

Assessment of STI capabilities to meet prioritized SDGs



1. Background

The 2030 Agenda, adopted at the United Nations Sustainable Development Summit in September 2015, positioned Science, Technology and Innovation (STI) as key means of implementation of the SDGs, and launched the UN Technology Facilitation Mechanism (TFM). The Annual Multi-Stakeholder Forum for Science, Technology and Innovation (STI Forum), supported by the Inter-Agency Task Team on Science, Technology and Innovation for the SDGs (IATT), has been the main fora for TFM to discuss topics of common interests of Member States and STI stakeholders in the context of the 2030 Agenda.

STI roadmaps and action plans to help realize the SDGs have been among the central topics through the first three STI Forums. In the Addis Ababa Action Agenda, Member States had committed to “adopt science, technology and innovation strategies as integral elements of our national sustainable development strategies” (para 119). In the 2017 STI Forum, participants highlighted that the STI roadmaps and action plans are needed at the subnational, national and global levels, and should include measures for tracking progress. These roadmaps incorporate processes that require feedback loops, evaluate what is working and not working, and produce continual revisions that create a real learning environment.

There is important knowledge and experience scattered across the 43 IATT members and stakeholders. Therefore, this initiative is expected to add value through facilitating a common approach and developing a coherent framework to examine gaps, synergies and trade-offs, prioritize actions, strengthen national STI systems, and promote cross-sectoral collaborations and Goal-specific “deep dives” for the SDGs.



2. The Approach and Method

SUMMARY

This Policy Brief provides basis for the application of Science, Technology and Innovation (STI) as a catalyst for achieving the SDGs in Ghana. The content forms part of a situational analysis conducted by CSIR-Science and Technology Policy Research Institute in collaboration with Ministry of Environment, Science, Technology and Innovation with technical support from UNESCO in line with the UN Inter-agency Task Team (UN-IATT). This is part of the UN Global Pilot Programme to initiate action on STI4SDGs Roadmap development in Ethiopia, Ghana, India, Kenya and Serbia. In discussing STI capability needs regarding human capital, infrastructural and delivery systems for fast tracking the achievement of SDGs 1, 2, 3, 4, 6, 8 and 9, this policy brief makes important recommendations including investing in Advance Digital Production (ADP) technologies and strengthening uptake of R&D.

In this policy brief, a sectorial approach is used to assess the STI capabilities available and gaps to be bridged in facilitating the achievement of the prioritized SDGs including goals 1, 2, 3, 4, 6, 8 and 9. On the basis of the prioritized SDGs, sectors focused on in the situational analysis included agriculture, industry, health, education and water & sanitation as well as the inter-linkages for enhanced STI4SDGs outcomes. For each of the sectors under consideration, the context is analyzed to bring out the developmental challenges and the STI gaps. Methods and data collection techniques employed in the study included desk research, interviews, Expert Group Discussion (EGD) and online survey.

Prioritization of SDGs for Ghana’s Roadmap

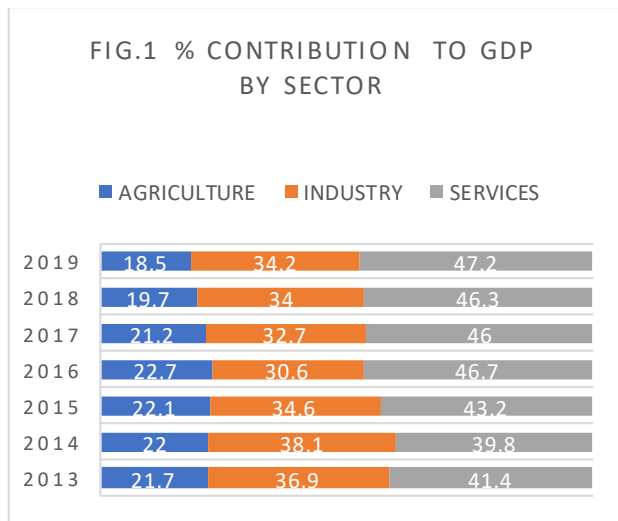
A National Steering Committee (NSC) comprising representatives of the relevant sector ministries and key stakeholders was constituted for the development of Ghana’s STI4SDGs Roadmap. The NSC was co-chaired by the Ministry of Environment, Science, Technology and Innovation (MESTI) and the Presidential Advisor on SDGs at the Presidency. Under the auspices of the NSC, the seventeen SDGs were prioritized for Ghana on the basis

of the current trajectory of national development and the aspirations of the people.



