

Circular Economy in Africa-EU Cooperation

Country report for Ghana



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EUROPEAN COMMISSION

Directorate-General for Environment
Directorate F — Global Sustainable Development
Unit F2 — bilateral and regional environmental cooperation

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Acknowledgements

We acknowledge the valuable contribution of several co-workers from within the four participating institutions, as well as the feedback received from DG Environment and other DG's of the European Commission as well as the Members of the EU delegation to Ghana.

Preferred citation

Hemkhaus, M.; Ahlers, J.; Kumi, E.; Boateng, P.; Hack, J.; Bauer, T.; Smit, Tycho; Akenji, L.; Van Hummelen, S. & McGovern, M. (2020) Circular economy in the Africa-EU cooperation - Country report for Ghana. Country report under EC Contract ENV.F.2./ETU/2018/004 Project: "Circular Economy in Africa-Eu cooperation", Trinomics B.V., ACEN, adelphi Consult GmbH and Cambridge Econometrics Ltd.



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Luxembourg: Publications Office of the European Union, 2020

PDF	ISBN 978-92-76-26835-2	doi:10.2779/50590	KH-06-20-061-EN-N
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Abbreviations

AFD	Agence Française de Développement
CE	Circular Economy
CENELEC	Comité Européen de Normalisation Électrotechnique
CEM	Circular Economy Mission
COTVET	Council for TVET
DFIs	Development Finance Institutions
EBO	European Business Organization
EEN	European Enterprise Network
EFSD	European Fund for Sustainable Development
EIB	European Investment Bank
EEE	Electric and Electronic Equipment
EPR	Extended Producer Responsibility
EPA	Environmental Protection Agency
EU	European Union
FLECT-VPA	Forest Law Enforcement Governance and Trade Action Plan
FMO	Dutch entrepreneurial development bank
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHS	Ghanaian Cedis
GIRCC	Ghana Innovation and Research Commercialisation Centre
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GRIPE	Ghana Recycling Initiative by Private Enterprises
GSA	Ghana Standardisation Authority
HDPE	High-Density Polyethylene
ICT	Information and Communication Technology
IFU	Danish Investment Fund for Developing Countries
KfW	German Credit Institute for Reconstruction
LTNDP	Long-Term National Development Plan

MESTI	Ministry of Environment, Technology, and Innovation
MMDAs	Municipal Metropolitan District Assemblies
MoE	Ministry of Education
MSMEs	Micro, Small and Medium-sized Enterprises
MSW	Municipal Solid Waste
NGOs	Non-Governmental Organizations
NIP	National Indicative Programme
NPAP	National Plastic Action Partnership
PET	Polyethylene Terephthalate
PPP	Public Private Partnership
RDI	Research, Development and Innovation
SLATLA	Sustainable Livelihoods and Transparent Local Authorities
SMEs	Small, Medium Enterprises
SGS	Société Générale S.A.
STEM	Science, Technology, Engineering and Mathematics
TVET	Technical and vocational Education and Training
UESD	University of Environment and Sustainable Development
UN	United Nations
WEEE	Waste Electric and Electronic Equipment
WRF	World Resource Forum

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Executive summary

Ghana's development objectives are expressed in the Long-Term National Development Plan (LTNDP) 2018-2057. By embarking on an ambitious journey towards a "Ghana Beyond Aid", the country has become one of sub-Saharan Africa's most politically stable economies that maintains a multiparty democratic system, benefits from an independent judiciary and upholds freedom of press. However, various issues prevent the country from truly moving "Beyond Aid" and transforming its economic model from a linear take-make-dispose system towards a circular one. For example, Ghana continues to rely on raw commodity exports, making its economic performance susceptible to volatile global commodity prices. Domestically, the existence of a wide-spread informal sector hinders the implementation of more effective monitoring and enforcement frameworks and promotes illegal practices. This report analyses the state of play of the circular economy (CE) transition in Ghana. It also provides recommendations for a more effective and integrated EU approach for promoting CE in Ghana, connecting the different levels of EU engagement including policy dialogues, development cooperation, trade and investments, innovation and research.

Circular economy trends in Ghana

Economic structure, trends and resource consumption

Over the past two decades, Ghana's resource extraction and domestic material consumption have almost doubled, amounting to about 190 million tons and 200 million tonnes of materials annually. Paired with rising levels of pollution, this necessitates a shift away from a linear economy dependent on natural resources towards a circular one that decouples human well-being from environmental impacts. To facilitate this process, this report focusses on the following three sectors identified as most promising, politically important and economically relevant for the EU-Ghana cooperation:

- agriculture;
- housing and construction; and
- waste management.

In line with both Ghana's national development priorities and the EU's current policy initiatives (the Green Deal, the Circular Economy Action Plan and the Farm to Fork Strategy), the report considers tourism, urbanization and digitization as important enabling factors that can accelerate the cross-sectoral transition towards CE.

Agriculture

Being one of the key sectors in Ghana, it is a major contributor to foreign exchange earnings of Ghana, accounting for export volumes of non-traditional agricultural commodities of around GHS 1,901 million (~ EUR 274 million). Recognizing the importance of agriculture as an economic driver of the country, the Government of Ghana provides subsidies for fertilizers, pesticides and seedlings to farmers. This report suggests that Ghana offers significant potential to increase agricultural yields by making use of regenerative approaches, organic fertilisers, biodynamic farming or permaculture. Many of these techniques are in line with CE-principles and, notably, congruent with traditional farming approaches in Ghana. They have been applied by Ghanaian farmers for decades and they can complement modern approaches to reduce the impacts on the natural environment.

In essence, agriculture has the potential to accelerate the transition to CE with regenerative practices that contribute to food security and can sustain a bio-energy industry based on feedstock from agricultural residues and domestic organic waste. Yet, a lack of capital and the high cost of inter- and intra-regional transportation hinder the more effective operation (and expansion) of agricultural businesses in Ghana. Notably, commercial financing instruments play a negligible role in providing start-up or operational capital, instead 90% of businesses are started from the founders' personal resources while 9% percent are supported with informal loans from (e.g.) family members. Thus, facilitating access to finance remains a pressing issue and will be crucial for accelerating the transition towards a circular agri-businesses in Ghana.

Housing and Construction

The construction sector is one of the biggest in Ghana, contributing more than 14% to the country's Gross Domestic Product (GDP). Moreover, it is one of the most important engine of employment, providing jobs to about 320,000 people and approximately 2% of all young people in Ghana. Due to the country's growing economy, there is increasing demand for new infrastructure. Notably, the annual housing deficit is estimated at over 100,000 units – a trend that is likely to aggravate as the

sector continues to grow rapidly. Amongst the most pressing barriers to meeting housing and construction demand is the lack of skilled labour, with an estimated shortfall of about 250,000 skilled artisans for frontier jobs, such as bricklaying, plastering, plumbing, roofing, steel-frame flooring, steep roofing and architectural assistants. Hence, the potential is high for creating green jobs in the sector and to provide training for CE skills and sustainable construction, reversible building design and the revival of abandoned vernacular architecture.

Moreover, the rising costs of materials and resources required in the housing and construction sector (water, cement and electricity) further aggravates this challenge. Many materials (specifically bitumen, copper, aluminium) and machinery are usually imported from abroad due to their perceived higher quality over domestic alternatives, especially in complex construction projects. Hence, variations in exchange rates and rising prices of raw materials on the global market often increases construction costs. In summary, to reduce its housing and infrastructure deficit without risking a spike in prices for raw materials, Ghana will need to explore large scale initiatives and certification of abandoned African vernacular architecture and hybrid construction techniques utilizing locally and sustainably sourced low-cost materials (e.g. stones, timber, bamboo, rattan and wood). In addition, new standards for housing construction and renovation should ensure that buildings last long, thus reducing demolition cycles and related wastes. Similarly, design for construction could prioritise materials recovery for new building components.

Waste management

Reliable statistics on the amounts of waste generated and the exact composition of waste streams are practically non-existent in Ghana. Assessments conducted by Ghanaian academic institutions suggest that the country generates 0.47 kg municipal solid waste (MSW) per person and day, translating into about 4.6 million tons of MSW per year. Organics account for the largest content of MSW in Ghana (61%), followed by plastics (17%), electronic waste (6%), paper (5%), metal (3%), glass (3%), textile (2%) and leather (1%). The remaining 3% represent miscellaneous or unidentifiable fractions. The key driving force behind waste collection, processing and disposal Ghana's large informal sector, which accounts for 88% of the country's workforce and 75% of its economic activity. Operating as a network of individual waste pickers, intermediaries and high-level aggregators, the informal sector engages collection, transport, sorting and, finally, end-processing. Yet, due to an acute lack of local end-treatment capacities and developed recycling infrastructure, most waste is disposed inappropriately, e.g. through uncontrolled dumping or open burning. Comprehensive accounts on sanitary landfills are not publicly available. Where they exist, they are typically stretched to maximum capacity and administered by local authorities.

To curb the country's growing amounts of plastic waste, the Government of Ghana joined the prestigious Global Plastic Action Partnership by announcing the launch of the Ghana National Plastic Action Partnership (NPAP) and the development of the National Plastic Policy. Another pressing issue is e-waste, where Ghana gained notoriety through the Old Fadama Scrap Yard (informally known as Agbogbloshie) as the world's presumably largest e-waste dumpsite. To counter the illicit waste management practices in the e-waste sector, the government introduced two key pieces of legislation in 2016 (namely Act 916 and LI 2250) and started to implement the principle of Extended Producer Responsibility (EPR). In comparison, management of organic and agricultural waste has received relatively little attention yet holds a multitude of opportunities to be explored. The most important residues from agricultural crops cultivated in Ghana include (in million tons per year) stalks, husks and cobs from maize (3.03), straws from yam (2.82) as well as trunks and leaves from plantain (1.68).

Enabling factors

In addition to agriculture, housing and construction and waste as key sectors, tourism, urbanization and digitization form important factors that enable a host of opportunities for Ghana's transition to a CE. For instance, tourism is a major driver behind the increasing demand for fast moving consumer goods. This can be exploited to aggregate demand for recyclable and biodegradable products to replace single-use alternatives (packaging, cutlery, straws etc.). Urbanization on the other hand, if managed properly, can concentrate human footprints on small areas of land and alleviate pressures from the natural environment, e.g. by expanding public transport infrastructure and promoting shared mobility concepts. This can make important contributions to address the growing urban sprawl in Ghana. Last but not least, digitization is an important enabler that allows cross-sectoral innovation through, for instance, waste-to-resource platforms and enhanced consumer awareness.

Policy framework supporting circular economy activities

The Government of Ghana has fleshed out clear sustainability commitments in the Long-term National Development Plan (LTNDP) and has gradually passed complementing policies to accelerate the transition to a CE, such as the Environmental Sanitation Policy (ESP) in 2010, e-waste regulations Act 917 and LI2250 in 2016, and the National Plastic Policy under the NPAP from 2019. Notably, the Government of Ghana also increasingly relies on principles of EPR to leverage additional funds from the private sector and enhance the quality of institutional set-ups and downstream infrastructure. Notably, both CE-related standards and domestic financing programmes are scarce and are not (yet) driven on a systematic basis. This leaving ample room for Ghana and the EU to engage in further dialogue and cooperation activities.

Trade and investments in the circular economy in Ghana

Trade of CE-relevant environmental goods and services does not yet play a major role in Ghana-EU trade (agreements). Notably, within the existing trade of environmental goods and services, there is a clear-cut trade imbalance of EU imports to Ghana dominating over exports from Ghana to the EU. In terms of volume, highly coveted imports include renewable energy technologies, (waste) water treatment technologies and cleaner or more resource efficient technologies/ products. Given that Ghana will expand its waste management infrastructure in the near future, demand for goods and services imported from EU can be expected to grow. Notably, Ghana's investment environment is relatively favourable when compared to other (West) African countries; yet, barriers in accessing finance persist and severely hamper the ease of doing business the country. According to surveys amongst micro, small and medium-sized enterprises (MSMEs), interest rates for loans in the range of GHS 100 to 15,000 (about EUR 15 to 2,200) for a period of 4 to 6 months are prohibitively high and consistently vary between 36% and 200% per annum. In absence of viable long-term alternatives, there is clear-cut rationale for Ghana and EU to develop and launch CE-related credit lines to improve access to finance for businesses in the mid to late growth stages of innovation and on the cusp of scale-up.

Existing awareness and capacities on circular economy in Ghana

Despite the absence of systematic, large-scale assessments on the general public's awareness on environmental issues and CE in particular, research suggests that Ghanaians are progressively becoming more aware of negative environmental impacts from human activities. While poor practices of waste handling (e.g. open burning and indiscriminate dumping) reflect rather low levels of awareness, there are some practices and solutions in Ghana that already follow CE-principles. For instance, take-away food bought at street vendors is typically wrapped in leaves or other biodegradable materials. Across industry, the concept of CE remains largely associated with improved end-of-life management practices. With regards to education and training capacities, evidence for the penetration of CE principles in Ghana's higher and secondary education landscape is limited. Similarly, the ecosystem for technical and vocational education and training (TVET) does not reflect the integration of environmental and CE-related issues on a systematic basis.

Existing and future economic, environmental and social impacts and benefits

The implementation of national policies and initiatives related to CE have several positive economic, environmental and social impacts and benefits. At the economic side, these include the creation of new business and employment opportunities, increasing international competitiveness of some sectors and increase of exports, transforming waste into more valuable products and creating revenues and mobilizing funds for innovative solutions. With regards to social benefits, these comprise improved livelihoods, particularly of informal workers who become part of the formal value chain, increased gender equality, stronger capacities and awareness on waste management practices and better health conditions of the public as a result of safer waste management practices. Last but not least, on the environmental side, CE initiatives have led to reduced emissions to air (especially GHG emissions), improved air quality due to lower degree of open burning of waste, lower influx of terrestrial waste into marine environments, water/resources/energy savings in production processes and reducing the amount of mismanaged waste.

In this study, we have also undertaken a forward-looking assessment, where a macro-economic model was used to estimate the impact of a (limited) set of circular economy measures in the identified priority sectors Agri-food, plastics, construction, electrical and electronic equipment (EEE) products and E-waste and general waste. Overall, the circular measures assessed could lead to an increase in economic activity and create additional jobs by 2030.

- **Economic benefits:**
 - A 1.9% increase of GDP (+EUR 1.9 billion) compared to business as usual;
 - An improvement of the trade balance, through a reduction in imports worth EUR 274 million;
 - Food loss reduction across the agricultural value chain and associated investments are the largest driver of the impacts found in our modelling assessment.
- **Social benefits:**
 - 61,000 additional jobs would be created compared to business as usual, which is equivalent to an increase of 0.3%;
 - If done in the right way, increased activities in waste collection and recycling could strengthen the economic position of (informal) waste workers, and attention for capacity building and training can ensure that these people will benefit from the CE transition as well.
 - The largest employment increases are found to occur in agriculture, education, health and other services (incl. waste management), financial intermediation and business activities as well as post and telecommunication.

In summary, the impacts indicate the potential effectiveness of CE measures, which unlock significant benefits to Ghana's economy. Prospectively, CE could become one of the cornerstones of the country's economic diversification and green growth strategies.

Mapping of CE-related cooperation activities between the EU and Ghana

Policy dialogue and cooperation agreements

CE is an emergent topic in policy dialogue and cooperation between Ghana and the EU but are yet to be reflected more clearly in joint programming efforts and agreements. So far, dialogue events are organised on a piecemeal basis and would benefit from being support by an accompanying framework addressing sector-specific issues. With the current National Indicative Programme (NIP) 2014-2020 coming to an end and a new Green "Team Europe Initiative" being underway and that should inform future programming, CE can become a cornerstone of upcoming programming agreements. Building on the momentum and interest created by the EU Circular Economy Seminar organized in May 2019, additional visibility could be generated by launching a series of sectoral and thematic seminars, which can be announced during the upcoming Circular Economy Mission (CEM) to Ghana and attended by the general public.

Development cooperation projects and programmes

EU and EU Members States increasingly drive CE-related cooperation projects. Those that include CE-related elements (e.g. in the waste sector) are usually comprised of a small circle of stakeholders, thus calling for effective donor coordination mechanisms to avoid duplication. Notably, both plastic waste and e-waste sector have received particular attention from third-party donors (e.g. the German Ministry for Economic Cooperation and Development, BMZ). Yet, others sectors have not been supported to the same extend. Particular opportunities exist for other key sectors, name agriculture (especially for utilization of agricultural residues) as well as housing and construction (to tackle issues around affordable housing and utilization of construction and demolition waste).

Activities by the EIB and other European DFIs

With regards to funding and guarantees approved by the European Investment Bank and other Development Finance Institutions (DFIs), this study finds a notable absence of EU financial guarantees leveraged by the European Fund for Sustainable Development (EFSD). Following the latest available EFSD operational report, guarantees in Sub-Saharan Africa approved in 2019 amounted to EUR 394 million and generated investments of EUR 2.9 billion; yet, the EFSD appears not to have leveraged any investments into CE-related projects in Ghana specifically. Merely one approved project is listed for Ghana (related to energy, not CE) in 2019. Hence, there are a multitude of opportunities for investments from the EU's side, e.g. by engaging more closely with national DFIs from EU Member States and/or domestic institutions in Ghana.

Trade and investments

On trade, agricultural goods as well as mineral fuels, lubricants and related materials account for the majority of the country's exports to the EU, i.e. 60.6% (agricultural goods) and 25.8% (others) respectively. Vice versa, imports from the EU to Ghana where driven by machinery and transport equipment. The ratification of Ghana's Economic Partnership Agreement (EPA) with the EU

represents a landmark achievement for trade relations between both economies. It entered into force in December 2016. Although the EPA between Ghana and the EU is explicitly designed as a development-oriented free trade agreement, it leaves room for strengthening the proposition of CE-related goods and services (e.g. processing equipment, recycling services). These may be considered in negotiations beyond the currently valid agreement and with regards to the implementation of the agreed upon market access calendar.

Research and technical cooperation

Research and technical cooperation on CE between Ghana and the EU is limited so far. While Ghanaian research institutes frequently partner with European counterparts and have successfully participated in Horizon projects, none of them have explicitly revolved around CE issues. Some developments in Ghana deserve particular attention. For one, the government of Ghana initiated the creation of a new entity, the Ghana Innovation and Research Commercialisation (GIRC) Centre under the purview of MESTI. The purpose of the GIRC-Centre is to harmonise research findings and translate them into marketable innovations. Secondly, the recently established University of Environment and Sustainable Development (UESD) will specialize in conducting research and disseminating knowledge in the sciences, agro-business and the built environment. Both developments represent excellent opportunities for the EU to engage in the discussions and evaluate collaboration on CE under the EU's RDI initiatives.

Snapshot of Recommendations

Policy dialogue and cooperation

To support a circular transition, more coordination, alignment and dialogue between institutions from EU and Ghana is needed. In summary, it is recommended to:

- develop a framework for CE-specific policy dialogue between both parties under the aegis of the EU's delegation to Ghana together with relevant DGs (e.g. ENV, RTD, TRADE) as well as Ghanaian counterparts (e.g. MESTI);
- launch a series of sectoral and thematic seminars on CE, which can be attended by the general public and should be announced during Circular Economy Mission (CEM) to Ghana in 2021;
- facilitate stronger involvement of EU business networks in Ghana (e.g. EEN and EBO) and use them as vehicles for sectoral exchange;
- create synergies with the organisation of the WRF, e.g. by organizing the CEM back-to-back with WRF (as initially planned in 2020) and/or engaging in joint promotional activities;

Development cooperation

In order to formally solidify cooperation on CE between Ghana and the EU, it is advised to:

- deepen the integration of CE-principles into the period beyond the current NIP, (notably in the Team Europe Initiative in development), by focusing on "sustainable, circular growth" as a means to curb Ghana's rising resource consumption;
- establish a clear link to national development plans, e.g. under the country's vision for "Ghana Beyond Aid", and make a strong case for CE investments as a mechanism for green recovery;
- launch thematic calls for grant proposals that support CE-related initiatives in line the new priorities set by the Team Europe Initiative, e.g. the development of regenerative agriculture or digital solution for a circular urban development;
- systematically target unoccupied spaces for CE-related donor-funded projects, e.g. as found in agriculture, housing and construction and digitization; and
- focus on issues that demonstrate additionality of activities in e-waste and plastic waste management, e.g. by collaborating in the development of the National Plastics Policy via existing initiatives in the CE space, most notably the UNDP Waste Recovery Platform and the Ghana NPAP.

Activities by the EIB and other DFIs

Providing access to finance for micro, small and medium sized enterprises (MSMEs) remains one of the most pressing economic challenges in Ghana. It is thus recommended to:

- engage with and raise awareness amongst Ghana's domestic financing institutions to discuss the economic benefits of circular business models;
- deploy dedicated financing mechanisms that integrate circularity principles and enable access to finance for MSMEs in the CE space by exploring agreements with micro-finance institutions;
- adapt the EIB CE guide to the Ghanaian context (taking into account the socio-economic conditions) and conduct a market screening;
- explore opportunities in agriculture, housing and construction, e.g. to boost affordable housing through the application of locally available low-cost materials; and
- discuss co-financing options with other European DFIs, e.g. for the establishment of collection and handover centres for e-waste and the on-going pilot-payment scheme (KfW) as well as state-of-the-art and locally adapted waste management infrastructure for plastic waste processing.

Trade and business-to-business relations

So far, CE has not played a major role in the trade relations between Ghana and the EU. To further strengthen CE in bilateral trade relations, the recommendations are to:

- launch a review of the economic impacts of the Ghana-EU EPA from a CE-angle, e.g. by asking evaluators to specifically look at goods and services with particular importance for closing material loops and increasing resource efficiency in Ghana and the EU respectively;
- strengthen the enforcement and regulation of transboundary movements of hazardous waste in line with the Basel Convention, particularly with regards to customs procedures and import/export controls on both sides (i.e. in both Ghana and the EU);
- explore the role of the Voluntary Partnership Agreement for the EU Forest Law Enforcement Governance and Trade Action Plan (FLEGT-VPA) in facilitating a transition to a circular bio-economy;
- examine the role of standards and enter in closer relations with the Ghana Standards Authority (GSA), e.g. to facilitate trade in polymers from secondary raw materials;
- consider deploying an European expert for standardisation in Ghana, drawing from international experience implemented in India (currently operating under the name of SESEI – seconded standardisation expert in India); and
- organise an online matchmaking series in the run-up to the EU Circular Economy Mission (CEM) to Ghana, ideally serving sectoral foci.

Education, research, development and innovation

In Ghana, environmental and circularity issues have so far received little attention in the context of primary/secondary education and technical vocational training (TVET). In order to strengthen further developments in this area, it is advised to:

- promote collaboration between the EU and Ghana's Council for Technical and Vocational Education and Training (COTVET) to anchor circularity in national training curricula for artisans;
- supporting increases in enrolment rates and careers in STEM fields as an important thrust area for Ghana's CE transition;
- facilitate the creation of green jobs programmes that support skills development especially in the areas of services, sustainable housing and construction;
- encourage Ghanaian partners from academia and industry to participate in calls from EU RDI programmes on CE (most notably Horizon Europe);
- launch RDI projects that explore the opportunities for circular construction techniques and reversible building materials by relying on sustainably sourced low-cost materials applied in vernacular architecture and secondary raw materials; and
- establish partnerships between EU research institutes, the newly formed University of Environment and Sustainable Development (UESD) and the GIRC Centre.

Sector-specific recommendations

With regards to **agriculture**, it is recommended to:

- facilitate knowledge and technology transfer and support Ghana in adopting technologies for biogas generation and compost production
- highlight the importance of utilising agricultural by-products in on-going programming efforts of the Team Europe Initiative
- initiate mutual exchange on the scalability of traditional CE-like farming practices and how these can be combined/enabled by digitization;
- explore the possibility of a Ghana-EU Green Partnership for sustainable food systems
- support smallholders and SMEs that seek to expand their business and operate in line with CE-principles in accessing finance via EFSD.

On **housing and construction**, the recommendations are to:

- support the Ghanaian government in exploring the value-added of using locally available and sustainably sourced low-cost materials in line with vernacular architecture to tackle the increasing need for materials and mitigate the adverse social effects of urbanisation;
- similar to agriculture, support access to finance in Ghana's housing and construction sector to reduce construction costs and promote affordable housing;
- promote the development of new standards for housing, construction and renovation and/or the adaptation of the Ghana Building Code (GS1207) to emphasise reversible building design, the use of long-lasting construction components and the utilization of demolition waste;
- support the Ghanaian government in developing guidelines on Green Public Procurement (GPP) and explore the launch of a GPP policy in line with CE principles; and
- launch technical cooperation projects that support reforms in urban planning processes, implement shared mobility concepts and expand public transport systems.

In the **waste management** sector, it is advisable to:

- support the development of the CE framework and plastic policy in Ghana, facilitated through existing networks and initiatives such as the NPAP and the UNDP Waste Recovery Platform;
- initiate processes around standardisation for recycled materials;
- support the development of public-private partnerships (PPPs) in the waste management sector, e.g. by mobilising EFSD finance and offering technical support for their development;
- promote the development of digital solutions for integrating and formalizing the informal economy into formal value chains, e.g. by developing waste apps that map out decentralized collection networks run by the informal economy; and
- target specific gaps in the existing system and seek high complementarity with on-going projects, e.g. the resource-energy nexus (collection and recycling of off-grid solar systems and batteries).

1 Introduction

1.1. This report

This report is one of eight ‘country reports’ to be produced as part of the study ‘Circular Economy in the Africa-EU Cooperation’¹. The general objective of this study is to provide a better understanding of the state of play of current and potential uptake of the circular economy in Africa. The study should also facilitate a better understanding of the potential impact of the transition to Circular Economy in the EU and Africa in terms of opportunities and trade-offs for Africa and highlight the role of EU-Africa cooperation in circular economy development in both continents.

This report analyses the state of play of circular economy activities in Ghana. It explains the potential economic, environmental and social impact of the transition to the circular economy in Ghana in terms of opportunities as well as trade-offs, and identifies policies and strategies to maximise the former and mitigate the latter. It also provides recommendations for a more effective and integrated EU approach for promoting the Circular Economy transition in Ghana, connecting the different levels of EU engagement including policy dialogues, development cooperation, trade and investments, innovation and research.

1.1.1. *Scope of circular economy activities and connection to the European agenda*

Circular Economy (CE) in this report is understood as an economic system which ultimately produces neither waste nor pollution by keeping products longer in use and by circulating materials at a high quality within the production system and, if possible, feeding them back into the biosphere to restore natural capital at the end of life. As such, the circular economy covers both economic aspects (e.g. value addition, job creation, GDP growth) as well as environmental aspects (focusing on materials and resources). In addition, it takes a full lifecycle perspective, including raw material extraction and processing, design & manufacturing, use & consumption, as well as end-of-use management to look at the potential for circularity throughout the value chain. Although we acknowledge that the transition to a zero-emission energy system is related to the circular economy concept, this study addresses only material resources and not renewable energy deployment.

This report is developed in the context of the implementation of the European Green Deal² agenda, and notably of its international dimension. Elements developed in the Circular Economy Action Plan³, but also in other EU strategies such as the Farm to Fork Strategy⁴ or in EU Waste prevention and management policies⁵ are taken as guiding principles. For instance, priority sectors or policy instruments have been taken as inspiration while not neglecting the local contexts and dynamics of the chosen African countries. Connections between the African and European policy agendas are shown throughout the report and potential future links are included in the recommendations chapter.

1.1.2. *Methodology*

The report has been prepared by Trinomics B.V., adelphi and Cambridge Econometrics in close cooperation with Ghanaian experts, Ebenezer Kumi and Prince Kwesi Boateng, who have contributed local knowledge to the analysis across all sections of the report. In addition, the EU delegation in Ghana has been consulted. Desk research has been the basis for Chapter 1 and Chapter 4, and has also fed into

¹ Country reports have been produced also for Nigeria, Senegal, Egypt, South Africa, Morocco, Rwanda and Kenya.

² European Commission (2020) [European Green Deal](#)

³ European Commission (2020) [EU Circular Economy Action Plan](#)

⁴ European Commission (2020) [Farm to Fork Strategy](#)

⁵ European Commission (2020) [EU Waste prevention and management policies](#)

Chapter 2. In addition, several international and national datasets have been analysed to be able to understand the status of CE in Ghana (Chapter 2).

Interviews with relevant circular economy stakeholders, including the Ghanaian Ministry of Environment, Science, Technology and Innovation (MESTI), City Waste Recycling, Closing the Loop, Plastic Punch, Coliba and the European Delegation to Ghana have served to complement Chapter 2, 3 and 4. The modelling of impacts and benefits on Chapter 3 has been carried out using Framework for Modelling Economies and Sustainability (FRAMES)⁶. The modelling has followed three steps: 1) collecting the required data for each country; 2) build the model (i.e. developing a model solution for each country); and 3) design and implement the scenarios.

1.2. Reading guide

This report has been structured as follows:

- **Chapter 2** provides an overview of the status of the circular economy in Ghana analysing circular economy trends, the policy framework supporting circular economy activities, trade and investments in the circular economy, and existing awareness and capacity;
- **Chapter 3** estimates the economic, social and environmental impacts and benefits of the Circular economy in Ghana at present and for the future;
- **Chapter 4** studies cooperation between the EU and Ghana, by mapping circular economy-related cooperation activities between the two, and by exploring opportunities and challenges for expanding such;
- **Chapter 5** provides recommendations for a more effective and integrated EU approach to promoting the circular economy transition in Ghana, connecting all levels of the engagement including policy dialogues, development cooperation, trade and investments, innovation and research;
- **Chapter 6** summarises the most important findings into key conclusions.

⁶ FRAMES is a new Input-Output (IO) tool with E3 linkages, capturing both direct and indirect (supply chain) impacts from a shift towards a more circular economy. FRAMES is particularly suitable for those countries not represented in E3ME due to data limitations, while its key features are similar to E3ME.

2 Status of the circular economy in Ghana

Section 2.1 briefly summarises the place that the circular economy (CE) has in Ghana. Section 2.2 provides overview on the country's economic structure, trends and resource consumption in Ghana. Section 2.3 follows by analysing CE related trend in key sectors, namely agriculture, housing and construction and waste. Subsequently, section 2.4 analyses the prevalent policy framework in Ghana. Subsequently, section 2.5 provides an overview on the environment of CE-related trade and investments. Finally, section 2.6. addresses existing awareness and capacities on CE in Ghana and identifies the education and skills gap for integrating circularity aspects into the country's educational and vocational training development agenda.

2.1. Ghana and the circular economy

Over the last three decades, Ghana has established itself as one of sub-Saharan Africa's most politically stable countries with a multiparty democratic system, an independent judiciary and freedom of press (World Bank Group 2019). Most observing international and independent agencies rate it consistently higher than the African average: it maintains a relatively high governance score in the Country Policy and Institutional Assessment; the 2019 Freedom House Index ranked Ghana as the third freest country in Africa; and the Global Competitiveness Report 2018/2019 indicated an improvement in the rank of Ghana's institutions to 59th from 111 (AFDB 2019).

However, there remain issues, some of them growing, with development of Ghana. The African Development Bank, for example, highlights that Ghana's economic performance is highly dependent on raw commodity exports, making the country susceptible to volatile global commodity prices; uneven distribution of transport infrastructure delinks rural communities from urban markets and has impeded the distributional impacts of economic growth especially in northern Ghana (AFDB 2019). In particular, the existence of a wide-spread informal sector - accounting for 88% of the country's workforce and 75% of its economic activity - has spurred international media attention and has cast a spotlight onto (often hazardous) informal waste management practices (Wayne Shand 2019).

Widely portrayed by various media articles and even documentaries is the Old Fadama Scrap Yard in Accra, which has become publicly known as Agbogbloshie. At times referred to as one of the most toxic places on planet earth (Scientific American) or "the world's largest e-waste dump" (Guardian 2014), Agbogbloshie is home to thousands of workers engaged in informal recycling activities such as open burning of cables and tyres, which come at terrible cost to human health and the environment. Informal, "low-tech" treatments practices are widely available and inexpensive means of separating and recovering valuables from waste. In Ghana however, the accessibility of Agbogbloshie has spurred far-reaching political attention and attracted a multitude of international donors. This also holds true for the EU's development support provided in Ghana, which currently funds a EUR 1.2 million project on waste from electrical and electronic equipment (E-waste Management in Ghana; E-MAGIN Ghana) and organised the first-of-a-kind circular economy seminar in 2019 (section 4.1).

Notably, informal economic activities and environmental impacts are neither restricted to Agbogbloshie nor do they apply to the e-waste sector alone. Instead, they are cross-sectoral, covering plastics, packaging, housing and construction as well as agriculture. Thus, the relevance of collaboration towards a CE in Ghana cannot be overemphasised, especially because Ghana has started taking concrete steps that this very direction. For instance, in October 2019, Ghana took a step forward and became the first African nation to join the Global Plastic Action Partnership, thus establishing the Ghana NPAP as a platform to share ideas among key actors (World Economic Forum 2019).

