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The impact of Geospatial Information on Sustainable Development Goals (SDGs) Agenda 2063 in Africa

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ABSTRACT
This article argues the need for the 2030 Agenda for Sustainable Development, at integrating economic, social and environmental geospatial datasets into measuring, monitoring and evaluation of the sustainable development goals (SDGs).The SDGs cover social and economic development issues including poverty, hunger, health, education, global warming, gender equality, water, sanitation, energy, urbanisation, environment, and social justice. Monitoring progress in the Sustainable Development Goals is a fundamental component of the post-2015 United Nations. Thus in order to make the "data revolution" truly revolutionary, it must be accompanied by a "presentation revolution" this paper reviews the impact of Geospatial Information on Sustainable Development Goals (SDGs) Agenda 2063 in Africa. It takes a look at**the** importance of Geospatial Information to Sustainable development, Geospatial Information management to support decision-making for Sustainable Development, issue of Geoinformation in Africa, the Sustainable Development Concept, the Sustainable Development Goals (SDGs), and the role of Geospatial information and Earth Observation in the 2030 Agenda for Sustainable Development Goals.

KEYWORDS: Geospatial Information, Earth Observation, Sustainable Development Goals (SGDs), Agenda 2063, Africa Monitoring& Evaluation

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I. INTRODUCTION

The importance and applicability of geospatial information for sustainable development, wasin 1992 when the world leaders adopted the Agenda 21 (UNCED, 1992). The issue was raised again ten years after at the World Summit Conference on Sustainable Development held in Johannesburg, South Africa, in August 2002. The summit strengthens the geographic foundation for natural resource management and development issues, especially in Africa. The geographic foundation includes a varied array of geospatial datasets, which include social, environmental, and economic datasets for developmental purposes; they also consist of maps and models, the outcome of analytical processes, and pattern of a geographic area at various scales.

1.1 Importance of Geospatial Information to Sustainable development

In the last few decades, geospatial information had played an increasingly significant role in supporting effective decision making in addressing social, economic, and environmental issues. Sustainable development integrates social, economic and environmental datasets for active decision-making Sustainable development can only be attained through a comprehensive understanding of the changing environment and monitoring the impact of human activities on the environment through the integration of geospatial information (Williamson et al., 2006). Locational information is required to observe, monitor, and understand changes and to create realistic simulations to changes that happen in the environment, as everything that happens in the world takes place at a location. Geospatial Information provides a common link to different activities and statistics relating to a geographical area, and this allows different datasets to be combined, viewed, analysed, and compared. This assists decision-maker in identifying where resources, people, and infrastructure can be found. This is important for evidence-based decision making; without it, decisions can be inadequate, counterproductive worst still, it can be costly. The government takes decisions to protect the environment, manage scarce resources, and protect the vulnerable populations (Kelm et al., 2017; Rajabifard & Williamson, 2006).However, it is reasonable to have access to such information and to use them for evidence-based decision making. However, in many countries, they lack these types and quality geospatial datasets services and products, especially in developing countries in Africa whose governments and citizens are still trying to deal with poverty, insecurity of tenure, natural disasters, gender inequality and the effects of climate change. Where such datasets do exist, it comes with these

associated issues such as difficulty in finding out what is available, whether it is fit-for-purpose, how to access it, who owns it, how to use it can also come with high cost (Kelm et al., 2017).

1.2 Geospatial Information management to support decision-making for Sustainable Development

Geospatial information activities in Africa tend to focus mainly on data collection for map-making. The collection is in itself not sufficient to assess and manage the complex process of sustainable development and the broad implications for social, economic, and environmental challenges confronting policy-makers and citizens in Africa (Gavin & Gyamfi-Aidoo, 2001). Capacity is necessary to evaluate natural and environmental changes in a strategic planning context mainly through analysis and forecasting of change models that take cognisance of policy options. Policy-makers and planners in Africa use standard economic forecasting tools and estimates from economic and demographic analysis to evaluate alternative for them to make an informed decision, hence analytical and forecasting framework is desperately needed.