3. Agriculture: Addressing Zero Hunger and Employment Creation through effective application of STI

SDG 2 is one of the important priority SDGs. Agriculture's contribution to GDP in 2019 is estimated to be 18.5 percent, with the Service and Industry sectors accounting for 47.2 percent and 34.2 percent respectively (Figure 1).



The current Ghana Agricultural Investment Plan (GhAIP 2018-2021) focuses on (i) promoting a demand driven approach to agricultural development (ii) ensuring improved public investment (iii) improving production efficiency and yield (iv)improving post-harvest management (v)enhancing application of Science, Technology and Innovation, (vi) promoting agriculture as a viable business among the youth, and (vii) Promoting livestock and poultry development for food and nutrition security and income generation. The sector, which is mainly private sector led, plays a critical contribution to poverty reduction. An overall goal is the modernization of the agricultural sector to drive private sector agribusinesses to provide decent and rewarding jobs along the agricultural value chain especially for the youth. In addition to provision of food to the growing population, agriculture provides raw materials to industries. Agriculture is predominantly on small scale with majority of farm holdings of less than 2 hectares per farmer.

Principal agricultural exports commodities include cocoa, timber, horticultural products, fish/sea foods. Despite the critical contribution of the agricultural sector to socio-economic development of the country, the sector is beset with challenges including low agricultural productivity (Figure 2), poor construction and management of irrigation infrastructure, inadequate post-production infrastructure; limited funding of food and agricultural research and extension services; low use of improved technologies in crops, livestock and fisheries; inadequate quality feed and water standards for livestock and poultry, lack of modern housing for livestock and poultry production, inadequate disease monitoring and surveillance system, low use and high cost of improved inputs; low access to mechanization services along the value chain and low use of intermediate technologies; negative impact of Climate Change, and inadequate disaggregated data/statistics on the sector.

COVID-19 has opened up opportunities for innovation in agricultural value chain systems including e-extension and business advisory services, product development to meet consumer needs – increasing demand for organic products, on-line marketing of agricultural products, local production of import substitute commodities such as rice and poultry in Ghana, packaging convenient foods for special delivery services and taking advantage of new consumer lifestyle and new food products to build immune systems of the weak and vulnerable. Taking advantage of such opportunities however will come with productivity improvement technologies such as greenhouse production systems and biotechnology for improved breeding. It also calls for building capacity in e-Agriculture, innovation platforms and strengthening the Research-Extension Linkage system.



4. Industry, Innovation and Employment Creation

SDG 9 aims to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. The industrial sector is of particular importance for Ghana's socio-economic development given that it underpins sustainable job creation, import substitution and exports. The contribution of the



industrial sector to Ghana’s GDP was estimated at 34.2 per cent in 2019 (GSS, 2020) with the manufacturing sub-sector contributing 11.2 per cent, mining & quarry (14.9 per cent) and construction (6.4 per cent). Industrialization enables countries to build and strengthen the skills and capabilities to compete and succeed within new technological paradigms.

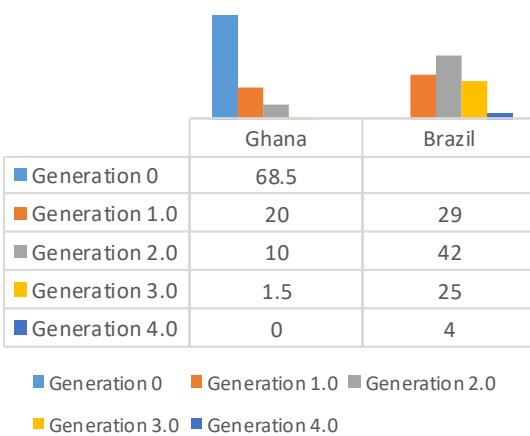
Considering the fact that growth rate in the manufacturing subsector has been dwindling from 9.5 (2017) to 4.1 (2018) growth rates, a focus on the level of use of Advanced Digital Production Technologies such as Advanced Robotics, Artificial Intelligence, Big Data and the Internet of Things for smart manufacturing was conducted (UNIDO Industrial Survey Report 2019) in Ghana. The survey covered 200 firms in the food products and beverages, textiles, furniture and wood,

- Limited access to medium and long-term financing;
- Unreliable power supply and limited access to land for industrial activity;
- Weak logistics and weak infrastructure support for industrial development;
- Cyber security and internet fraud;
- Influx of foreign competitive products and downward pressure on prices of locally produced goods and services;
- Bureaucratic delays in certification by regulators.