In fact, Ghana is at crossroads as it seeks to create jobs and reduce poverty through several programmes, including its flagship One District One Factory (1D1F) industrialization agenda, while reducing its environmental footprint through adoption of a CE approach to production and consumption. The 2013 National Climate Change Policy underscored this dilemma and aimed to “ensure a climate-compatible economy while achieving sustainable development through equitable low-carbon economic growth” (MESTI und NCCC 2013). In its most recent communication to the United National Framework Convention on Climate Change, the Government of Ghana reaffirmed this importance and highlighted waste as an important thrust area (Pwamannng et al. 2020). On this basis, Ghana has also initiated various policy frameworks, such as the Environmental Fiscal Reform Policy, National Climate Change Adaptation Strategy, amongst others.

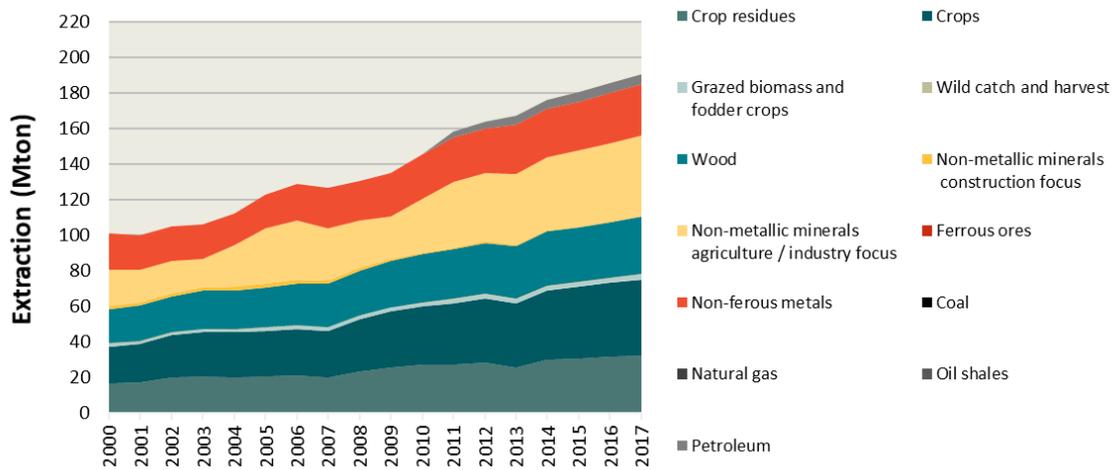
Ghana’s governmental leadership has made partnership and collaboration key to its strategy, and in this the EU is very prominent. Ghana’s trade with the EU amounts to EUR 5.5 billion (approx. GHS 25.6 billion). The EU is Ghana’s main market for its agri-business products (cocoa beans and transformed cocoa, canned tuna, fruit etc.) and supplies a large part of the equipment that contributes to economic growth. The EU also supports Ghana’s competitiveness through dedicated development cooperation programmes at national and regional levels (European Commission 2017). In summary, Ghana’s importance as a trade partner with the EU as well as the on-going initiatives by industry, development partners and civil society organizations provide ample ground for mutually reinforcing both economies’ transition to a circular one. This report provides an in-depth analysis to guide this process.

2.2. Economic structure, trends and resource consumption in Ghana

During the last two decades, the structure of Ghana’s economy has undergone a dramatic shift (Annex - Figure 1) where the importance of the services sector has grown considerably, at the expense of the primary sector (agriculture, forestry and fisheries). Between 2000 and 2019, the share of the primary sector shrunk from 39% to 20%, whereas the share of services grew from 32% to 46%. During this period, the share of industry in Ghana’s GDP grew as well from 28% to 34%, with an intermittent drop between 2006 and 2012 before the start of the global economic crises mainly due to a change in government and a slowdown in the construction sector. The structure of Ghana’s economy is quite typical for a sub-Saharan country, although the share of industry in Ghana’s GDP is considerably higher than in most sub-Saharan countries. Compared to the global average, the economy of Ghana is still strongly dependent on the primary sector (Annex - Figure 2) which contribution to the overall value creation is still five times higher than in the global average. Similarly, the share of the services sector is a third smaller in Ghana’s economy than in the global average.

Resource extraction in Ghana has almost doubled in the past two decades, which can be observed in Figure 1. While the largest part of extraction relates to biomass, extraction levels of non-metallic minerals and non-ferrous metal ores have substantially grown as well. Furthermore, since 2011, the country has also been extracting significant amounts of oil. The most important non-ferrous metals in terms of extraction volume are Bauxite, manganese ores and lead ores. Next to this, Ghana also produces significant amounts of gold. In 2016, 124 tonnes of gold were produced, of which 64% was mined by large companies and the remainder by small-scale artisanal mining. Another important product group in Ghana’s resource extraction is the non-metallic minerals. Ghana has a production capacity for cement of 12 million tons/year (Global Cement News 2020). Next to this, Ghana produces significant volumes of sand and clay (Jonah et al. 2015).

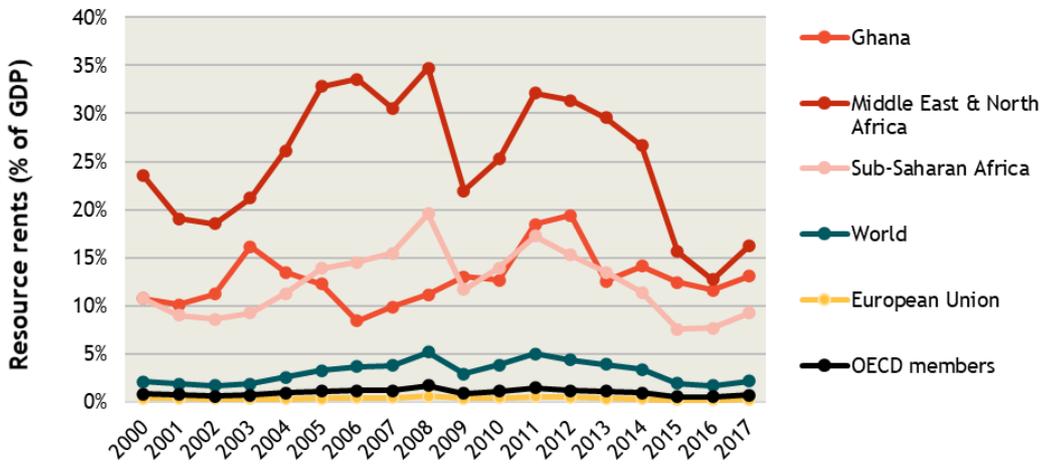
Figure 1 Resource extraction in Ghana by type for the period 2000-2017



Source: (UN Department of Economic and Social Affairs - Statistics Division 2020)

The extraction and trade in natural resources represents a significant source of income for Ghana’s economy, accounting on average for around 13% of the GDP between 2000 and 2017. In this respect the resource rents in Ghana are close to the sub-Saharan average (12%), but still considerably higher than in the EU (0.4%) or the global average (3%), which can be seen in Figure 2. This further substantiates the impression that Ghana’s economy is still highly dependent on domestic extraction of primary resources.

Figure 2 Resource rents as share of GDP (%) in Ghana compared to regional averages



Source: (The World Bank 2019)

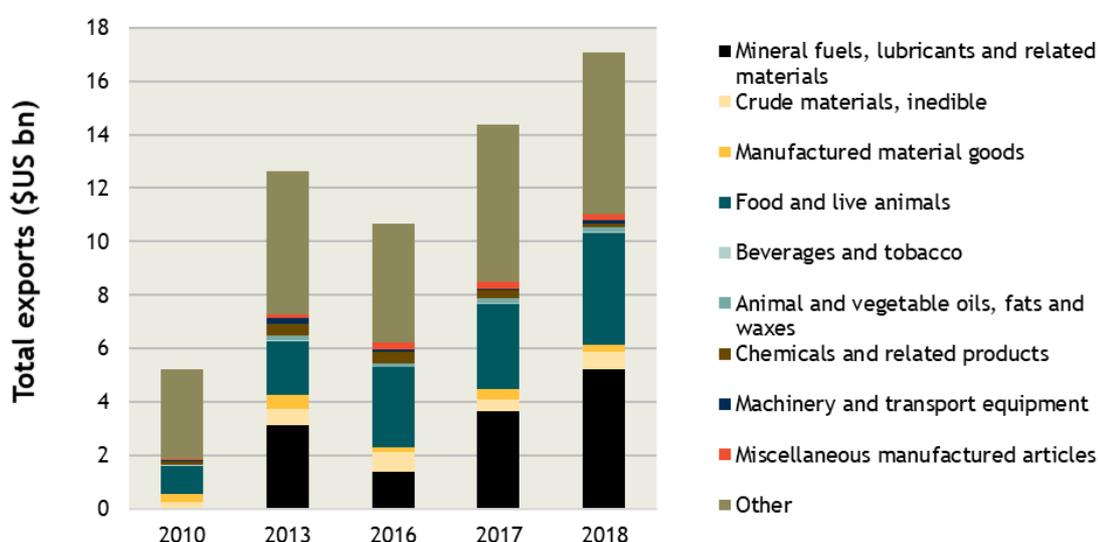
As shown in

Annex - Figure 3, timber constitutes a key import commodity from Ghana to the EU, with the region accounting for 25% of Ghana's timber exports in value terms, thus making it the 3rd most important destination of all timber products exported from Ghana between 2011 and 2017. However, Ghana is losing its forest cover; from 1990 - 2010, it lost a third mainly due to poor forest governance driven by trade. Such a strong relationship could shape forest rents in Ghana to follow CE principles: minimising overall extraction of forest resources, especially virgin forests, optimising circulation of timber products to last in society for as long as possible, and investing in reuse or repurposing and recycling of timber products.

With regards to Ghana's exports, the category 'other products' represents the largest part of Ghana's exports, followed by food products and mineral fuels (Figure 3). Gold exports represent over 99% of the value in the 'other products' category. In the years 2016-2018, Ghana's gold exports amounted on average to a value of EUR 5.5 billion (UN Department for Economic and Social Affairs 2019). A large share of Ghana's gold originates from artisanal and small-scale mines (about one third), which often operate with simple machinery, limited investment, a large workforce and without a license. Although these informal mines offer important income opportunities for Ghana's rural populations, they can also be connected to severe human rights violations such as child labour or cause serious environmental damage (Kippenberg 2015). This highlights potential social benefits that can be unlocked by shifting from raw material extraction to circulation of secondary raw materials in line with CE principles.

Within the food products category, coffee, tea and spices accounted on average for 73% of the export value during the years 2016-2018. Oil exports account for virtually the entire export value in the mineral fuels category, amounting to an average value of EUR 3.4 billion during the period 2016-2018.

Figure 3 The share of different products in Ghana's total exports in the period 2010, 2013, 2016-2018.



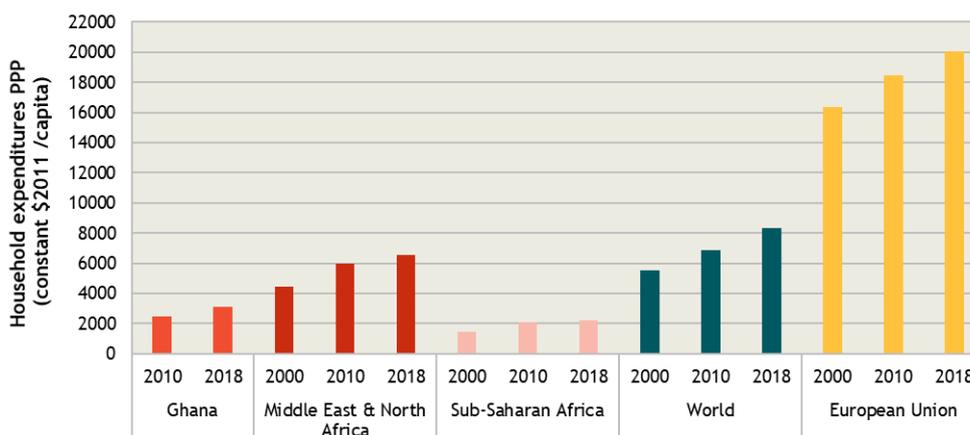
Source: UN Comtrade

The main agricultural export crop of Ghana is cocoa, for which Ghana contributes about 20% of global exports and has a reputation for high quality beans and little risk to buyers. Cocoa accounts for over 20% of Ghana's total foreign exchange earnings (The World Bank 2017). Yet, working conditions in Ghana's cocoa farming have been widely criticised by civil society organisations because workers are frequently exposed to occupational hazards and child labour remains common practice (N'djoré und McCoy 2020). Other crops that are grown and processed in the country include oil palm, shea-nut, coffee, rubber and coconut. Increasingly, annual crops are also domestically processed prior to export, e.g. in the case of cassava, sweet potatoes, plantain and cocoyam (Ministry of Food & Agriculture Ghana 2018).

Overall consumption levels have been steadily growing in Ghana, up by 121% in the period from 2006 to 2018. During the same period, per capita household expenditures increased by 66%. This is similar to the

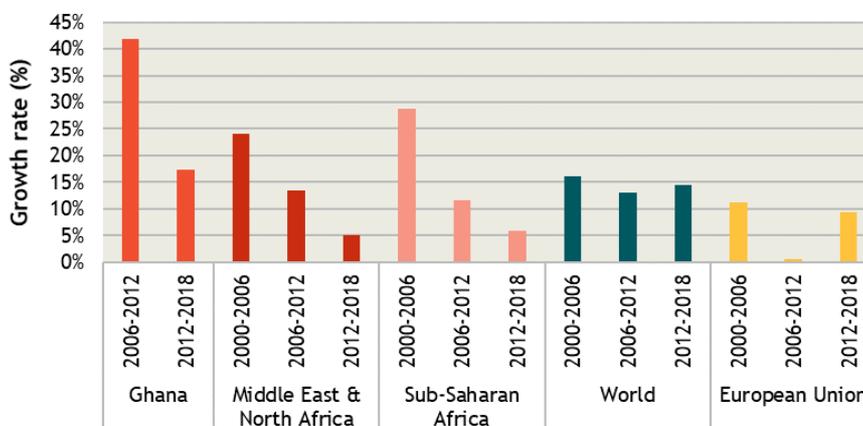
growth in GDP per capita, which amounted to 61% in the same period. The growth rate in per capita household expenditures in Ghana has been much stronger than on average in Sub-Saharan Africa, and growth has been particularly strong in the late 2000s (cf. Figure 4). Besides the fact that per capita household expenditures in Ghana grew faster than in the rest of sub-Sahara Africa, the absolute consumption levels of households in Ghana are also higher than the average in Sub-Saharan Africa. Still Ghana's per capita household expenditures are 62% below the global average, even when correcting for differences in purchasing power. Comprehensive, reliable analyses which scrutinise households spending for CE-related products and services (e.g. waste management, shared mobility concepts, second-hand products) do not exist.

Figure 4 Household expenditures per capita for Ghana compared to regional averages



Source: (The World Bank 2019).

Figure 5 Growth in household expenditures for Ghana compared to regional averages



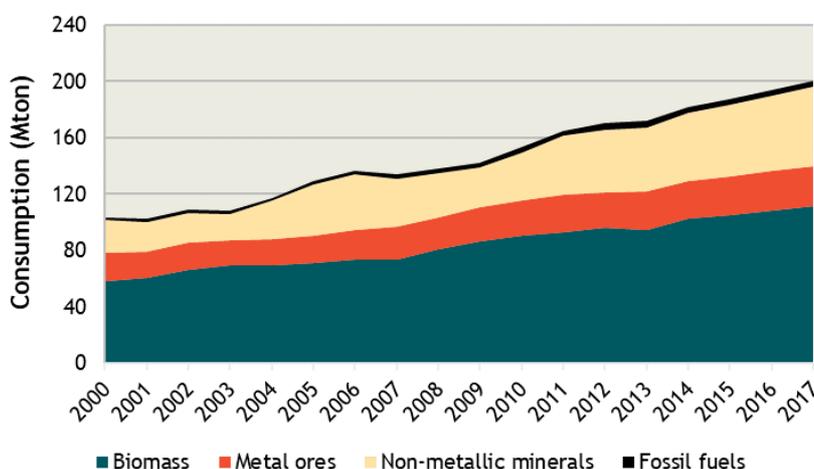
Source: (The World Bank 2019)

Along with the growth of the population and the economy, Ghana's domestic material consumption has grown as well. In the period 2000-2017, domestic material consumption almost doubled from about 104 million tons to over 201 million tons (Figure 6

Figure). Biomass-type resources account for the largest part of domestic material consumption in Ghana, accounting on average for 57% of the total material consumption between 2000 and 2017, thus highlighting opportunities for transitioning towards a circular bio-economy. The share of biomass in total domestic material consumption remained virtually constant during this period, whereas the share of non-metallic minerals in overall consumption grew, at the expense of metals. Overall, Ghana is responsible for 3% of the total domestic material consumption in Africa, making it the 8th largest consumer in the continent (UN Department of Economic and Social Affairs - Statistics Division, 2020). The largest part of the overall growth in domestic material consumption in Ghana can be explained by population growth,

as the country's population grew with 51% between 2000 and 2017. Simultaneously, per capita material consumption grew by 28% during this period. However, compared to the rest of the world, Ghana's relative material consumption levels are still very low (Annex - Figure 5). Per capita material consumption in Ghana in 2017 was 43% higher than the Sub-Saharan average, but 47% lower than the average consumption levels in Europe.

Figure 6 Overview of domestic material consumption by type in Ghana for the period 2000-2017.



Source: (UN Department of Economic and Social Affairs - Statistics Division 2020)

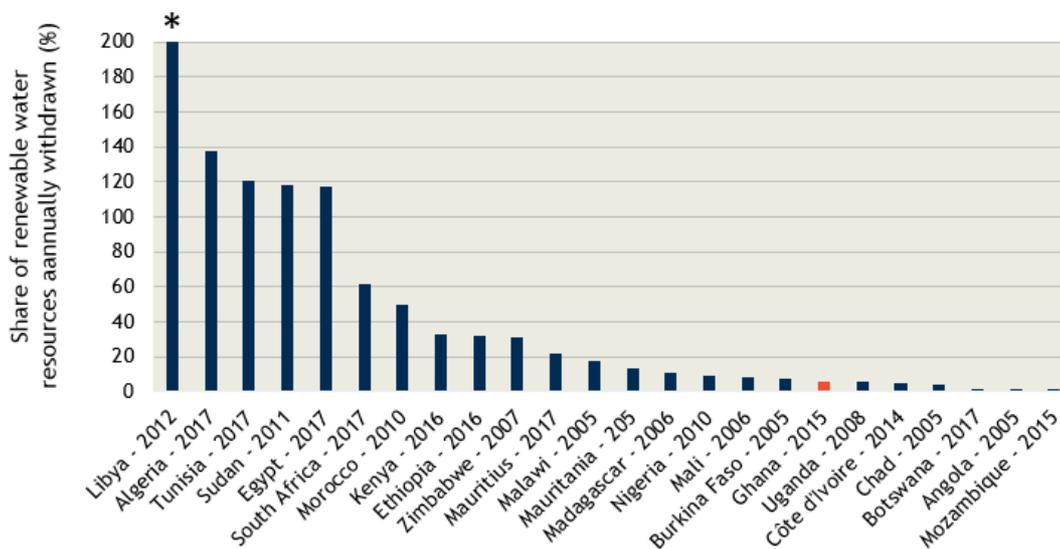
Globally, cement, steel and plastics account for almost 70% of the direct global greenhouse gas (GHG) emissions from industry and therefore, it is relevant to look at the trends in the consumption footprint for these materials. Cement consumption in Ghana is growing, but currently there is an overcapacity for cement production in the country (Global Cement News 2020). Still, with a relative consumption of only 0.21 tons/capita in 2020 (Global Cement News 2020), Ghana's cement consumption remains 47% below the world average in 2017 (IEA 2020). With regards to steel, we see that consumption jumped from around 0.5 million tons in the years 2008-2010 to around 0.8 million tons in 2010, after which it remained relatively stable (World Steel Association 2019). Between 2008 and 2017 per capita steel consumption in Ghana has grown 24% from 22 tonnes/capita to almost 27 tonnes/capita in 2017 (Annex - Figure 6) although this is still only 11% of the average per capita steel consumption level in the world. Similarly, between 2009 and 2015, plastics consumption per capita in Ghana grew from 5.7kg to 7.4kg (Babayemi et al. 2019), putting the per capita consumption lower compared to 95.5kg/capita in the Europe and a global average of 44.9kg/capita (PlasticsEurope und European Association of Plastics Recycling & Recovery Organisations 2017).

In Ghana, water stress levels are relatively modest, with only 6% of the available renewable freshwater being extracted on an annual basis (Figure 7) (Food and Agriculture Organization of the UN 2020). In 2015, a desalination plant in Ghana started operations, producing 60,000 m³ of freshwater from seawater on a daily basis, providing a supply of drinking water to 300,000 people. However, the plant closed down in 2018, due to the fact that the plant could not recuperate its operating costs and was generating significant financial losses (Water. desalination + reuse 2018). After a short period of re-opening, it was shut down again in October 2019 by the Ghana Water Company Limited citing excess chemicals that pose a health threat to consumers (Modern Ghana 2019).

In Ghana's rural areas, only 11% of the population has access to safely managed drinking water, in urban areas this is 57% (World Health Organization und UNICEF 2019). Overall the access to safely managed drinking water increased between 2000 and 2017 from 13% of the population having access to 36%, but these figures show that the majority of people in Ghana still do not have access to safely managed drinking water supplies. Recently, increasing pollution of fresh water bodies that are the main source of

potable water, household chores and other activities from illegal small-scale gold mining has been reported. This threatens the implementation of Ghana's Integrated Water Resources Management (IWRM) Plan, which seeks to manage water sustainably at all levels of society.

Figure 7 Freshwater withdrawal as a proportion of the available freshwater resources for Ghana and other African countries (with recent data).



Source: (Food and Agriculture Organization of the UN 2020)⁷

Potable water is mainly supplied to individuals in form of 500 ml water sachets made from high-density polyethylene (HDPE), which are sold in local stores and by street vendors. Once consumed, the sachets are often tossed indiscriminately into the environment, thus littering streets, beaches and waterways. Since HDPE is generally regarded as an easily recyclable polymer, there are significant opportunities in relation to household-level water consumption for collecting sachets and processing them into secondary raw materials in line with CE principles. In summary, consumption trends on water indicate that there are significant opportunities for introducing CE-concepts to improve water management in Ghana, e.g. by promoting local rainwater harvesting, implementing closed-loop technologies and lowering the impact from the wide-spread use of water sachets.

In summary, Ghana's overall consumption levels have been rising steadily in recent years mainly due to increasing population and per capita household expenditures. With an increasing GDP per capita, households are increasingly satisfying their material needs. Although the country's per capita material consumption remains lower than the average consumption levels in Europe, its current sustained population and economic growth will lead to higher demand for resources. This trend can only be expected to continue or even accelerate. However, since consumption of resources and finished products to date are still relatively low, the country has the opportunity to improve the well-being of its citizens without increasing resource consumption to the levels seen elsewhere in developed nations.

Examples for CE-consumption practices already prevalent in Ghana today include leaves from local produce, such as Katamfe, plantain or maize which are used for food wrapping. Often, these are considered by-products from agricultural production and, albeit traditionally applied across Ghana, tend to be replaced by conventional, modern packaging derived from oil-based polymers. Leveraging the industrial and household-level application of such agricultural residues in Ghana's consumption system presents a valuable opportunity for leapfrogging towards CE practices based on locally available materials.

⁷ In Libya the annual water consumption is equivalent to >800% of the available renewable fresh water resources

Economic impact of COVID-19

Ghana and Africa in general, are highly dependent on external markets and already suffer from a lack of private sector investment, Covid-19 will exacerbate this situation further. The Covid-19 pandemic will have far-reaching economic impacts on Ghana, with growth rates for 2020 being adjusted from 6.8 down to 2,6%. Considering the expected socio-economic impacts, the Government of Ghana seeks to adopt a Coronavirus Alleviation Programme to facilitate economic recovery, amongst other fiscal incentives (Larbi-Odam et al. 2020).

2.3. Circular economy-related trends in key sectors

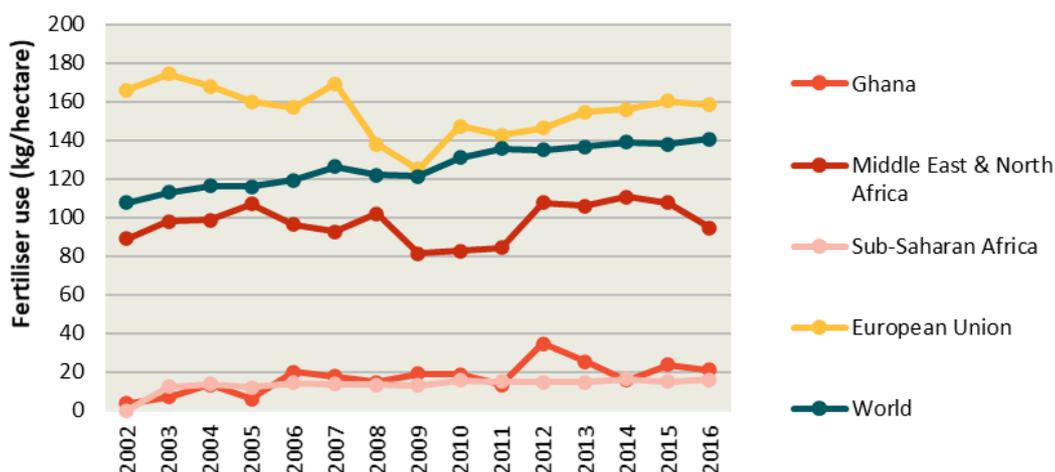
Literature suggests that domains where consumption and production have the highest environmental impact are food and agriculture, housing and construction and waste management. These are therefore areas where a CE approach could be most impactful in lowering negative externalities while also contributing to economic development in Ghana. For the aforementioned domains, the first two - agriculture and housing construction - are among some of the largest economic sectors in Ghana and are thus analysed in this section. Moreover, the waste management sector (although partially covered agriculture and housing/construction) offers ample opportunities and examples for CE-related improvements. In addition, due to their significance to the structure of the Ghanaian economy, urbanisation, digitisation and tourism have been looked at from the viewpoint of enabling factors for the transition to CE.

2.3.1. Agriculture

Agriculture is one of the key sectors in Ghana and is critical in supporting the economy and livelihoods of a significant size of the population (World Bank 2018). The Ministry of Food and Agriculture reports that the agriculture sector grew at an average rate of 3.5% over the period 2010 to 2016. Despite this growth, the share of agriculture's contribution to the GDP of Ghana was 18.9% in 2017; this marked a decline from 29.8% in 2010, owing to the expansion of the economy to service and industrial sectors (Ministry of Food & Agriculture Ghana 2018). Agriculture employs over 44% of the country's workforce, most of whom are engaged in production of either crops, livestock, fishing or in processing and marketing of agricultural produce. Agriculture is also a major contributor to foreign exchange earnings of Ghana; export of non-traditional agricultural commodities increased from about GHS 962 million Ghanaian in 2014 to GHS 1,901 million (from about EUR 139 million to EUR 274 million) in 2016 (Ministry of Food & Agriculture Ghana 2018).

The government provides subsidies for fertilizers, pesticides and seedlings to farmers, through the Ministry of Food and Agriculture as well as through the Ghana Cocoa Board. The expansion of agricultural production in Ghana is also connected to the increased application of fertilizers. Figure 8 shows the fertilizers use intensity in Ghana compared to regional averages. This clearly demonstrates that although very similar to the sub-Saharan average, fertiliser use is still very low in Ghana compared to fertiliser consumption in the rest of the world, with consumption levels being 87% lower than the global average and 89% lower than the EU average. This shows that Ghana still has potential to increase agricultural yields by increasing the use of fertilizers. At the same time, it offers a good opportunity to develop the country's agricultural economy in consideration of a CE. This could, for example, be achieved by optimising and expanding the use of organic fertilisers, biodynamic farming, or permaculture, all of which would help to close nutrient cycles, thus reducing the need for mineral fertilisers.

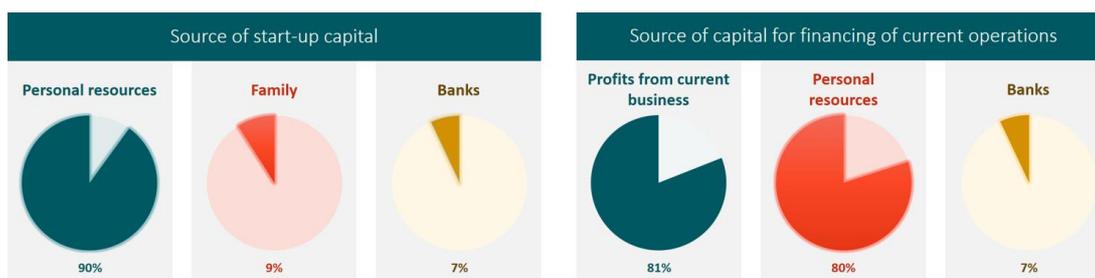
Figure 8 Fertilizer use intensity in Ghana compared to regional averages



Source: (The World Bank 2019)

Lack of capital and high cost of transporting products are by far the biggest constraints to operating an agricultural-input retail business. Commercial financing instruments such as bank loans or equity, as well as other opportunities such as cooperative and microfinance institutions typically play almost no role in providing start-up or operational capital for agricultural dealer businesses in Ghana, with less than two percent relying on such sources. 90% of agricultural input dealership are started from resources of the founder personal resources while nine percent loans from family members; 80% of operations are from business profits. A graphical representation of the sources of financing for agricultural enterprises can be found in below, in Figure 9. Achieving circularity in the agricultural sector is a vital component in ensuring overall sustainable development within a region; hence, it would be important to address this issue from a policy and financing perspective. Likewise, one of the underlying objectives of microfinancing, enabling access of financial support to economically less privileged members of society, is currently not achieved, despite the growth of microfinance institutions (Huq und Tribe 2018).

Figure 9 Sources of financing for agricultural input dealerships



Source: (Krausova und Afua 2010)

Other significant factors limiting agricultural-input retail business include lack of technical knowledge (especially in the Northern and Upper West regions where less than a third of agricultural input dealers receive any formal training), lack of suppliers and lack of customer demand. Among the number of dealers that had received some form of training in the recent two years, most were trained on: proper application and recommended dosages for fertilizers and chemicals; proper usage, proper storage and safe handling of products while in the store; and only about half were trained in general business management. Absent in such analysis, and an opportunity towards CE, is supporting diversity of agriculture and complementary approaches of traditional farming methods that have been handed down and have been compatible with the local ecosystem over several generations. Support for traditional skills and knowledge would also further demonstrate that CE is not a new concept but one that is already embedded in some Ghanaian societal practices for a long time. Yet, a traditional slash-and-burn agriculture, though contested for its

questionable ecological impacts, is still widely applied in Ghana. While this method appeals to small-scale farmers for its simplicity and low capital requirements, alternative clearing methods which preserve soil quality and sequester carbon could be further explored.

Further, with its low yields, Ghana stands to benefit from opportunities that explore using agricultural residues and waste generated in agri-food processing for use as organic fertilizers and pesticides as alternatives to chemical fertilizers or as part of energy recovery solutions. Currently, agriculture waste is conventionally and minimally reused on farms using traditional knowledge without a specific programme or initiative. Although the government's flagship programme "Planting for Foods and Jobs" offers 50% subsidy on the cost of seeds and fertilizers for smallholder farmers, it does not emphasize use of organic fertilizers. In the absence of large-scale programmes supporting the utilisation of agri-waste from major crops such as palm oil, cocoa, shea-nut, coffee, rubber, few entrepreneurial initiatives exist in Ghana.

2.3.2. Housing and Construction

The construction sector is one of the biggest in Ghana, contributing significantly to GDP growth and employment (Darko und Löwe 2016). The sector has consistently registered growth rates higher than average for all sectors and has been significant in its contribution to Ghana becoming a middle-income country by World Bank classification. The growth of construction corresponds to increasing demand for cement. For example, in the two years between 2010 and 2012, cement use in Ghana grew from 4.8 to 5.5 million metric tonnes. In a boost to industry, increasingly more of the cement is produced in the country (Darko und Löwe 2016).

Construction is a major source for jobs, especially for the youth, and employs about 320,000 people and approximately 2% of young people (Darko und Löwe 2016). According to data compiled by the UN University World Institute for Development Economics Research, there were about 23,000 registered contractors in the country (Owoo und Lambon-Quayefio 2018). Being very labour intensive, the industry provides training and apprenticeship opportunities for young people. Government statistics referenced by the Overseas Development Institute show that for those working in the sector, about 29% are employees, 27% are apprentices and another 21% are casual workers.