Lack of awareness is particularly prevalent at the policy and decision-making levels in most developing countries. National policies, and technical capacities and capabilities, need to be better aligned and considerably strengthened so that all countries have the opportunity to develop and contribute to a vibrant national geospatial information ecosystem. Geospatial information has been described as a national asset and infrastructure which helps to identify what is happening where and what time, contributing to economic transformation in many countries, including e-government, e-service and e-commerce and managing smart city (UN-GGIM, 2018a). A better understanding and management of geospatial information allows for the integration of location-based data and services that can enable more efficient resource allocation for better service delivery. It has been primarily established that accessibility to reliable geospatial datasets helps policy-makers, international organisations, civil society and others gain better insights into the distribution of needs and ways to optimise development planning and investments (Masser, 1998). However, there remains a considerable lack of understanding and often awareness particularly at the policy and decision-making levels in developing countries about the role of geospatial information and its contribution to national development (Feeney, 2003; Feeney et al., 2001). Quality and up-to-date geospatial information are fundamental to achieving all-inclusive growth and sustainable development, but quite several times, they are often overlooked during the policy-making process. While the government in developing countries may have a considerable amount of geospatial information relating to education, health, poverty and disaster-prone areas, held in various databases at different locations within a geographical area that is critical in improving lives and livelihoods, these datasets are often not of the right quality, nor shared with other agencies who might also need them, or integrated with other required datasets

1.3 Issue of Geoinformation in Africa

Geospatial datasets are becoming more available for use in different applications and new emerging services in most African countries, despite this, data access, sharing, integration, and management is a big challenge (Akinyemi & Uwayezu, 2011; Makanga & Smit, 2010; Mwange et al., 2016, 2017; Nhamo, 2017; Okuku et al., 2014; Sebake & Coetzee, 2011; Siebritz & Fourie, 2015; UNECA, 2007). These geospatial datasets are redundant because of the lack of coordination between the various data producers, thus leading to the fragmentation of the geospatial dataset within the different databases (Reed, 2011). Another concern likewise, lack of systematic monitoring and access to social, economic, and environmental datasets, causing a significant barrier to effective and efficient to take an informed decision concerning sustainable development within the African continent, maybe that is the reason.Makanga & Smit, (2010) concluded that "SDI initiative is still at the infancy stage, as compared to SDIs in the developed countries, such, the U.S. National SDI (NSDI), Infrastructure for Spatial Information in Europe(INSPIRE), Spatial Data Infrastructure for Australia and New Zealand (ANZLIC).Other issues are the detailed metadata required to gain information about geospatial datasets origin, custodians, as well as a clear understanding of copyright and condition for geospatial information potential reuse for sustainable development, all of which engender confidence for research outputs. Metadata (data about data) enable exchange, sharing, and transfer of geospatial information, which enable users to be aware of its provenance, spatial extent, and restrictions and suitability for developmental projects.

Achieving the objective of sustainable development requires the integration of various geospatial datasets on social, economic, and the environment (Lehmann et al., 2014). Ever since world leaders adopted the SDGs, also known as Global Goals in September 2015, which officially came into force on 1 January 2016, some researchers had attempted to develop various frameworks to understand the workability of integrating Geospatial and Earth Observation (EO) datasets to measure, evaluate and monitor the 17 SDGs Agenda, 169 targets, and their 250 indicators.Anderson et al., (2017), their work recognised the importance of adequate spatial data, the study observed that the Group on Earth Observation (GEO, developed some initiatives in the use of EO to measure and monitor the Global Goals. GEO is the coordinating body for the Global Earth Observation Systems of Systems (GEOSS), developed an objective on how to integrate EO and geospatial information into national development and monitoring frameworks for the SDGs. The research further explains

that GEO had launched a series of pilot projects to assess and track SDG, the initiative try to show the societal benefits of the use of EO to support the implementation, planning, monitoring SDGs. The research further highlighted various way which EO could play in the use of EO to monitor specific agendas such as GOAL 2: Hunger, GOAL 1 Cities, and GOAL 15: Ecosystems.