In the manufacturing sector, there is the need to leverage on ongoing initiatives using Advance Digital Production (ADP) Technologies and strengthen uptake of R&D. For Ghana to catch up with the 4th Industrial Revolution, ADP Technologies needed include the following:

- Renewable energy technologies to address energy challenges;
- Software platforms, industrial Internet of Things and Big Data Analytics;

Fig.3 Level of Adoption of Advanced Digital Production Technologies

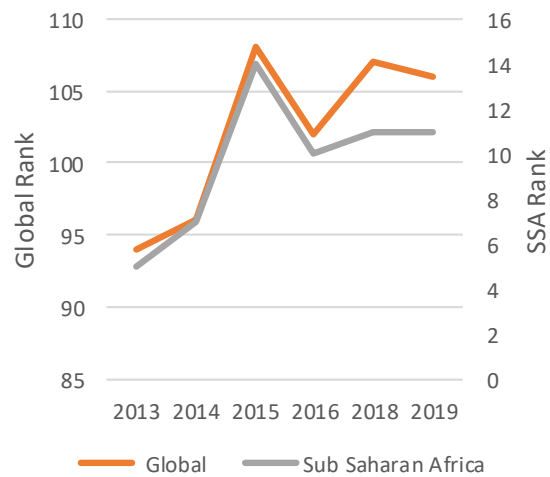


metal and plastics & rubber industries in Greater Accra and Ashanti regions of Ghana. Majority of the manufacturing firms surveyed were using industry 1.0 and 2.0 generation technologies. Globally, the firm-level data showed Ghana as a laggard in the use of ADP technologies. Only 1.5% of firms surveyed were using 3.0 and 4.0 generations digital technologies (Figure 3). Compared to Brazil, this is a rather poor industrial performance.

The relatively poor performance of the industrial sector and particularly the manufacturing sub-sector is attributed to but not limited to:

- High cost of capital and electricity;

Fig. 4 Global Innovation Index - Ghana



- Artificial Intelligence/Machine learning, Cloud Computing, Sensors; and
- Smart Production/Smart factory and additive manufacturing.

On the whole, Ghana is currently vigorously pursuing an industrialization agenda through; (i) a stimulus package/fund arrangement for selected distressed but viable local companies (ii) One-district, one factory flagship programme (iii) Strategic anchor industrial initiatives focusing on petrochemicals, iron and steel, integrated aluminum, pharmaceuticals,



automotive, industrial salt, garment and textiles, among others, (iv) Industrial subcontracting exchange programme that seeks to link SMEs to feed large-scale enterprises. The implementation of the industrialization agenda is at the heart of Ghana's socio-economic growth. The Global Innovation Index benchmarks 129 countries according to 80 indicators divided into innovation inputs and innovation output. In 2019, Ghana was ranked 106 and 11 at Global and Sub-Sahara Africa respectively (figure 4). Clearly, more efforts at promoting innovation have to be made. MESTI will need to mobilize its agencies for a more effective cross-sectoral innovative impact especially in relation to the industrialization strategy.

The World Bank's Ease of Doing Business, which is a forward-looking report on measures of business regulations and their enforcement across 190 economies ranked Ghana at 114 in 2019. Again, in 2019, Ghana ranked 111 in the Global Competitiveness Index down by 5 over the 2018 position. It is not only a reflection of Ghana's low competitiveness at the global stage. It is also a weakness in economic performance. SDG 8 calls for "inclusive and sustainable economic growth" which is prerequisite for achieving many of the SDGs. The competitiveness landscape demands more effort to increase productivity particularly in the LDCs. The prevailing situation highlights the necessity of addressing the spillover effects and externalities, positive and negative, intended or unintended, of a policy or strategy beyond the direct objective achieving macro-economic targets.

environment (iv) improves the socio-economic status of the population, and (v) ensure sustainable financing for health. A 5-year National Healthcare Quality Strategy (2017-2021) to develop a robust and sustainable quality culture institutionalized in the healthcare delivery system has been launched with clear measurable standards in terms of safety, efficiency, effectiveness, timeliness, equity and patient-centeredness. As a financial risk management strategy, the healthcare quality strategy seeks to strengthen the National Health Insurance Scheme (NHIS) as well as encourage the population to subscribe to the NHIS and other private insurance schemes where appropriate.