One recent observation in the construction industry is related to competition for contracts awarded by government, where local contractors are seen to be losing out to international firms. About 60% of contractors in Ghana can only afford the skills and financial resources to undertake projects in the low- and middle-end housing markets, costing up to USD 200,000. Thus, in order to develop the capacities of local contractors, the government has preferential procurement processes where these low-value contracts favour the less endowed Ghanaian contractors. Such preferential treatment in procurement processes could be adapted and extended to CE criteria for accessing or bidding for public contracts, e.g. by requiring contractors to use locally and sustainably sourced materials, constructing buildings in line with traditional approaches in line with CE (e.g. vernacular architecture) and emphasising reversible building design that enables deconstruction (as opposed to necessitating demolition) at the end of life.

In analysing the challenges to housing sector in Ghana, UN University World Institute for Development Economics Research has identified multiple institutional bottlenecks to meeting the demand for housing. One of the most pressing issues to this regard is - with an estimated shortfall in skilled artisans in the construction sector of about 250,000 - the lack of skilled labour. In Ghana there is a limited quantity and quality of sophisticated frontier skills such as bricklaying, plastering, plumbing, roofing, steel-frame flooring, steep roofing and architectural assistants. These are in high demand for commercial, multi-storey and high-rise buildings as well as for heavy engineering and road works. However, the majority of artisans and construction workers, including over 90% of youth in the construction sector, operate in the

informal economy, with little skill and training to match the expertise required for modern construction projects. The potential is high for creating green jobs in the sector and to provide training for CE skills and sustainable construction.

Apart from the lack of skills, the rising costs of raw materials in Ghana such as water, cement, and electricity is another major issue for the housing and construction sector in Ghana. Combined with delays in locating quality materials and the associated transportation costs, this leads to increased costs of construction. Further, building and construction materials such as bitumen, copper, aluminium and machinery are usually imported from abroad, e.g. South America and Europe. Imports are preferred over similarly produced domestic options, due to their perceived higher quality, especially in complex construction projects. As such, with fluctuations in exchange rates, rising prices of raw materials on the world market can suddenly and often increase construction costs (Owoo und Lambon-Quayefio 2018). A CE approach could address the issue of rising costs and at the same time reduce environmental impacts of raw material extraction and use through promotion of increased use of secondary and recycled materials.

With a growing economy needing newer infrastructure, an annual housing deficit of over 100,000 housing units (Kavaarpuo und Sarfoh 2016) and existing infrastructure needing upgrading, experts predict that the sector will continue to grow rapidly and that the existing skills gap will only grow wider as the numbers and complexity of construction needs increase. To this regard a CE perspective for the construction industry and training for commensurate skills is a likely priority in Ghana although no major initiative has been undertaken on a national level to date. Few pilot projects and innovations such as the use of recycled plastic for pavement blocks by Nelplast (Reuters 2018) and a pilot construction of a public toilet from plastics by Ghana Recycling Initiative by Private Enterprises (GRIFE) in collaboration with Building and Road Research Institute (BRRI) of the Council for Scientific and Industrial Research are raising awareness on possible circular opportunities in the construction sector (Takouleu 2019).

Yet to reduce its housing and infrastructure deficit without a corresponding increase in cement demand, Ghana would need to explore large scale initiatives and certification of abandoned African vernacular architecture and hybrid techniques which utilizes stones, timber, bamboo, rattan and other locally sourced materials in its building and construction sector. In addition, new standards for housing construction and renovation should ensure that buildings last long, thus reducing demolition cycles and related wastes. Similarly, design for construction could prioritise materials recovery for new building components. While such approaches hold great opportunities in Ghana, their application needs to be further investigated to what extent material loops can be closed through the use of innovative materials while ensuring that the natural environment can grow back and primary resources are preserved.

The Ghana Real Estate Developers Association places the Ghana housing market in three categories based on construction cost and social status: high-end market comprises housing units costs upwards of USD 200,000; middle-end market housing units range from USD 100,000 to USD 150,000; while low-end housing market units cost below USD 100,000 (Owoo und Lambon-Quayefio 2018). Low-end market, which is also known as affordable housing are least profitable for the construction industry, while ironically being the category of housing in particularly high need.

Increasing costs of construction, a difficult land tenure system and lack of access to finance make it challenging to meet demand for affordable housing. Part of the reason for high construction costs is the lack of basic amenities such as portable water and electricity in areas where construction is needed. While it is seen as responsibility of government to provide these amenities, the lack of them forces housing developers to take the responsibility of linking new housing development to the necessary amenities, thus significantly raising costs of production and making it difficult for those in need to afford.

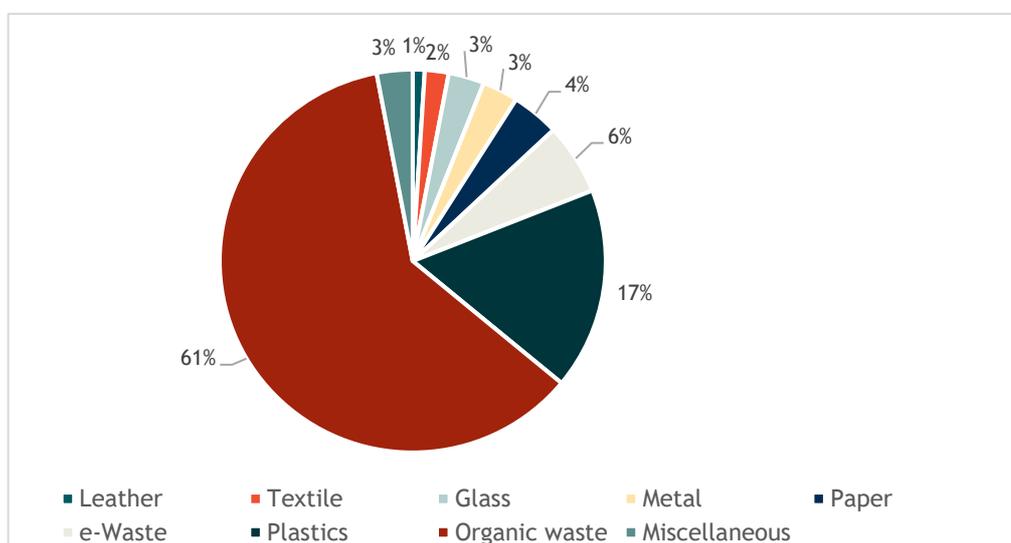
Thus developers prefer to operate in high- and middle-end housing markets where clients can pay for the costs of bringing the necessary basic facilities and profit margins are higher (Owoo und Lambon-Quayefio 2018). Given the link between affordable housing, social sustainability and circular economy, affordable housing is of importance to a thriving sustainable Ghana. Immediate opportunities for CE include enforcement of housing standards for new and renovated buildings that require them to be low-energy, long lasting and designed for recycling and reuse (reversible building design).

2.3.3. Waste Management

In recent years, waste management issues have gained increasing public attention in Ghana. Although reliable statistics on the amounts of waste generated and the exact composition of waste streams are scarce, assessments conducted by the Kwame Nkrumah University of Science and Technology in Kumasi suggest that the country generates 0.47 kg MSW per person and day. With an assumed population of 27,043,093 people (2015), this translates into about 12,710 tons of waste per day or roughly 4.6 million tons per year.

According to Keesman (2019), the composition of MSW in Ghana is similar to other developing countries and is characterized by a high organic content (61%). Other important waste fractions include plastics (17%), electronic waste (6%), paper (5%), metal (3%), glass (3%), textile (2%) and leather (1%), the remaining 3% being miscellaneous or unidentifiable fractions (see Figure 10). Similar figures are reported by Miezah et al. (2015) with organics accounting for 61%, plastics for 14% and inert materials (e.g. sand and concrete) for 6%, followed by miscellaneous (5%), paper (5%), metals (3%), glass (3%), leather and rubber (1%) and textiles (1%). Notably, Miezah et al. highlight that waste compositions vary considerably across different regions, with the rate of waste generation per person being higher in coastal and forest zones generated higher waste than the northern savannah zone and higher in metropolitan areas as opposed to municipalities.

Figure 10 Composition of MSW in Ghana



Source: (Keesman 2019)

Waste collection, processing and disposal is mainly managed by Ghana's informal sector. The sector essentially consists of a widespread network of individual waste pickers, which engage in door-to-door-collection (in more affluent areas) and scavenge streets, neighbourhoods and dumpsites for valuable materials (in less affluent areas). Upon collection, the waste is transported by using a range of different vehicles (mainly pushcarts and three-wheelers) and is sold to intermediaries and waste aggregators for subsequent processing. Looking at the funding models for municipal solid waste management in Ghana, the system largely financed by household fees, ranging from GHS 20 to 100 per month (equivalent to around EUR 3.30 to EUR 16.50), depending on area and household size. The fees are collected by waste

management operators. Yet, payment discipline is generally low and households, which refuse to pay, are usually stopped being serviced altogether.

Due to an acute lack of local treatment capacities and developed recycling infrastructure, the vast majority of these waste streams are disposed of through inappropriate means. First and foremost, this includes uncontrolled dumping into open pits without leachate control or cover materials and open burning to reduce volume. Comprehensive accounts for formally operated landfills are not publicly available. However, one of the most important ones serving the Accra-Tema corridor is the Kpone landfill. It is administered by the Ministry of Local Sanitation and Water Resources together with Tema Municipality. Originally designed with a capacity of 500 tons of waste per day, it is now receiving 1,200 tons per day and is largely overstretched.

According to interviews conducted by Keesman (2019), 80% of the services in the Ghanaian waste sector are provided by the private sector (including both formal and informal companies). An overview of the most renowned formal private organizations active in Ghana's waste management sector (operators for collection, recycling and landfilling) is shown in Annex - Table 2.

Organic waste

Reliable estimates for collection and recycling rates as well as economic opportunities for utilizing different types of waste do not exist. Given the importance of agriculture for Ghana's economic performance, there are significant volumes of organic waste and agricultural residues from cultivated crops, which are yet largely unutilized in Ghana. According to Thomson (2014), there are significant opportunities for valorisation of residual materials, particularly highlighting the potential of increasing domestic capacities for anaerobic digestion and composting. An estimation of agricultural residues generated from the ten most important crops cultivated in Ghana is shown in the table below.

Table 1: Types and volumes of agricultural residues generated from the ten most important crops cultivated in Ghana

Crop	Residue	Generation in million tons/year
Cassava	Stalk, peelings	1.43
Cocoa	Pods	0.67
Cocoyam	Straw	0.61
Oil palm	EFB, kernel shells, fibre	0.74
Maize	Stalks, husks, cobs	3.03
Peanut (ground nut)	Shells, straw	1.18
Plantain	Trunks and leaves	1.68
Rice	Straw, husks	0.31
Sorghum	Straw	0.46
Yam	Straw	2.82

Source: (Thomsen 2014)

Plastic waste

Concerning plastics, Keesman (2019) reports that a total of 25 plastic recycling companies currently operate in Ghana. Together, they represent a combined processing capacity of 320 tons of flexible plastic per day, mainly originating from water sachets. According to Ghana's EPA, 2.58 million tons of virgin plastics are imported to Ghana every year. Thereof, 73% effectively ends up as waste, while only 19% is

reused and less than 0.1% is recycled. The remaining quantities go accounted for and end up being landfilled, burned or indiscriminately dumped in the open (Oppong-Ansah 2018). Other estimates put the rate of plastic waste generation at 1.7 million tons per year, with a recycling rate of 6% (Linnenkoper 2019). Interestingly, Keesman highlights particular untapped value-creation potential from PET recycling. Citing figures by the Ghana Plastic Manufacturers Association (GPMA), PET bottle production in Ghana presumably stands at 68,000 million tons a year. By adding imports, it is estimated that some 73 million kg waste from PET bottles enters the environment every year. Recycling rates of PET bottles only stands at 2% owing to cost parity of recycled PET and virgin material.

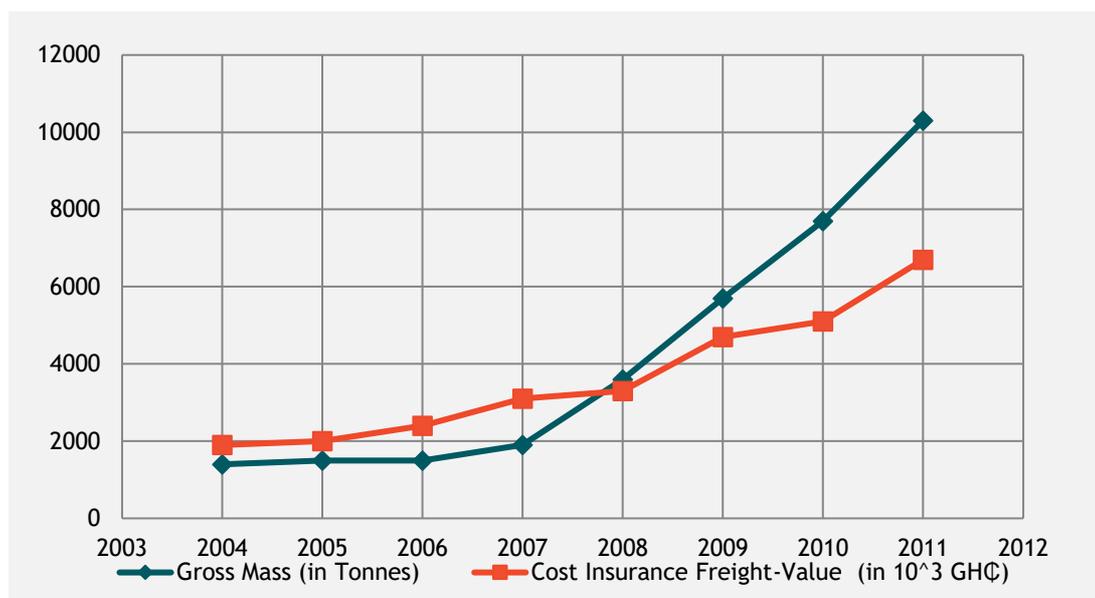
In April 2019, Zoomlion announced the commissioning of an Integrated Recycling and Composite Plant (Jospong Group of Companies 2019). The plant was set up by a new limited liability entity operating under the name of IRECOP Ltd. It functions as a multi-purpose waste treatment and material recovery facility with two production lines potentially operating at a capacity of 400 tons of waste per day each and a recovery rate of up to 90%. In addition, the plant can generate up to 60 tons of compost per day (Integrated Compost & Recycling Plant Ltd). Types of waste processed by the plant include scrap, paper, tires, plastics (including PET) and electronic waste (e-waste). The project essentially presents a type of public private partnership (PPP) between Zoomlion and the Government of Ghana, with the former making an investment of USD 20 million and the government contributing the land free of charge. According to Keesman (2019), the mobile equipment of the plant (a rotary screening machine and a shredder) were supplied by Komptech Austria.

E-waste

Handling waste from electrical and electronic equipment (WEEE or e-waste) presents a major challenge in Ghana. This is epitomised by the Old Fadama Scrap Yard (better known as Agbogbloshie), located in Ghana's capital Accra, which has attracted international attention for being the world's presumably largest dumpsite for e-waste. Common activities include open burning of cables and manual disassembly of lead-acid batteries, resulting in significant environmental pollution and damage to human health. These are carried out by the Ghana's informal workforce, which operates all over Ghana. The e-waste sector is estimated to provide employment for 20,000 to 35,000 people, with more than 120,000 depend indirectly on the industry. According to the Prakash et al. (2010), informal workers collecting e-waste earn as little as USD 2.3 to 4.6 per day whereas recyclers earn about USD 5.8 to 9.5 on a daily basis. Despite these low-income levels, the e-waste sector represents an important part of Ghana's economy; according to some estimations, it accounts for USD 105 to 268 million indirect contributions to the country's GDP.

The expansion of the country's e-waste sector can in part be attributed to Ghana's Integrated Policy on Information and Communication Technology (ICT) for Accelerated Development, which was first introduced in 2003. The policy seeks to "transform Ghana into an information-rich knowledge-based society and economy, through the development, deployment and exploitation of ICTs within the economy and society" (Government of Ghana 2003). To ensure affordable access to ICT products and promote usage, the government lifted import taxes of computers and computer accessories in 2004. This resulted in increasing amounts of imported computers (see figure below). By 2011, the imported gross mass of computers reached 10,300 tons, a sevenfold increase compared to levels recorded in 2004.

Figure 11 Import of used computers into Ghana from 2004-2011



Source: data taken from (Grant und Oteng-Ababio 2012)

Besides Ghana's ICT-driven development strategy, the growing Ghanaian economy and the associated emergence of middle-income class consumers has resulted in increasing demand for both new and used electronics. In 2009, Ghana's EPA estimated that imports of EEE (electrical and electronic equipment) reached 215,000 tons per year, consisting of 30 % new equipment (65,500 tons) and 70 % used EEE (150,500 tons). In the same year, 280,000 tons of e-waste were generated in Ghana. Thereof, it was estimated that 57% were repaired, 8% were stored and 34% were collected and processed through informal collection mechanisms. According to the same estimates, a mere 1% was collected and processed by formal waste management companies (Amoyaw-Osei et al. 2011). According to more recent estimates, around 350,000 tons of EEE are imported per year. Used EEE has become a major import commodity due to its affordability. Yet, about 20% of imported used EEE has been estimated to have a short life span of less than two years and is commonly referred to as near-end-of-life-equipment (Amoyaw-Osei et al. 2011).

This issue is further aggravated by illegal imports of dysfunctional equipment (e-waste), which presumably accounts for 10-20% of all imports (ibid.) and are shipped by exporters in industrialized countries by falsely declaring them as used EEE. This breaches with the internationally binding Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal, which was introduced in 1989 (UN Environment Programme 1989).

2.3.4. Enabling factors: tourism, urbanization and digitization

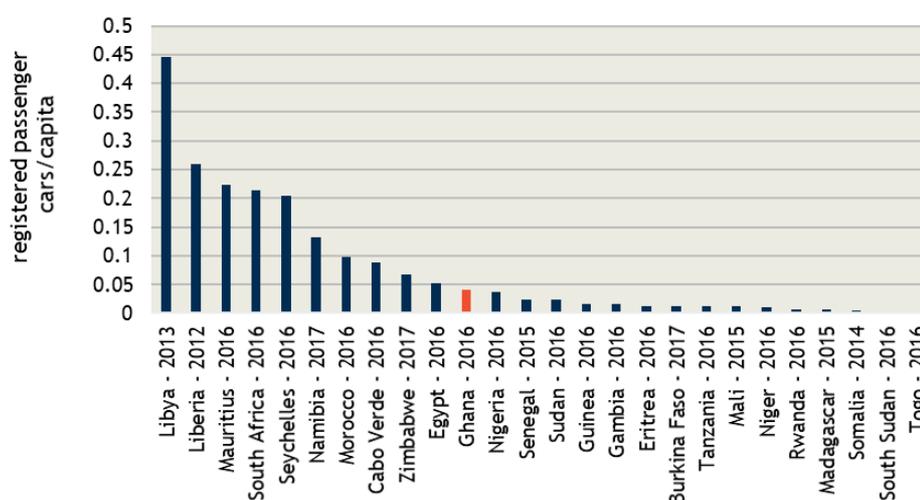
Despite the key sectors covered above, tourism, urbanization and digitization can be understood as important enabling factors for the CE transition in Ghana. Tourism has experienced continuous growth over the past few years and is set to expand further. However, to maintain this trend and tap its full potential, Ghana will need stronger commitment to ensuring higher quality standards. Given that the CE has risen to the highest policy level in Ghana and the government wants to expand tourism activities at the same time, it would be sensible to investigate potential synergetic efforts that could generate a significant enthusiasm.

Tourism is typically characterized by a high throughput of fast moving consumer goods wrapped in single-use plastics or making use of disposable cutlery. By pushing for more circular approaches in the tourism segment, e.g. by applying alternative, biodegradable packaging materials, Ghana could create an important market pull that positively affects the packaging industry. Moreover, tourism can create significant demand for local products that are cultivated in regenerative, interconnected farming systems making use of cascading approaches and circular nutrient flows. With regards to accommodation, the hospitality sector can serve as an important platform for circular products, e.g. by procuring refurbished furniture or making use of architectural designs that promote the use of locally available materials.

Another important enabler in the country's CE transition is urbanization. Ghana's urban population has grown from 50.3% in 2009 to 56.71% in 2019 (Plecher 2020). While urbanization generally helps in concentrating human footprints to densely populated areas and sparing the natural environment, Ghana's landscape is increasingly impacted by outward-expanding cities. For instance, spatial data analysed by Agyeman suggests that between 2008 and 2016, dense vegetation in the peri-urban areas of the Greater Accra Metropolitan Area decreased by almost 227% whereas settlements increased by 120%.

This type of urban sprawl also increases the dependency on cars as a primary means of transport. While car ownership in Ghana is still comparatively low (cf. figure below), with around 1 in 24 people owning a car in 2016, it is estimated that roads carry 95% of all passengers and 98% of the country's freight (PwC 2013). Buses are the main mode of transport accounting for about 60% of passenger movement with taxis accounting for only 14.5% and the remaining accounted for by private cars. Mass transport systems rarely exist in Ghana with a triangular rail network of 950 km linking the inland city of Kumasi to the coastal cities of Takoradi in the west, and Accra-Tema in the east.

Figure 12 Car ownership per capita in Africa, highlighting Ghana.



Source: (World Health Organization 2020)

Private sector players are stepping in to fill the gap with ride-hailing services such as Uber, Bolt and Yango fast becoming popular among young people due to dissatisfaction with existing public transit

services. However, overreliance on car-sharing could lead to unsustainable outcomes due to an increased rate of deterioration of roads (Acheampong und Siiba 2019). Moreover, with rapid rates of urbanization of its major cities, the transportation deficit presents an enormous challenge and opportunity for CE investments and initiatives in transportation, infrastructure and logistics (Nkume 2017). The government therefore could seize the opportunities of urbanization and deliberate efforts to invest in reliable and efficient public transportation systems and to prioritise shared mobility systems over privatised ownership structures. Furthermore, there is indication that better zoning practices in urban areas can decrease not only urban sprawl but also road congestion and more dynamic neighbourhoods.

Lastly, digitalization is considered as a third and important enabler for the CE transition in Ghana. In fact, digitalization offers a host of opportunities and can be understood as a cross-sectoral driver for innovation and more circular approaches along the entire lifecycle of products and services. Steady technological advancement in Ghana has already promoted cross-network mobile banking interoperability and created a market for various digitized service applications that not just transform the communications sub-sector, but affect the banking, insurance and medicare systems.

With regards to agriculture, digitization enables the application of precision farming to complement traditional approaches and increase agricultural yields. Despite, it can increase the accessibility of food information along the supply chain and can support consumers in making informed choices (Climate-KIC 2018). In urbanized areas, digitization acts as a catalyser for shared mobility concepts and computer assisted planning tools. In the waste sector, digitization drives the adoption of recovery platforms and enables industrial symbiosis, can expand the reach of sales channels for refurbished products (e.g. electronics) and may empower stakeholders from the informal economy to become part of formal value chains (Kabadiwalla Connect 2020).

2.4. Policy framework supporting circular economy activities

2.4.1. Overview of the policy framework in the context of circular economy

Despite Ghana's Long-term National Development Plan (LTNDP), which makes clear commitments towards integrated social, economic, environmental and institutional development, the government has put forward its Intended Nationally Determined Contributions, also known as INDCs, to the UN Framework Convention on Climate Change. The Intended Nationally Determined Contributions contain both climate change mitigation and adaptation programmes to be implemented over a ten-year period from 2020 to 2030. An update is expected to be brought forth in November 2020. These actions, which would drive Ghana's circular economy approach, including resilient, low-carbon development, fall under seven priority economic sectors: sustainable land use including food security; climate proof infrastructure; equitable social development; sustainable mass transportation; sustainable energy security; sustainable forest management; and alternative urban waste management (Government of Ghana 2015).

Concerning the overarching structure of the waste management system, two initiatives have been critical for Ghana's development thus far. In 1993, the Local Government Act (Act 462) was issued in order to drive decentralisation of public services. To this end, responsibility for providing waste management services was delegated to local authorities, the Municipal Metropolitan District Assemblies (MMDAs), which in turn were mandated to set up waste management departments. Yet, according to Keesman 2019, waste management departments only exist in four cities today. In addition, the country's National Environmental Sanitation Policy (ESP) from 2010 stipulates that large parts of environmental sanitation services shall be carried out by the private sector. Today in Ghana, this is done by a complex array of instruments, such as contracts for PPPs, franchises, concessions and other agreements. In effect, the Environmental Sanitation Policy has driven the involvement of the private sector to the extent that, according to the Ministry of Sanitation and Water Resources, 80% of the services in the Ghanaian waste sector are now provided by the private sector (Keesman 2019).

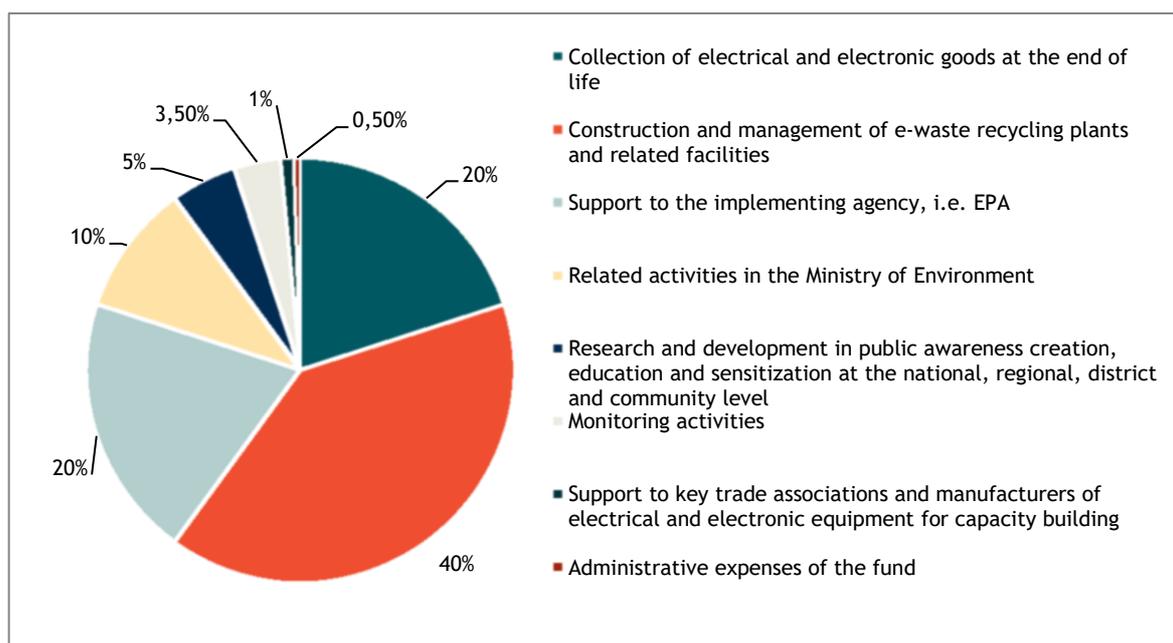
Apart from these overarching frameworks, two waste streams have moved to the forefront of CE related policy making in Ghana: plastic waste and e-waste. In 1996, the government of Ghana introduced an environmental excise tax on imported plastics and plastic products. However, the tax was not levied until 2011 and a management authority was never set up. As a result, the environmental funds were never disbursed and have not yet benefitted the development of Ghana's plastic waste management system. In 2018, the fund was said to hold a staggering USD 163 million of which "not one cent has yet been made available to recyclers" (Linnenkoper 2019). The more recent initiation of the GRIPE formed under the Association of Ghana Industries spurs hope that the sector will soon benefit from the disbursement of available funds to kick-start the transition towards a circular plastics industry.

The Ghanaian government - under the leadership of the Ministry of Environment, Technology, and innovation (MESTI) - is currently also in the process of adopting a National Plastic Management Policy that will leverage comprehensive management of plastics to drive sustainable development, green job creation and environmental protection. In October 2019, Ghana entered a partnership with the Global Plastic Action Partnership by launching the NPAP. As part of this initiative, Ghana is committed to develop a Circular Economy framework and strengthen its legal and regulatory enforcement regime (Boachie 2019). The strategy for implementation of NPAP rests on three pillars: a) knowledge, by undertaking a scoping and diagnostic exercise in Ghana to the largest levers for change and develop an evidence-based baseline; b) community, by convening a range of high-level stakeholders from government, private sector, civil society and international partners; and c) investment, by directing funding and support from inter-governmental organization partners, towards high-impact initiatives to reduce plastic marine debris (Global Plastic Action Partnership 2020).

Concerning e-waste, Ghana is signatory to the Basel Convention on Transboundary Movements of Hazardous Wastes and Their Disposal. However, as outlined above, this has not stopped the import of obsolete and near-end-of-life EEE and corresponding generation of e-waste. In order to respond to the disastrous impacts of current e-waste management practices in Ghana, the Government passed the Hazardous and Electronic Waste Control and Management Act (Act 917) in July 2016. The Act addresses the issue of improper e-waste management by placing stricter regulation on imported goods by assigning a higher responsibility to producers and private importers of EEE. At its core, it does this by harnessing the principle of Extended Producer Responsibility (EPR). According to the OECD, this principle can be defined as an “environmental policy approach in which a producer’s responsibility for a product is extended to the post-consumer stage of a product’s life cycle” (OECD 2001).

Since Ghana relies mainly on imports of EEE, most EPR obligations address importers who place EEE onto the Ghanaian market. First and foremost, importers are required to register with the Environmental Protection Agency (EPA) and pay an Advance Eco Levy at the exporting country for goods processed or imported to Société Générale S.A. as a designated external service provider as per Act 917. These levies are pooled in a fund under the aegis of the Ministry of Environment, Science, Technology and Innovation (MESTI) in consultation with the Ministry of Finance. According to the provisions of Article 21 and Article 28 of Act 917, the appointed Administrator under MESTI is responsible for the disbursement of the funds. The intended shares of disbursement are displayed in the figure below.

Figure 13 Intended disbursement of funds generated under Act 917



Source: (Republic of Ghana 2016)

The government has made substantial progress in the implementation of Act 917. This is reflected, inter alia, by i) the passing of a corresponding Legal Instrument, the Hazardous, Electronic and other Wastes (Classification), Control and Management Regulations (LI 2250) in 2016 and ii) the introduction of the mandatory Technical Guidelines on Environmentally Sound E-Waste Management for Collectors, Collection Centres, Transporters, Treatment Facilities and Final Disposal in Ghana in 2018. While full implementation and enforcement has been pending since Act 917 was introduced in 2016, the collection of levies has commenced and the government of Ghana finished the construction of an integrated training centre for e-waste management in 2019. Currently, the construction of a centralized handover centre is underway. From

this facility, collected e-waste will be disbursed to authorized companies for subsequent treatment and recycling.

Overall, the developments in the e-waste sector appear to be more promising than in the plastic waste sector. While the concept of CE enjoys broad support from the government (particular MESTI and the Ministry for Sanitation and Water Resources), an absence of relevant legislations and policies can be observed in areas such as waste recycling, farming (agricultural residues, producing fertilizers out of solid and liquid waste), construction as well as manufacturing. An overview of existing legislations and policies is presented in Annex -Table 3.

2.4.2. Environmental standards

The Ghana Standards Authority (GSA) is the national statutory body responsible for the development and promulgation of standards in Ghana. As a standards organization, it has the overall responsibility for standardization and quality assurance of goods and services for both the local market and for export. The GSA was established by a decree of the Government of Ghana, the Standards Decree 1967, and NLCD 199, which was superseded by NRCDC 173 of 1973. It currently has seven divisions, namely Standards, Metrology, Inspection, Testing, Certification, Finance and Administration.

GSA plays a critical role in Ghana's trade relations by harmonizing technical specifications of products and services, making Ghana's industry conform to international standards thus facilitating the movement of goods, services and technologies between Ghana, the EU and the global community. (Ghana Standards Authority).

In general, although Ghana doesn't have specific standards geared towards CE, various existing standards enforced by the GSA have provisions that promote CE principles. In addition the GSA is a member of regional and global standard-setting bodies such the African Organization for Standardization (ARSO), the International Organization for Standardization (ISO), thus promoting and certifying Ghanaian firms in key international CE related standards such as the ISO 14000 series (Ghana Standards Authority). It also hosts the Secretariat of the Economic Community of West African States Harmonization Committee for Food and co-hosts the Secretariat for the ISO sub-committee on Cocoa in a twinning arrangement with the Netherlands Standardization Institute. In recent times, specific sectorial standards, codes and guidelines have been developed to ensure conformity to international goods practices, some of which are presented in Annex - Table 4.