The work of Scott & Rajabifard, (2015), proposes a conceptual framework on how geospatial and EO datasets can be integrated into the Global Goals. The framework argues that for countries to measure and monitor Global Goals agenda progress, it will highly depend on diverse and reliable data to provide the evidence base for decision-making and reporting. The research opined that the National Geospatial Strategic framework should be designed as an overarching national policy framework to integrate geospatial and crucial other information into national sustainable strategies that will contribute to the country's implementation agenda. The research also argued that an enabling environment should be established where government and its agencies, stakeholders can cooperate and collaborate to improve the management and exchange of geospatial information, as such information will support and serve the national interest, consequently making the value of geospatial information be realise for sustainable development. The framework further proposes a "data flow" for the national information systems, which comprises, mix national data on 'real-world' datasets on social, economic, and environmental challenges, conditions, and circumstances for the country, which needs to be measured and monitored. It concluded that the national information agencies, geospatial datasets, and Earth Observation professionals would need to collaborate more closely with other stakeholders.

1.4 The Sustainable Development Concept

Sustainable development is a concept that has been broadly used to describe a wide and complex range of objectives, activities, and human activities. The concept implies creating a balance between social, economic, and technological activities so as not to overload the capacity of the surface and atmosphere of the Earth (environment) to absorb their impact (Campagna, 2006). The UN and associated agencies worried about the increasingly worrisome evidence of ecological degradation and other biophysical damage, worsening cases of poverty, around the world, especially in the "third world" countries due to the rapid world population and economic growth (Kemp et al., 2005). In addressing these challenges, there have been over 20 important international conferences between 1970 to date, showing growing concern to the issue and importance of sustainable development as an emerging paradigm. "Paradigms are important in that they are a philosophical and theoretical framework within which we derive theories, laws and generalisations" (Bell & Morse, 2003). The historical development of this important paradigm is based mainly on the clear historical trend towards greater awareness of an emphasis on environmental issues and the concomitant recognition of the need to synchronise social, economic, and environmental factors for developmental projects. In short, whatever is done now does not harm future generations (Venning & Higgins, 2001). Sustainable development can be succinctly defined as a "development meets the need of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1989; WCED, 1987), this definition was taken from a landmark document, a report entitled *Our Common Future* by the World Commission on Environment and Development (WCED) in 1987. This report is also called the Brundtland report, because, the WCED was headed by Gro. Harlem Brundtland(Brandon & Lombardi, 2010). Payutto (1998), as in the opinion that this definition of sustainable development from Western viewpoint can lead only to what the author called a "*cul-de-sac*: The author further states that compromising the future used in the definition is a western ideology of competition. Compromising means lessen the need of all parties, and if a party is not ready to compromise, it can lead to frustration. Therefore development is not sustained. The WCED report concluded thatecological and social failures had common causes and demanded a typical response.

Sustainable development is a multi-actor process that is inherently collaborative and participatory. Everyone involved in developmental projects, from citizens, managers, organisations, entrepreneurs, interest groups, to social advocates, should have equal access to information for decisions. Promoting collaborating decision-making, fostering participation, and promoting public and capacity building by using GIS as a tool and SDI as an enabling environment to produce, maintain, analyse, maintain, and disseminate environmental datasets. Information plays a significant role in the planning and decision-making for pursuing the various objectives of sustainable development. Geospatial technology offers a wide range of tools to support sustainable development led to activities and development. Figure 1 illustrates the core of mainstream sustainability, thinking that has effectively incorporated social, economic, and environmental dimensions in decision making for Sustainable development (Adams, 2006; Ting & Williamson, 2001). Social, economic, and environmental processes are inherently spatial, 80% of the information for developmental processes has a geospatial element and can only be fully understood where their locational dimensions are put into consideration. Man and its environment can only be represented with reference to a specific location. Human development impacts spatially on the environment, which is described by the topological relationship among physical objects on the earth's surface (Campagna, 2006).

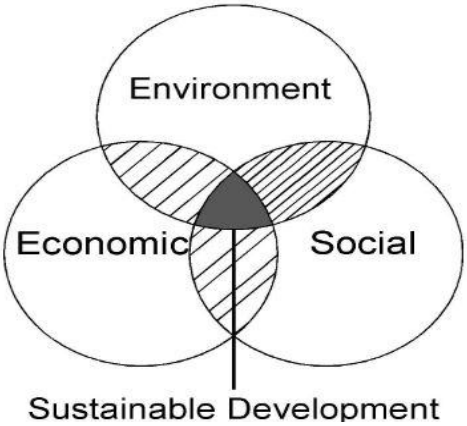

Figure 1 Creating a balance between social, economic and environmental processes for Sustainable Development (After Adams, 2006; Lisa Ting & Williamson, 2001)

It is necessary to concurrently understand the "economic", "social", and "environmental" components for sustainable development. According to Harris (2000), sustainable development concept had since been based on generally on recognition of three aspects:

Economic: Sustainable economy system should be able to produce goods and services continuingly, try and maintain manageable levels of government and external debt, and facilitate a balance between agricultural or industrial production sectors so that neither systems are damaged.

