports, 26 conference papers

Table 12 GAEC Indicators

5.4 NATIONAL BIOSAFETY AUTHORITY

The data reflects a concentrated effort on GMO-related activities, with 4 decisions made on GMO use compared to 1 on non-GMO, suggesting a regulatory or strategic focus on GMOs. While monitoring and inspection efforts were limited, with only 2 conducted, there was a stronger emphasis on outreach and capacity-building initiatives. The organization prioritized training, conducting 12 sessions, and public education, with 5 programs, indicating a commitment to enhancing awareness and skills related to GMO and non-GMO issues. Overall, the activities suggest a proactive approach in decision-making and education, albeit with comparatively fewer resources allocated to monitoring and enforcement.

No.	Indicator	2023
1.	Number of Decisions Made on GMO Use	4
2.	Number of Decisions Made on Non-GMO Use	1
3.	Number of Monitoring and Inspections Conducted	2
4.	Number of Public Education Programmes Conducted	5
5.	Number of Trainings Conducted	12

Table 13 Biosafety Regulation

5.5 NUCLEAR REGULATORY AUTHORITY

The data provides insights into the regulatory compliance and operational dynamics of radiation facilities. With 590 users adhering to regulations and an equal number of facilities inspected and authorized, it demonstrates strong alignment between compliance efforts and regulatory oversight. The addition of 103 new pieces of equipment to the register suggests an ongoing modernization of radiation technology, likely to maintain high safety standards and meet evolving regulatory requirements. Meanwhile, the issuance of 357 permits out of the 590 inspected facilities represents a permitting rate of approximately 60.5%, which may reflect specific eligibility criteria or temporary non-compliance issues for some facilities.

Moreover, the low number of enforcement notices, only 12 issued across all facilities indicates a high level of regulatory compliance. This low enforcement rate, representing about 2% of inspected facilities, suggests that most users are meeting regulatory standards effectively. Overall, the data portrays a well-regulated sector with active engagement in safety practices, frequent inspections, and a significant number of permits issued. The high compliance rate, coupled with relatively few enforcement actions, underscores the effectiveness of current regulatory frameworks in ensuring safe and controlled use of radiation.

No.	Indicator	2023
1.	Number of Users of Radiation Applying the Regulations and Guidance Documents	590
2.	Number of New Equipment Added to the Register	103
3.	Number of Facilities Inspected and Authorized	590
4.	Number of Permits Issued	357
5.	Number of Enforcement Notices Issued	12

Table 14 Enforcement and Compliance of Ionizing and Non-Ionizing Radiation

6.0 GAP ANALYSIS

The **2023 Annual Statistical Report** provides a broad assessment of the Ministry of Environment, Science, Technology, and Innovation (MESTI) and its sector agencies. However, notable gaps exist in data completeness, resource allocation, and the functional assessment of agencies.

One significant gap is the **limited data from the Council for Scientific and Industrial Research (CSIR) and the Ghana Atomic Energy Commission (GAEC)**. These gaps limit the ability to fully assess the contributions of these institutions to national development, policy implementation, and scientific advancements. A more comprehensive and structured data collection approach is necessary to address these deficiencies.

For CSIR, which oversees **13 research institutes**, the report does not adequately reflect key performance indicators (KPIs) for the **Building and Road Research Institute (CSIR-BRRI)**, **Science and Technology Policy Research Institute (CSIR-STEPRI)**, **Plant Genetic Resources Research Institute (CSIR-PGRRI)**, and **Oil Palm Research Institute (CSIR-OPRI)**. The absence of data from these institutes means that their contributions to infrastructure research, policy advisory roles, plant genetic conservation, and oil palm development are not captured, thereby reducing the overall goal of the report.

Similarly, GAEC, which comprises **seven research institutes**, has missing data from the **School of Nuclear and Allied Sciences (SNAS)**, **Ghana Space Science and Technology Institute (GSSTI)**, and the **Nuclear Power Institute (NPI)**. These institutes play critical roles in nuclear science education, space technology research, and nuclear power development, yet their activities, student enrollment trends, and research outputs are not sufficiently documented in the report. The exclusion of such key information limits a holistic understanding of GAEC's contributions to Ghana's scientific and technological progress.

To enhance the accuracy and completeness of future reports, a **more robust data collection and reporting framework** should be adopted. Each institute should be required to submit standardized KPIs annually, ensuring that all activities, research outputs, and technological developments are accounted for. Strengthening collaboration between **MESTI and focal persons** at each agency will also help streamline data submission and verification processes. Furthermore, increased investment in data management systems and training for agency staff could improve the reliability and timeliness of reported information.

Addressing these data gaps is essential for ensuring that MESTI's statistical reporting accurately reflects the achievements and challenges of its agencies. A more comprehensive approach will not only support **evidence-based policy decisions** but also enhance transparency and accountability in the **science, technology, and innovation (STI) sector**. Another major gap is the **limited resources for data validation and quality assurance**. The process of verifying data collected from the agencies is resource-intensive, requiring adequate funding, personnel, and time. Due to these constraints, some aspects of data validation may not have been conducted comprehensively, which could impact the reliability of the findings. Enhancing resource allocation for data validation would improve the quality of future reports.

In conclusion, the report's main gaps include **incomplete data from CSIR and GAEC, limited resources for validation, and a lack of functional assessment linking agency activities to their mandates**. Addressing these issues in future reports will enhance the comprehensiveness, accuracy, and strategic value of MESTI's annual statistical reporting.