In 2018 for instance, the government launched the Ghana Building Code GS 1207: 2018 a modified adoption of the International Building Code that sets out requirements and recommendations for efficient standards for residential and non-residential buildings and covers planning, management and practices in the construction of buildings. Among other regulations, it promotes energy efficiency, the generation of renewable energy and overarching sustainability by setting out green building requirements. It mandates energy audits in all business buildings and reduction of energy consumption through efficient lighting and air conditioning. In addition to the mandatory Ghana Building Code, key institutions in Ghana are taking a further step to build according to the requirements and guidelines of voluntary standards and certifications schemes in the construction sector such as the World Bank's EDGE that promotes green buildings. Notable EDGE certified buildings in Ghana include the Kotoka International Airport, CalBank Ghana head office and the Mother and Baby Unit of the Komfo Anokye teaching hospital in Kumasi.

With regards to environmental management, Ghana's EPA is entirely responsible for assessing investment and undertakings for conformity to sound environmental management practices. Firms are required by the EPA to submit an environmental management plan indicating resource efficient and cleaner production options being implemented in the course of operations.

On the other hand, in the agricultural sector, the Food and Drugs Board regulates the manufacture, importation, exportation, distribution, use and advertisements of food, drugs, cosmetics, medical devices and household chemicals with respect to ensuring their safety, quality and efficiency. The Food and Drugs Board mandate is to protect and promote public health by ensuring that food and drugs consumed in Ghana are wholesome and safe (Ashitey 2012). All food products imported, advertised, sold or distributed in the country must first be registered with the Food and Drugs Board under Section 18 and 25 of the Food and Drugs law, 1992 (PNDCL 305B) and Section 4 (b) of the Food and Drugs (Amendment) Act 523, 1996.

In the agriculture sector, the Horticulture Development Unit of the Crops Services Directorate of the Ministry of Food and Agriculture Ghana, the German GIZ through its Market Oriented Agriculture Program and the GSA initiated the Green Label Certification Scheme, a voluntary scheme that guides farmers to cultivate fruits and vegetables in an environmentally sustainable and sound way for local consumption and exports.

2.4.3. Nationally driven financial programmes and initiatives supporting CE-related sectors;

Increasing Ghana's domestic revenue mobilisation on the central and regional level will be required in order to provide fiscal stimuli, which boost the transition towards a CE. According to examples of local government disbursements (Wayne Shand 2019), a minuscule amount of funding is currently provided to tackle environmental management and CE-related issues. An overview of on-going CE-related financing initiatives is displayed in a spreadsheet format in Annex -Table 5.

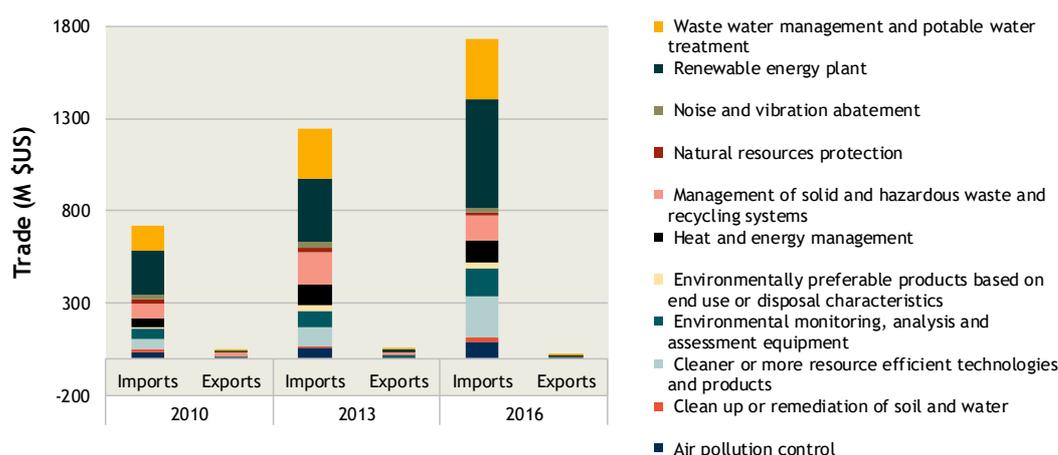
2.5. Environment on CE-related trade and investments in Ghana

2.5.1. Trade in environmental goods and services

In 2018, around 22% of Ghana's exports were going to the European Union and around 27% of the imports of Ghana originated from the European Union. In the period between 2015 and 2018, Ghana has increased its exports to the EU and decreased its imports from the EU. In 2018, Ghana accounted for approximately 0.15% of the total Extra-EU trade of the EU, more specifically for 0.14% of the extra-EU exports and 0.16% of the EU imports from outside the EU (EUROSTAT 2020). Africa accounted for 5% of the EU's imports from outside the EU in 2018, of which 2% approximately originated from Ghana. As such, Ghana is the 11th most important export partner for the EU in Africa and ranks as the 10th import partner in Africa.

So far, trade of environmental goods and services in relation to CE has not yet played a major role in Ghana-EU trade (agreements). Yet, in Ghana in the period 2010-2016, the environmental goods and services sector has increased slowly from 3% to 5% of the total trade volume. When looking at the trade balance, imports dominate trade in environmental goods and services, where renewable energy technologies, (waste) water treatment technologies and cleaner or more resource efficient technologies and products account for the biggest shares respectively.

Figure 14 Imports and exports of environmental goods and services in Ghana for the years 2010, 2013 and 2016.



Source: OECD - Trade in Environmental goods and services.

Notably, between 2009 and 2015, plastics imports in Ghana increased tremendously from 199 to 242 kilotons with exports alternating between 1 and 2 kilotons for the same period (Babayemi et al. 2019) - although these do not strictly count towards the trade balance for environmental goods and services. Given that Ghana is committed to develop its domestic recycling capacities for plastics, removing tariffs on intermediary goods and machinery from the EU on (e.g.) processing equipment (chippers, extruders) will ultimately lower the price of inputs for Ghana's businesses and support both industrial development and the country's integration into global CE value chains (European Commission 2019b). The same applies to more efficient technologies relevant in Ghana's key manufacturing sectors (e.g. aluminium smelting, food processing, and cement).

The need for efficient technologies for production of goods and end-of-life treatment is reflected by a request for expression of interest (EoI) that was launched by Ghana's Ministry of Finance in relation to a newly approved major economic transformation project financed by the World Bank. The project entails four different components, one of which being the promotion of special economic zones to attract additional foreign direct investment (Ministry of Finance Ghana 2020). This represents a valuable opportunity to engage with the Ghanaian government to discuss the integration of CE-principles into economic strategies, e.g. by supporting the uptake of industrial symbiosis, waste-to-resource approaches and resource-efficient cleaner production measures.

2.5.2. Opportunities and barriers for CE-related trade and investments

Ghana applies few formal non-tariff barriers with specific import exclusions and controls for environmental, health, public safety and security reasons and under international conventions (PwC 2018). As a signatory to the Basel Convention (see section 2.4.1 above) it strictly prohibits the import of hazardous waste (including waste from electrical and electronic equipment) and has recently started to raise an eco-levy for any (used or new) EEE imported to the Ghanaian market. A similar instrument was applied for imported plastics by imposing an environmental excise tax. Impacts of these instruments on Ghana-EU trade for used EEE and plastics are not fully understood and would deserve further scrutiny when aligning relations with regards to CE.

In regards to 'ease of doing business index', Ghana outperforms the average score of Sub-Saharan Africa, North Africa and the World. In the period from 2015-2019 Ghana's score has improved slightly from 57 in 2015 up to 59 in 2019, ranking higher than the Sub-Saharan average (The World Bank 2020). According to the World Bank's enterprise survey (2013 edition)⁸, 1.3% of the respondents mention political instability as the biggest

⁸ Data is not available for later editions.

obstacle when doing business in Ghana. This makes political instability the 8th biggest obstacle to doing business in the country.

According to the World Bank's indicator on the 'ease of getting credit', Ghana's score went down from 81 in 2013 (on a 0-100 scale) to 60 in 2019 (World Bank Group 2020). This observation is in line with the results of the enterprise survey conducted in 2007 and 2013 by the World Bank, in which the lack of access to finance was ranked as the #2 and #1 obstacle to doing business in the country. Moreover, interviewees contacted during the course of this study also mentioned that high interest rates can present a significant barriers to starting or upgrading CE-related business activities in Ghana (e.g. required for installing costly waste processing infrastructure). Notably, entrepreneurs interviewed by Trombetta et al. in 2017, mentioned MSMEs typically tend to rely on short-term funds (amounts ranging from GHS 100 to 15,000) for a period of 4 to 6 months. These are provided by different formal and informal financiers (sou-sou) at substantial interest rates, which can vary between 36% and 200% p.a. Moreover, 54% cited high interest rates to create difficulties in accessing loans, whereas 16% cited the lack of collateral as a key bottle neck and 10% found the process complicated.

According to the authors (ibid.: p. 16), "this kind of financing allows covering emergencies or basic needs, but prevents from making big investments such as purchasing modern machinery or equipment and technology to scale up their business". Hence, the above mentioned range can be seen missing middle of funding for (but not necessarily restricted to) MSMEs with relevance to CE, particularly those in the mid to late growth stages of innovation that seek long-term investments. These could be met by deploying more targeted micro-finance loans and blended finance instruments from the EU side. As the Government of Ghana hopes for the nascent manufacturing sector to broaden the basis for growth and plans to formalize the economy, this opens a plethora of CE-related trade and investment opportunities for resource-efficient agri-food processing, waste management technologies (particular e-waste, plastics, and agri-food residues), construction and concepts for affordable housing in line with the opportunities identified in section 2.3.

2.6. Awareness and capacities on CE in Ghana

2.6.1. National awareness on CE

Although the national awareness-level on CE is still in a rather premature stage, Ghanaians are progressively becoming aware of both its environmental impact and the opportunities offered by green economy elements (UNEP et al. 2015). This tendency is, among other things, reflected by the development and implementation of several environmental policies and legislations such as the National Climate Change Policy, Act 917 and the NPAP under which a circular economy framework is planned to be developed (see chapter **Error! Reference source not found.** for details). As part of its industrial policy, the country also aims to implement low carbon development measures including the regulation of overaged machinery imports and the deployment of state-of-the-art plants and machinery in industries (PAGE 2015b).

Businesses/industries awareness

Business and industry awareness of CE-related approaches in Ghana is for the most part still limited to concepts for end-of-life waste management, where they tend to focus on waste collection and transport rather than waste treatment and disposal (Keesman 2019). Being responsible for over 80% of waste services in the 254 MMDAs, the private sector is heavily involved in this area and has - in the recent years - effectively improved waste collection services in major Ghanaian cities (Keesman 2019). Waste recycling approaches in the country are mainly limited to plastic waste and e-waste, with collection and treatment taking place at the municipal level where waste collectors are usually organised in cooperatives. After collection and cleaning, the recyclable plastics are transported to one of currently 25 established plastic waste recycling companies (SMEs) in Ghana where they are processed into take-away carrier bags, refuse bags, buckets,

dustbins, shoe soles, doormats, car mats etc. According to the Ghana Plastics Manufacturers Association, there are two companies which are currently setting up plants to process plastic waste into diesel fuel (Keesman 2019).

With regards to agriculture as one of the key sectors mentioned above, awareness about circularity approaches appear to be particularly low in Ghana. According to analyses carried out by Boon und Anuga (2020), the majority of the study's respondents (63%) had never heard of the CE concept. Moreover, only 50% percent think that CE is relevant to Sub-Saharan Africa while about 56% do not believe that agricultural actors in Ghana can rely on CE approaches. Yet, many farmers tend to practice CE approaches without being aware of them. Needs to improvement were identified in the area of (nutrient) recycling, solar farming and row planting.

A noteworthy development that underlines the industries increasing awareness of waste recycling in particular is the GRIPE. The initiative was founded in November 2017 by 8 multinational companies with varied products with a proven track record of involvement in sustainability actions concerning plastics in other countries. The founding members include Coca-Cola Bottling Company of Ghana; Dow Chemical West Africa Limited; Fan Milk Ghana Limited; Guinness Ghana Breweries Limited; Nestlé Ghana Limited; PZ Cussons Ghana Limited; Unilever Ghana and Voltic (GH) Limited. Notably, the initiative is discussed ambiguously and has been met with criticism from NGOs to be of limited effectiveness. Activities of the initiative include, amongst other things, public awareness campaigns and education about plastic waste issues; placing waste containers in Accra and Tema; construction of a sorting centre in Tema; and a pilot project around plastic modified concrete (Association of Ghana Industries). While GRIPE maintains an active social media presence since as early as 2017, it appears that little high-impact results have been achieved so far and few activities are implemented regularly. Notable examples include one-day workshops and some pilot-type research activities to develop toilets from plastic waste together with the Building and Road Research Institute.

The initiatives undertaken by the Ghanaian industry are further complemented by UNDP efforts to establish a digitally enabled multi-stakeholder platform to connect key stakeholders with data and technological solutions for resource recovery, stimulate partnerships, and address waste management data and policy implementation gaps, with the ultimate goal of promoting a transition towards a CE. Through the Waste Recovery Platform, some key stakeholders were enabled to form partnerships for waste recovery in Ghana. For example, two active members, namely Voltic and Coliba (a local start-up collecting recyclables), have partnered on a new initiative called IRecycle to establish plastic collection centres in partnership with Total Ghana to enhance plastic waste recovery (UNDP 2020a). Despite facilitating the development of the National Plastic Management Policy and the NPAP, the Platform currently develops digital solutions (waste resource map, "Uber for Waste" mobile app) and has successfully funded Waste Innovation Challenges with the Netherlands Embassy and the Coca-Cola Foundation which have so far disbursed USD 310,000.

Ghanaian businesses and industry landscape are already taking shape in a variety of ways. A selection of additional CE-related enterprises and industry initiatives in Ghana is presented in the following table.

Table 2 Examples of CE related enterprises and industry initiatives in Ghana

<p>Suame Magazine</p> <p>Suame Magazine in Kumasi is the largest artisan engineering cluster in Ghana. It has a working population of over 200,000 and approximately 12,000 shop-owners, mainly engaged in vehicle repairs, sale of spare parts and different processes in metal scrap recovery. Its core activities in dismantling and processing scraps place Suame Magazine at the heart of CE related activities in Ghana.</p>
<p>Ghana Bamboo Bike Initiative</p> <p>The Ghana Bamboo Bike initiative manufactures bikes made of bamboo, which replaces the metal frame and is abundantly available in Ghana. The company further has plans to diversify into e-bikes and solar bikes. Besides providing bicycle rentals in urban and resort centres the initiative has distributed free bamboo bicycles to far-flung corners of Ghana through their partnership with US-based African Bicycle Contribution Foundation (Ghana Bamboo Bike Initiative).</p>
<p>Chaint Afrique GH Ltd</p> <p>Chaint Afrique GH Ltd is a Change, Innovation and Transformation Hub that specializes in simplifying environmental, social and governance factors for organisations, ensuring that they focus on material issues to innovate and achieve maximum returns from their sustainability investments. With their flagship initiative “EcoRewards-Africa” the company seeks to pioneer a circular economic platform that rewards positive actions across households, communities and businesses by establishing a mobile application and a messaging system that facilitates the collection of recyclables (Climate Innovation Centre Ghana).</p>
<p>Zaacoal</p> <p>Zaacoal produces clean burning and efficient charcoal from environmental waste (coconut husks and shell). The company is focused on contributing to curbing deforestation, pollution, global warming and other health issues facing Ghana and other African countries (zaacoal).</p>

Consumer awareness of CE

Despite the lack of large-scale assessments that scrutinise Ghanaians’ attitudes and knowledge on CE related practices, consumer awareness levels appear to remain rather low, with the concept of CE not being widely known to most Ghanaians. This is also reflected by poor cultural practices of waste handling, such as waste burning and indiscriminate dumping, e.g. in gutters during the rainy season or on open plots of land during the dry season (Kanhai et al. 2019; EPA 2015; Netherlands Enterprise Agency; Keesman 2019). Yet, it must be noted that some of the cultural and social practices in Ghana already cover important CE dimensions. For example, it has been a cultural practice to wrap food in leaves. While this is a common sight amongst street vendors in Ghana, traditional, biodegradable materials are becoming incrementally replaced by conventional plastic packaging in supermarkets and stores.

Over the recent years a number of awareness creation initiatives for CE-related measures were launched in Ghana. In addition to state-organised donor- and state-funded initiatives, social entrepreneurs in Ghana are also increasingly involved in awareness-raising efforts for CE. Some of the most relevant awareness initiatives are listed in the following table.

Table 3 CE awareness creation initiatives in Ghana

Coliba
Coliba is a digital plastic recycling start-up that uses an innovative approach to help homes, businesses and communities start recycling programs through an incentive-based model. The enterprise's mission is to increase Ghana's recycling rate from the current 2% to 92% by 2030 working with waste pickers across the value chain. Through the #IRECYCLE initiative the enterprise has collaborated with Voltic Ghana Limited and Total Petroleum Ghana Limited (Total) to launch a plastic collection project for proper management of plastic waste from households in Accra and the Tema metropolis.
Environment360
Environment360 aims to support the creation of circular economies by creating inclusive collection systems that empower informal sector waste workers to have an economic and environmental impact on their communities. The initiative creates community and corporate recycling programs in Ghana. It collects the waste and sells of the recyclables. It further works on awareness raising on waste recycling and sanitation issues.
EPA - Awareness and Outreach Programmes
In the past, the EPA of Ghana has implemented various awareness raising programmes in schools, which aim to sensitise school children to the principles and concepts of sustainable environmental management (EPA 2015). Moreover, EPA has carried out numerous awareness creation and education programmes through the electronic and print media at the national, regional and district levels. A key activity in this context included the Environment Channel programme on Ghana TV that airs every Tuesday night at 6:30 pm. The EPA further organised various radio and television discussion on environmental topics and other related issues (EPA 2015). Despite, the EPA also uses the celebration of International Environmental Days at regional and national levels as a cardinal vehicle to shape their thoughts and behaviours and make them environmentally responsible (EPA 2015). Most recently, the EPA has joined the organisation of digital formats on World Environment Day, June 5 2020 (Ghana News Agency 2020).
Greenway International
Greenway is an environmental protection organization driven by young people. It provides alternative solutions to single-use plastic, organises and engages in reforestation to sequester carbon dioxide. In addition, their work covers landscape restoration, climate education, awareness campaign, conducting research, outreach activities, and collaborating with key stakeholders to implement sustainable solutions (Greenway International Foundation 2018).
Plastic Punch
Plastic Punch's mission is to raise awareness on the dangers of plastics to the environment, marine life, and humans, as well as finding and providing sustainable waste management solutions for Ghana and beyond. Plastic Punch engages in a variety of activities that reduce plastic waste and educates the public about the dangers of mismanaged plastic waste and the importance of sustainable practices including plastic-free beach clean-ups up-cycling and workshops. Plastic Punch routinely organises beach clean-ups. In the past, these organized together with the EU, aiming at the collection of all kinds of waste, sorting it into plastics, metals, e-waste, glass etc., and selling to its partners such as Nelplast and rePATRN for recycling. The initiative is currently conducting a study on alternative packaging solutions to plastic in collaboration with College of International Agro-Development in France (Plastic Punch 2020).
Recycle Up! Ghana
Recycle Up! Ghana« aims to increase teenagers' awareness about adverse societal effects of pollution and to empower them to develop recycling solutions. Consequently, the organization adopts a long term, sustainable approach. Following the idea of "local problems can best be solved by local people," the initiative organizes a camp to educate young Ghanaian Senior High School Students to become "Recycle Up! Ambassadors". The training includes expert inputs about

waste and waste management, personality development as well as soft skill trainings. It stimulates creativity and entrepreneurship. Therefore, these “Recycle Up!” summer camps equip local, high potential students with means to work on own creative solutions (Center for Evaluation and Development 2016).

EU Climate Weeks and Awareness Programmes

Since 2018, the EU organises Environment and Climate Weeks to create awareness on environment and Climate issues on an annual basis. These weeks are organised in partnership with local NGOs and MESTI, mainly taking place in local communities and schools. In 2020, upcycle workshops and photo competitions were hosted together with several of the partners mentioned above. In short term, an awareness project on waste will be organised in 25 schools of Greater Accra.

Sources: see above

The EU Delegation is starting a project to create awareness in a few schools of Greater Accra on the need of re-using, recycling and reducing waste. The project’s main objective is to promote good practices for the protection of the environment through recycling, reducing and re-using waste in schools. In addition, it will combine a few actions to fight COVID-19. Besides awareness creation, the project will provide solutions to enable the schools to separate and transform their waste and will make agreements with waste management companies to collect the waste at schools.

2.6.2. National capacities on CE Education and skills gaps

In the recent decades, Ghana has achieved significant accomplishments in advancing access to education for its citizens. The country’s literacy rate increased from 71% in 2000 to 86% in 2010 and Ghanaian children now attend school in higher rates than their counterparts in many other African countries, as well as in developing nations in other world regions (Kamran et al. 2019). In 2019, the country had 10 public universities, 8 technical universities, and seven university-level professional training institutions. While the universities are usually multi-faculty institutions, advancing teaching and research in several branches of learning, the technical universities and professional institutions in Ghana are more narrowly specialized in particular disciplines. However, some of the larger public universities, such as the University of Energy and Natural Resources, the University of Education, Winneba as well as the recently formed University of Environment and Sustainable Development (UESD), also have a narrower focus relevant to CE and may form valuable partners for technical and research cooperation with European counterparts (Kamran et al. 2019).

With a view to expanding CE in Ghana, a pressing problem of Ghana’s education system is that the STEM subjects (science, technology, engineering and mathematics), on which the country relies in order to create meaningful opportunities for promoting and implementing CE approaches in the future, often lack a tangible link to the everyday life of the pupils. As a result, overall performance in these subjects is generally low, with many graduates not considering a career in the STEM fields after completing their education (Siemens Stiftung 2020). As such, promoting enrolment rates and careers in STEM fields is an important thrust area for Ghana’s CE transition and may also be considered as part of research and technical cooperation activities (cf. chapter 4.6).

Further deficits can be identified in Ghana’s educational programmes aimed to raise public awareness of the environment and its importance for the country’s economic and social life. Development and implementation of these programs fall within the responsibility of the country’s EPA. As the agency is, however, limited in terms of resources and capacity, Ghana has not yet developed a stand-alone national legislation or strategy on neither environmental education nor education for sustainable development (ESD). In practice, EE is included in the formal education system through an integrated science curriculum for Primary 1 to 6, Junior High School (1-3) and Senior High School (1-3). The respective curricula are prepared by the Ministry of

Education (MoE) through the Ghana Education Service. Environmental education, education for sustainable development and CE efforts are further complemented by environmental NGOs, with support from the EPA (Global Environmental Education Partnership Secretariat). Cooperation between EPA and MoE could be further strengthened in order to integrate CE-related aspects into primary and secondary educations.

Vocational training capacities

During the last two decades, there has been a considerable amount of national policy debate on TVET reforms in Ghana. In the period 2002-13, this has not only led to a number of policy documents relating to TVET but also to an expansion and improvement of TVET capacities in Ghana (Darvas und Palmer 2014). Operating over 200 public TVET institutes, the Ghanaian government acts as a large provider of vocational training within the country. Public TVET institutions include 45 technical training institutes under the MoE and 116 vocational institutes under the Ministry of Employment and Industrial Relations, which in turn comprise the National Vocational Training Institutes, the Integrated Community Centres for Employable Skills, the Centres for Social Welfare and the Centres for Opportunity Industrialisation. The remaining institutes are clustered under different ministries (Darvas und Palmer 2014).

Public institutional TVET providers can be found in all 10 regions of the country. With the exception of the publicly funded the Integrated Community Centres for Employable Skills and the Youth Leadership and Skills Training Centres, which are predominantly rural, they are usually located in urban areas. Overall, public TVET institutions are responsible for 7% of all basic skills training. Complementing the public TVET providers, Ghana has a wide range of private vocational training institutions including for-profit and non-profit institutes as well as NGOs (Darvas und Palmer 2014). Combined, these private institutes train about twice as many students as the public ones (13% of training capacities). The largest provider of basic skills in Ghana, however, remains the informal apprenticeship system, training more than 440,000 young people at once (80% of training capacities), representing about four informal apprentices for every apprentice enrolled in formal public and private training centres. While the informal apprenticeship is generally operational in Ghana, it severely hampers the wide-spread adoption of industry standards, codes and occupational health and safety requirements (Darvas und Palmer 2014). Hence, providing formal education in line with (CE-related) industry standards will be a key challenge for transitioning the Ghanaian economy towards more circularity (Pavlova 2019).

Streamlining the national efforts to formulate national policies on skills development across pre-tertiary and tertiary education in formal and informal sectors of the economy, the government in 2006 established a dedicated TVET coordination body, the Council for TVET (COTVET). COTVET is not only mandated to coordinate and supervise the activities of public and private TVET providers, including informal sector apprenticeships, but also for issuing reports on the state of skills development in the country. It is also advising the government on all matters relating to the management and improvement of TVET in Ghana (Darko und Löwe 2016). Among the eight objectives of COTVET is the progressive integration of greening philosophies into the TVET curricula, workplace practices and communities. To achieve this goal, the council aims to:

- (1) create awareness and promote adoption of green technology across TVET stakeholders;
- (2) develop the capacities of TVET institutions in carrying out green practices;
- (3) include green philosophies in the curriculum of TVET institutions and;
- (4) ensure a collaboration between training providers and industry in developing new green technologies (COTVET 2020)

While the explicit commitment to developing green philosophies and new green technologies provides clear opportunities for integration of CE-principles, progress in this area has so far been slow and not yet received sufficient attention to unfold impact at a larger scale. A starting point for launching CE-related TVET may

include Ghana's waste management sector, which largely operates on an informal basis has not yet been in the centre of attention of formal TVET institutions.

In the past, the Ghanaian TVET sector struggled with a lack of market relevance of the respective formal institutional and school-based vocational education and training. This is partly due to the fact that vocational education and training curricula tend to be too theoretical, well-trained teachers/trainers are rare and difficult to attract and teachers are often not encouraged to acquire the necessary practical experience through industrial training. As a result, students often still lack practical experience necessary to find paid employment after their training. Other market links such as industry liaison officers, training for the informal sector, short courses and post training support are almost absent. As most training-institutes lack the autonomy needed to respond to market changes or trends (Darvas und Palmer 2014), capacities for vocational training on CE or green economy are not yet visible in Ghana.

3 Impacts and benefits of the CE in Ghana

3.1. Existing impacts and benefits

Although the implementation of national policies and initiatives have not yet contributed to a systematic shift towards CE, they have several positive economic, environmental and social impacts. Till date, these have not been quantified in a systematic manner. The following sections provide a brief overview and summarize the main initiatives and impacts in an aggregate table below. It should be highlighted that the assessment serves as an indicative snapshot of on-going activities in the CE space in Ghana. Due to the complexity and interrelations, their impacts cannot be assessed exhaustively within the scope of this study.

3.1.1. Economic impacts and benefits

In general, economic impacts observed in Ghana include:

- Creation of new business opportunities;
- Increasing international competitiveness of some sectors and increase of exports;
- Transforming waste into more valuable products; and
- Creating revenues and mobilizing funds for innovative solutions.

3.1.2. Social impacts and benefits

In summary, social impacts achieved by CE initiatives in Ghana include:

- Improved livelihoods, particularly of informal workers who become part of the formal value chain;
- Increased gender equality;
- Increased capacities and awareness on waste management practices; and
- Better health conditions of the public as a result of safer waste management practices.

3.1.3. Environmental impacts and benefits

In summary, environmental impacts in Ghana include:

- Reduced emissions to air (especially GHG emissions);
- Improved air quality due to lower degree of open burning of waste;
- Lower influx of terrestrial waste into marine environments;
- Water/resources/energy savings in production processes; and
- Recycling of wastes instead of their disposal, thus reducing the amount of mismanaged waste.

Table 4 Existing economic, social and environmental impacts and benefits of CE-related initiatives

Initiatives	Impacts and benefits		
	Economic	Social	Environmental
Archipelago Programme (ARCHIPELAGO und EU 2020a, 2020b)	<ul style="list-style-type: none"> 140 new MSMEs set up by trainees 75 partners companies are mobilized for the skill gaps identification and involved for hosting on-the-job training 3000 direct beneficiaries that have been made aware of the opportunities of TVET 	<ul style="list-style-type: none"> 400 young women and returnees are trained and 300 young women and returnees are employed 25 TVET centres trainers are trained 5 new relevant training services are to be developed and offered by local business support organizations 	<ul style="list-style-type: none"> Contributing to the development of an inclusive Green Economy in Ghana Working with farmers to help them increase their productivity after acquiring and utilising improved inputs and new technologies
Boosting Green Employment and Enterprise Opportunities in Ghana (GrEEn) (SNV 2020)	<ul style="list-style-type: none"> At least 100 MSMEs have been incubated or accelerated to expand their business At least 1,500 decent and sustainable jobs created by MSMEs 	<ul style="list-style-type: none"> Create and strengthen local ecosystems that support youth, women and returnees (self-) employment Accelerate SMEs that offer decent and sustainable jobs to youth, women and returnees 	<ul style="list-style-type: none"> Support of SMEs that enable green and climate resilient local economies
Environmentally Sound Disposal and Recycling of E-waste in Ghana	<ul style="list-style-type: none"> Economically viable e-waste recycling business models are introduced and developed at meso-level. Kick-starting and promoting a sustainable e-waste recycling sector Set-up of pilot a financial incentive based collection system in Accra 	<ul style="list-style-type: none"> Capacity development of stakeholders in the informal recycling sector on occupational health and safety Setting up and strengthening of support networks to improve the livelihoods of Ghana's informal sector 	<ul style="list-style-type: none"> Sensitization to sustainable e-waste dismantling techniques to reduce environmental pollution Establishment of funding mechanisms for sustainable treatment of e-waste, thus avoiding environmental externalities
EPA Awareness Programmes	<ul style="list-style-type: none"> Training of over 600 primary school teachers 	<ul style="list-style-type: none"> Engaging youth actors with seminal topics and sensitising them for relevant subject matters (incl. waste management) 	<ul style="list-style-type: none"> Increasing awareness on green economy endeavours and climate change of youth actors and school teachers
EU Climate Weeks and Awareness Programmes (Ike Dzokpo 2019)	<ul style="list-style-type: none"> Strengthening of response to threats of climate change in the context of Global Warming 	<ul style="list-style-type: none"> Awareness project on waste to be organised in 25 schools of Greater Accra organised in partnership with local NGOs and MESTI, mainly taking place in local communities and schools 	<ul style="list-style-type: none"> Several upcycle and recycle workshops hosted Organized beach clean ups to reduce and avoid marine litter
E-waste Management in Ghana (E-MAGIN)	<ul style="list-style-type: none"> Strengthening of the e-waste recycling sector in Ghana through workshops, roundtables and seminars 	<ul style="list-style-type: none"> Promotion of best practices to ensure accordance to health and safety regulations at workspace; 	<ul style="list-style-type: none"> Promoting sustainable businesses and environmentally safe practices across different sectors Establishing green entrepreneurship principles

Initiatives	Impacts and benefits		
	Economic	Social	Environmental
		<ul style="list-style-type: none"> • promoting the livelihoods of Ghana's informal workforce in the e-waste sector 	
Ghana Bamboo Bike Initiative	<ul style="list-style-type: none"> • Creation of a business models that employs 30 workers, of which 20 are bike assemblers and 10 are farmers 	<ul style="list-style-type: none"> • Empowering communities through training in assembly and manufacturing of bamboo bikes • Distribution of free bamboo bicycles to far-flung corners of Ghana, thus increasing (social) mobility 	<ul style="list-style-type: none"> • Promotion of environmentally friendly modes of transportation • Use of renewable resources
Ghana Recycling Initiative by Private Enterprises (GRIPE)	<ul style="list-style-type: none"> • Participation of 8 multinational companies in the integration of sustainable waste management solutions 	<ul style="list-style-type: none"> • Creation of a waste separation and collection system for 19 schools in Tema Newtown with an ambition to cover 60 schools in surrounding municipalities by 2020 • Participation of 38,000 students 	<ul style="list-style-type: none"> • Increase plastics waste collection rates and thereby decrease plastics sent to landfill potentially polluting the environment.
Global Plastic Action Partnership (GPAP)	<ul style="list-style-type: none"> • Enable innovation and technology transfer 	<ul style="list-style-type: none"> • Promote gender equality and meaningful work • Ensure transparent governance and accountability in the transition to a circular plastics economy 	<ul style="list-style-type: none"> • Incentivize changes in material use • Build capacity in waste management and recycling • Raise awareness and changing behaviours to reduce the consumption of single-use plastics
Growing Economic Opportunities for Sustainable Development (GEOP)	<ul style="list-style-type: none"> • Local job creation, revenue mobilisation and expansion of economic activities • Promoting links between public, private and non-profit business initiatives 	<ul style="list-style-type: none"> • Setting up improved apprenticeships and accreditations for craftsmen, young women, school leavers and people with disabilities 	<ul style="list-style-type: none"> • Expansion of economic activities for citizens in an environmentally friendly manner (Christian Aid 2017; Christian Aid Global 2018)
IRecycle	<ul style="list-style-type: none"> • Creating job opportunities by establishing plastic collection centres in partnership with Total Ghana to enhance plastic waste recovery 	<ul style="list-style-type: none"> • Community support in starting recycling programs through incentive-based models • Empowerment of female waste pickers 	<ul style="list-style-type: none"> • Increase plastic collection for proper management of plastic waste from households in Accra and the Tema metropolis, avoiding mismanagement of plastic waste
SEED (SEED 2019, 2017)	<ul style="list-style-type: none"> • Organised a series of Practitioner Labs for Policy Prototyping to boost the adoption of policies that promote green and circular MSMEs • Creation of formalised jobs for plastic waste collectors • Raising productivity through better sanitary and health conditions among low-income populations 	<ul style="list-style-type: none"> • Community support in starting recycling programs through incentive-based models • Empowerment of female waste pickers • Improving health conditions of over 200 households by reducing sanitation-related diseases • Strengthening awareness about waste segregation 	<ul style="list-style-type: none"> • Recycling of 570 tonnes of plastic into 104000 pavement slabs and 40000 tiles per annum • Recycling water and sludge for usage in agriculture or landscaping

Initiatives	Impacts and benefits		
	Economic	Social	Environmental
Sustainable Livelihoods and Transparent Local Authorities (SLATLA) (Deborah Smallie Lomotey 2019)	<ul style="list-style-type: none"> Promoting economic growth and opportunities for individuals involved in the informal sector in 25 communities in the Brong Ahafo region and 15 communities in the Greater Accra region Targeted at providing livelihood and skills training in plumbing, tiling, embroidery, ICT, plastic waste management, poultry feed, mushroom, grass cutter, vegetable, and poultry farming 	<ul style="list-style-type: none"> Promoting decent work for women, women groups and engaging youth reliant on informal economic structures Improve transparency, accountability and revenue mobilization of Local Authorities 	<ul style="list-style-type: none"> Advancement of environmentally friendly livelihoods within the professions listed under the economic impacts and benefits
UNDP Waste Recovery Platform (UNDP 2020b)	<ul style="list-style-type: none"> Enabling circular economy and its coinciding economic benefits within waste management chain 	<ul style="list-style-type: none"> Connecting stakeholders and expanding information flows for more efficient collaboration and coordination Engaging citizens to become an active participant in implementing measures for reduce, reuse and recycle 	<ul style="list-style-type: none"> Improved collection of plastic waste and dissemination of proper treatment methods for municipal waste Promotion of innovative environmentally friendly technologies and projects through initiatives such as the “Waste Recovery Innovation Challenge”
WIDER UPTAKE	<ul style="list-style-type: none"> Unlock potential economic savings through the use of treated wastewater for urban agriculture purposes and the production of bio char from treated sludge 	<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> Decrease of deforestation through the replacement of wood fuel with bio char in the textile and chemical industries Water savings from usage of treated wastewater

3.2. Future impacts of CE activities in Ghana

As the Ghanaian economy moves away from a traditional linear economy towards a more circular economy (CE), this will be expected to have economic, social and environmental impacts. The following subsections present our modelling results, highlighting the direction and magnitude of potential impacts of the CE in Ghana.