Under the emergency readiness and management, the policy seeks to strengthen surveillance and response systems to prevent, detect, investigate, protect against, control and provide a public health response to the spread of diseases resulting from epidemics and disasters such as the Coronavirus disease (COVID-19). Challenges in the health sector as captured in the National Health Policy (2020) are:

- Inadequate health facilities in terms of infrastructural and equipment including ICT infrastructure and AI-powered healthcare services;
- Need for re-tooling of existing facilities;
- Need for construction and siting of additional purpose-built facilities, promote the availability and use of high-quality assistive devices and technologies;
- Inadequate human resource particularly medical personnel – Doctor patient ratio of one doctor to 8000 patients;
- Adoption of digital technologies for pandemic planning, surveillance, testing, contact tracing, quarantine, and health care; and
- Institutionalization of comprehensive Health Technology Assessments (HTA) to inform the selection and procurement of all medical technologies required.



5. Health Sector: Good Health and Well-being through effective application of STI

The Ghana National Health Policy (2020) aimed at ensuring universal access to health services and ensuring healthy lives for all. It is directly linked to the national efforts at achieving SDG 3. The health policy is anchored in the Coordinated Programme of Economic and Social Development Policies (2017-2024) and aligned to global continental and regional policy frameworks such as the African Union (AU) Vision 2063: "The Africa We Want" and the African Health Strategy (2016-2030). The health policy objectives seek to (i) strengthen the healthcare delivery system to be resilient (ii) encourage the adoption of healthy lifestyles, (iii) improve the physical

Digital Health

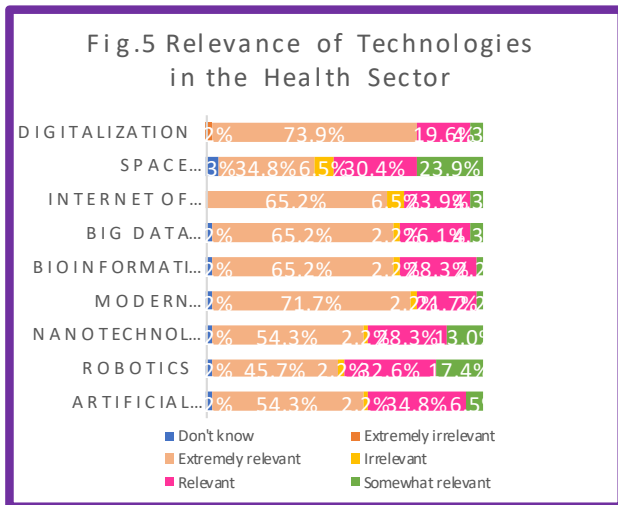
Digital health can improve access and quality of inclusive health services, enhance diagnostics, training and better prevention of diseases. ICT and digital health solutions offer the prospect of using digital health services to accelerate the achievement of SDG 3 and making universal health coverage for all a reality by 2030. According to WHO 2018 reports, over 63% of countries have implemented digital health policies and national strategy through the WHO-ITU co-created National E-Health Strategy Toolkit. The initiative is aimed towards

establishing the foundations in countries to sustainably implement digital health initiatives and scale up the use of digital technologies in the health sector – to improve quality, accessibility and affordability of health services for all and bring impact to SDG 3.

The importance of integration and interoperability is key to allow for digital programs to transfer and retrieve information and data across systems. Capacity building in the area of software engineering, technical capacity to design systems that response to end-user needs. Strategic direction and leadership at the highest level is required to create the enabling environment and regulatory system for effective management of digital health care systems and ICT4D. Figure 5 indicates that 73.9 percent of the online survey respondents consider digitalization as extremely relevant in the health sector.

accountable system to improve quality in basic education through an improved quality of teaching and learning materials in the education service delivery. Ghana has Inclusive Basic Education Policy formulated to provide a universal design for learning framework, which is free, compulsory and accessible to all school-aged children including children with special education needs. Government of Ghana initiated the free Senior High School (SHS) programme to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Some of the polytechnics have been converted into technical universities in order to respond to job market demands. There has been a steady improvement in gross enrolment at all levels of education since 2017. In particular, enrolment at SHS level (public, private and GES TVET) for 2018/19 increased by 14.1 percent increase over the 2017/18 level. The free SHS policy contributed to this increase in enrolment.