Environmental: An environmentally sustainable system should sustain a stable resource base that would produce over-exploitation of renewable resource systems or environmental asset functions using only non-renewable resources if the resources are renewed through investments. Also, this should include maintenance of biodiversity, atmospheric stability, and other ecosystem functions not ordinarily classed as economic resources.

Social: A socially sustainable system must safeguard distributional equity, make suitable provision of social services such as equal access to health and education, create gender equity and political participation and responsibility.

Hence, it is necessary to fully understand opportunities and gain further insights that are required for the use of geospatial technologies and applications to support sustainable development processes.

1.5 The Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs), 2030 Agenda for Sustainable Development, was officially adopted by world leaders at the United Nations Sustainable Summit in New York on 25–27 September 2015.The 2030 Agenda was built on the MDGs came to force in January 2016, it articulated a new comprehensive global development agenda, the 17 Sustainable Development Goals, or SDGs which set out quantitative objectives across the social, economic, and environmental dimensions of sustainable development – all to be achieved by 2030 and their 169 targets were accepted with the signatures of 193 countries, these goals include eradicating poverty in all its forms and dimensions, tackling climate change, fighting inequality and justices. The objectives of the SDGs are multi-dimensional, the goals were designed as a web of interrelationships and dependencies, where progress towards one goal can enhance progress in others. They reflect a shift in global policy from a predominantly economic focus to one that holistically addresses the economic, social, and environmental dimensions of sustainable development. Integrated development is at the heart of the 2030 development agenda. An integrated approach to policy coherence can help to capitalise on interconnections and avoid conflicts (Can & Alatas, 2017).

While only one of the MDG7 was explicitly for environmental concern, the SDGs put the environment on equal footing with economic and social concerns; on that account, environment concerns were directly reflected in seven goals. Implementing sustainable development requires an understanding of the interdependencies between the economy and environment, including the impact the economy has on the long-term health of natural systems. To achieve these synergies across policy areas and trade-offs of domestic and international policy concerning development goals must be identified (Can & Alatas, 2017; United Nations, 2015b, 2015c). The core of the Agenda is a set of 17 lofty objectives set out quantitative and qualitative objectives for the next 15 years, comprising 169 targets that draw on a large number of previous international agreements, especially concerning development, the environment and human rights (Figure 2). These targets are

"global in nature and universally applicable, taking into account different national realities, capacities, and levels of development and respecting national policies and priorities". (United Nations, 2015c).

Source: United Nations.

Figure 2: The 2030 Sustainable Development Goals

Sustainable development should be evaluated in the context of the following goals, and policies should be produced in the direction of these goals:
The 2030 SDGs constitute the most updated targets of sustainable development

Sustainable Development Goals

- Goal 1. End poverty in all its forms everywhere
- Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 3. Ensure healthy lives and promote well-being for all at all ages
- Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- Goal 5. Achieve gender equality and empower all women and girls
- Goal 6. Ensure availability and sustainable management of water and sanitation for all
- Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
- Goal 10. Reduce inequality within and among countries
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
- Goal 12. Ensure sustainable consumption and production patterns
- Goal 13. Take urgent action to combat climate change and its impacts*
- Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
- Goal 17. Strengthen the means of implementation and revitalise the global partnership for sustainable development

II. THE ROLE OF GEOSPATIAL INFORMATION AND EARTH OBSERVATION IN THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT GOALS

The 2030 Agenda is a landmark development in society's efforts to managing social inclusion, economic growth, and environmental sustainability towards progress concerning sustainable development. The SDGs and the associated Global Indicator Framework allows for data-driven framework in which countries can

engage with the aim of evidence-based decision-making and development policies. The Agenda recognises that 'if you cannot measure it, you cannot manage it' and data is the enabler for the 2030 Agenda implementation., the UN recognises the role that location plays in integrating information about the society, the economy, and the environment, as well as to simply track each of the SDGs. United Nations Statistical Commission encourages each country to develop a framework that helps measure SDGs progress in an open, timely, and make data-driven decisions in real-time so that they can nurture positive change too fast track development. It aims that both developed and developing countries are involved, and "no one is left behind". The scope, scale, as well for the need to explore and integrate new datasets, is daunting enough many countries may need to overhaul many of their national statistical and geospatial systems, to measure and monitor the progress of these targets and indicators effectively.