3.2.1. Modelling approach and framework

The modelling of the macro-economic impacts of the CE in Ghana was carried out using Cambridge Econometrics' FRAMES model. This is an advanced input-output model, designed to enable the assessment of socioeconomic and environmental effects of energy, environment, and economy policies (for details see Annex 3). A conventional difference-to-baseline approach is followed. The CE scenario is compared against a baseline⁹ in which no explicit assumptions are made about CE activity (a 'business-as-usual' scenario, in other words), in order to compare outcomes between the two.

We have adopted an 'activities' approach (rather than a 'policies' approach) to modelling the CE scenario. This choice means that the analysis does not assess potential impacts of specific policies but instead looks directly at the links between specific changes in an economy and the direct, indirect and induced effects, without making any explicit assumptions about whether these changes are driven by policies, behavioural change or new technology.

3.2.2. Modelling inputs for the CE scenario

Circular economy narrative

Based on our research on the trends in and opportunities for CE activities in the eight case study countries, five priority sectors have been chosen to be covered in the modelling exercise. Those are the waste sector, electronics manufacturing, the plastics sector, the agri-food sector and the construction sector. It should be noted that some specific circular activities that are currently commonly mentioned within the European policy and industry context were left out as we did not consider them realistic to be implemented within the coming decade, due to a lack of industrial development or CE awareness or the fact that the impacts will only materialise on a longer timescale (e.g. building design for de-construction or modular building design).

The sectors that we have focused on are the waste sector, the plastics (packaging) sector, electronics, agriculture and construction. The waste sector is an important enabler of a (more) CE and to be effective in this waste collection rates and recycling rates need to increase. Plastic (packaging) waste is a daunting problem in most African countries, a combination of more effective plastic waste collection and the recycling of plastic waste into new plastic packaging can make an important contribution to solving this urgent problem. E-waste is another challenge in several African countries, but with proper and safe treatment practices in place it also represents an opportunity for reusing and remanufacturing, resulting in an increased supply of affordable EEE products as well as an opportunity for recycling of valuable materials present in the e-waste, when high-value CE strategies are not feasible. Agriculture is still a critical part of the economy in many African countries. In this sector, substantial potential resides in the improvement of handling, storage and distribution of food products to prevent losses and to increase the use of organic fertilizers. Lastly, construction is a booming activity in Africa, but up to now circular practices are virtually absent. Therefore, for the short term there seems to be potential for increasing the use of secondary materials in this sector, either directly or via construction products that incorporate by-products or waste materials.

⁹ The baseline is E3ME's standard projection to 2030 for the Ghanaian economy, based on official published economic and energy forecasts. See Annex 3 for more details.

Modelling assumptions

Where possible the aforementioned sectoral narratives have been translated into modelling assumptions. It should be noted that the aim of the exercise has not been to forecast the future in 2030, but to explore the impacts that more increased circularity could have by that year, were this to become a reality. To this end, we made evidence-based assumptions about the form and scale CE activities could take in Ghana by 2030 and used these as inputs into the model. These model inputs are summarised in the table below.

Table 5 Circular economy activities and corresponding modelling inputs

Category	Circular economy activity	Modelling input
Waste management	Improved waste collection rate	Increase in waste sector output
	Improved recycling of valuable materials in e-waste	Investment in recycling sector to improve health & safety standards (50% funded by industry, 50% funded through public/ODA financing)
		Exports of materials recovered from e-waste recycling
	Increased use of recycled materials in electronics production, replacing virgin metals and plastics	Shift in plastics' intermediate demand: reduced purchases from metals and plastics sectors, replaced by purchases from recycling sector
Agriculture	Prevention of food loss in agricultural supply chain through improved storage and logistics	Substitution of agricultural imports by domestic agricultural production
		Investment in storage and logistical capabilities (50% funded by industry, 50% funded through public/ODA financing)
	Increased use of organic fertilisers materials in agriculture , replacing use of mineral fertilisers	Shift in intermediate demand in agriculture: fewer purchases from chemicals, more purchases from agriculture
Plastics packaging	Increased use of recycled feedstock in plastics production, replacing virgin feedstock	Shift in plastics' intermediate demand: reduced purchases from chemicals sector, replaced by purchases from recycling sector
Construction	Increased use of recycled minerals in construction, replacing virgin minerals (glass, cement, sands, ceramics)	Shift in plastics' intermediate demand: reduced purchases from non-metallic minerals sector, replaced by purchases from recycling sector

Modelling limitations

As shown in the table, the CE activities and the related modelling assumptions focus on recycling and trade activities as well as on raw material inputs. There are two main reasons for this. First of all, due to the lack of well documented data, other activities ranking higher in the waste hierarchy, such as high-quality refurbishing (e.g. in the EEE sector), had to be neglected. Secondly, the technical construction and set up of the FRAMES model restricted the type of assumptions and inputs that could be used. For instance, in such a demand-driven framework, it is difficult to model an increase in recycling when this is not fully coupled with an increase in demand for recycled materials across sectors. As such, growing activity in the waste sector was limited to increasing waste collection rates. Furthermore, some activities are hard to represent in the modelling as the sectoral aggregation is too coarse to allow for modelling for changes in production processes within sectors. These limitations are important to take into account, when interpreting the results presented in the following sections. The impacts that circular economy

could potentially bring to the chosen sectors and countries are thus not fully covered in the modelling, and could thus differ from the modelling outcomes in reality.

3.2.3. Modelling results

The modelling results presented in this section reflect differences between the CE scenario and the baseline by 2030, rather than the net effect of economic developments occurring between 2020 and 2030. For instance, if the price level in the CE scenario is reported as -1% by 2030, this does not imply that deflation occurred in the CE scenario, but that inflation was slightly lower in this scenario than in the baseline scenario.

Economic impacts and benefits

Our modelling suggests that circular economy activities in Ghana would have a positive impact on the Ghanaian economy. By 2030, Ghana's GDP is projected to be around 1.9% higher in 2030 in the circular economy scenario compared to the baseline scenario. In other words, this suggests that the Ghanaian economy would be slightly larger as a result of increased circular economy activity than it would be in a 'business-as-usual' situation. The table below shows the CE scenario results for each of the components of GDP, as well as for the price levels. Results for the CE scenario are presented as differences from the baseline scenario by 2030, in absolute (monetary) and relative (percentage) terms.

Table 6 Macro-economic impacts of the CE scenario

Variable	Absolute difference from baseline scenario by 2030 (EUR 2019)	Relative difference from baseline scenario by 2030 (%)
GDP	+ EUR 1.9bn	+ 1.9%
Consumer	+ EUR 789m	+ 0.9%
Investment	+ EUR 331m	+ 2.3%
Exports	+ EUR 526m	+ 1.2%
Imports	- EUR 274m	- 0.6%
Inflation	-	- 0.9%

These results suggest that the positive economic impacts would be spread relatively evenly across the components of GDP: consumption, investment and the trade balance all see an improvement as a result of circular economy activity.

Some of these impacts can be attributed to the direct effect of the input assumptions in the CE scenario. The investment impact is partly driven by assumptions of increased investment in the agricultural and recycling sectors. We have also assumed a fall in imports of agricultural products, which has directly affected the trade balance to a significant degree.

However, circular economy activities would also have indirect impacts, as the effects of these activities spread through the rest of the economy. Firstly, the assumed changes to agricultural investment and imports (substituted by domestic production) would create indirect effects through the supply chain, as growth in agricultural output would create demand for intermediate goods from agriculture's suppliers, such as business services and petrochemicals. Secondly, some of the increased agricultural output would be exported, further improving the trade balance. Thirdly, consumption would also see a positive impact as a result of output growth in the relatively labour-intensive agricultural sector, which would create a relatively large impact on employment. The additional incomes from this increased employment would be recycled into consumption demand for other final goods in the economy. Similar effects would be seen to a smaller degree as a result of input assumptions in other sectors, such as the increase in output in the waste management sector (which is assumed as a means of modelling a higher waste collection rate).

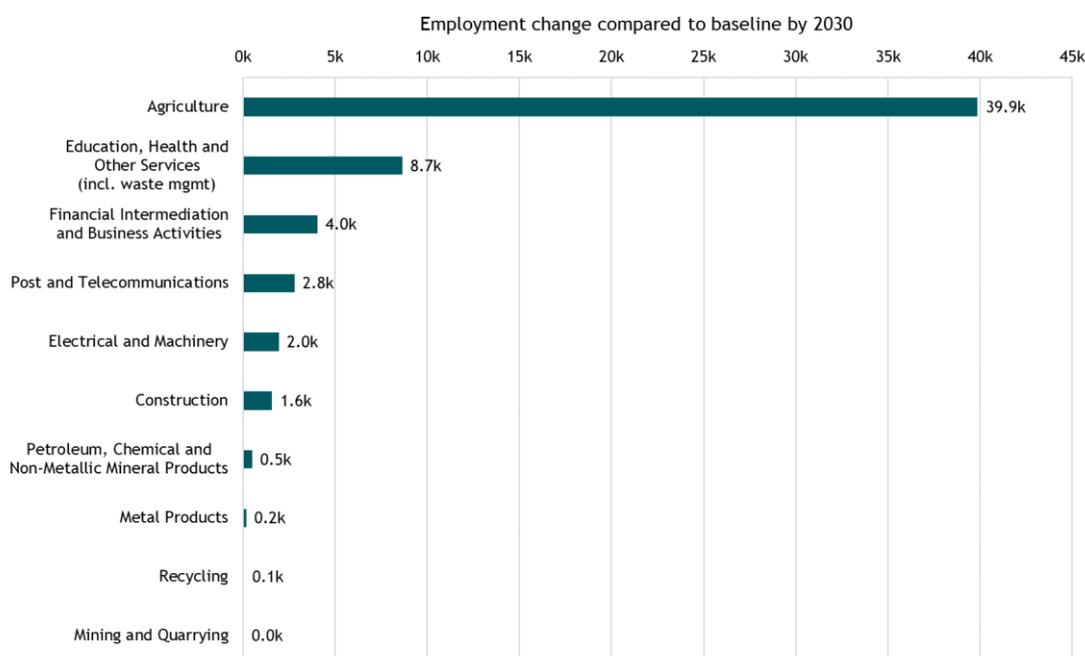
The rise in consumer expenditure drives a large part of the economic impact, as consumption is a relatively important component of GDP in Ghana. Rising consumer expenditure also has a small positive impact on imports, which softens the negative impact of the assumed reduction in agricultural imports. Our CE scenario also modelled a change in intermediate demand by the plastics, agriculture and construction sectors away from virgin materials towards recycled materials. Our results suggest that these changes in intermediate demand would have little net effect in aggregate terms. The initial reduction in intermediate demand for the petrochemical, metals and mining sectors would be replaced by rebounds in demand from higher economic activities elsewhere. Importantly, this implies that an increase in circular economy activity in Ghana, as we have defined it, would not lead to a decrease in the use of virgin materials.

When interpreting these economic results, it is important to note that not all of the projected impacts in the CE scenario would necessarily be sustained beyond 2030. On the one hand, we may expect a permanent impact from CE activities such as preventing food losses in the agricultural supply chain, or increasing waste collection rates, assuming efforts are made to maintain these practices in the future. On the other hand, some of the projected GDP impacts are a direct result of time-limited injections of funds into the economy, such as the assumed increase in investment in agriculture. We have assumed that half of this investment stimulus would be funded either through public deficits or official development assistance: if this type of funding were to be discontinued from 2030, then we would expect the GDP impact to be somewhat smaller from 2031 onwards.

Social impacts and benefits

In line with the positive economic effects, the CE in Ghana would also have positive employment effects. Overall, a net increase in employment relative to the baseline scenario of around 0.3% is projected, or approximately 61,000 additional jobs compared to the baseline (see figure below).

Figure 15 Absolute employment changes in selected sectors in CE scenario (relative to the baseline scenario)



The job creation associated with CE activity would be concentrated in specific sectors of the economy.¹⁰ As with the economic impacts, the employment impacts in the CE scenario are concentrated mainly in

¹⁰ For a detailed overview of employment impacts for all sectors see Annex 3 - Part 2.

the agricultural sector, which was the subject of the largest scenario assumptions in monetary terms (including an increase in investment and a substitution of imports by domestic production). The increase in agricultural employment accounts for around two thirds of the total employment impacts seen in the modelling results. Employment impacts would also be relatively large in the waste management sector (part of the 'Education, Health and Other Services' sector in FRAMES) and recycling (in percentage terms - see full results in Annex 3), both of which would also be directly impacted by CE activity.

Other sectors would benefit indirectly from CE activity: telecommunications and business services would see intermediate demand for their products increase, while construction and machinery would benefit from an increase in investment expenditure.

The positive economic impacts from CE activities would be sufficiently large and dispersed that producers of virgin materials (such as mining and petrochemicals), whose output we would normally expect to shrink as a result of circular economy activity, would in fact see no reduction in employment relative to the baseline scenario. These rebounds in material demands can only be captured in a full modelling framework such as in this study. Positive impacts from circular economy could have unintended consequences on the use of resources.

As explained throughout this report, the impacts of CE strategies on informal workers is very important in Ghana. The model is only capable of quantifying changes in overall employment volumes (including both formal and informal workers - see Annex 3 for more details), but not to assess the impacts of specific groups within the workforce in qualitative terms. This means that the shifts in economic activities in this assessment can affect the job types and skill sets required. Involving informal workers in the economic transformation process is thus crucial for achieving societally beneficial outcomes.

Environmental impacts and benefits

Our model suggests that the economic growth seen as a result of CE activity in Ghana would produce higher carbon emissions than in the baseline, with CO₂ emissions forecast to be 1.8% higher than baseline levels by 2030.¹¹

The power generation (as part of 'Electricity, Gas and Water') and transportation sectors would be responsible for the greatest increase in emissions. These are among the most energy- and carbon-intensive sectors in the Ghanaian economy, and would see greater intermediate demand for their services by other sectors in the economy as a result of economic growth generated by circular economy activity. Any CE scenario would be unlikely to achieve both a positive economic impact and carbon neutrality without an increase in take-up of renewable energy sources in these two sectors.

A smaller part of the increase in CO₂ emissions is attributable to the recycling and agricultural sectors, which would see their output and energy demand directly impacted by the circular economy activities we considered.

It is important to take account of some methodological limitations when interpreting these environmental impacts. Firstly, our modelling likely overestimates emissions impacts from certain CE activities, such as in agriculture, as we faced limitations in how accurately we could model these. For instance, we modelled the prevention of food losses in the agricultural supply chain as an increase in demand for domestically produced agricultural goods, to substitute for imports of those goods. This implies that preventing a given amount of food losses requires the same amount of energy as growing an equivalent amount of food. It

¹¹ These results include only emissions of CO₂ from energy use (such as burning of fossil fuels in transport). They therefore do not take account of emissions of other greenhouse gases (such as methane), nor of emissions of CO₂ from other sources (including emissions from industrial processes, from changes in land use and from landfill). This is due to a lack of reliable data for these emissions at the sectoral level required in this study. As a result, the CE scenario emissions results do not fully capture the climate impacts of CE activities, in particular in the agricultural and waste sectors.

is surely the case, however, that the former is more energy-efficient than the latter as this food was already produced in the baseline case, but no measures were taken to prevent it from being lost. Similarly, the model does not necessarily capture the effect that greater recycling rates would have on reducing landfill emissions, or the effect of reduced food losses on organic waste emissions, as our results only include emissions from energy use and process emissions.

Secondly, it should be noted that the results presented here only project the emissions impacts in Ghana, and do not attempt to project the net impact on global emissions. For instance, a substitution of imports for domestic production would, all else being equal, result in no net change in emissions, as production has simply relocated from one place to another. However, this development is represented in our results as an increase in emissions in Ghana, without taking account of any corresponding decrease in emissions outside of its borders.

Thirdly, these emissions impacts should be seen in the context of environmental goals, more broadly defined. For instance, the increase in emissions as a result of CE activities must be weighed against the abatement of other forms of pollution, such as that generated by uncollected waste. Economic statistics such as national accounts generally don't capture the broader co-benefits of increasing waste collection output in terms of human health, ecosystem services, reduced pollution, resource savings and natural capital.

4 Cooperation between the EU and Ghana

4.1. Policy dialogues and cooperation agreements

CE is slowly emerging as an important topic of policy dialogue and cooperation between Ghana and the EU. Most recently, the EU arranged a seminar on Circular Economy Opportunities in Ghana, which took place from May 7-8, 2019 in Accra. The seminar was attended by two hundred participants and brought together stakeholders from industry, government and civil society. According to the EU, the lively participation in the event “demonstrated the need to continue the discussion and to identify few key points to be addressed and actions to be implemented” (Delegation of the European Union to Ghana 2019a). The discussions largely revolved around opportunities in the e-waste, plastics and agriculture sector and provide fertile ground for further involvement by the EU. Summarizing the event, key intervention areas for the EU include:

- i. the organisation of educational events to raise awareness;
- ii. moving beyond generic events addressing CE as an overarching concept and towards discussions targeting specific value chains; and
- iii. supporting domestic organizations to implement tangible pilots which lead the transition towards a CE.

In addition, various other aspects were discussed, touching upon policy support as well as research, information and capacity development (Delegation of the European Union to Ghana 2019b).

A key issue raised several times during a subsequent SWITCH Africa Green regional event on Integrated Waste Management and CE, which took place from on 11-12 June 2019 in Ghana, was the need to better support and involve the academic world in knowledge development and input for policy-making. It was argued that universities and research centres should play a bigger role in translating and shaping new policies, as there is still a gap in communication between industry and government. In addition, the event recommended to develop a regional framework (covering multiple African states including Ghana) on integrated waste governance to regulate domestic and inter-country trade on waste and to minimise free movement of goods to enable value-creation from waste and by-products (SWITCH-Africa Green 2019).

For 2021, EU is planning to conduct a Circular Economy Mission (CEM) to Ghana, which was initially scheduled to take place in June 2020 and is now rescheduled for next year (1st or 2nd half of 2021) due to travel restrictions associated to the on-going COVID-19 pandemic. The option of holding the event back-to-back with the upcoming World Resources Forum (WRF) is still being discussed.

Another emerging exchange platform for the EU, Ghana and other EU-member states are international conferences with a central focus on CE and CE-related topics. A noteworthy example is the WRF, which was intended to be held in Accra in 2020 and has now been postponed to 2021. However, the WRF still hosted three conference calls from June 23rd to June 25th 2020. The three main topics of the conferences were primary resources, secondary resources and CE. The conference call was attended by a range of different stakeholders including EU-institutions such as European Commission DG for Environment, the Delegation of the European Union to Ghana, and Cicerone, as well as stakeholders from other EU member states (GIZ, SRI, StEP, and FOEN), private organizations such as the Ellen MacArthur Foundation and SYSTEMIQ. Ghanaian partners and chapters of African organisations were also represented by several institutions during the call, including the MESTI, the African Circular Economy Network, the Ghana Chamber of Mines, the Ghana National Cleaner Production Centre, Caritas Ghana and the NPAP (World Resources Forum 2020). The series of online meetings did not provide recommendations or conclusive

statements on the way forward, but was intended to keep the momentum on CE going until the organisation of a physical conference in 2021. Conferences can help in strengthening dialogue and establishing connections between key stakeholders in CE-related matters for the involved parties.

In terms of smaller events that align to the overall thematic focus of CE, the EU delegation has also been active in organizing beach clean-ups in Accra. These events are a diversified, somewhat informal in nature and seek to foster cooperation by facilitating connections with local NGOs. For example, a beach clean-up organized in 2017 included the participation from Hipsters of Nature, an environmental NGO and the Accra Metropolitan Assembly. It featured technical inputs on the recycling options of the collected waste by the participants (Delegation of the European Union to Ghana 2017). The EU-delegation to Ghana hosted another clean-up exercise in 2019 in Accra (Ghana Business News 2019), organised close partnership with Plastic Punch and Accra Metropolitan Assembly, reaffirming the ambitions of the EU and Ghana in tackling the challenges posed by marine litter. Recently, another beach clean-up was organised in September 2020, following the COVID-19 precautions.

Opportunities & Barriers for future CE-related policy dialogues between Ghana and the EU

CE has not yet become an integrated part of cooperation agreements and policy dialogue in the last years of intervention. Although dialogue on CE between Ghana and the EU are currently organized in piecemeal manner, the success of the seminar in 2019 clearly highlights the growing interest of Ghanaian stakeholders in this topic. This offers the opportunity to organize events on a more regular basis and, with the on-going restrictions of COVID-19 likely to continue well into 2021, in form of blended sessions (i.e. international experts joining online). Following the outcomes of the CE seminar, other seminars could be organized with sectoral foci. Notably, these may be aligned with the priority areas identified in the Team Europe Initiative: Green (and Circular) Economy, Urban Management and Climate-smart Agriculture and Biodiversity. The sectors covered under each of these areas may be aligned with the European Green Deal and the Farm to Fork Strategy, e.g. by discussing plastic/packaging, EEE, building and construction as well as agriculture. Due to the emergence of a prospective Ghanaian policy on digitization, the role of digital solutions as enablers for the transition towards a closed-loop economy can be discussed as a cross-cutting issue.

4.2. Development cooperation projects and programmes, including by the EU Member States

General orientations for development cooperation between the EU and Ghana are further provided in the National Indicative Programme (NIP) 2014 - 2020. Under the NIP the EU allocated EUR 323 million to Ghana under the following key development priorities: i) governance, decentralisation, public sector reform and accountability (EUR 75 million); ii) productive investment for agriculture in Savannah Ecological Zones (EUR 160 million); iii) employment and social protection (EUR 75 million) and iv) support to civil society (EUR 9 million) (Republic of Ghana und European Union 2014). With the period of the NIP coming to an end, current programming efforts are reflected by the Team Europe Initiative 2021-2027: Smart, green and digital recovery in Ghana. The three priority sectors include:

- i. sustainable inclusive growth;
- ii. sustainable Cities and Urban Governance; and
- iii. climate smart agriculture, agribusiness and natural resources management.

In addition to Team Europe, the EUs Joint Co-operation Strategy with Ghana reflects the agreement between the EU, Denmark, France, Germany, the Netherlands, Switzerland and the United Kingdom to support the implementation of Ghana's LTNDP. The agreement's strategic objective is to "accompany Ghana's transformation process and consolidation of its middle-income status, economic growth and democratic governance" (referred to as "Ghana beyond Aid" by the Ghanaian government). The

cooperation aims to go beyond traditional aid, choosing a more comprehensive approach including trade, competitiveness, migration and climate change. To this, the partners have committed a total financial envelope of EUR 1.25 billion for the period 2018-2021, (Delegation of the European Union to Ghana 2018a). Annex -Table 7 provides an overview of the indicative financial allocation through the current EU-Ghana Joint Programming Phase.

The EU and several EU member states are currently also funding development cooperation projects in Ghana, some of which with implications on CE¹². An overview of these projects is presented in Annex - Table 8 “CE-related projects in Ghana funded by EU and EU Member States”.

Prominent examples of CE-related projects financed by the EU include those funded under the SWITCH Africa Green initiative, e.g. “E-waste Management in Ghana: From Grave to Cradle” (E-MAGIN), as well as other endeavours, such as the “Growing Economic Opportunities for Sustainable Development” project and the “Sustainable Livelihoods and Transparent Local Authorities” (SLATLA) project:

- E-MAGIN supports implementation of the Ghanaian Hazardous and Electronic Waste Control and Management Act (Act 917) through sustainable consumption and production approaches. It targets informal MSMEs linked to e-waste, and brings them together with formal sector associations, manufacturers, wholesalers and distributors of consumer electronics, technical institutions as well as government authorities to engage in sustainable e-waste management processes. Activities include establishing a collection mechanism for e-waste, disseminating best practices through capacity building and training of trainers, providing decision support and creating awareness among the key target groups of the project.
- Supporting the collaboration between a strengthened civil society and government, the “Growing Economic Opportunities for Sustainable Development” project aims to create economic opportunities for young people and women in Ghana’s informal sector (including CE-related fields, such as waste management). The project brings together civil society and local authorities in Ellembelle District, Western Region and in Ayawaso East and Ablekuma South sub-metros in Accra Metropolitan Assembly into partnerships that promote local job creation, revenue mobilisation and expansion of economic activities in an environmentally sustainable manner (Delegation of the European Union to Ghana 2018b).
- Similarly, the project SLATLA focuses on the informal sector (including waste management) in Brong Ahafo and Greater Accra regions in Ghana by working with local authorities and promoting environmentally sustainable livelihoods and decent work for women, women groups and youth dependent on informal economies. The project seeks to improve transparency, accountability and revenue mobilization of local authorities (Delegation of the European Union to Ghana 2018c).
- The GrEEn project (Boosting Green Employment and Enterprise Opportunities in Ghana) is a joint initiative from the European Union, the Embassy of the Kingdom of the Netherlands in Ghana, the UN Capital Development Fund and SNV. It is implemented over the course of four years under the European Union Emergency Trust Fund for Africa and seeks to support the transition of local economies to green and climate resilient development.
- On February 25th 2020, the European Commission further published a call for grant applications on Promoting a Circular Economy and Local Development in Ghana. The call

¹² More details of projects can be found on the webpage of the Delegation of the EU to Ghana at https://eeas.europa.eu/delegations/ghana/area/projects_en

followed a two-step application process but results are yet to be announced (European Commission 2020b).

Opportunities & Barriers for future circular economy related development cooperation and programmes between Ghana and the EU

With the NIP for 2017-2020 reaching an end, upcoming support of the EU is being prepared and discussed with key Member States notably as part of the identification of a “Team Europe Initiative”. The EU intention is to prioritize three areas: Green Economy, Urban Management and Climate-smart Agriculture and Biodiversity. Acknowledging the potential to boost more inclusive and sustainable growth by spurring innovation, generating efficiencies, improving services, and fighting corruption, digital transformation initiatives will be included in all three pillars. A solid gender dimension will be systematically adopted on all pillars. By promoting CE as a viable development model more visibly in the Team Europe Initiative (e.g. as form of a Green Economy), Ghana and EU would provide fertile ground for implementing circular development cooperation projects.

Currently, a multitude of development cooperation projects are implemented in Ghana. Projects more directly associated with CE approaches (e.g. in the waste sector) usually encounter and include many of the same stakeholders. Yet, information on on-going activities is often not shared forthcomingly, making donor coordination and joint program implementation extremely difficult. While much attention has so far been directed towards plastic waste and e-waste (particularly from the German government), others sectors have not been supported as much in their transition towards more circularity. Particular opportunities for promoting circularity approaches via development cooperation activities exist in the sectors for agricultural residues as well as housing and construction. Further opportunities exist in the areas of digitization, tourism and urbanization, which can be considered as enabling and cross-cutting factors.

4.3. Activities by the European Investment Bank (EIB) and other European Development Finance Institutions (DFIs)

Due to the growing attractiveness of Ghana’s economy, a multitude of international financing institutions and development banks are active in Ghana. Notable examples apart from the EIB includes the German KfW, the Danish IFU, the French AFD and the Dutch FMO. Recently, many of these institutions have signalled stronger interest in supporting Ghana’s transition towards a CE, e.g. by financing projects in the country’s waste management sector. Yet, none of them has explicitly launched CE projects as such. An overview is provided in the table below.

Table 7: CE-related DFI activities in Ghana

EIB
<p>The EIB has been engaged in 35 projects in Ghana with a total financing of EUR 0.4 billion. Most projects concerned the energy or financial sector (EIB 2019). The bank for instance supported the construction of a hydroelectric power plant close to Akuse together with the French AFD (Volta River Authority). The project aimed to extend the plants operational lifespan and increase its safety as well as efficiency for the next 30 years. While AFD awarded the Ghanaian government a concessional loan facility of EUR50m in 2012, the government signed a co-financing agreement with EIB in 2018 to the amount of EUR 12.5 million. Another project, which was however terminated early aimed at modernizing an aluminium plant close to Accra (European Union 2001). One of the objectives was furthermore to expand the plant and equip the company for aluminium recycling in the future.</p>
KfW (Germany)

KfW began to support two Rural Water Supply projects began in 1994. These comprised of the rehabilitation and upgrading of 3,600 water supply facilities in seven regions in Ghana, mostly the Eastern region, Ashanti and Brong Ahafo. Another 100 wells were drilled in the Ashanti region. Besides ensuring water supply, trainings were provided for 260 mechanics in the respective areas. Equipment and tools to maintain the facilities were also provided as part of the project, which operated under the supervision of the Community Water and Sanitation Agency (KfW 2005). A third Rural water supply project started in 1999 with the construction of 512 drilled wells in 309 communities in the Eastern and Ashanti regions. The project mainly aimed to provide the rural population with access to safe water and reduce the risk of waterborne diseases. To accompany the investment in infrastructure the programme also strengthened the institutional decentralisation of rural water supply and raised the target group's awareness of appropriate water use. Furthermore, it was attempted to involve the private sector in the provision of maintenance and repair services (KfW 2012).

The Village Infrastructure Programme was largely based on a previous World Bank project and was co-financed with the KfW. A main objective of the Programme, which began in 1997 and was implemented nationwide, was to support agricultural production and increase marketing activities in the targeted village communities, in order to raise farming income. One of the measures taken was the improvement of agricultural water supply, rural transport as well as post-harvest infrastructure (KfW 2006).

In 2017, KfW initiated a financial cooperation project with EUR 20 million together with the German Federal Ministry for Economic Cooperation and Development (BMZ) and the government in Ghana. The idea behind the project was to construct e-waste collection points and help collectors purchase electronic scrap that is particularly hazardous during recycling processes for a price that is perceptibly above the market price in order to divert those fractions from unregulated recycling. At the same time, this would support formal companies disposing and recycling materials adequately using sustainable practices; without further support from KfW (and prospectively Act 917), they would not be able to compete against the informal sector. The final objective is to keep at least 200 tonnes of cables and 2,000 tonnes of plastic from the unregulated market and instead bring them to regulated recycling centres (KfW 2017).