7.0 CONCLUSION

The preparation and publishing of the projects, programmes and activities of the Agencies under the Ministry of Environment, Science, Technology and Innovation is a key activity of the Research, Statistics and Information Management (RSIM) Directorate of the Ministry. This activity is important because it gives adequate and reliable data/information for informed policy decision-making. It also serves as means through which the public access and assesses projects and programmes of the Ministry as well as provides the general public with some level of transparency on Government projects and programmes supervised by the Ministry. The activity is characterized by the review of indicators covering all aspects of projects and programmes undertaken by the Agencies of the Ministry. This serves as the main element for data collection and the review is done in collaboration with focal persons (representatives) of the Agencies. Data is then collected and analyzed to develop the statistical Report.

The Research, Statistics, and Information Management (RSIM) Directorate of the Ministry of Environment, Science, Technology, and Innovation (MESTI) is responsible for compiling and publishing data on the projects, programmes, and activities of the Ministry's agencies. This effort is essential for informed policymaking, promoting public transparency, and assessing the effectiveness of government initiatives. The process involves reviewing indicators of agency

projects, collaborating with focal persons for data collection, and analyzing the information to produce statistical reports.

The Council for Scientific and Industrial Research (CSIR) has advanced in ICT solutions, releasing improved crop varieties, and facilitating technology adoption by farmers. The Environmental Protection Agency (EPA) has equipped 40 Metropolitan, Municipal, and District Assemblies (MMDAs) to take climate action, but high greenhouse gas emissions remain a concern, necessitating stronger mitigation strategies. The Ghana Atomic Energy Commission (GAEC) has excelled in training and research but faces challenges in employee retention. The National Biosafety Authority (NBA) has concentrated on GMO-related activities but requires more resources for monitoring and enforcement. The Nuclear Regulatory Authority (NRA) has maintained robust regulatory compliance and oversight of radiation facilities.

Recommendations emphasize the need to enhance data collection and management processes for reliable information. Strengthened coordination among agencies is necessary to address cross-cutting issues and foster knowledge sharing. Targeted strategies should be developed to resolve specific challenges such as employee retention at GAEC and climate change mitigation at EPA. Efforts should focus on translating research and innovation into practical socio-economic benefits. Capacity building and stakeholder engagement initiatives should be prioritized to empower communities in environmental protection and science, technology, and innovation.

Although this Report, symbolizes an effort at harmonizing varied data across the activities and operations of the Sector, the data reported and analyzed herein, significantly represent available data within the Sector which can be used for informed decision-making by policymakers, and information for key stakeholders, especially the science ecosystem.

8.0 GLOSSARY

- **Administrative Data:** Data collected and maintained by organizations, often used for monitoring and evaluating programs and services.
- **Agency:** A subordinate organization under a ministry responsible for executing specific mandates or programs.
- **Annual Statistical Report:** A document summarizing key data, activities, and achievements of an organization for a specific year.
- **Biosafety Act:** Legislation that governs the safe use of biological and genetically modified organisms (GMOs) to protect health and the environment.
- **Chemical Licenses:** Authorizations issued for the production, use, or disposal of chemical substances, ensuring compliance with regulations.
- **Civil Service Law:** Legal framework guiding the operations and responsibilities of civil service organizations.
- **Climate Action:** Initiatives aimed at addressing and mitigating the effects of climate change.
- **Council for Scientific and Industrial Research (CSIR):** A national agency focused on scientific research and innovation to support development.
- **Data Collection:** The process of gathering information to support decision-making, analysis, and reporting.
- **Decision-Making:** The process of selecting a course of action based on data and analysis.
- **Environmental Protection Agency (EPA):** A regulatory body ensuring environmental protection and sustainable development.
- **Environmental Sustainability:** Practices aimed at preserving natural resources and ecosystems for future generations.
- **Executive Instrument (E.I.):** A legal directive issued by an executive authority to enforce specific policies or laws.
- **Ghana Atomic Energy Commission (GAEC):** A national institution responsible for research and application of nuclear science and technology.
- **Greenhouse Gas Emissions:** Gases released into the atmosphere that contribute to global warming and climate change.
- **Indicators:** Specific metrics used to measure progress or achievement of goals in projects or policies.
- **Innovation:** The process of developing and applying new ideas, technologies, or methods.
- **Licensing:** The process of granting official permissions to individuals or organizations for specific activities.

- **Local Government:** Decentralized administrative units responsible for local policy implementation and governance.
- **Ministry of Environment, Science, Technology, and Innovation (MESTI):** The government body responsible for policies on environmental protection, science, technology, and innovation.
- **Monitoring:** Continuous assessment of activities or programs to ensure they align with objectives and standards.
- **National Biosafety Authority (NBA):** An agency responsible for regulating and monitoring biosafety, including GMOs.
- **National Data Sharing Policy:** A framework to ensure the accessibility and sharing of government-generated data.
- **Nuclear Regulatory Authority (NRA):** A body that oversees the use of nuclear and radioactive materials for safety and compliance.
- **Particulate Matter:** A combination of solid particles and liquid droplets in the air.
- **Permits:** Official authorizations for specific activities, such as construction, mining, or emissions.
- **Policy Formulation:** The process of developing policies to address specific issues or achieve organizational goals.
- **Research:** Systematic investigation to establish facts, develop new ideas, or solve problems.
- **Research, Statistics and Information Management (RSIM) Directorate:** The unit within MESTI responsible for data collection, analysis, and reporting.
- **Statistical Unit:** A division within an organization dedicated to managing and analyzing data.
- **Statistics:** Quantitative data representing various activities, achievements, or indicators.
- **Sustainability:** The practice of meeting present needs without compromising future resources.
- **Technology:** Tools, systems, and methods used to solve problems or improve efficiency.



MINISTRY OF ENVIRONMENT, SCIENCE, TECHNOLOGY AND INNOVATION STATISTICAL REPORT

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A soft copy of the **2023 Statistical Report** can be downloaded from the Ministry of Environment, Science, Technology and Innovation website:

www.mesti.gov.gh