Sustainable development concept can be applied to virtually all issues faced by humankind, making it one of the buzz-words around, hence meaning different things to different people. However, the fact that it can be measured has made global leaders embrace those mentioned above, in solving ongoing and emerging global developmental challenges, for this reason, the UN calls for the integration of geospatial and Earth Observations (EO) dataset to support the Sustainable Developmental Goals (SDGs) targets and indicators (Scott, 2013; Scott & Rajabifard, 2017; UN-GGIM, 2018; UN, 2005; UN-ECOSOC, 2011).During the General Assembly on 25th September 2015, the Head of States declared that "we have adopted a historic decision on a comprehensive, far-reaching and people-centred set of universal and transformative Goals and targets. We commit ourselves to work tirelessly for the full implementation of this Agenda by 2030". It was agreed that there is a need for action for people, planet, and prosperity. The declaration was a consensus effort by the global community to address the issues of poverty reduction and human development successfully. It recognises that eradicating poverty in all its forms and dimensions, including extreme poverty, is the most significant globalchallenge and an indispensable requirement for sustainable development.

It had been established that access to and the use of geospatial information helps governments, especially in developing countries, to develop effective policies and support decision-makers in directing aid and development resources. Geospatial data is crucial to target the Sustainable Development Goals (SDGs) intervention. Social inclusion and collaboration are the core values of SDGs. There is a paradigm change in the availability of geospatial data it is now recognised that geospatial data is not used for mapping purposes alone but for integration, analytics, and aggregation – capable of providing more informed decision making. Most countries in Africa are seeking to come to terms with developmental challenges become besides balancing social cohesion and environmental protection for economic growth can be an overwhelming policy drive in these countries (United Nations, 2017). The use of geographical data and information to solve decision problems are referred to as spatial decision problems, which requires a large number of feasible alternatives to be evaluated based on multiple criteria make spatial decisions multi-criteria in nature (Malczewski, 1999; Massam, 1988). The need for sustainable development agenda to integrate geospatial and EO datasets to link social, economic and environmental issues requires multi-criteria decision making (Feeney et al., 2001). Multi-criteria decision-making is a more complicated process as compared to when using a single criterion, because it is difficult to find an alternative that all other criteria, as the number of stakeholders that are involved in the decision process tend to increase the complexity of the spatial problems (Malczewski, 2006; Massam, 1988), individual differences and preference on the outcome of the decision consequences. The 2030 SDGs Agenda specifically mandated governments to exploit and explore the contribution of Geo-Information (GI) to support the monitoring and tracking of SDGs targets and indicators in making informed decisions. Geospatial information and Earth Observation (EO), together with modern data processing and big data analytics, can leverage and offer extraordinary opportunities to revolutionise national statistical systems and consequently to make a substantial leap in the capacities of countries to efficiently track social inclusion, economic growth and environmental sustainability towards progress concerning sustainable development.. The MDG 2015 report specified that the location of people and things, as well as their relationship to one another, is essential for informed decision-making. Wide-ranging location-based information is helping governments develop strategic priorities, make sustainable decisions measure, and monitor outcomes. SDI still remains enabling platform in achieving this, based on its fundamental principle of "produce once and use many times" (Scott & Rajabifard, 2017; United Nations, 2015a). SDI has been implemented at various level of governance, from local, national, regional and global levels (Čada & Janečka, 2016), both the developed and developing countries had delved into the SDI initiatives specifically to serve specific applications, such as Disaster Management, Cadastral/Land Information, Biodiversity Conservation, Ecosystem Services, e-governance, Real Estate, Water Management (Rajabifard et al., 2002). The objectives of these initiatives are to promote social inclusion and economic development, foster environmental sustainability in order to stimulate good government across various level of public governance (Masser, 1999).