IFU (Denmark)

IFU engaged in solid waste recycling between 2008 and 2013 by providing support of some DKK 5.4 million (about EUR 0.73 million) (Investment Fund for Developing Countries Denmark). From 2001 to 2010, IFU supported Larsen Ghana Limited, a waste treatment service provider in their collection and treatment of waste streams. This way the company was established as a partner in the government's initiative to address the problem of environmental sanitation in Ghana, particularly in the Accra Metropolitan Area. One of the operational objectives of the project was to convert waste into fertilizers and power generation (J. Stanley-Owusu Group 2020).

AFD (France)

In Ghana, the French AFD is traditionally engaged in the four focus areas: food security, safer energy, intellectual production and finally urban development and local government support. As part of the latter, AFD has been active for 10 years and aims to address the strongly increasing urban population in Ghana's cities and the negative effects of this rapid growth. To develop more sustainable cities some of the projects covered the construction and maintenance of drainage infrastructures. As a result of their activities, communities have experienced health improvements from measures taken by the AFD against poor sanitation and flooding (Agence Française de Développement 2019).

FMO (Netherlands)

The Dutch FMO supported the development of a recycling system together with the local partner Fan Milk Limited, a leading manufacturer and marketer of ice cream and yoghurt in West Africa. The launch of a sorting centre in

2017 close to Accra marked the start of this a project. One of the objectives of the project was to develop an inclusive recycling system, which will contribute towards a plastic-free environment. It was estimated that at the end of a two years and a half period, the company would be recovering an equivalent volume of 30% of all post-consumption waste that the company generates. A more recent goal is to recycle more plastic than it uses by 2022. At the same time, waste pickers should be empowered by helping them to develop skills necessary to increase both their waste recovery rates and their income. This will be further enhanced by the creation of waste pickers' cooperatives where recyclables will be sorted and then sold to recycling plants. Downstream, recyclables will be collected door-to-door in households and in markets, industries and lorry stations. The project moreover covers the technical and operational training of waste pickers in Greater Accra. As a result of the collaboration between Fan Milk and its partners including FMO, the social entrepreneurship project Pick-it was established.

To boost investments in Africa and the European Neighbourhood, the EU adopted the External Investment Plan in 2017. The plan aims at de-risking future investments and leveraging match-funding together with financial institutions. At its core, the External Investment Plan aims to i) contribute to the achievement of the UN's Sustainable Development Goals while tackling the root causes of migration; and ii) mobilise and leverage public and private investments to improve economic and social development with a particular focus on decent job creation (European Commission 2020d). Key investment windows include:

- sustainable energy and connectivity;
- MSMEs financing;
- sustainable agriculture, rural entrepreneurs and agribusiness;
- sustainable cities; and
- digital for development.

Under the External Investment Plan the EU has earmarked EUR 4.6 billion to the European Fund for Sustainable Development (EFSD), the plans key financing instrument, and seeks to leverage investments by an order of magnitude of 10 times more (i.e EUR 44 to 47 billion by 2020) (European Commission 2019a, 2020c). The EFSD blended finance operations are composed of two regional investment platforms: the Africa Investment Platform and the Neighbourhood Investment Platform. According to the latest available EFSD operational report, guarantees in Sub-Saharan Africa approved in 2019 amounted to some EUR 394 million and generated investments of EUR 2.9 billion; Notably however, the EFSD appears not to have leveraged any investments into CE-related projects in Ghana specifically. The operational report lists merely one approved project (related to energy, not CE) for Ghana in 2019 (European Commission 2019c).

Opportunities & Barriers for future CE-related DFI-activities in Ghana

Existing actions by DFIs are mostly concerned with energy and water supply as well as the construction of infrastructure, which have been important fields of activity as a starting point for further action. As a way forward however, more DFIs could take an active role in projects that prevent resources from following a linear direction into landfills but instead could be directed back into circular systems. The absence of any specific CE-related projects backed by the EFSD suggests that a wide range of opportunities remain untapped, particularly when looking at the fund's primary investment windows relevant for Ghana (agriculture, sustainable cities and digitization). Interestingly, these windows are very much in line with the core focus areas of the Team Europe Initiative and could thus be further strengthened with a focus on the priority sectors for CE. Given that no projects on CE have so far been leveraged by EFSD funding, ample opportunities remain.

Besides, second hand and near-end-of-life equipment as well as virgin plastic materials are frequently imported from the EU to Ghana, where the materials quickly become waste and a lack of necessary disposal and recycling facilities leads to alarming consequences for communities and the environment. Hence, providing financial support (e.g. in form of loans, grants or blended finance) for establishing collection and treatment infrastructure, offers

valuable opportunities for applying instruments from the EU's financing toolbox. Based on the analysis in previous chapters, the most apparent CE-related opportunities exist in utilisation of agricultural residues and recycling waste from PET bottles or HDPE water sachets.

4.4. CE-related trade and investments

In 2019, Ghana's trade with the EU amounted to roughly EUR 4.4 billion. Agricultural goods (60.6%) as well as mineral fuels, lubricants and related materials (25.8%) accounted for the majority of the country's exports to the EU. Imports from the EU to Ghana were dominated by machinery and transport (European Commission 2020f). According to the World Bank definition, Ghana's exports of environmental goods comprised primarily of: containers of any form for liquid or solid waste of iron, steel and aluminium; aluminium reservoirs, tanks, drums and similar containers for any material, while imports were dominated by electrical control and distribution boards as well as polypropylene in primary forms (PAGE 2015a).

Ghana's EPA with the EU entered into force in December 2016. It will be replaced by the regional EU-West Africa EPA once the latter enters into force. The EPA between Ghana and the EU is explicitly designed as a development-oriented free trade agreement (European Commission 2020e). Yet, the text of the EPA omits specific provisions on CE and leaves room for strengthening the proposition of CE-related goods and services (e.g. processing equipment, recycling services) in negotiations beyond the currently valid agreement (Stepping Stone Economic Partnership Agreement 2016).

Under the EPA, Ghana and the EU have agreed on a market access calendar. According to this schedule, the EU provides duty-free, quota-free access for Ghana's exports to the EU. Starting in 2020, Ghana will progressively reduce its tariffs to zero for 78% of its imports from the EU by 2029. In the future, the EU and Ghana might decide to expand the EPA to include, for example, investment and trade in services. Notably, the latest impact study on the interim EPAs between the EU, Ghana and Côte d'Ivoire refers to a very narrow set of goods and services, the ones with the closest relevance to CE being non-powdered cement (i.e. clinker - important for housing and construction, HS6 code 252310), household articles or hygienic (plastic, HS6 code 340119) as well as a number of agri-food products (AETS und Delegation of the European Union 2019). Given the increasing relevance of CE in Ghana-EU relations, future impact studies may take a closer look at other CE-related products (e.g. agri-food processing equipment, recycling technologies) in order to determine the effect of prospective EPAs on trade creation or diversion (and thus economic well-being).

Ghana has also ratified the Voluntary Partnership Agreement for the EU Forest Law Enforcement Governance and Trade Action Plan (FLECT-VPA). The FLECT-VPA ensures the export of sustainable tropical timber by committing the partners to sustainable forest governance and adherence to a verification system for the legality of timber products. Upon ratification, the country's compliance is mandatory. The VPA helps to ensure that imported timber products are legally sourced and comply with environmental standards within the timber trade (EU FLEGT Facility 2017).

Apart from interim EPA and the FLECT VPA, Ghana is further signatory of several treaties and international trade conventions, including CITES, the Montreal Protocol, and the Basel Convention on Hazardous Waste. Despite these conventions going hand in hand with import prohibitions and a rather long list of products that, prior to importation, require a permit from responsible authorities, Ghana still shows an absence of streamlined import licensing procedures (WTO 2014). The country is further lacking effective measures countering uncontrolled disposal of waste and in 2013, even announced a reduction of the Environmental Excise Tax from 15% to 10% on imports of plastics. This development was found to be inadequate to help

devising appropriate waste management schemes, especially as the import of different types of waste (at times hazardous, e.g. e-waste) has further aggravated in Ghana (Bell et al. 2019).

Opportunities & Barriers for CE-related trade and investments between Ghana and the EU

The EPA between Ghana and the EU has defined a number of core areas relevant in the nexus of trade and development cooperation. These include (European Commission 2017):

- reinforcing and upgrading the capacity of productive sectors;
- improving of the business climate;
- cooperating on financial and fiscal adjustment;
- implementing trade rules in the agreement; and
- facilitating trade and improving customs procedures.

Given the commitment of both parties to seek further economic integration, all of these core areas can be aligned with CE-related support activities. Through this, the EU can contribute to (inter alia) increasing the efficiency of the agri-food industry by reducing losses along the value chain, boosting the competitiveness of Ghanaian companies by adopting circular business models and/or streamlining the customs procedures while simultaneously strengthening import controls to prevent transboundary movements of hazardous waste.

With Ghana's ratification of the African Continental Free Trade Agreement in May 2018, the emergence of an African single market creates a host of opportunities for strengthening the transition to a CE on a national level. Free movement of (environmental) goods and services across economies can be understood as an important enabler for CE because it allows for trading by-products and key processing technologies in a more liberalised manner and facilitates the creation of transboundary value chains.

Current trade arrangements still not adequately address the rising levels of pollution in Ghana. Various waste streams are finding their ways from the EU to Ghana, where a lack of necessary disposal and recycling facilities leads to alarming consequences for communities and the environment. Action is highly needed to close loopholes in the trade arrangements and enforce higher control mechanisms of imports, especially concerning waste and e-waste. The lack of monitoring and enforcement of existing import restrictions on hazardous waste can be understood as a significant barrier to transitioning to a closed-loop economy in Ghana.

4.5. EU companies with circular economy operations in Ghana

Due to Ghana's attractiveness as an emerging market for environmental goods and services, several EU companies have become active in the country. Some of them are presented in the table below.

Table 8: Examples of EU companies active in Ghana

Closing the Loop

Closing the Loop is a circular business model for the recycling of discarded mobile phones in Ghana. The Dutch company has a mobile phone offset program, in which it strikes a deal with big governmental organizations and private companies in the Netherlands. The moment these companies purchase new mobile phones for their employees, they pay Closing the Loop to collect an equal amount of discarded mobile phones in Ghana. The precious metals in the phones add to the business model. Closing the Loop aims to expand its operations in Africa. This business model could probably be applied to other products as well (Keesman 2019).

Danone - parent company of Fan Milk

Fan Milk is one of the companies cooperating in the Pick-it project, outlined in chapter 4.1.3 and Danone is a parent company of Fan Milk. The project described in the chapter receives funds and technical expertise from the Danone Ecosystem fund.

Komptech Austria

Komptech is a supplier for machinery and mechanical systems for the treatment of solid waste and biomass, as a renewable energy source. Their business involvement was briefly alluded to in chapter 2.2.6. They supplied the mobile equipment of the plant (a rotary screening machine and a shredder) for an integrated recycling and composite plant in Accra.

Fairphone

Fairphone - a Dutch smartphone manufacturer dedicated to developing environmentally friendly and socially sustainable -cooperated with Closing the Loop in order to carry out the e-waste reduction project (Miquel 2017). They sponsor their activities in Ghana through the sales of their smart phones.

Safi Sana

Safi Sana is a Dutch holding enterprise that designs, constructs and operates waste-to-energy factories in developing countries. In 2016 the company established a factory in Ashaiman, which processes waste from the local food market and slaughterhouses as well as the output of the Communal Service Blocks in the area (Public Toilets also built by Safi Sana). The factory can currently process 9 tonnes of waste per day, which will be increased to 25 tonnes in the future. Waste is treated in a number of stages, resulting in energy, irrigation water, organic fertiliser and seedlings (safisana).

Sea2See

Spanish social enterprise that seeks to provide a new source of income for fishermen (both in Ghana and beyond) by making them collectors of abandoned plastic fishnets. The objective Sea2See is to raise awareness about marine litter, thus reducing the environmental impact of fishing industries and rewarding collectors financially for their contribution. The company involves hundreds of fishermen and aims at collecting 500 kg of marine plastic per day.

Opportunities & Barriers for future CE-related operations of EU companies in Ghana

The EU can capitalise on the number and diversity of EU companies already active in Ghana during the upcoming CEM. To facilitate the creation of Ghana-EU business partnerships, a series of online matchmaking events may be organised beforehand. Ideally, this would be differentiated by sectors (focusing on agriculture, housing/construction, plastics and potentially e-waste) in order to provide room for Ghanaian and EU companies to present their business models and formulate expectations towards potential partners. Potential partnerships could be further facilitated and supported via instruments from the EU's financing toolbox (EFSD). This stands to benefit from stronger involvement of the European Enterprise Network (EEN) and the European Business Organization (EBO) Ghana.

4.6. Research and technical cooperation

Currently there are no bilateral agreements on joint research initiatives or other framework documents that govern research and technical cooperation between the EU and Ghana. However, Ghana has been a participant of several cooperation initiatives, which were implemented in order to establish and nurture the scientific exchange network between European and African researchers. For example, both the

Kwame Nkrumah University of Science and Technology in Kumasi and Zoom Domestic Waste Services Limited were on the consortium of the Integrated Waste Management in Western Africa project from 2010 to 2012. Currently the Council for Scientific and Industrial Research is involved in the long-term EU-AU Research and Innovation Partnership for Food and Nutrition Security and Sustainable Agriculture. Ghana is also an active member of the AfriAlliance (Kraemer-Mbula et al. 2018). However, very few projects have a particular thematic focus on CE-related research.

Notably, several Ghanaian research institutes have actively collaborated with EU partners in a number of EU funded research programmes, including Horizon 2020. As the EU's main strategic research, development and innovation (RDI) cooperation initiative, Horizon 2020 also forms the basis for many smaller complementary RDI projects. Accordingly, there are a handful of CE-related projects supported by Horizon 2020, which feature Ghanaian research institutes. Most recently, the H2020 Green Deal Call also provided opportunities for Ghanaian research partners to submit a proposal for “Accelerating the green transition and energy access Partnership with Africa” (European Commission 2020a). A list of current Horizon 2020 projects with relevance for CE that feature an involvement of Ghanaian partner is presented in the table below.

Table 9: Samples of current Ghana-EU research projects

Project ID	Description	Involved Ghanaian partner	Budget (EUR)	Time Frame
SustInAfrica	Sustainable intensification of food production through resilient farming systems in West & North Africa (CORDIS 2020b)	University of Cape Coast University for Development Studies Dexafrika Limited Farmerline Ltd	7,000,000	2020 - 2025
WIDER UPTAKE	The overall objective of WIDER UPTAKE is to co-develop a roadmap for widespread implementation of water smart symbiotic solutions for wastewater reuse and resource recovery, based on the principles of circular economy (CORDIS 2020a).	Council for Scientific and Industrial Research	12,000,000	2020 - 2024
DiBiCoo	The overall objective of the project is to support the European biogas industry by preparing markets for the export of sustainable biogas technologies from Europe to developing and emerging countries. One of the target countries is Ghana. (CORDIS 2019)	Institute for Sustainable Energy and Environmental Solutions	3,000,000	2019 - 2022

Source: see above

Some of the former EU funded research programmes, such as the 6th and 7th Framework Programme also featured some CE-related cooperative research activities. In terms of total participations, Ghana ranked

second amongst all sub-Saharan countries in projects under the 7th Framework Programme (Kraemer-Mbula et al. 2018). The Council for Scientific and Industrial Research Ghana also collaborated in the BIOWASTE4SP project. The project addressed the development of sustainable biotechnological processes for converting biodegradable, industrial, municipal and animal waste into value added products such as biogas, organic based fertilizers, food or even healthcare and nutraceutical products. It started in 2012 and ended after a three-year period (CORDIS 2012c). Another notable initiative includes the GRATITUDE project, which looked at post-harvest losses of cassava and yam farms and researched different pathways that would lead to a reduction in overall losses. This also included utilisation of wastes to produce value added goods for human consumption, such as snack foods and for animal feed. The Caltech Ventures Ltd., the St. Baasa Ghana Limited and the Social Development and Improvement Agency LBG were all involved as participants in the project (CORDIS 2012a). A similar project was carried out in the fisheries sector in 2012, called the SECUREFISH-project. Ghana was represented by the Council for Scientific and Industrial Research and contributed by providing a fish product value chain case study (CORDIS 2012b).

Two recent developments in the Ghanaian research landscape deserve particular attention. For one, the Ministry of Education, intends to establish an entirely new University at Trom-Somanya in the Yilo Krobo Municipality in the Eastern Region under the name of the University of Environment and Sustainable Development. The academic body will specialize in conducting research and disseminating knowledge in the sciences, agro-business and the built environment (University of Environmental and Sustainable Development - Ghana 2017). The university admitted a first batch of students in September 2020 (Ghanaian Times 2020). Secondly, the MESTI recently established the Ghana Innovation Research and Commercialisation Centre (GIRC-Centre) in September 2020 to drive and grow research and support the transportation of innovation & research into industry (MESTI 2019). The Centre is designed as a coordinating agency ensuring that national research addresses national priorities, are well coordinated and properly disseminated. Moreover, it will be linked to National Research Fund into which at least 1% of Ghana's GDP will be channelled. The corresponding National Research Fund Bill 2019 is currently in the draft stage and has been submitted to the parliament for further consideration (Gakpo 2020).

Opportunities & Barriers for future CE-related research cooperation between Ghana and the EU

Ghanaian academic institutions' involvement and research on CE-related issues has so far been limited to improving downstream processes - the majority of CE-related literature from Ghanaian researchers narrowly focuses on waste management issues, especially on plastics and e-waste. This highlights opportunity to facilitate further interactions between European and Ghanaian research institutes on circular design and innovative consumption models.

Stronger involvement from academia was an essential recommendation emerging from a SWITCH Africa Green regional event on waste management, which took place on June 11-12 in Accra, Ghana. In addition, stakeholders also mentioned the limited interaction between academic institution and stakeholders from the private sector poses a major barrier for the take-up of solutions from RI on CE in Ghana. Given that the Team Europe Initiative highlights higher education and academia as potential beneficiaries for investment and support from EU side, a host of opportunities opens up - particularly when looking at the newly formed UESD. Notably, the UESD focuses on important sectors, such as agri-food and building/construction that play a major role in the European Green Deal and the Farm to Fork Strategy.

Recently, the government of Ghana initiated the creation of a new entity, the GIRC-Centre under the purview of MESTI. The purpose of the Centre is to drive Ghana's socio-economic development by centrally harmonising research findings and translating them into marketable innovations. Proposed strategic technology areas include agriculture and food processing, sanitation, waste management and recycling as well as oil and gas. Thus far, MESTI has held consultations with South Africa's Technology Innovation Agency, the German GIZ, MakeIT, University of Rostock as well as representatives of France, Israel and Switzerland. Since the Centre is supposed to become

operational in 2020, this presents an excellent opportunity for the EU to engage in the discussions and evaluate the alignment the Centre's research agendas in line with the EU's RDI initiatives.

5 Recommendations

5.1. General recommendations

5.1.1. Policy dialogue and cooperation

So far, policy dialogue on CE between Ghana and the EU has not been conducted in a systematic manner. While the EU successfully organised a CE seminar in May 2019 and latched onto the SWITCH Africa Green regional event on integrated solid waste management in June later that year, CE-specific events are yet to be organised on a more institutionalised basis. It is therefore recommended to develop a framework for CE-specific policy dialogue between both parties under the aegis of the EU's delegation to Ghana together with relevant directorates (e.g. ENV, RTD, TRADE) as well as Ghanaian counterparts (e.g. MESTI, MoE). Building on the analysis of this report, the framework may cover priority areas in Ghana as identified above (housing and construction, agriculture and waste management amongst other enabling factors) as well as important thrust areas of the European Green Deal, the Farm to Fork Strategy and the new Circular Economy Action Plan. Ideally, the framework would also tie into already existing forms of dialogue - e.g. as part of the Heads of Mission, the Heads of Cooperation as well as other (sub-)working groups - to address common challenges. The key elements of such a framework may include:

- identification of dialogue avenues and key stakeholders for public events/conferences and internal working groups;
- definition of key priority areas, starting with the framing of CE in relation to high-level policies and legislative initiatives in Ghana (e.g. Long-Term National Development Plan, Ghana Beyond Aid, National Plastic Policy, National Climate Change Policy) and the EU (Green Deal, Circular Economy Action Plan, Farm to Fork Strategy);
- selection of priority sectors, covering high-impact segments with large importance for Ghana's economy and resource consumption, e.g. agriculture, housing and construction, waste management;
- identification of cross-cutting issues, addressing research and innovation, education and awareness, financing and investment as well as a host of enabling factors (urbanization, digitization, tourism); and
- development of a draft implementation schedule for topical exchanges, starting with high-level strategies and overarching topics (see second point above) and followed by sectoral sessions and cross-cutting issues (see point three and four above).

Further aspects to be considered as part of a framework for policy dialogue is the integration of CE-principles into the period beyond the currently binding NIP. The on-going development of "Team Europe Initiative" suggests that key areas for Ghana-EU collaboration in the years 2021-2027 could be i) Sustainable inclusive growth, ii) Sustainable Cities and iii) Urban Governance and Climate smart agriculture, agribusiness and natural resources management. All of these aspects can be examined in the context of CE, e.g. by discussing the role of Ghana-EU partnership in developing a joint understanding of the CE (relevant also for Ghana's National Plastic Policy), exchanging on the role of CE for housing and construction (focus may be on vernacular architecture in densely populated areas) and debating the role of regenerative agriculture for mitigation and adaptation purposes or the reduction of food losses along the agri-food value chain.

In order to increase the visibility of Ghana-EU cooperation in promoting a transition to CE amongst both parties, we further recommend to launch a series of sectoral and thematic seminars, which can be attended by the general public. In order to generate public attention, the series of seminars can be announced during the CEM to Ghana, which is scheduled to take place in 2021 (cf. chapter 4.1). Building

on the outcomes of the CEM (and the development of travel restrictions associated with COVID-19), the seminars (and possibly the CEM itself) can be held as blended online/offline sessions in order to deepen partnerships initiated during the Mission and keep the momentum beyond its implementation. In this context, stronger involvement of the focal points by EEN and EBO in Ghana is highly recommended as they may be used as vehicles for institutionalizing sectoral dialogues on CE.

Another important opportunity for the EU to publicly engage in the realm of CE is the WRF, which is scheduled to take place in 2021. Notably, the outcomes of an online stakeholder consultation on CE in preparation to the upcoming WRF 2021 was organised on 26th June 2020. It captured four important areas for further dialogue in Ghana, namely: the need to promote circular design across Ghanaian manufacturing industries; the need for social inclusivity when transitioning towards a CE in Ghana; the role and need for empowerment of consumers as important actors for change; and finally, Ghanaian ownership of CE-related approaches, ideally by driving change in a bottom-up process. We recommend strongly creating synergies with the organisation of the WRF, e.g. by organizing the CEM back-to-back with WRF (as initially planned in 2020) and/or engaging in joint promotional activities.

5.1.2. Development cooperation

The NIP for 2014-2020 did not feature a particular focus on CE-related aspects. Given that joint programming efforts for the period beyond 2020 are currently underway, it is advisable to strengthen the position of CE as a central pillar for EU-Ghana relations as part of the “Team Europe Initiative” currently being developed. Currently, the “Team Europe Initiative” refers to CE as one part of various sub-sectors. This is understandable because it is a cross-cutting model of development. However, we recommend to further strengthen the integration of CE by focusing on “sustainable, circular growth” as a means to curb Ghana’s rising resource consumption.

Since circular approaches bear clear economic rationales, we recommend that programming efforts make clear links to Ghana’s national development plans, e.g. under the country’s vision for “Ghana Beyond Aid” (cf. chapter 4.2). More specifically, the transition towards a CE can make valuable contributions to the achievement of Goal 1 in building an industrialised, inclusive and resilient economy. This presents an excellent opportunity for further strengthening the position of CE in bilateral development cooperation plans. Moreover, the results of the modelling exercise presented in Chapter 3.2 clearly highlight the potential for green recovery in addressing the fiscal impacts of the COVID-19 pandemic through circular economy approaches, resulting in +1.9% additional GDP growth by 2030. We strongly recommend highlighting these potentials in the next programming agreement.

In terms of prospective grants for development cooperation projects, the EU may consider launching thematic calls for grant proposals that link CE-related approaches. For example, the most recent call on Circular Economy and Local Development (EuropeAid/168109/DD/ACT/GH) addressed priority (i) of the NIP 2017-2020 on governance, decentralisation, public sector reform by mandating cooperation with MMDAs. In the same spirit, prospective calls could focus on the new priorities set by the Team Europe Initiative, e.g. the development of regenerative agriculture or digital solution for a circular urban development. The latter option could be inspired by a recent EU call launched for Georgia, which seeks to support the role of CSOs in advocating sustainable development (EuropeAid/167370/DD/ACT/).

With regards to priority sectors and focus areas for development cooperation, the analysis presented in this report (cf. 2.4 and 4.2) suggests that there is an unoccupied space for CE-related donor-funded projects efforts in agriculture, housing and construction and digitization. None of these areas have yet received much attention from the EU and/or its European partners. Instead, most CE projects tend to focus on plastic waste and e-waste but (yet) fail to expand to the framing of CE to other sectors. This provides significant opportunities for the EU to seize first-mover advantages.

With regards to plastic waste and e-waste management, we strongly recommend that Ghana-EU programming efforts focus on issues that demonstrate additionality of activities. Given that the Government of Ghana seeks to promote circularity for plastics, EU involvement could offer added-value from the development of the Plastics Strategy and is thus strongly recommended. In this context, we further recommend to support donor coordination activities via existing initiatives in the CE space, most notably the UNDP Waste Recovery Platform and the Ghana NPAP.

In case European partners supporting Ghana's development (Denmark, France, Germany, the Netherlands, Switzerland and the UK) decide to launch a follow-up Joint Cooperation Strategy beyond the latest one from 2018, we recommend to include a stronger emphasis on CE-related aspects across all of the identified priority sectors. So far, these include (i) competitiveness and support to the private sector; (ii) energy generation and supply (incl. renewable energy); (iii) agriculture, agribusiness and rural development; (iv) decentralisation; (v) public finance management; and (vi) accountability and anti-corruption. The sectors (i), (iii) and to some extent (iv) are inherently compatible with the rationale of CE and could benefit from a CE framing. Since various European partners have already launched CE initiatives in Ghana, donor coordination would greatly benefit from defining joint focus areas in order to avoid duplication and enable the creation of complementarity and synergies.

5.1.3. Activities by the EIB and other DFIs

Providing access to finance for MSMEs remains one of the most pressing economic challenges in Ghana. Often, domestic financing institutions provide long-term loans at high interest rates, making it prohibitive for Ghanaians to expand and scale their business. Existing financing instruments, especially by banks and micro-finance institutions, show a mismatch between how businesses in Ghana operate and design of the finance instruments. The innovative, disruptive and non-traditional character of circular businesses further aggravates this challenge, especially because awareness on CE - both amongst industry and domestic financing institutions - is low (cf. chapter 2.6). To address this issue, we recommend that the EU engages in dialogue with and raises awareness amongst Ghana's domestic financing institutions to discuss the economic benefits of circular business models.

In addition, via EIB and the EFSD together with DFIs from EU member states and Ghanaian banks (e.g. the Agricultural Development Bank), the EU can deploy dedicated financing mechanisms that integrate circularity principles and enable access to finance for MSMEs in the CE space. Based on the investment windows of the EFSD and the analysis brought forth in 2.5, we suggest exploring agreements with micro-finance institutions that are able to provide loans in the range of GHS 100 to GHS 15,000 for a period of 4 to 6 months to address the "missing middle" in the Ghanaian banking sector. In this context, it is recommended to tie the provision of loans via micro-financing institutions to MSMEs' expansion of CE-related activities.

The EIB's recently published Circular Economy Guide is an excellent tool and can form the basis for initiating dialogue with other DFIs and domestic banks. In addition, it can be used for supporting due diligence processes and identifying potential investees, which currently have difficulties in accessing finance via other institutions. As a first step, we recommend adapting the CE guide to the Ghanaian context (taking into account the socio-economic conditions) and conducting a market screening. The identification of potential investees can be further facilitated via policy dialogue and dedicated awareness raising events.

In case the EIB decides to leverage guarantees from/with the Agriculture Development Bank in Ghana, CE funding could be primarily provided to agri-food businesses, which apply regenerative farming methods that have been handed down from previous generations and are compatible with the local ecosystems (e.g. by making use of permaculture or cascading approaches). In addition, value-extraction from

agricultural by-products from cultivation palm oil, plantain, cocoa, shea-nut, coffee or rubber present valuable untapped opportunities that are also in line with the EU's Farm to Fork strategy (cf. 2.3.1). Since Ghana's agricultural output is still mainly driven (and limited) by manual labour, more efficient and wide-spread use of (organic) fertilizers, pesticides and mechanisation should also be promoted alongside traditional small-scale methods.

Another promising area for leveraging guarantees is Ghana's construction sector, specifically to address the vacuum of affordable housing (cf. 2.3.2). Here, larger long-term loans can be provided through the EFSD to promote the application of abandoned African vernacular architecture and hybrid techniques which utilizes stones, timber, bamboo, rattan and other locally sourced materials. We recommend that the EU engages in dialogue with the Ministry of Finance (MoF) to discuss the linkages and complementarity between EFSD and the National Housing and Mortgage Finance Scheme established in 2019 (MoF - Ghana 2019), as well as potential CE investment lines. Another notable stakeholder is the Republic Bank Ghana, which runs a "Buy, Build & Own A Home" (BHOME) scheme designed for low-income applicants who can only purchase their own home by acquiring land and developing it over time (Republic Bank 2020).

Other relevant DFIs from EU member states with potential interest to promote CE in Ghana include the Dutch FMO and the German KfW. Both banks have successfully funded CE-related initiatives in the past or are involved in on-going financing projects (cf. chapter 4.3). In this context, it may be of particular interest to fund the establishment of collection and handover centres for e-waste (KfW) as well as state-of-the-art and locally adapted waste management infrastructure for plastic waste processing (e.g. from PET bottles, HDPE water sachets) or agricultural residues (biogas, composting). Additional widows for investment relate to sustainable cities and digitalisation. Here, further analyses would be required to fill future pipelines. In any case, the almost complete absence of guarantees approved for Ghana (and the lack of connection to CE therein) clearly highlights the need for additional CE-specific investments facilitated by EFSD.

5.1.4. Trade and business-to-business relations

So far, CE has not played a major role in the trade relations between Ghana and the EU. By agreeing on a market access calendar, Ghana and the EU will become more economically integrated. In this context, we recommend to launch a review of the economic impacts of the EPA from a CE-angle, e.g. by asking evaluators to specifically look at goods and services with particular importance for closing material loops and increasing resource efficiency in Ghana and the EU respectively. Examples include agri-food processing equipment, recycling technologies or secondary raw materials (e.g. recycled polymers). An extensive list of prioritised goods and services may be drawn up in close coordination between DG ENV and DG TRADE. This would help determine the effect of prospective trade relation and market access agreements for circular goods and services.

Furthermore, upcoming trade arrangements may encompass explicit references to the transition towards a CE. Most likely, such reference would be included in provisions referring to environmental protection, customs duties, transparency and information exchange. While the direct impacts of such explicit references would need evaluation (see recommendation above), it may strengthen the role of CE as an essential component of bilateral trade relations. Since Ghana is currently facing challenges in enforcing and regulating the transboundary movements of hazardous waste in line with the Basel Convention, a particular emphasis should be put on the improvement of customs procedures and import/export controls on both sides (i.e. in both Ghana and the EU).

Besides considering the integration of CE-principles into trade agreements and stepping up efforts to comply with the Basel Convention, we recommend exploring the role of the Voluntary Partnership Agreement for the EU Forest Law Enforcement Governance and Trade Action Plan (FLEGT-VPA) in

facilitating a transition to a circular bio-economy. This may be achieved by including specific provisions for applying closed-loop, regenerative practices in tropical forestry in line with EU legislation.

Going beyond bilateral negotiations and moving towards harmonisation of technical specifications of goods and services, we suggest for the EU to examine the role of standards and enter closer relations with the GSA. Due to the absence of standards on secondary raw materials, it is advised that the EU supports the development of standards that facilitates trade in polymers from secondary raw materials in collaboration with GSA. More specifically, such standards could include, for example, quality standards for recycled polymers and performance standards for products made of recycled plastics as well as the application requirements in relation to various products (e.g. foodstuffs).