The developmental issue has been ensuring quality education that produces problem solvers in order to reduce over-reliance on foreign experts, employable skills and competence-based lifelong learning that offer opportunities for home-grown solutions to developmental challenges. There is human resource capacity-gap in emerging technologies such as biotechnology, photonics, microelectronics nanotechnology, material science and engineering. At the basic Education level, there is the need for training of basic school teachers in the delivery of BSTEM and equipping basic schools with Science, Technology, Engineering and Mathematics (STEM) equipment in line with Government’s policy of strengthening and generating interest in Mathematics, Science and Technology. There is need for stimulation of creativity at all levels of education.



6. Inclusive and Equitable Quality Education through effective application of STI

Ghana’s Educational sector has undergone various reforms over the years in an attempt to improve equity, quality, availability, accessibility and affordability of education in line with SDG4. Access to quality early development and basic education through strengthened management systems of the schools by 2022 has been the strategic policy direction. The Education Strategic Plan (ESP) 2018-2030 seeks to establish a sustainable and

Digital Education

Digital technology, ICT and mobile applications improve access to education particularly those in remote areas. Smart learning solutions contribute to ensuring inclusive and equitable quality education and lifelong learning opportunities for all, bringing impact to SDG4 at scale. From the online survey conducted in this study, majority (over 80%) of respondents considered ICT and digitalization as extremely relevant in delivering quality education at all levels of the educational system. Some targets to drive the vision and mission for science and technology education include the following:



- By the year 2030, 60% of all students in the public universities and 80% of those in the polytechnics and vocational institutions are registered in science and science-related disciplines;
- Post-graduate education in science and technology disciplines must have a minimum of 10 per cent of the student population in tertiary educational institutions enrolled
- Special incentives for students and graduates to pursue science and technology to be provided;
- Major improvements in science education at all levels and in all aspects of the educational system, especially at the basic and secondary levels;
- Promotion of technical and vocational education and training to enhance middle level management in science and technology delivery to all sectors;
- Enhance the country's capacity in the training of personnel in emerging technologies such as biotechnology, photonics, microelectronics nanotechnology and material science and creative engineering; and
- Enhance collaboration between research institutions and universities to train high-level scientific manpower.

the provision of adequate and equitable sanitation and hygiene for all. The most recent ones include the National Drinking Water Quality Management Framework for Ghana (NDWQMF) introduced in 2015 and the new mining policy framework (2018) that seeks to regularize and reform mining activities in Ghana. Mining generally has deleterious effects on the lakes and rivers and their tributaries, which are the sources of drinking water for local communities. In the 2020 Budget Statement, expansion of nationwide water quality monitoring network, implementation of water governance, ecosystem restoration and conservation as well as groundwater monitoring and management are some of the activities budgeted for by the Water Resources Commission in Ghana.

Sanitation is a major challenge. About 20 per cent of the entire country's population practice open defecation. The practice is much more widespread in the three regions of Northern Ghana (Northern, Upper East & Upper West Regions) where more than 70 per cent of the population practice open defecation. A high proportion (almost 51 per cent) of Ghanaians use communal latrines which, according to the Joint Monitoring Programme of WHO/UNICEF, are classified as unimproved. Poor sanitation has negative implications on health, soil and water contamination, life on land and water among others. One of the key causes of poor sanitation is poverty and low prioritization of sanitation at all levels of development planning – district, regional and national. The Ministry of Sanitation and Water Resources with support from the World Bank is constructing sustainable toilets using biofill technology. For accelerated impact, the Ministry is considering construction of central Sewage Systems, Community-led Total Sanitation and support to the poor and vulnerable including the aged, PLWDs, widows and female headed-households without a dequate social-support system.

The National Environmental Sanitation Strategy and Action Plan (NESSAP) is a response to the need to refocus attention on environmental sanitation in Ghana and provide clear strategies and action plans that will guide implementation by Metropolitan, Municipal and District Assemblies (MMDAs). The NESSAP covers:

- Awareness creation - change in sanitation-behavior and attitudes towards all wastes encompassing advocacy at the highest political levels, effectively implementing policies, and enhancing Environmental sanitation education and enforcement management;
- Phased programme for incremental improvements in



7. Facilitating the Achievement of SDG6 with Application of STI

The Ministry of Sanitation and Water Resources is responsible for ensuring that all Ghanaians have access to safe water, sanitation and hygiene practices and sustainable management of water resources. SDG 6 is a key priority for the country. Developmental challenges that confront the ministry include limited access to safe drinking water in rural and some urban areas, poor water quality, low water-use efficiency and poor sanitation and improper hygienic practices.