To effectively achieve the SDGs goals and objectives availability and integration of geospatial datasets that can be used to measure, monitor and manage progress targets that has a spatial dimension of the global indicator framework of the SDGs for the next 15 years (Mohammadi & Binns, 2006; Scott & Rajabifard, 2017; United Nations, 2017).The all-embracing principle of the 2030 Agenda for Sustainable Development is that no one should be left behind, "Data which is high quality, accessible, timely, reliable and disaggregated by income, sex, age, race, ethnicity, migration status, disability and geographic location and other characteristics relevant in national contexts" (United Nations, 2015).In the term of reference, adopted by the Inter-Agency and Expert Group on the Sustainable Development Goal Indicator (IAE-SDGs), the working group on Geospatial Information, shows, that the United Nation Statistical Commission was tasked by member states of the UN to develop the Global Indicator Framework, when they adopted 17 ambitious goals, in September 2015 for the 2030 development agenda in realising the SDGs. The purpose of the Framework is to appreciate the fact that no is left behind in the scheme of things, being one of the overarching principles underpinning the 2030 Agenda for Sustainable Development (UN-GGIM, 2018b). This Global Indicator Framework must adequately and systematically address the issue of alternate data sources and methodologies, such as the contribution from wide range earth observation and geospatial information in the context of geographic location. Data from diverse and disparate sources allows for various geospatial analysis to make informed decisions. Many National Statistical offices are now seeing the need to integrate geospatial datasets, earth observations, and big data into their methodologies to support official statistics, this is necessary was because of lessons learned from implementing the MDGs, where there was lack of availability and access to reliable geospatial data for analysis for decision making. However, accurate and up-to-date data underpins good decision making in every sphere of life, whether public administration system of government or corporate governance (Anderson *et al.*, 2017; Chai, 2009; Ilic', 2009). The ability for geographic information to generate, identify problems by providing added value, help in proposing alternatives, mode of action to be followed, solve problems effectively are preliminary steps towards achieving decision making for sustainable development (Feeney *et al.*, 2001).

III. CONCLUSION

Management of social economic and environmental datasets in a sustainable manner is ultimately a process of evaluation and decision-making. Decision-making usually involves a complex process that involves value judgments and analysis of a broad array of information. SDI remains an enabling platform, which can be used to integrate many types of datasets into a usable format. It allows for the production, analysis, modelling of datasets for alternative scenarios. Many decision-makers in developing countries have no experience with SDI concept as a spatial decision-support tool, and thus do not appreciate its potential. Other obstacles hampering SDI development for the geospatial decision-making process, include the orientation of projects toward geospatial data production only, instead of towards developmental applications; lack of planning for the decision-support process, communication silo between technicians and scientists within an organisation; and lack of inclusion of university and geoscientific research that could drive data analysis. SDSS demand will grow in Africa, and this is because of the call to prioritise the use of geospatial information and statistics for the SDGs Agenda, which can help in decision making. Human, societal, and organisational capacity is needed to integrate geospatial information and spatial decision-support support tools into the decision-making process.

Decision-makers will need to improve understanding of motivations that will improve collaboration in response to societal challenges, and the SDGs Agenda seems to be an urgent solution to address help in this vital objective. SDI offers reliable tools to support analysis, problem-solving, planning, decision-making and management of the processes required to pursue a sustainable development agenda. The geospatial community has a role to play in further investigate opportunities in solving sustainable development problems employing the various goals and targets and also promoting awareness of all the actors involved in the potential of geospatial technologies.

The development of National Geospatial Data Infrastructure in Africa has been going on over a decade, but they still reflect an incoherent piecemeal approach and also characterised by loose networks and informal relationships. For geospatial information to be successfully used for used in policy and decision-making to support sustainable development in Africa, the continent should, among other things put the following in place:

- Develop a collaborative network to share geospatial information and interoperable systems between geospatial custodians, the public, education, and research institutions for decision making.
- Develop a geospatial information policy, create regional and national fundamental data sets through a collaboration network, and invest in capacity development.
- Explore and exploit global geospatial datasets in the production of their fundamental datasets transparent.

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