Due to the importance of improving the e-waste management system in Ghana, EU standards of particular relevance include EN 50625 family for collection, logistics and treatment of WEEE as well as EN 50614 on preparation for reuse of WEEE and EN 50574 on cooling and freezing requirements. Exploring the adaptation of these standards is particularly interesting for two reasons. Firstly, Ghana is currently in the process of developing its domestic collection and recycling infrastructure for e-waste aided by donor-funded technical cooperation projects from the EU (E-MAGIN) and Germany (KfW, GIZ). Secondly, the EU is currently discussing the development of an implementing act to complement the WEEE Directive 2012/19/EC. If the act is passed, it could make the application of the above mentioned e-waste standards mandatory and may even allow for counting EU-generated e-waste, which is treated outside of the EU, to count towards member states' recovery targets. Notably, the development of e-waste standards in Ghana should take into account and complement the Technical Guidelines issued by EPA. Given that these guidelines are not fully implemented yet, it is recommended to support the development and operation of a system for conformity verification assessment.

In the longer term, the EU may consider deploying a European expert for standardisation in Ghana. Such a project would draw from international experience implemented in India (currently operating under the name of SESEI - seconded standardisation expert in India), which seeks to promote the use, adaptation and harmonisation of European EN/CENELEC standards.

In order to facilitate business-to-business relations between Ghanaian and EU businesses, we furthermore recommend organising an online matchmaking series in the run-up to the EU CEM to Ghana. Ideally, the online sessions would be organised for specific thematic focus areas (e.g. agriculture, housing and construction, waste management, digitization) and would involve actors identified in this report as well as projects already active in the CE realm in Ghana. Moreover, stronger involvement of European business associations, such as the EEN and the EBO Ghana, is strongly advised.

5.1.5. Education, research, development and innovation

In Ghana, environmental and circularity issues have so far received little attention in the context of primary/secondary education and technical vocational training (TVET). This provides ample opportunities for the EU to support Ghanaian stakeholders in integrating CE principles into existing curricula. Hence, it is advisable to promote collaboration between the EU institutions and Ghana's Council for Technical and Vocational Education and Training to anchor circularity in national training curricula for artisans. Another concrete option presents itself in developing CE skilling programmes for all levels of management together with the Ministry of Roads and Highways' inter-ministerial training centre at Koforidua in the Eastern Region to support a transition towards CE in public infrastructure development. Despite, promoting enrolment rates and careers in STEM fields is an important thrust area for Ghana's CE transition and may also be considered as part of joint research and technical cooperation activities.

Moreover, to address the lack of skilled labour, green jobs programmes can support skills development especially in the areas of services, sustainable housing and construction (e.g. to alleviate the acute lack

of formally educated artisans), sustainable agriculture and waste management (cf. chapter 2.3). Such programmes will help to orientate traditional and professional skills towards circularity and would help bring the large informal sector into the more formal economy. In addition, in times of COVID-19 and beyond, they can be reinforced by seizing the benefits of digital solutions and distance learning to maximise impact and outreach. A relevant EU-financed reference is the CIRCular Economy through Integrated LEarning in VET: CIRCLE (project reference: 2019-1-LT01-KA202-060517) running from 2019-2021 under ERASMUS+. Learnings from the project could be adapted and transferred to the Ghanaian context in line with prospective green job programmes.

In order to boost research, development and innovation, stakeholders have repeatedly emphasised that it is essential to promote the involvement of Ghanaian research institutions in the CE-space. In addition, facilitating the translation of research findings into actionable projects and marketable products/services, linking Ghanaian academic institutions and private sector representatives is key. Both aspects - the general involvement of academia as well as academia-business relations - could receive stronger support from EU-side, e.g. by encouraging Ghanaian industries to participate in calls from EU RDI programmes (most notably Horizon Europe) and supporting higher education institutions in promoting standardisation and policy work.

A notable opportunity in this context is related to the use of locally available low-cost materials, reversible building design and secondary raw materials. While the application of such measures appears highly beneficial from a CE-perspective, Ghana's construction industry continues to operate in a highly linear manner and has not yet seized any of the innovation potentials in this area. This nexus would need further investigation and thus represents an avenue for Ghana-EU RDI cooperation.

Given that the Team Europe Initiative highlights higher education and academia as potential beneficiaries for investment and support from EU side, a host of opportunities opens up. More specifically, we recommend to promote partnerships between EU research institutes and the newly formed UESD. Notably, the UESD focuses on important sectors, such as agri-food and building/ construction that play a major role in the European Green Deal and the Farm to Fork Strategy. In the same spirit, it is recommended to collaborate with the newly established GIRC-Centre. Being a governmental agency under the aegis of MESTI, the GIRC Centre could become a crucial partner in programming future joint RDI initiatives between Ghana and the EU. While CE appears not to be a research priority of the GIRC Centre yet, its statutory mission holds great promises for speeding up the development innovative production, consumption and treatment technologies, which promote the transition to CE in Ghana.

5.2. Sectoral recommendations

Findings	Recommendations
Agriculture	
<p>Agriculture remains one of Ghana’s key economic sectors and therefore offers valuable opportunities for propelling the country towards a circular future. Most notably, due to the scale at which farming takes place, there is significant value creation potential in utilising agricultural residues from most important crops cultivated in Ghana, i.e. cassava, cocoa, yam, oil palm, maize, peanut (ground nut), plantain, rice and sorghum. Today, large parts of these by-products remain unutilised and are disposed of in a linear fashion.</p>	<ul style="list-style-type: none"> • The EU could facilitate knowledge and technology transfer and support Ghana in adopting technologies for biogas generation and compost production. • In line with chapter 5.1.2, we recommend highlighting the importance of utilising agricultural by-products in on-going programming efforts of the Team Europe Initiative.
<p>In Ghana, there is a large diversity of traditional farming methods. Traditionally, such approaches are inherently compatible with the mind-set of CE because they cascade nutrients, improve soil quality and rely on organic fertilisers and pesticides. While the existence of traditional skills and knowledge demonstrates that CE is not a new concept, the core challenge will be to scale these practices while increasing the output of the Ghanaian agri-economy.</p>	<ul style="list-style-type: none"> • Ghana and the EU would immensely benefit from initiating mutual exchange on the scalability of traditional CE-like farming practices. At the same time, these can be combined with innovative, high-tech approaches that are enabled by digital solutions. • Taking into account the recommendations on policy dialogue and cooperation in chapter 5.1.1 as well as the provisions of the EU’s Farm to Fork Strategy on “promoting the global transition”, we recommend to initiate a dialogue on a potential Ghana-EU Green Partnership for sustainable food systems.
<p>Lack of capital and high cost of transporting products are by far the biggest constraints to operating an agricultural-input retail business in Ghana. Moreover, agriculture has been largely overlooked as a recipient of micro-finance and is particularly affected by difficulties in accessing finance.</p>	<ul style="list-style-type: none"> • We recommend supporting smallholders and SMEs that seek to expand their business and operate in line with CE-principles in accessing finance via EFSD. A viable cooperation partner for EU institutions is the Agriculture Development Bank in Ghana, e.g. by collaboratively developing a CE-focused credit line based on the EU’s guide for CE financing together with the EIB and EFSD.
Housing and construction	
<p>Ghana’s housing and construction sector still operates on a linear logic and is expanding the built environment at an accelerating rate; yet, the sector continues to lack affordable housing options for the bottom of the pyramid, in part due to rising costs of construction materials (foremost cement).</p>	<ul style="list-style-type: none"> • To tackle the increasing need for materials and mitigate the adverse social effects of urbanisation, the EU may support the Ghanaian government in exploring the value-added of using locally available and sustainably sourced low-cost materials, following principles of vernacular architecture and promoting circular designs that allow for material recovery at the end of a building’s life.

Findings	Recommendations
	<ul style="list-style-type: none"> Similar to agriculture, Ghana’s housing and construction sector would stand to benefit from CE-focused investments from the EFSF. This would open a host of opportunities to reducing construction costs and promote affordable housing.
<p>In Ghana, public bodies are responsible for commissioning a large number of buildings and public infrastructure. Thus, the transition to CE could be further accelerated by supporting the Ghanaian government in launching a green public procurement (GPP) policy. GPP is a relatively novel area in Ghana and has not received much attention yet.</p>	<ul style="list-style-type: none"> While GPP generally addresses environmental issues, the EU’s circular procurement brochure may serve as a basis for integration CE-practices in Ghana. We recommend supporting the Ghanaian government in adapting these guidelines and/or developing guidelines on their own to ultimately launch a GPP policy. Typical examples for circular procurement in the housing and construction sector include life-time costing (e.g. including electricity) for selection of the most economically advantageous tenders (MEAT), the use of recycled structural elements (concrete, steel, aluminium) as well as circular interior design elements, which adhere to minimum standards (recyclability, recycled content). In this context, the EU may also consider assisting the Ghanaian government in updating the Ghana Building Code GS 1207, which (for now) primarily focuses on energy efficiency and overarching sustainability requirements. In addition, supporting the Ghana Standards Authority in developing new standards for construction and renovation could increase the lifetime of buildings, reduce costs (beneficial to affordable housing) and minimise demolition waste.
<p>Currently, the Ghana Building Code GS1207 regulates construction in terms of site development and land use, planning and management practices. While some stipulations also integrate sustainability requirements, they mainly pertain to energy efficiency and traditional environment, health and safety measures.</p>	<ul style="list-style-type: none"> The housing and construction sector is characterised by high material throughput that flows in a linear fashion and create large amounts of demolition waste. By prolonging the lifecycle of buildings, promoting reversibility and deconstruction, obsolescence rates can be reduced and resource savings can be maximised. To address this issue, it is recommended to promote the development of new standards for housing, construction and renovation and/or the adaptation of the Ghana Building Code (GS1207) to emphasise reversible building design, the use of long-lasting construction components and the utilization of demolition waste.

Findings	Recommendations
<p>Urban areas in Ghana tend to suffer from chronically congested streets. In this context, digitization can be seen as an important enabler for the transition to a circular urban environment.</p>	<ul style="list-style-type: none"> • Through technical cooperation projects, the EU can support the Ghanaian government in reforming urban planning processes, implement shared mobility concepts and expand public transport systems. • Notably, the inefficient administration of the Ghana Railway Corporation has led to considerable delays in connecting the Accra-Kumasi-Takoradi corridor and may be receptive to EU support. We recommend exploring avenues further down this line.
<p>Waste management</p>	
<p>The Government of Ghana has embarked on a journey to develop a CE framework and a comprehensive plastic waste policy that seeks to take into account the life-cycle impacts of different types of materials, more sustainable alternatives, technologies suitable for processing different types of waste and requirements concerning sorting and cleaning, etc.</p>	<ul style="list-style-type: none"> • We strongly advise EU support to the development of the CE framework and plastic policy in Ghana. Most efficiently, this can be facilitated through existing networks and initiatives, first and foremost the NPAP and the UNDP Waste Recovery Platform. Here, the EU can provide guidance based drawing from experiences of the European Plastics Strategy in a Circular Economy.
<p>There is an absence of standards on secondary raw materials that facilitate intra- and extra-country trade of recyclates.</p>	<ul style="list-style-type: none"> • The EU can initiate standardisation initiatives for recycled materials. More specifically, such standards could include, for example, quality standards for recycled polymers and performance standards for products made of recycled plastics as well as the application requirements in relation to various products (e.g. foodstuffs). Another important area for standardisation is e-waste. • In the long-term, the EU could second a standardisation expert to Ghana, promoting stronger harmonisation between both economies.

Findings	Recommendations
<p>Given that the large parts of Ghana’s waste management sector is occupied by informal collectors and recyclers applying low-tech processes, there is an urgent need to upgrade and integrate them into formal structures that adhere to environment, health and safety standards.</p>	<ul style="list-style-type: none"> • To this end, the EU can offer support in developing public-private partnerships (PPPs) in the waste management sector, e.g. by mobilising EFSD finance and offering technical support for their development. Such PPPs should not just support companies that have the capacity, knowledge and business models to recycle waste products into secondary raw materials, but should also provide funding to integrate the informal sector into formal value chains. • Due to the government’s limited financial resources, a viable support mechanism for expanding Ghana’s waste management infrastructure is to provide preferential access to land through a programme of guarantee arrangements in collaboration with MMDAs. A notable example, which successfully aided the deployment of state-of-the-art waste management infrastructure is Zoomlion’s IRECOP which was enabled by provision of free land through the Ghanaian government. • The development of digital solutions for integrating and formalizing the informal economy into formal value chains should be further explored, e.g. by developing waste apps that map out decentralized collection networks run by the informal economy.
<p>With regards to e-waste, the Old Fadama Scrapyard (Agbogbloshie) receives much attention, mainly due the prevalent practice of openly burning cables. As a consequence, development cooperation activities have so far focused on reducing the number of cable burnings. Slowly but steadily, actions are being taken to curb the mismanagement of other polluting fractions.</p>	<ul style="list-style-type: none"> • Due to the multitude of donor-driven initiatives in the Ghanaian e-waste sector, we recommend targeting specific gaps in the existing system and seek high complementarity with on-going projects. For instance, the resource-energy nexus has received comparatively little attention. Here, the EU could support and fund projects that contribute to effective management of solar panels and batteries at the end-of-life (particularly in rural areas).

6 Conclusions

Ghana is amongst the most politically stable and economically developed countries in West Africa. Yet, its flourishing economy is still based on a linear take-make-dispose model. Fortunately, the government of Ghana has acknowledged its dependence on natural assets and, since the 1990s, has adopted a wide range of environmental policies and legislations, which seek to conserve natural capital and phase out environmental externalities. Among others, this includes ambitious regulations addressing the country's growing amounts of plastic waste and e-waste. While some progress has been achieved, the transition towards truly circular models is still in early stages.

6.1. Circular economy trends in Ghana

Ghana's resource extraction and domestic material consumption have almost doubled in the past two decades. The largest part of extraction and consumption relates to biomass-type resources, thus highlighting opportunities for transitioning towards a circular bio-economy. The share of biomass in total domestic material consumption remained virtually constant in the past, whereas the share of non-metallic minerals in overall consumption grew. Overall, Ghana is responsible for 3% of the total domestic material consumption in Africa and is thus the 8th largest consumer in the continent. The largest part of the overall growth in domestic material consumption in Ghana can be attributed to population growth - its population grew by 51% between 2000 and 2017.

Agriculture, housing and construction and waste management represent important sectors for Ghana's transition to a circular economy (CE). From a policy point of view, the waste management sector has received relatively much attention in the recent past - especially when looking at e-waste and (to a somewhat lesser extent) plastic waste. In comparison, both agriculture as well as housing and construction have not been blessed with similar attention and thus offer a multitude of opportunities for advancing CE practices. Exploiting these opportunities will ultimately depend the collaboration between a wide range of stakeholders as well as the sensitization of Ghana's population - including both consumers and industry - for sustainable consumption and production. In addition, technology and knowledge transfer between Ghana and the EU will be crucial for achieving the country's long-term development goals and move beyond aid.

6.2. Trade and investments in the circular economy in Ghana

Ghana's exports are mainly driven by gold, oil and agricultural products. Trade of CE-relevant environmental goods and services does not yet play a major role in Ghana-EU trade (agreements), with EU imports to Ghana dominating over exports from Ghana to the EU. The most coveted goods imported from EU to Ghana include renewable energy technologies, (waste) water treatment technologies and cleaner or more resource efficient technologies and products. While Ghana is characterized by a comparatively favourable investment environment compared to other (West) African countries, barriers in accessing finance severely hamper the ease of doing business the country. Research suggests that prohibitively high interest rates for small- to medium-sized loans (varying between 36% and 200% p.a. for a loaning period of 4 to 6 months) and the absence of viable long-term alternatives discourage Ghanaian entrepreneurs from expanding their business operations, especially when being in the mid to late growth stages of innovation or operating at the cusp of scaling up. Here, further action for CE-related activities are required.

6.3. Existing awareness and capacities on circular economy

Although Ghanaians are progressively becoming aware of negative environmental impacts from human activities, national awareness on CE as a development concept is still limited. In industry, the concept is mainly associated with improved end-of-life management practices. Amongst consumers, poor practices of waste handling (e.g. open burning and indiscriminate dumping) reflect low levels of awareness on CE-related issues. Yet, there are some cultural and social practices in Ghana that already follow CE-elements, e.g. wrapping food in leaves. Being a common sight amongst street vendors in Ghana, these biodegradable materials become increasingly replaced by conventional single-use alternatives. CE principles do not play a major role in Ghana's higher and secondary education landscape. A similar situation is observed with regards to the ecosystem for technical and vocational education and training (TVET) where environmental sectors and, more specifically, CE-relevant job profiles are not common yet.

6.4. Existing and future economic, environmental and social impacts and benefits

The implementation of national policies and initiatives related to CE have several positive economic, environmental and social impacts and benefits. These include:

- creation of new business and employment opportunities, increasing international competitiveness of some sectors and increase of exports, transforming waste into more valuable products and creating revenues and mobilizing funds for innovative solutions;
- improved livelihoods, particularly of informal workers who become part of the formal value chain, increased gender equality, stronger capacities and awareness on waste management practices and better health conditions of the public as a result of safer waste management practices; and
- reduced emissions to air (especially GHG emissions), improved air quality due to lower degree of open burning of waste, lower influx of terrestrial waste into marine environments, water/resources/energy savings in production processes and reducing the amount of mismanaged waste.

The forward-looking assessment, where a macro-economic model was used to estimate the impact of a (limited) set of circular economy measures in the identified priority sectors agri-food, plastics, construction, EEE products and E-waste and general waste, prognoses that the circular measures could lead to an increase in economic activity and create additional jobs by 2030.

- **Economic benefits:**
 - A 1.9% increase of GDP (+€1.9 bn) compared to business as usual;
 - An improvement of the trade balance, through a reduction in imports worth € 274 m;
 - Food loss reduction across the agricultural value chain and associated investments are the largest driver of the impacts found in our modelling assessment.
- **Social benefits:**
 - 61,000 additional jobs would be created compared to business as usual, which is equivalent to an increase of 0.3%;
 - If done in the right way, increased activities in waste collection and recycling could strengthen the economic position of (informal) waste workers, and attention for capacity building and training can ensure that these people will benefit from the CE transition as well.
 - The largest employment increases are found to occur in agriculture, education, health and other services (incl. waste management), financial intermediation and business activities as well as post and telecommunication.

Overall, these findings show that implementing CE measures can bring substantial benefits to Ghana's economy. This illustrates that CE could be one of the cornerstones of the country's economic diversification and green growth strategies in the future.

6.5. Mapping of CE-related cooperation activities between the EU and Ghana

CE is slowly emerging as an important topic of policy dialogue and cooperation between Ghana and the EU but has not yet become institutionalized. Dialogue events can be conducted on a more systematic basis and may be supported by an accompanying framework addressing sector-specific issues in line with prominent EU policies, such as the Green Deal, the Farm to Fork Strategy and the Circular Economy Action Plan, as well as its Ghanaian counterparts. While the EU and EU Members States increasingly drive CE-related cooperation projects, there is a marked absence of EU financial guarantees leveraged by EFSD. Similarly, CE-related trade and business-to-business relations as well as research and cooperation activities between EU and Ghana can be further strengthened and would benefit from a systematic alignment towards CE focus sectors (agriculture, housing and, to more limited extent, waste).

6.6. Sector-specific conclusions

6.6.1. Agriculture

Agriculture is one of the key sectors in Ghana and is critical to the economy and in supporting the livelihoods of a significant size of the population. It is also a major contributor to foreign exchange earnings of Ghana; export of non-traditional agricultural commodities increased from about GHS 962 million in 2014 to GHS 1,901 million in 2016. Due to the sector's economic importance, subsidies for fertilizers, pesticides and seedlings to farmers are provided via the Ministry of Food and Agriculture and the Ghana Cocoa Board. Ghana has potential to increase agricultural yields by increasing the use of organic fertilisers, biodynamic farming or permaculture. Many of these techniques are in line with traditional farming approaches in Ghana. They have been applied by Ghanaian farmers for decades and they can complement modern approaches to reduce impacts on the natural environment.

Besides, lack of capital and significant cost of transporting products represent the biggest constraints to operating an agricultural business in Ghana. Commercial financing instruments (domestic bank loans or equity as well as cooperative and microfinance institutions) play almost no role in providing start-up or operational capital. Thus, enabling access of financial support to economically less privileged members of society is currently not achieved and remains a pressing issue for agri-businesses in Ghana.

6.6.2. Housing and construction

The construction sector is one of the biggest in Ghana, contributing significantly to GDP growth and employment, especially amongst the youth - it is estimated that the sector employs about 320,000 people and approximately 2% of young people. With a growing economy in need of new infrastructure and a housing deficit of over 100,000 housing units per year, the sector is posed to grow rapidly. Notably, this will aggravate the existing skills gap as the complexity of the built environment increases. To reduce its housing and infrastructure deficit without a corresponding increase in resource demand, Ghana will need to explore large scale initiatives and certification of abandoned African vernacular architecture. Such approaches make use of hybrid techniques, utilizing stones, timber, bamboo, rattan and other locally and sustainably sourced low-cost materials. Moreover, new standards for housing construction and renovation should ensure that buildings last long to reduce demolition cycles and the generation of waste.

6.6.3. Waste

In recent years, waste management has gained increasing attention in Ghana. This holds particularly true for two specific waste streams, namely plastic waste and e-waste. With regards to plastics, the Government of Ghana joined the Global Plastic Action Partnership by announcing the initiation of the

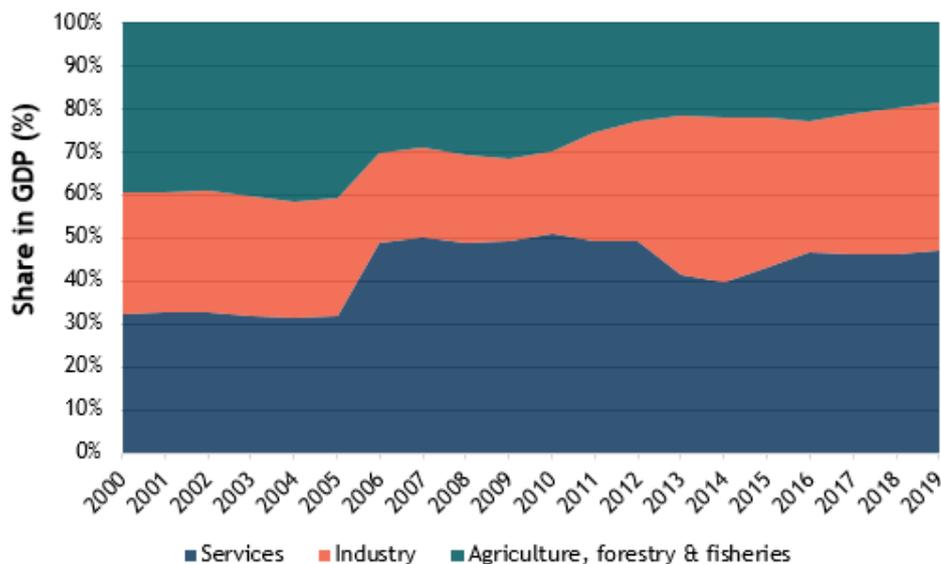
Ghana NPAP under which a National Plastic Policy is being developed. In regards to e-waste, the government introduced the Hazardous and Electronic Waste Control and Management Act 917 and the Hazardous, Electronic and other Wastes (Classification), Control and Management Regulations (LI 2250) in 2016, thus embracing the principle of EPR. In comparison, management of organic and agricultural waste has received relatively little attention yet holds a multitude of opportunities to be explored.

6.6.4. Enabling factors

Despite these key sectors (agriculture, housing and construction and waste), tourism, urbanization and digitization should be considered as important enabling factors for the CE transition in Ghana. Tourism has experienced continuous growth over the past few years and, due to the importance in the fast moving consumer goods segment, can create a market pull away from single-use products towards recyclable and biodegradable products. Urbanization can help to alleviate pressures from the natural environment resulting from urban sprawl, e.g. by expanding public transport infrastructure and promoting shared mobility concepts. Lastly, digitization is an important cross-cutting issue that can accelerate the CE transition across all areas mentioned above.

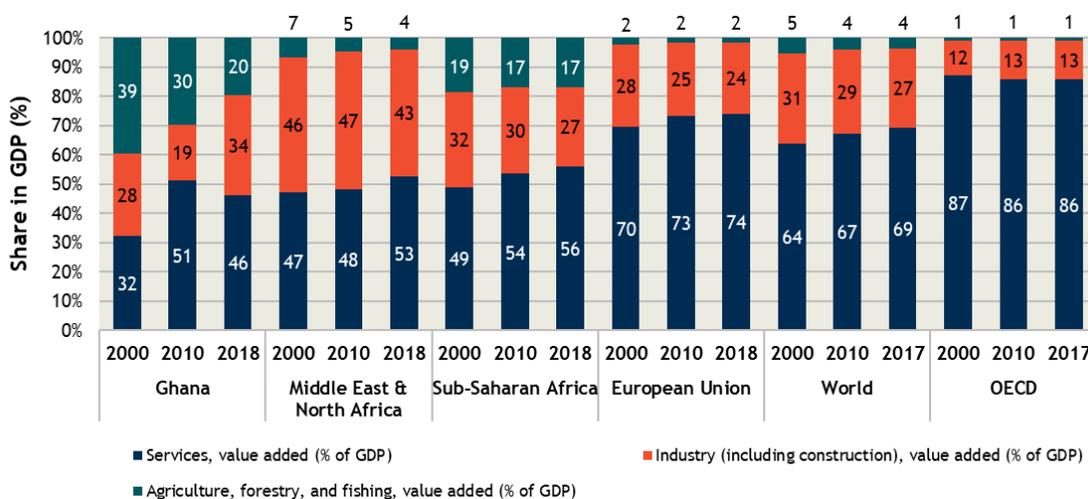
Annex 1 Figures

Annex - Figure 1 Contribution of the primary sector, industry and services to Ghana's economy



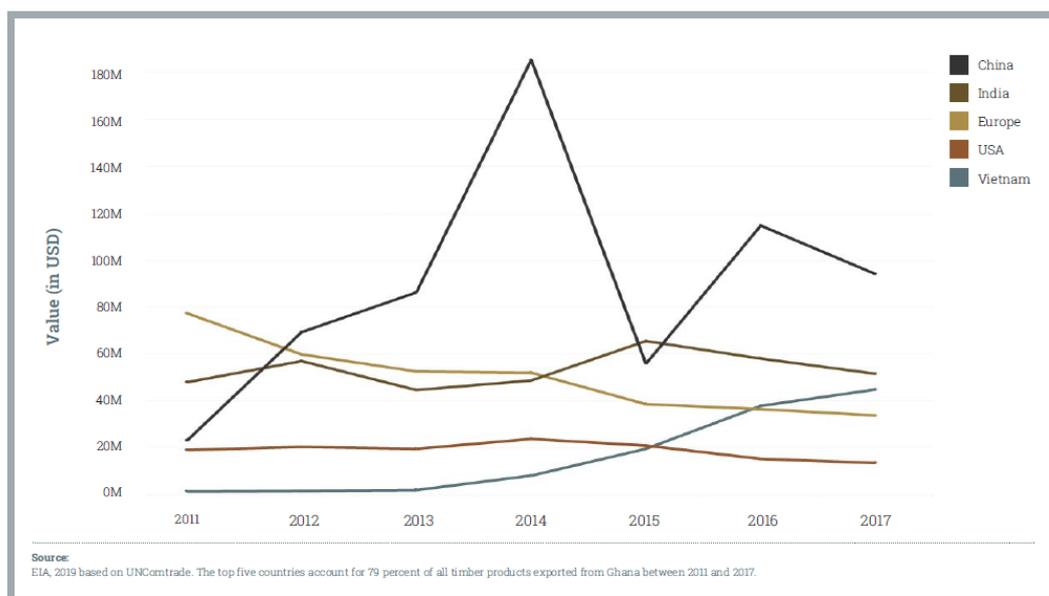
Source: (The World Bank 2019)

Annex - Figure 2 Comparison economic structure of Ghana with regional averages



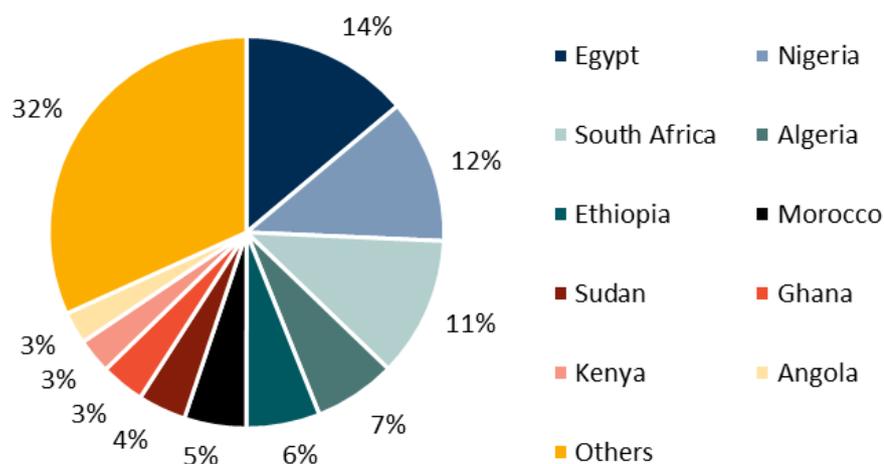
Source: (The World Bank 2019)

Annex - Figure 3 Top 5 Ghanaian timber partners



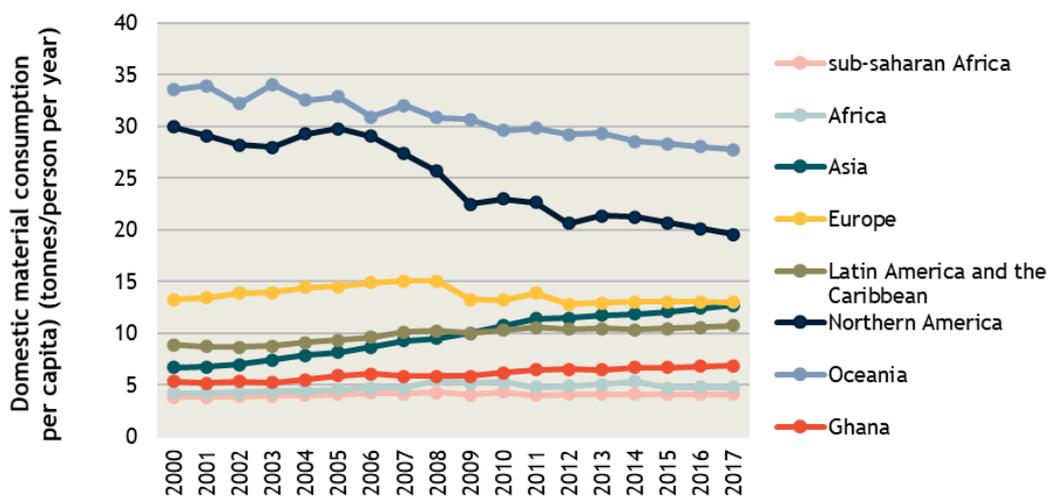
Source: (Environmental investigation agency 2019)

Annex - Figure 4 Share of Ghana and other African countries in total domestic material consumption Africa



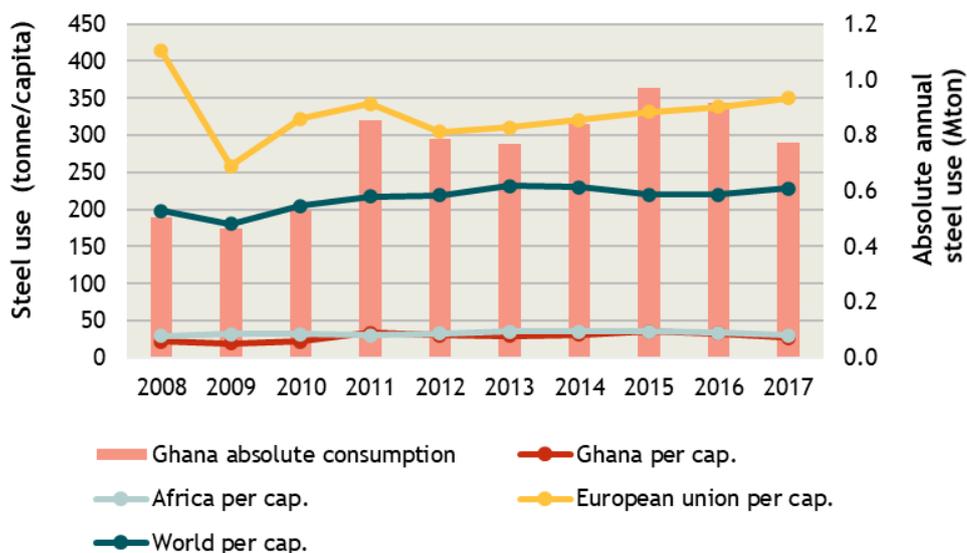
Source: (UN Department of Economic and Social Affairs - Statistics Division 2020)

Annex - Figure 5 Material consumption per capita in Ghana compared to regional averages



Source: (UN Department of Economic and Social Affairs - Statistics Division 2020)

Annex - Figure 6 Consumption of finished steel products per capita in Ghana compared to regional averages.