Several factors contribute to the lack of safe water access in Ghana (Agyeman 2019). Most people rely on surface water sources, lack of basic training and capacity to maintain wells, hand pumps and other systems, lack of proper sanitation and hygiene frequently compounds contamination of existing water sources. In order to increase targets under SDG goal 6 to 100 percent by 2030, a number of policies and programmes have been put in place to ensure efficient management of water resources, accelerate the provision of safe, adequate and affordable drinking water and speed-up

all aspects of environmental sanitation services targeting the reduction of wastes for final disposal;

- Effective coordination of and collaboration among, sector stakeholders for country-wide adoption of policies, plans and programmes;
- Creation of green jobs in the environmental sanitation sector; and
- Resource use efficiency and reduction in MMDA's cost of managing waste.

Technology options considered in targeting the poor and vulnerable for basic sanitation services in Ghana include improved pit latrines, ventilated improved pit latrine, pour-flush latrines and aqua privy latrines and bi-digesters. Another area for consideration is sanitation related by-laws enforcement and the use of indigenous knowledge as well as local institutions in implementing sustainable sanitation options to ensure social and community acceptance.

One of the worrying concerns in Ghana has been the issue of plastic menace which impacts negatively on water and sanitation and the environment. The Ministry of Environment, Science, Technology and Innovation in January, 2020 published the National Plastics Management Policy. The vision of the policy was centered on reaping national benefits on sustainable plastics management through Science, Technology and Innovation (STI). The document outlined the processes of creating public awareness, building management capacity, promoting the adoption of innovative practices, identifying innovative financial sources and promoting effective inter-institutional collaboration as the objectives of effective plastics management. The policy identified Science, Technology and Innovation as the first important systematic pillar for achieving its objectives. There are emerging technologies to manage waste including pyrolysis, gasification and thermal hydrolysis for processing solid waste into useful and marketable products. Technologies for recycling plastic waste are particularly important.



8. Conclusion and Policy Recommendations

The STI capability needs regarding human capital, infrastructural and delivery systems for fast tracking the

achievement of prioritized have been assessed and the following policy recommendations are made:

- Develop strategies to take advantage of innovations in agri-food system, health and education delivery systems, and regulate Ghana's technological space;
- Invest in Advance Digital Production (ADP) technologies and strengthen uptake of R&D;
- Address infrastructural gaps in irrigation, low adoption rates of climate smart technologies and inadequate human resources;
- Invest in STEM education, scientific equipment and e-learning facilities at all levels;
- Build local capacity and workforce in industrial equipment maintenance to reduce over-reliance on foreign expertise, and initiate equity law to protect local industries;
- Invest in water quality monitoring and management systems as well as behavioral initiatives on sanitation and good hygiene practices.



9. References

Addo, P. K. (2019). Review of Ghana's educational policies and its implication for educational leadership in Developing Countries.

Essegbey, G.O. (2017) Positioning Science, Technology and Innovation as a Primary Focus for Tertiary Education in Ghana, Commissioned Report submitted to the National Council for Tertiary Education, Accra.

Ghana's Voluntary National Review (VNR) report on the implementation of the 2030 agenda for sustainable development (June, 2019)

IIATT Background Paper Science, Technology and Innovation for SDGs Roadmaps June 2018

Quaye, W., Akon-Yamga, G., Daniels, C., Ting, B., & Asante, A. (2019). Mapping of Science, Technology and Innovation Policy Development in Ghana Using the Transformative Change Lens. <http://www.tipconsortium.net/resource/mapping-of-science-technology-and-innovation-policy-development-in-ghana-using-the-transformative-change-lens/>

Ministry of Health, (Unpublished). Holistic Assessment Report 2020.

MESTI. 2017. National Science, Technology and Innovation Policy (October 20017 DRAFT).



UNESCO (2015) UNESCO Science Report Towards 2030, UNESCO, Paris.

UNIDO (2019) Industrial Development Report 2020- Industrializing in the Digital Age, UNIDO, Vienna.

Ministry of Health. (2020). National Health Policy: Ensuring healthy lives for all (Revised Edition, January 2020) (Issue January).

UN (2019) A Guidebook for the preparation of STI for SDGs Roadmaps May, 2019; An Input to the fourth STI Forum, New York.

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