Source: (World Steel Association, 2019b)

Annex 2 Tables

Annex - Table 1: List of interviewees

Name	Institution
Mr Jürgen Meinel	City Waste Recycling
Mr Reinhardt Smit	Closing the Loop
Mr Prince Agbata	Coliba Ghana
Mrs Letitia Nyabaa	Ghana National Cleaner Production Centre
Mr Oliver Boachie	Ministry of Environment, Science, Technology and Innovation Special Advisor
Mr Richmond Kennedy Quarcoo	Plastic Punch
Mr Roberto Schiliro, Ms Susana Martins	European Delegation to Ghana

Annex - Table 2: Private sector organisations active in Ghana's waste sector

Name	Activities
Alliance Waste (Jospong Group)	Active in collection of household, commercial and industrial waste and disposal at approved waste disposal sites.
Ashanti Waste and Environmental Services (Jospong Group)	Integrated waste management company; operates as a subsidiary of Zoomlion for the Ashanti region.
Atlantic Recycling	Active in collection, repair/refurbishment and recycling of e-waste, including consumer electronics, mobile phones, transmitters, computers, tablets and laptops; engaged in B2B collection, repair, refurbishment and marketing of e-waste from businesses, household and landfills and illegal dumpsites.
Blancomet	Collection and recycling of end-of-life materials on behalf of consumers and institutional disposers; dealing with different types of municipal solid waste (MSW), such as carton, paper, organic waste, e-waste and plastics.
City Waste Recycling	Recycles a wide range of waste, including e-waste, batteries, sawdust and plastics; sources materials from local industries and waste collectors in the city of Ho; produces plastic pellets and biogas (compost); exports recycled e-waste components (e.g. printed circuit boards, shredded copper from cables, refrigerant gases).

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Closing the Loop	Operates a mobile phone offsetting program for governmental organizations and private companies (mainly in developed markets); institutions that purchase new mobile phones for their employees pay an offsetting fee to Closing the Loop to collect an equal amount of discarded mobile phones in Ghana; subsequently, the phones are being exported and recycled in the EU.
Environment360 (NGO) and Evolve Recycling (for profit)	Creates community and corporate recycling programs in Ghana (mainly for plastics, but also e-waste to some degree); collects waste and sells recyclables; runs awareness raising programs on waste recycling and sanitation issues.
Ghana Recycling Initiative by Private Enterprises (GRIPE)	Industry coalition of eight major manufacturing companies under the Association of Ghana Industries; operates a pilot of a five-seater sanitary facility in Kumasi built from plastic modified concrete.
IRECOP (Jospong Group)	Operates a Material Recovery Facility (MRF); sorts and separates different types of waste and produces recycled products, including compost.
J. Stanley-Owusu @ Company (JSO)	Offers recycling services for different types of waste, including glass, paper and metals; active in management of municipal solid waste recycling sites, management of hazardous waste and landfilling operations
Jekora Ventures	Active in household waste collection, management and recycling in and around Accra; recycling of organics and plastics, compost production.
Netplast	Recycling plastics into stone-like pavement blocks for road construction; according to Netplast, all types of plastics can be utilized and recycled
rePATRN	Active in recycling and upcycling of PET bottles
Safi Sana	Collects faecal and organic waste from urban slums (toilets, food markets, industries and slaughterhouses); waste is treated in a digester to create organic fertilizer, irrigation water and biogas
Skyfox Services	Agri-business, water, renewable energy, sanitation and solid waste; active beyond Ghana (e.g. Burkina Fasso, Sierra Leone and Guinea)
Toahouse Company	Construction of affordable housing using plastic waste (e.g. bottles); exports recycled intermediate products from plastic waste (e.g. PET flakes)

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Universal Plastic Products and Recycling (UPPR) (Jospong Group)	Plastics recycling company (part of the Jospong group); operating plants across the ten regions of Ghana
Venital	Active in waste management and sanitation in Western Ghana
Waste Landfills Co (Jospong Group)	Engaging in waste disposal, treatment and related services, including plastics recycling
Winsbeaver Company	Provides environmental services, such as in plastic waste collection
Zoomlion Ghana (Jospong Group)	Ghana's largest waste management company, also active in five other African countries. Waste collection, public cleansing, e-waste, composting, recycling, liquid waste, etc.

Sources: (Keesman 2019)

Annex - Table 3: Overview of Ghanaian policies and regulations with relevance to CE

Name	Year	Relevance to CE
Local Government Act (Act 462)	1993	Defines the structure and responsibilities of local governments Municipal Metropolitan District Assemblies (MMDAs) in Ghana; decentralizes and delegates responsibilities for waste management to MMDAs; defines that MMDAs shall have waste management departments.
EPA Act 490	1994	Establishment of the EPA of Ghana under the aegis of the Ministry of Environment, Science and Technology (MESTI).
Customs and Excise (Duties and Other Taxes) Act (Act 512)	1996	Introduces an Environmental Excise Tax on plastic and plastic products (on polythene bags and other plastic packaging materials).
Ghana Landfill Guidelines	2002	Issued by the EPA; specifies the responsibilities and requirements for site selection, landfill operations, licensing and monitoring between EPA, landfill operators and MMDAs.
National Environmental Sanitation Policy (ESP)	2010	Regulates the management of solid and liquid waste, industrial and hazardous wastes, storm water drainage, environmental and hygiene education, vectors of disease, and disposal of the deceased; stipulates that a major portion of environmental sanitation services should be carried out by the private sector through contracts, franchises, concessions and other agreements.
National Environmental Sanitation Strategy and Action Plan (NESSAP)	2010	Specifies strategies and action plans to guide the implementation of the Environmental Sanitation Policy by MMDAs; supplemented by a Strategic Environmental Sanitation Investment Plan (SESIP) for 2010-2015.
Renewable Energy Act (Act 832)	2011	Promotes the expansion and use of renewable energy by setting a regulatory framework that attracts investments; defines feed-in-tariff, purchase power agreements, renewable purchase obligations, open access to transmission lines and establishes a renewable energy fund.
Ghana National Climate Change Policy	2013	Aims at effective adaptation to the changing climate in Ghana, takes into account social development and mitigation measures; policy measures refer to the need for sustainable landfills with

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		proper methane extraction and the need to increase recycling and divert from landfill.
Oxo-biodegradable directive for plastics	2015	Stipulates that all plastic products should include an oxo-biodegradable component to allow for composting; stipulates that all plastics produced in Ghana should be above 20 micron.
Hazardous and Electronic Waste Control and Management Act 917	2016	Regulates the management of hazardous waste and e-waste on the basis of EPR; establishes an eco-levy on new and used equipment (US\$ 0.15 - 15 per control and product, depending on the type) which is paid upon import and pooled in a central fund.
Hazardous, Electronic and other Wastes (Classification), Control and Management Regulations (LI 2250)	2016	Gives effect to Act 917; regulates classification, control and management of waste, establishes a mechanism for listing of waste management activities that do not need official waste management permits, prescribes requirements for the establishment of take-back systems, and outlines general duties of waste generators, transporters and waste managers, amongst other things; includes a waste catalogue and a list of hazardous waste types.
Technical Guidelines on Environmentally Sound E-Waste Management for Collectors, Collection Centres, Transporters, Treatment Facilities and Final Disposal in Ghana	2018	Issued by the EPA and mandatory in compliance with Act 917 and LI 2250; regulate every undertaking operating in the field of collection, storage, transport, treatment and final disposal of e-waste in Ghana.

Source: Government of Ghana

Annex - Table 4: Selected standards and code in Ghana

Name of standard	Sector	Purpose
Ghana Building Code GS 1207	Housing	Sets regulations safeguarding construction, site development and land use, energy efficiency and sustainability, fire and smoke protection measures, planning, management and practices under construction and requirements for plumbing and electrical systems.
Technical Guidelines on Environmentally Sound E-Waste Management for Collectors, Collection Centres, Transporters, Treatment Facilities and Final Disposal	E-Waste	Regulates an effective instrument to support e-waste recyclers to improve depollution activities and implement health and safety measures on-site and serve as an environmental benchmark for small scale collectors, buy back centres and transporters that are engaged in the e-waste business.
The Ghana Green Label Scheme (GGLS)	Agriculture	<p>The Ghana Green Label Scheme ensures farmers (both smallholders and large scale) farmers undertake their activities in a safe and environmentally sustainable manner.</p> <p>The certification, which is voluntary requires food safety, reduction of use of chemicals in farms, environmental protection as well as worker health and safety on farms. It also provides consumers with a system to easily recognize quality, safe fruits and vegetables; and over time, build consumer confidence in the consumption of locally produced fruits and vegetables.</p>

Annex - Table 5: Selected CE-related financing initiatives and instruments in Ghana

Type	Scope
Eco-levy for import of electrical and electronic equipment (EEE)	Based on provisions of Act 917; levies are raised at the point of export and subsequently pooled in a corpus fund, which is administered by an external service provider. The fund's resources are used for various purposes, including subsidies for collection, the development of recycling infrastructure in Ghana, research and innovation programs, etc. Currently, the German KfW is providing seed funding for starting the collection process via designated handover centres; in the future, the fund will disburse funds generated from the collection of the eco-levy.
Environmental Excise Tax for import of plastics	The environmental excise tax of 10% is paid by payable by plastic manufacturers importing plastics into Ghana. It was first set up and collected in 2011 and was meant to be channelled to a designed plastic levy fund authority (PLFA); however, this entity has not yet been set up and the fund may have accrue up to GHS 918 (EUR >200 million). Recently, this prompted industry representatives to urge the Ghanaian government to release funds for its intended purpose.
Public Private Partnerships (PPPs)	The National Policy for Public Private Partnerships was passed in 2011 and provides the basis for PPPs in Ghana. Since 2013, a corresponding Bill is pending in its draft stage but there is currently no timeframe for adoption. As such, PPPs as financing mechanisms in the context CE-related initiatives are still rare. One notable example is the construction of an Integrated Recycling and Compost Plant (IRECOP), which was commissioned by Zoomlion. The PPP-arrangement included the provision of free land from the government to Zoomlion.

Annex - Table 6: Most recent credit ratings by Standard & Poor's for African countries and their outlook (N=20) with Ghana's rating highlighted in orange

S&P	# countries	Outlook	# countries
A-	1	Stable	12
B+	3		
B	10	Developing	4
B-	2	Negative	4
BB	2		
CCC+	2		

Annex - Table 7: Indicative financial allocations through EU-Ghana Joint Programming Phase II

Ghana's Long-term development goals	Sector/Subsector	Overall contribution by European Partners (million EUR)	Funds already committed by European Partners (million EUR)	Funds not yet committed by European Partners (million EUR)
GOAL 1) Build an industrialised, inclusive and resilient economy	1.1 Competitiveness, Private Sector, Employment Policy, Social Welfare and Protection	290.6	175.2	125.4
	1.2 Energy	262.2	180.4	92
	1.3 Agriculture, Agribusiness, Rural Development, Forestry, Fisheries	333.4	136.4	197
GOAL 4) Build effective, efficient and dynamic institutions	4.1 Decentralisation	189.9	99.9	90
	4.2 Public Finance Management, Tax Policy and Tax Administration	90.2	72.2	18
	4.3 Accountability, Anticorruption & Rule of Law	84.1	84.1	0
Total (million EUR)			748.2	502.4
Total Joint Indicative financial allocation (million EUR)		1,250.6		

Source: EEAS, 2017

Annex - Table 8: CE related projects in Ghana funded by EU and EU Member States

Project name	EU contracted amount (total cost) in EUR	Implementation period	Implementing organisation	Funding instrument
Growing Economic Opportunities for Sustainable Development	700,000 (of 947,001)	Feb 2017 - Jan 2020	Christian Aid	DCI - Non State Actors and Local Authorities in development
Sustainable Livelihoods and Transparent Local Authorities (SLATLA)	700,000 (of 822,876)	Feb 2017 - Jul 2020	Action Aid Ghana	DCI - Non State Actors and Local Authorities in development
E-waste Management in Ghana: From Grave to Cradle (under SWITCH Africa Green)	1,199,898 (of 1,333,220)	Jan 2018 - Dec 2022	University of Cape Coast, Ghana National Cleaner Production Centre, City Waste Recycling, adelphi	DCI - Environment and sustainable management of natural resources including energy
Strengthening the capacity of non-state actors to improve FLEGT-VPA and REDD+ processes in Western Africa	3,000,000 (of 3,333,536)	Jan 2017 - Jan 2021	Stitching Tropenbos International (Implemented in Liberia, Cote d'Ivoire and Ghana)	DCI - Global Public Goods and Challenges (GPGC)
Boosting Green Employment and Enterprise Opportunities in Ghana- GrEEen	20 million	May 2020- May 2024	SNV and United National Capital Development Fund	European Union Emergency Trust Fund for Africa
Evidence based approach for sustainable management of tuna resources in the Atlantic - Atlantic Ocean Tuna Tagging Programme (AOTTP)	13,480,000 (of 15,000,000)	May 2015 - May 2020	Comision Internacional Para La Conservacion Del Atun Atlantico (with partners in Azores, Brazil, Cape Verde, Ghana, Ivory Coast, São Tomé and Príncipe, Senegal, South Africa and Spain)	DCI - Food Security
E-waste Payment Scheme (Financial Cooperation Project)	20,000,000	2016 - 2020 (to be extended)	Ministry for Environment, Science, Technology and Innovation and GOPA Infra	Kreditanstalt für Wiederaufbau (KfW)

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Environmentally Sound Disposal and Recycling of E-waste in Ghana (Technical Cooperation Project)	10,000,000	2016 - 2023	Gesellschaft für Internationale Zusammenarbeit (GIZ)	German Federal Ministry for Economic Cooperation and Development
SRI Project (Swiss) ¹³	n/a	n/a	World Resources Forum, Empa, Ecoinvent, Ghana National Cleaner Production Centre, Mountain Research Institute, Ökoinstitut, EPA	Swiss State Secretariat for Economic Affairs

¹³ While Switzerland is not a EU Member State, the SRI project involves a number of important EU partners and is thus included in this table.

Annex 3 Method for modelling of impacts

Part 1 - Methodological details of the modelling approach

The FRAMES model

The process of estimating economic and jobs impacts of circular economy activities in Ghana was carried out using Cambridge Econometrics' FRAMES model. The direct, indirect, and induced impacts of additional circular economy activities are captured in this modelling framework, to estimate the full impacts of the circular economy transition in Ghana.

FRAMES, the Framework for Modelling Economies and Sustainability, is an advanced input-output tool. It is designed to enable the assessment of socioeconomic and environmental effects of E3 (energy, environment, and economy) policies.

The key features of FRAMES are:

- An economic accounting framework based on the system of national accounts.
- Integrated treatment of the economy, energy, and the environment.
- Detailed sectoral disaggregation, and a national level input-output table, reflecting the specific structure of the economy.

FRAMES was built using the structure and principles of the E3ME model. E3ME is a global, macro-econometric model of the world's economic and energy systems and the environment. FRAMES, as a single-country framework, was designed to minimise data requirements, to enable modelling work for regions where time series data are limited. The data requirements are substantially lower than more complex macroeconomic models like E3ME. Table 10 summarises the data sources used to construct FRAMES.

Table 10 Scenario design

Data	Variables	Source(s)
National accounts	<ul style="list-style-type: none"> • GDP • GVA • Consumption • Investment • Trade • Gross output 	<ul style="list-style-type: none"> • World Bank - World Development Indicators • Eora National IO Tables - Ghana (2015)
Employment	<ul style="list-style-type: none"> • Employment • Compensation of employees 	<ul style="list-style-type: none"> • International Labour Organisation • Eora National IO Tables - Ghana (2015)
Population	<ul style="list-style-type: none"> • Current population • Population forecast 	<ul style="list-style-type: none"> • UN - Population Division
Energy	<ul style="list-style-type: none"> • Final energy consumption • Primary energy consumption 	<ul style="list-style-type: none"> • International Energy Agency • Eora National IO Tables - Ghana (2015)
Environmental	<ul style="list-style-type: none"> • Emission coefficients 	<ul style="list-style-type: none"> • E3ME
Economic forecast	<ul style="list-style-type: none"> • GDP forecast 	<ul style="list-style-type: none"> • International Monetary Fund (2019, 2020) • HSBC (2018)

The input-output table used to model the structure of the Ghanaian economy was sourced from the Eora National IO Tables database. The economic sectoral classification follows this source input-output table, which includes the following 26 economic sectors:

1. Agriculture
2. Fishing
3. Mining and Quarrying
4. Food & Beverages
5. Textiles and Wearing Apparel
6. Wood and Paper
7. Petroleum, Chemical and Non-Metallic Mineral Products
8. Metal Products
9. Electrical and Machinery
10. Transport Equipment
11. Other Manufacturing
12. Recycling
13. Electricity, Gas and Water
14. Construction
15. Maintenance and Repair
16. Wholesale Trade
17. Retail Trade
18. Hotels and Restaurants
19. Transport
20. Post and Telecommunications
21. Financial Intermediation and Business Activities
22. Public Administration
23. Education, Health and Other Services
24. Private Households
25. Others
26. Re-export & Re-import

Figure 16 illustrates the economic structure and key relationships in FRAMES. Key parameters estimating the magnitude of relationships were taken from E3ME, specifically an aggregate ‘Rest of Africa’ region.

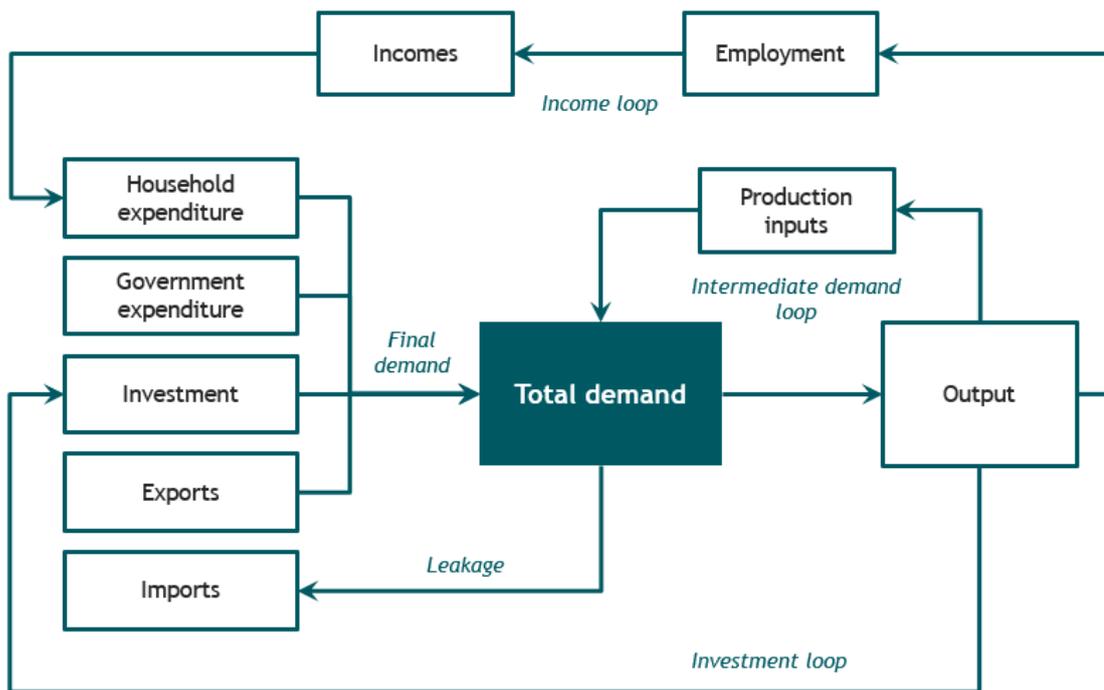


Figure 16: Economic Structure in FRAMES

Treatment of the informal sector

The informal sector is an important consideration when modelling circular economy activities in Africa, as much economic activity may not be fully recorded in official national statistics. This issue is most relevant to agriculture, given the importance of smallholder agriculture in many African countries.

Our employment results include informal labour, as they are based on data from the International Labour Organization which estimate informal activity. The economic results in FRAMES are calibrated to World Bank economic aggregate data, which also incorporate estimates of the informal sector. However, the input-output relationships and sectoral shares in FRAMES are drawn from EORA’s National IO Tables, which do not capture informal economic activity. The EORA data therefore required some adjustments to match the International Labour Organization and World Bank data, namely by adjusting GVA, wages and household consumption in the agricultural sector to align with World Bank data on GVA shares by sector. The implicit assumption of this adjustment is that the products of informal agriculture are entirely purchased by other households, and the value added from these sales are entirely channelled into labourers’ wages (as opposed to profits or taxes).¹⁴

Scenario design

FRAMES has been designed to be used for scenario analysis, evaluating the impacts of an input shock to a reference scenario. An input shock may be either a change in policy, a change in economic assumptions or another change to a model variable. By comparing different scenarios - each representing an alternative future with different policies and/or economic assumptions - it is possible to assess the impact of a change in policies and/or economic assumptions. For this report, the following scenarios were modelled: a baseline and a circular economy (CE) scenario with a scale of circularity on top of the level embedded in the baseline, as shown in Table 11.

¹⁴ For smallholder farmers, there is of course little distinction between wages and profits anyway.

Table 11: Scenario design

Scenario	Scenario Description
Baseline	A baseline constructed based on official published economic and energy-sector projections. The modelling baseline does not explicitly assume a certain level of circular economy activities.
Circular Economy	This scenario assumes an ambitious uptake of the circular economy, in addition to the baseline scenario. The base year for the modelling is 2020 and the target year is 2030.

We have adopted an ‘activities’ approach (rather than a ‘policies’ approach) to modelling the CE scenario. This choice means that the analysis does not assess potential impacts of specific policies but instead looks directly at the links between specific changes in an economy and the direct, indirect and induced effects, without making any explicit assumptions about whether these changes are driven by policies, behavioural change or new technology.

The activities approach implies generating modelling inputs from a sectoral perspective. Inputs are formed by studying the plausible circular economy activities that will take place in selected key sectors and their supply chains. This is to reflect that the impact of a transition to a more circular economy will vary between sectors, as sectors differ in the way in which resource flows and relationships with the consumer are organised.

Increased waste collection and recycling are modelled as central circular economy activities. In addition, activities for four additional sectors are modelled, selected based on existing policy priorities, but also on the basis of the anticipated scale of the potential benefits (in consultation with country experts): electronics (e-waste), plastics, agriculture and construction.

The selected activities are translated into modelling inputs and methods, so that the economic, social and environmental impact can be simulated in FRAMES. Together, the selected activities should be broad enough to represent the most important circular economy changes and their potential impacts.

Scenario assumptions

Table 12 provides a summary of the selected circular economy activities and how the identified circular economy activities were translated to modelling inputs that have been implemented in FRAMES.

Table 12: Scenario assumptions

Category	Circular economy activity	Modelling input	Input size
Waste management	Improved waste collection rate	Increase in waste sector output	Increase from 44% to 75%
E-waste	Improved enforcement of e-waste trade restrictions	Reduction in e-waste (i.e. electronics) imports	€36m
	Improved recycling of valuable materials in e-waste	Investment in recycling sector to improve health & safety standards	€1m
		Share of recycling investment paid for by private and public sectors	50:50
		Exports of materials recovered from e-waste recycling	€2.6m

Agriculture	Prevention of food loss in agricultural supply chain through improved storage and logistics	Substitution of agricultural imports by domestic agricultural production	€360m
		Investment in storage and logistical capabilities	€107m
		Share of investment paid for by private and public sectors	50:50
Circular production	Increased use of recycled materials in industrial production	Electronics production: shift from virgin metals and plastics inputs to recycled inputs	20% of virgin inputs replaced by recycled inputs
		Plastics production: shift from virgin feedstock to recycled feedstock	25% of virgin inputs replaced by recycled inputs
		Construction: shift from virgin non-metallic minerals (glass, cement, sands, ceramics) to recycled minerals	10% of virgin inputs replaced by recycled inputs
		Agricultural production: shift from mineral fertilisers to organic fertilisers	20% of mineral fertiliser replaced by organic fertiliser

As indicated in the last two columns, the various economic changes associated with the circular economy are modelled through specific input assumptions. They mainly relate to gross output, input-output coefficients, investment and the trade balance.

Gross output

The increase in the waste collection rate is modelled as a change in output in the waste management sector. This increase in gross output can be thought of as resulting from a government mandate, rather than being caused by an increase in a component of demand.

Input-output linkages (intermediate demand between sectors)

We have modelled an increase in the circularity of production for a number of sectors through adjustments to the existing input-output structure of the model. This reflects changes to the supply chain of a sector as a result of higher circular economic activities. For example, if the construction sector uses less primary aggregate material, and substitutes these for recycled materials, this change is entered to FRAMES as an adjustment to the input-output linkages (i.e. coefficients) of the construction sector: it purchases less from the mining and non-metallic mineral sectors and more from the recycling sector.

Investment

Some of the modelled circular economy activities are associated with an increase in investment, such as the investment required to prevent food losses in the agricultural sector, or to increase health and safety in the recycling sector. In these cases, assumptions are also needed regarding the share of the investment costs that will be paid by the private and public (or aid) sectors: we have assumed a 50:50 split in all cases. In practice, this means that 50% of the investment input is represented as a cost to the investing industry; the other 50% is assumed to fund by deficit spending or official development assistance, and is thus represented as an injection of funds into the economy.

Trade balance changes

In some cases, the modelled changes to the trade balances represent circular economy activities which directly relate to the trade balance, such as the reduction in imports of e-waste. In other cases, changes to the trade balance are a way to represent a change in productivity in a demand-led model. For instance, we have modelled a reduction in food losses in the agricultural supply chain (effectively an increase in agricultural productivity) as a reduction in imports of agricultural products, as domestic supply is better able to meet domestic demand. Similarly, some portion of the materials recovered from e-waste recycling are modelled as an increase in exports, as we do not assume that domestic demand for these materials has necessarily increased.

Mapping inputs to FRAMES sectors

In some cases, the sectors available in FRAMES were too broad to allow for the targeting of inputs at the level described in Table 12 above. For example, modelling the shift from virgin plastics to recycled plastics as inputs to the production of electronics requires the disaggregation of two FRAMES sectors. Firstly, we must establish the share of electronics output within the broader “Electrical and Machinery” FRAMES sector. Secondly, we must establish what share of this sector’s purchases from the “Petroleum, Chemical and Non-Metallic Mineral Products” FRAMES sector are actually of plastics, as opposed to other petrochemical and mineral products. Once these shares are established, the magnitude of the modelling inputs can be adjusted accordingly.

Table 13 provides an overview of how each of the modelled activities corresponded to the sectors available in FRAMES. An estimate of output or intermediate demand shares was required in cases where the activity sector did not correspond directly with the FRAMES sector. These shares were estimated, where possible, using data from the relevant national accounts and other sources. If no data were available, the shares were inferred using data for the “Rest of Africa” region in E3ME.

Table 13: Mapping to FRAMES sectors

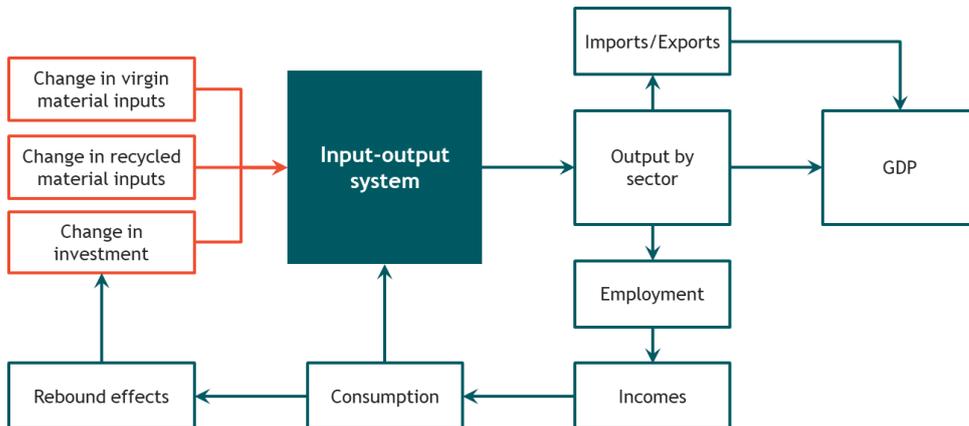
Activity sector	FRAMES Sector	Variables affected by modelling inputs
Waste management	Education, Health and Other Services	Gross output
Recycling	Recycling	IO coefficients, Investment, Exports
Electronics	Electrical and Machinery	IO coefficients, Imports
Plastics	Petroleum, Chemical and Non-Metallic Mineral Products	IO coefficients
Construction	Construction	IO coefficients
Agriculture	Agriculture	IO coefficients, Investment
Metals	Metal Products	IO coefficients (electronics input)
Chemicals	Petroleum, Chemical and Non-Metallic Mineral Products	IO coefficients (plastic feedstock, mineral fertilisers)
Mining of non-metallic minerals	Mining and Quarrying	IO coefficients (construction materials)
Production of non-metallic minerals	Petroleum, Chemical and Non-Metallic Mineral Products	IO coefficients (construction materials)

Model linkages and feedbacks

The impact of circular economy activities will not be linear. A change in investment or material consumption may have feedback effects that may in turn alter investment and consumption levels. An advanced input-output model like FRAMES is able to capture these complex interactions, enabling a deeper analysis of the trade-offs inherent in a circular economy transition, as limits are placed on certain economic activities while demand for others increases.

Figure 17 illustrates the key linkages in modelling material demand substitution in FRAMES. The modelling inputs adjust input-output coefficients in select sectors, substituting demand away from extractive sectors, towards the recycling sector. This shift in the value of supply-chains affects intermediate demand across sectors, and as a result, levels of gross output across sectors. Differences in output levels result in employment changes by sector; variation in labour intensities across sectors affects net employment change. Output changes across sectors also affect levels of trade and investment activity. Induced effects result from changes in employment, which affect incomes, and therefore consumption.

Figure 17: E3ME linkages - flow diagram



The net environmental impacts of circular economy activities are not certain, a priori. For instance, the shift towards recycled materials will decrease the share of material use in the economy met by virgin material. On the other hand, the shift towards recycled materials may also be associated with increased employment, increasing disposable incomes and consumption (see Figure 4). The additional investment required by the transition would also filter through the economy, increasing demand in the financial and construction industries, among others.

The overall consumption of raw materials is determined by these trade-offs within the economy. If the rebound effects from the additional demand are strong, the impact of circular economy activities may be to increase the extraction of raw materials more than ever, with improved resource efficiency offset by higher consumption overall. As the relative importance of sectors with different labour and carbon intensities changes as a result of the circular economy, we may expect to see similar dynamics in terms of employment and carbon emissions in aggregate, with employment and carbon emissions being added in certain areas of the economy while employment and emissions potentially being reduced in other areas of the economy. Through its model linkages and feedbacks, FRAMES captures these various effects and estimates the net impacts.

Part 2 - Detailed modelling results

Table 14: Detailed employment results by sector

Sector	Baseline scenario employment, 2030 (000s)	CE scenario employment, 2030 (000s)	Absolute difference from baseline scenario in 2030 (000s)	Relative difference from baseline scenario in 2030 (%)
1. Agriculture	4630.7	4670.5	39.87	0.86%
2. Fishing	221.1	221.6	0.49	0.22%
3. Mining and Quarrying	138.8	138.8	0.02	0.02%
4. Food & Beverages	320.0	320.0	0.00	0.00%
5. Textiles and Wearing Apparel	88.6	89.0	0.34	0.39%
6. Wood and Paper	335.6	335.6	0.00	0.00%
7. Petroleum, Chemical and Non-Metallic Mineral Products	435.0	435.5	0.50	0.11%
8. Metal Products	273.6	273.7	0.19	0.07%
9. Electrical and Machinery	793.3	795.3	1.95	0.25%
10. Transport Equipment	241.5	241.7	0.25	0.10%
11. Other Manufacturing	111.8	111.8	0.00	0.00%
12. Recycling	2.4	2.5	0.05	2.27%
13. Electricity, Gas and Water	62.3	62.3	0.02	0.03%
14. Construction	561.4	563.0	1.58	0.28%
15. Maintenance and Repair	65.9	65.9	0.00	0.00%
16. Wholesale Trade	1562.0	1562.0	0.00	0.00%
17. Retail Trade	1451.4	1451.4	0.00	0.00%
18. Hotels and Restaurants	749.2	749.2	0.00	0.00%
19. Transport	249.3	249.6	0.27	0.11%
20. Post and Telecommunications	275.0	277.8	2.80	1.02%
21. Financial Intermediation and Business Activities	517.2	521.3	4.05	0.78%
22. Public Administration	381.4	381.4	0.00	0.00%
23. Education, Health and Other Services	1592.1	1600.8	8.65	0.54%
24. Private Households	564.5	564.5	0.00	0.00%
25. Others	318.4	318.4	0.00	0.00%
TOTAL	15942.6	16003.6	0.00	0.00%

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